

THE
FOREST FLORA



OF
NEW ZEALAND.

BY T. KIRK, F.L.S.

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THE

F O R E S T F L O R A

OF

N E W Z E A L A N D .

BY

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ERRATA.

- Plate I., for AXILLARIS read AXILLARIS.
" XXXVIIIa., XXXVIIIb., XXXVIIIc., for CRASSIFOLIA read CRASSIFOLIUM.
" XLIV., for RAURUA read RAUKAWA.
" XLVI., for TENNIFOLIUM read TENUIFOLIUM.
-

- Page 30, line 8 from bottom, for fruit read seed.
" 47, line 8 from top, for habit read habitat.
" 101, line 8 from top, for Jacques read Jacquinet.
" 123, line 20 from top, for becomes read is.
" 124, line 20 from top, for good read great.
" 185, line 3 from bottom, for Matai read Maitai.
" 219, line 13 from bottom, for localities read habitats.
" 221, line 11 from top, for branches read branchlets.
" 310. Insert between lines 4 and 5 from top "DIVISION I. POLYPETALÆ."

P R E F A C E.

THE preparation of a descriptive account of the economic trees and shrubs comprised in the New Zealand flora was authorised by the Hon. John Ballance, late Minister of Lands, and confirmed by his successor in office, the Hon. G. Richardson. The primary objects of the work are to diffuse a knowledge of the forest resources of the colony—to describe the chief methods of working and conversion employed, and to establish a uniform series of common names. The last object, especially, is one of considerable importance, as, owing to the loose manner in which common names are generally employed in the colony, timbers of but little value are frequently used instead of the kinds specified, often causing needless expenditure and great inconvenience. One instance may be mentioned here: At least a dozen kinds of small-leaved trees are termed “birch,” with the prefix “black,” “white,” “red,” “brown,” “grey,” or even “yellow” applied, as the imagination of the bushman may suggest, scarcely any two bushmen being agreed as to the correct application of the qualifying term, while architects and contractors for the most part are but little better informed. The brown-birch of Otago is the white-birch of Nelson; the white-birch of Westland, again, is a totally different tree; the black-birch of Auckland is termed red-birch in Wellington, brown-birch in some parts of Nelson, while in Otago it appears to be termed indifferently black-birch or red-birch. Other cases where similar confusion exists will be found recorded in various parts of this work.

The plan of the work may be briefly stated. A separate account is given of each species—the head-lines stating the systematic name, the Native name, or in some cases a common name, which may be substituted with advantage; also the name of the natural order to which the plant belongs, with a reference to the plate on which it is represented.

The first portion of the text contains historical information and other particulars of general interest connected with the plant, an account of its dimensions, habit of growth, &c., and a more or less detailed statement of the structure of the flower and fruit, devoid of technicalities. This is followed by a concise account of its Properties and Uses, and, in the case of the more important kinds, the mode of working the forest, conversion, commercial value, &c. A brief statement is given of the Distribution of the Genus, and a more detailed account of the Distribution of the Species. The article is completed by a botanical description of the species and an explanation of the plate. In most cases enlarged representations of the parts of the flower and fruit are given to facilitate identification.

NATIVE AND COMMON NAMES.

Considerable difficulty has been experienced in ascertaining the Native names of many species, and it can scarcely be hoped that all errors have been avoided. Mr. Colenso and Maori scholars generally have borne testimony to the precise application of names to plants and other natural objects by the older

Natives ; but those of the present generation rarely evince the slightest interest in the subject, and can rarely state the names of any except the commonest kinds, so that the total loss of many names need cause little surprise. Another difficulty lies in the application of different names to the same plant, and, conversely, in the application of the same name to different plants.

When this work was somewhat advanced I ventured to forward a list of Maori names, which had been obtained from various sources, to W. Colenso, Esq., F.R.S., with a request that he would oblige me by correcting any obvious errors: this he very generously consented to do, and returned the catalogue with corrections and additional names quite new to me. After page 45 I have regularly indicated all Native names inserted on Mr. Colenso's authority. To the Ven. Archdeacon W. L. Williams I am specially indebted for a valuable catalogue of Native names, more particularly of those used in the East Cape District; and I have also to express my acknowledgments to C. Traill, Esq., for a list of names used by the Stewart Island Maoris.

In the great majority of cases the Maori names are much better adapted for commercial use than those commonly employed; happily, no attempt has been made to replace "kauri," but the unmeaning names of "red-pine," "black-pine," "white-pine," &c., are inferior to rimu, matai, and kahikatea, as they are employed in other countries to distinguish different kinds of timber, and are moreover liable to be confused with each other. This is shown by the fact that the red-pine of the Nelson district is termed black-pine in other parts of the colony.

In most cases, therefore, it appears preferable to adopt the ordinary Native names as the common names, but a notable exception will be observed in the beeches—the Native name "tawai" or "tawhai" is used as a generic term to include all the species, and is not capable of being applied with precision. It is therefore proposed to term the different kinds "tooth-leaved beech," "entire-leaved beech," "silver-beech," &c., as indicated under the description of each. Reference has already been made to the trouble arising from the misleading ordinary names, "red-birch," "white-birch," &c., applied to these timbers.

In other instances it may be found convenient to substitute a common name for that employed by the Natives for the sake of brevity. For instance, "fuchsia" may advantageously replace "kohutuhutu;" but cases of this kind are very few.

As doubts have been expressed respecting the possibility of substituting the names of tooth-leaved beech, silver-beech, &c., for "red-birch," "white-birch," &c., it may be pointed out that if the proposed names are uniformly employed by the officers of the Public Works, Survey, and Railway Departments, they will speedily come into commercial use and be generally adopted.

ON THE ASCERTAINED STRENGTH OF NEW ZEALAND TIMBERS.

The information at my disposal on this subject is less complete in all cases than could be desired, and in some instances is very defective. In 1865 the late Mr. J. Melville Balfour, Marine Engineer, prepared a report embodying the results of a series of Experiments on the Strength of New Zealand Woods, which exhibits a vast amount of careful and patient labour. Until lately it was the only authority on the actual and relative strength of New Zealand timbers, but in 1879 Mr. W. N. Blair, Assistant Engineer in the Public Works Department, published the results of experiments made to determine the strength of Otago timbers. The series of experiments on kauri, conducted by Mr. T. Laslett, Timber Inspector to the British Admiralty, is, however, of the highest

value, and far surpasses any work of the kind performed in New Zealand. Specimens were selected from logs taken from the base, middle, and upper portion of the tree, and from various places in each log, so that the sections tested represented nearly all stages of development between young and fully-matured timber.

I have drawn freely from the results of the different series of experiments, and, while pointing out their discrepancies, have tried to do justice to the careful observation and patient labour exhibited by all. At the same time it must be stated that the omission of all mention of several vital points materially detracts from the value of the results obtained: no information is given, for instance, as to the age of the tree experimented upon, the time of year at which it was felled, or the nature of its habitat, whether rocky or swampy, sandy or argillaceous, &c.; yet these and other points are of great importance in determining the average strength of any timber. It was intended to carry out a copious series of experiments with the chief New Zealand woods, in which these matters would have received proper attention, and to accompany the statement of results with drawings of the structure of each kind as shown under the microscope; but this has been frustrated for the present by the abolition of the Forestry Department.

Most of the drawings were made by draughtsmen of the Survey Department, and a few by Mr. D. Blair and Mr. A. Hamilton. The whole of the plates were printed at the Government Lithographing Establishment under the direction of Mr. A. Barron, and the letter-press at the Government Printing Office.

It has been deemed advisable to include drawings of a few small species of Coniferæ on account of their interesting character, although they possess but little economic value.

As it was intended that the work should be published in parts no attempt was made to arrange the species in systematic order; but a synopsis of the characters of the orders and genera included in this work is presented in the Appendix, together with a Glossary of Derivations and another of Botanical Terms.

Owing to many of the plates having been drawn during the absence of the author from Wellington a few slight errors have crept into the work, but happily they are not of sufficient importance to cause inconvenience.

I have to express my thanks to numerous correspondents who have rendered assistance in supplying recent specimens or furnishing special information during the progress of this work, and would specially mention the names of Mr. Justice Gillies, Mr. J. D. Enys, F.G.S., Mr. J. Buchanan, F.L.S., Mr. T. F. Cheeseman, F.L.S., Mr. R. Helms, Mr. W. Colenso, F.R.S., Mr. C. Traill, and the Ven. Archdeacon W. L. Williams.

January, 1889.

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Olearia avicenniæfolia, <i>Hook. f.</i>	CXI.
Myrtus pedunculata, <i>Hook. f.</i>	CXII.
Aristotelia racemosa, <i>Hook. f.</i>	CXIII.
Olearia Cunninghamii, <i>Hook. f.</i>	CXIV.
Podocarpus Totara, <i>A. Cunningham</i>	CXV.
Senecio rotundifolius, <i>Hook. f.</i>	CXVI.
Leptospermum scoparium, <i>Forster</i>	CXVII.
Metrosideros tomentosa, <i>A. Cunningham</i>	CXVIII.
Metrosideros polymorpha, <i>Forster</i>	CXIX.
Veronica salicifolia, <i>Forster</i> , var. <i>gracilis</i>	CXX.
Meryta Sinclairii, <i>Hook. f.</i>	CXXI.
Eugenia Maire, <i>A. Cunningham</i>	CXXII.
Dracophyllum latifolium, <i>A. Cunningham</i>	CXXIII.
Myoporum lætum, <i>Forster</i>	CXXIV.
Quintinia serrata, <i>A. Cunningham</i>	CXXV.
Beilschmiedia Tawa, <i>Bentham and Hook. f.</i>	CXXVI.
Metrosideros florida, <i>Smith</i>	CXXVII.
Metrosideros robusta, <i>A. Cunningham</i>	CXXVIII.
Ascarina lucida, <i>Hook. f.</i>	CXXIX.
Avicennia officinalis, <i>Linné</i>	CXXX.
Myrtus bullata, <i>Banks and Solander</i>	CXXXI.

	Plate
Coprosma arborea, <i>T. Kirk</i>	CXXXII.
Sideroxylon costatum, <i>Bentham and Hook. f.</i>	CXXXIII.
Plagianthus <i>Lyallii, Hook. f.</i>	CXXXIV.
Fagus apiculata, <i>Colenso</i>	CXXXV.
Discaria Toumatou, <i>Raoul</i>	CXXXVI.
Olearia Forsteri, <i>Hook. f.</i>	CXXXVII.
Olearia angustifolia, <i>Hook. f.</i>	CXXXVIII.
Coriaria ruscifolia, <i>Linné</i>	CXXXIX.
Pisonia Brunoniana, <i>Endlicher</i>	CXL.
Cordyline australis, <i>Hook. f.</i>	CXLI.
Olearia Traillii, <i>Kirk</i>	CXLII.



Horopito.
(DRIMYS AXILLARIS).



Horopito.
 (DRIMYS AXILLARIS).
 Var. *Colorata*.

DRIMYS AXILLARIS, Forster.

THE HOROPITO.

ORDER—MAGNOLIACEÆ.

(Plates I. and II.)

THE horopito, or pepper-tree of the settlers, is an ornamental shrub or small tree occurring in woods, on the margin of which it is sometimes found in great abundance. It attains a maximum height of nearly 30ft., but is frequently reduced to a much-branched shrub, and is characterized by black bark, green glossy foliage, and a profusion of small yellowish-green flowers, which are succeeded by bright crimson fruit.

In the variety *colorata* the leaves are smaller, paler in colour, and blotched with red. The attractiveness of the plant is increased by the lower surface of the leaves being usually of a faint bluish-green tint, sometimes approaching white.

The plant commences to flower during the month of October, and continues in a flowering state until the middle or close of December. The fruit ripens in March and April.

The specific name "axillaris" is derived from the flowers being developed in the axils of the leaves.

This species is of easy cultivation, and, from its ornamental appearance, should find a place in every shrubbery.

One species of this genus—*D. Winteri*—yields the Winter's bark of the druggist. It was discovered in Magellan Straits in 1578 by Captain Winter, commander of the "Elizabeth," belonging to the fleet of Sir Francis Drake. The bark was steeped in honey to remove its acridity, and proved a valuable remedy for scurvy on the voyage home.

PROPERTIES AND USES.

Although very ornamental, the wood of the horopito is of small dimensions, as the trunk rarely exceeds 8in. in diameter; it is of a reddish colour, with pale markings. It is used by cabinet-makers chiefly for inlaying. The wood of the variety is usually of a paler tint than that of the type. Unfortunately, the demand is limited and intermittent, so that the wood is rarely placed on the market. It is not durable when exposed. The leaves and bark are aromatic and pungent; the former are occasionally used by settlers suffering from diarrhœic complaints.

DISTRIBUTION OF THE GENUS.

In addition to the present species, four others are included in *Drimys*: two of these are found in Australia, one in Borneo, and one in America, extending from Cape Horn to Mexico.

DISTRIBUTION OF THE SPECIES.

Drimys axillaris is restricted to New Zealand, and extends from the North Cape to Stewart Island; but the distribution of the variety *colorata* differs from

that of the type: the former is essentially a northern plant, the latter essentially southern. The type does not occur south of Banks Peninsula, unless, possibly, on the West Coast. The variety does not occur north of Ohinemutu; it is found in great profusion on Stewart Island. Both forms ascend from sea-level to 2,500ft. On the hills around Wellington they overlap at about 1,500ft.; the type descends to the sea-level throughout its area, the variety in the South Island only.

DESCRIPTION.

Drimys axillaris, Forster.

D. axillaris, Forst., Hook., Icones Plantarum, t. DLXXVI.

Wintera axillaris, Forst., Prodrömus.

A shrub or small tree with black bark; leaves alternate, shortly stalked, elliptic-ovate or lanceolate, obtuse, entire, coriaceous, 1in.—4in. long, $\frac{3}{4}$ in.—2in. wide, usually glaucous beneath. Flowers perfect, or unisexual, solitary or in fascicles in the axils of the leaves or of leaf-scars; pedicels from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. long; calyx, two- to four-lobed; petals, five or six, linear; stamens, about ten, in three series with short flattened filaments; carpels, four or five. Fruit of three or four carpels, each containing several seeds.

Variety *colorata*.

D. colorata, Raoul, Choix de Plantes de la Nouvelle-Zélande, t. XXIII.

Leaves usually smaller, more coriaceous, blotched with red. Flowers smaller; calyx saucer-shaped, often quite entire, with rarely more than two carpels ripening into fruit.

Mr. Colenso and Mr. Buchanan are of opinion that this plant should be considered a distinct species, but the characters stated above pass into those of the typical form by almost imperceptible gradations.

The typical form varies considerably in the texture of its leaves, which are often membranous and green on both surfaces. In the variety the leaves are invariably glaucous beneath, and many of the flowers are abortive.

EXPLANATION OF PLATES I. AND II.

I. *Drimys axillaris*, Forst., natural size. 2. Bud. 3. Perfect flower. 4. Carpels after the stamens have fallen. All more or less enlarged.

II. *Drimys axillaris*, Forst., var. *colorata*, natural size. 2. Bud. 3. Perfect flower. 4. Carpels. All enlarged.



Mahoe.
(MELICYTUS RAMIFLORUS)

MELICYTUS RAMIFLORUS, Forster.

THE MAHOE.

ORDER—VIOLARIEÆ.

(Plate III.)

THIS tree is called by the natives mahoe in the North, hinahina in the South. It was discovered during Cook's first voyage by Banks and Solander, who gave it the manuscript name of *Tachites umbellulifera*. During Cook's second voyage it was rediscovered by Forster, and subsequently described under the name by which it is now generally known.

Frequently it is little more than a shrub or even a small bush, but trees to 30ft. high with trunks from 12in. to 20in. in diameter are common; specimens of still larger dimensions are occasionally observed. The head is small and very dense, owing to the vast development of short branchlets, which are of an extremely brittle character. In mountain forests it frequently forms a large portion of the undergrowth; but in situations of this kind the trunk divides at the base into a number of naked spreading arms, which fill a large space, and present an imposing appearance not frequently observed in lowland forests. The leaves vary in shape: one tree may have all obtuse, while another in its vicinity may have every leaf acute. Obtuse and acute leaves may be found on the same branch.

DISTRIBUTION OF THE GENUS.

Melicytus comprises four species, all restricted to New Zealand, except *M. robustus*, which extends to Norfolk Island.

DISTRIBUTION OF THE SPECIES.

Melicytus ramiflorus is common in woods from the North Cape to the Bluff, and is also reported from Stewart Island by Mr. D. Petrie, but has not been collected by other collectors, so that it is evidently rare in that locality. Its range extends from sea-level to 2,800ft. or higher.

PROPERTIES AND USES.

The foliage is eaten by cattle and horses, and is often of great value to settlers during dry seasons.

The wood is of a pale-brown colour and very brittle, but is not of an ornamental character.

Its chief value is for the production of charcoal for certain kinds of gunpowder, for which purpose it has been largely employed at the Owake Mills. It is also used for firewood, and occasionally for inlaying.

DESCRIPTION.

Melicytus ramiflorus, Forster.

A shrub or small tree 20ft. to 30ft. high. Leaves alternate, 3in. to 5in. long, carried on slender petioles; oblong-lanceolate or lanceolate, obtuse or



Mahoe.
(MELICYTUS RAMIFLORUS)

MELICYTUS RAMIFLORUS, Forster.

THE MAHOE.

ORDER—VIOLARIEÆ.

(Plate III.)

THIS tree is called by the natives mahoe in the North, hinahina in the South. It was discovered during Cook's first voyage by Banks and Solander, who gave it the manuscript name of *Tachites umbellulifera*. During Cook's second voyage it was rediscovered by Forster, and subsequently described under the name by which it is now generally known.

Frequently it is little more than a shrub or even a small bush, but trees 25ft. to 30ft. high with trunks from 12in. to 20in. in diameter are common; specimens of still larger dimensions are occasionally observed. The head is rounded and very dense, owing to the vast development of short branchlets, which are of an extremely brittle character. In mountain forests it frequently forms a large portion of the undergrowth; but in situations of this kind the trunk usually divides at the base into a number of naked spreading arms, which cover a large space, and present an imposing appearance not frequently exhibited in lowland forests. The leaves vary in shape: one tree may have all the leaves obtuse, while another in its vicinity may have every leaf acute. Sometimes obtuse and acute leaves may be found on the same branch.

DISTRIBUTION OF THE GENUS.

Melicytus comprises four species, all restricted to New Zealand, except *M. ramiflorus*, which extends to Norfolk Island.

DISTRIBUTION OF THE SPECIES.

M. ramiflorus is common in woods from the North Cape to the Bluff, and has been reported from Stewart Island by Mr. D. Petrie, but has not been observed by other collectors, so that it is evidently rare in that locality.

It ranges from sea-level to 2,800ft. or higher.

PROPERTIES AND USES.

The foliage is eaten by cattle and horses, and is often of great value to settlers during dry seasons.

The wood is of a pale-brown colour and very brittle, but is not of an ornamental character.

Its chief value is for the production of charcoal for certain kinds of gunpowder, for which purpose it has been largely employed at the Owake Mills. It is also used for firewood, and occasionally for inlaying.

DESCRIPTION.

Melicytus ramiflorus, Forster.

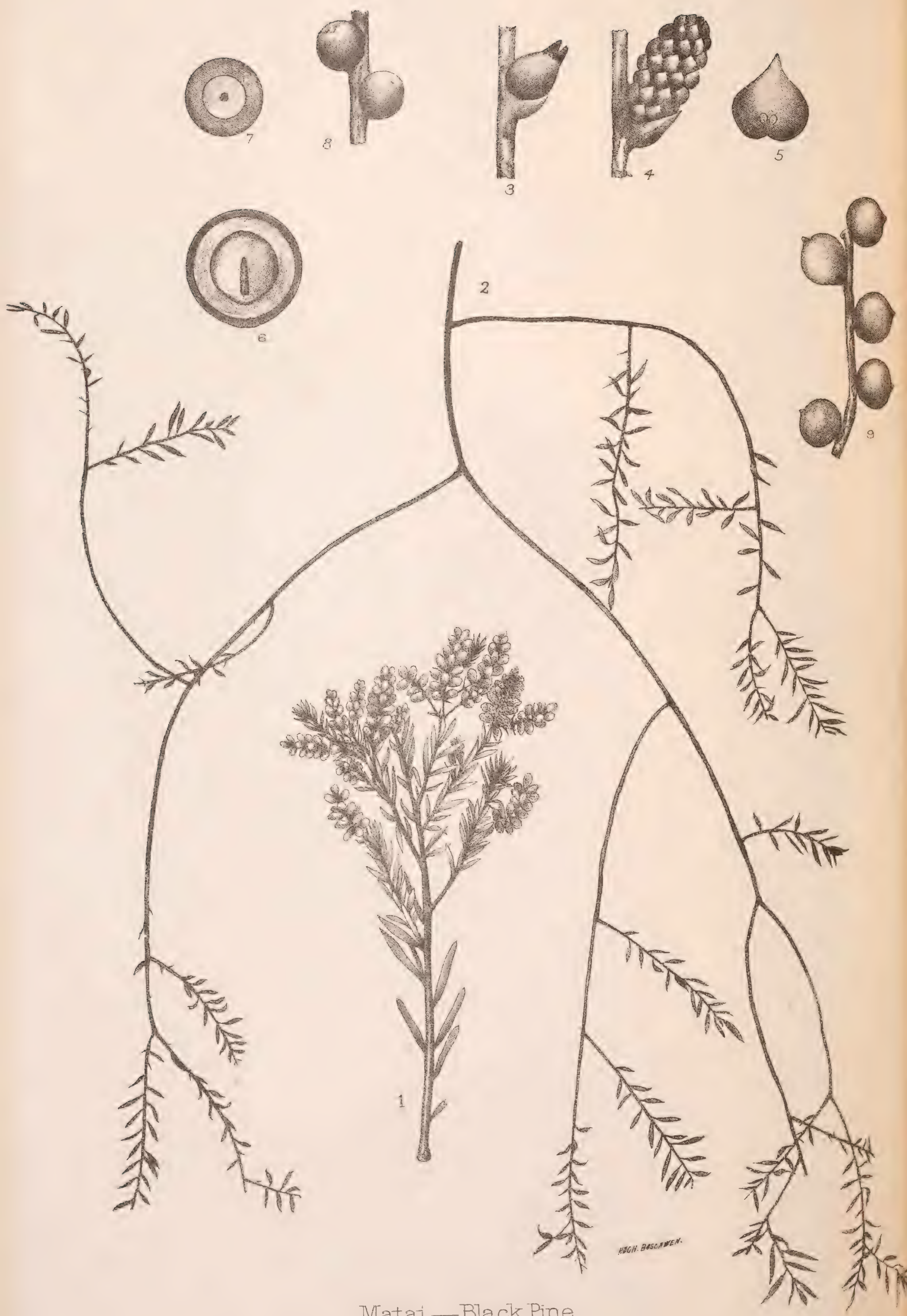
A shrub or small tree 20ft. to 30ft. high. Leaves alternate, 3in. to 5in. long, carried on slender petioles; oblong-lanceolate or lanceolate, obtuse or

suddenly narrowed to a sharp point at the apex; margins cut into small obtuse teeth. Male and female flowers on different trees, arranged in small fascicles in the axils of the leaves or on the naked branchlets. Flower-stalks rarely exceeding $\frac{1}{2}$ in. in length, each with two minute bracts. Flowers: calyx-teeth, five, minute; petals, five; male, anthers five, sessile, obtuse; female, stigma five- to six-lobed. Fruit: a one-celled berry; violet-coloured, $\frac{1}{3}$ in. diameter; seeds angular, black.

The flowers are produced from November to January.

EXPLANATION OF PLATE III.

Melicytus ramiflorus, Forst. Female specimen in the flowering stage, natural size. 1. Female flower, enlarged. 2. Male flower, enlarged. 3. Fruit, natural size. 4. Fruit enlarged to show the bracteoles on the peduncle.



Matai — Black Pine.
(*PODOCARPUS SPICATA*).



Matai — Black Pine.
(*PODOCARPUS SPICATA*).
With female flowers.

T. KIRK, DIRECTOR.

SURVEY DEP. LITHO. 1222

PODOCARPUS SPICATA, R. Brown.

THE MATAI.

ORDER—CONIFERÆ.

TRIBE—PODOCARPEÆ.

(Plates IV. and V.)

THE matai is commonly termed "black-pine" by the settlers except in the Nelson District, where it is known as "red-pine," a name applied to the rimu (*Dacrydium cupressinum*) in other parts of the colony. It was originally discovered by Banks and Solander, who gave it the manuscript name of *Dacrydium taxifolium*, and was described by Robert Brown in Horsfield's "Plantæ Javanicæ" under the name of *Podocarpus spicata*, being subsequently figured by Sir William Hooker in "Icones Plantarum" in 1843, t. DXLIII. It belongs to the section *Stachycarpus* of Bentham and Hooker, characterized by the flowers being arranged in spikes.

It must be admitted that at first sight the matai does not agree with the popular idea of a coniferous tree: instead of a cone of woody bracts arranged in a spiral manner to protect a large number of winged seeds, its fruit is fleshy, resembling a small plum in structure, and contains but a single seed: its leaves are flat instead of being needle-shaped, solitary instead of being produced in fascicles of two, three, or five; they are arranged in two rows, one on each side of the branchlet, instead of forming a series of spirals; lastly, the cotyledons, the first leaves produced by the germinating seed, instead of being numerous, are two in number, as in ash or elm. It exhibits, however, the essential character of the order in the structure of the leaves and wood, and in the naked ovule (or seed-bud); also in fertilisation being effected by the direct access of the pollen-grains to the nucleus of the ovule.

The matai attains a maximum height of 80ft., with a trunk but rarely exceeding 3ft. in diameter; larger specimens are occasionally met with. As with many other of the New Zealand trees there is a singular difference between the early and mature stages: young trees from 10ft. to 20ft. high exhibit crowded, slender, pendulous branches, ramifying into innumerable branchlets, the small narrow leaves, which are of a bronzed tint, being confined to the extremities; in this stage it is a weeping tree of most remarkable appearance, and differs so widely from the mature state that both Natives and settlers have assured me that it is a different tree, of which neither flowers nor fruit have been discovered! Young trees from 10ft. to 20ft. high may always be found having the pendulous branches with brown leaves developed on the lower part of the stems, and ordinary erect branches with green leaves above.

In the mature state the matai forms a round-headed tree, with erect branches, ultimately developing a vast number of short, strict, close-set branchlets. The leaves rarely exceed $\frac{1}{2}$ in. in length; they are green above and whitish beneath. Both the male and female flowers are arranged in spikes, and are produced from

the middle of October in the North to the close of December in the South. The fruit is small and black; it arrives at maturity in March and April: in favourable seasons it is produced in great abundance.

DISTRIBUTION OF THE GENUS.

Podocarpus comprises about sixty-three species, and finds its northern limit in Japan, extending southward to New Zealand. No species is found in Europe. Four species are found in Australia, and seven in New Zealand. All the New Zealand species are confined to the colony, and one is restricted to mountain districts of the South Island.

DISTRIBUTION OF THE SPECIES.

Podocarpus spicata is distributed throughout the colony, but is extremely rare on Stewart Island, where I observed a solitary specimen growing on the southern side of Half-moon Bay. It ascends from sea-level to 1,800ft. It is most plentiful in the central portions of the North Island and in the western and south-western parts of the South Island.

PROPERTIES AND USES.

The matai affords a timber of great value on account of its smooth even texture, strength, and durability; it is heavy and close-grained, but is easily worked; its colour varies from a light to a full deep brown. Its rate of growth is the slowest of all New Zealand pines; from 50 to 80 concentric rings may be counted in a single inch, measured near the centre of the trunk. Mr. J. Buchanan mentions an instance in which he counted 88 rings to the inch.* Mr. Blair states the number to be 23.†

Its specific gravity varies from .572 to .792:‡ its weight per cubic foot varies from 34.97lb. to 49.36lb. according to Balfour. Mr. Blair states the weight at from 75.534lb. to 77.798lb. in the green state; when seasoned, 46.862lb. to 47.508lb.; and estimates the breaking weight at 384.03lb. for a piece 2ft. long and 1in. square, supported at each end and loaded in the centre.||

It has been applied to a great variety of uses, amongst which may be mentioned bridges and constructive works generally, house-blocks, framing, joisting, weatherboards and flooring, railway-sleepers, bridge-piles, bedplates for heavy machinery, and occasionally for millwrights' purposes. For the floors of churches, schools, public halls, ballrooms, theatres, skating-rinks, &c., it is the best of our native timbers, although on account of its hardness it cannot be laid so quickly as kauri or white-pine.

Its general durability is so well known that it is almost superfluous to mention special instances. One or two, however, may be given. Trees that have been lying in the forest for protracted periods may often be found perfectly sound. Mr. Buchanan gives an account of a matai which was found prostrate in the bush, and over which three broadleaf trees (*Griselinia littoralis*) had grown, enfolding it in their roots; on felling these trees it was found that they were upwards of three hundred years old, but the matai was perfectly sound and was split up for fencing-posts.§ Mr. Blair¶ states that a matai which had been prostrate in Waikiwi forest from "time immemorial" had a fuchsia with a trunk

* Trans. N.Z. Institute, Vol. IX., p. 182.

† Blair's "Building Materials of Otago," p. 223.

‡ Balfour: "Results of Experiments on New Zealand Woods." Some doubt attaches to the lowest figures.

|| Blair's "Building Materials of Otago," pp. 224, 225.

§ Trans. N.Z. Institute, Vol. IX., p. 182.

¶ Blair's "Building Materials of Otago," p. 176.

gin. in diameter growing across it. Used for weatherboarding and similar purposes, it is found in good sound condition after twenty-eight years, with every appearance of enduring for an indefinite period. House-blocks, fencing-posts, and piles are found in excellent condition after being down from fifteen to twenty years or longer. I found sleepers on the Taupiri tramway with the heart perfectly sound after having been in use nine years, which is the more remarkable on account of their having evidently been taken from young trees. I believe that, so far as data are available, this exceeds the average life of a totara sleeper.

The general opinion respecting the durability of matai is not unanimous. It was formerly in demand for railway sleepers, but other timbers are now preferred. Although I have heard no reason stated, there can be but little doubt that the fraudulent substitution of miro by contractors, a very common practice, has been the chief cause of matai falling into disrepute: and it must also be stated that the lowland matai of the North Island is not equal in durability to that of hilly districts, or of the South Island generally; but the instance of the durability of matai sleepers in the Waikato district given above shows that even in the North Island it must be of great value under trying circumstances.

The bark is occasionally used by the tanner, but only to a small extent.

The proportion of sapwood in mature trees is usually small and well defined. Matai is occasionally liable to heart-shakes, but they are rarely serious. When shakes occur the watery portion of the sap accumulates in the cavities in large quantities, and during the growing season forms a refreshing beverage for the thirsty bushman, who frequently taps an old tree to procure it. It is rarely obtained in quantity from young trees, and in very old trees has a sour, acrid, and unpleasant flavour. When newly tapped on a hot day it is brisk and refreshing; but, like many other beverages, speedily becomes "flat" when exposed to the air.

DESCRIPTION.

Podocarpus spicata, R. Brown.

A tree from 40ft. to 80ft. high or more; branches pendulous in the young state, and leaves of a bronzed hue: in the mature state, leaves arranged in two rows, green on the upper surface and glaucous beneath; rarely exceeding $\frac{1}{2}$ in. in length, narrow linear, often with a minute point at the apex. Male and female flowers arranged in short spikes on separate trees. Male catkins ovoid, numerous. Female three to six on a spike. Fruit a drupe, $\frac{1}{3}$ in. in diameter; globular, sessile.

The flowers are produced during November and December; the fruit ripens in March.

EXPLANATION OF PLATES IV. AND V.

IV. *Podocarpus spicata*, R. Brown. 1. Specimen with male flowers, natural size. 2. Pendulous branch of young plant, natural size. 3. Female flower, enlarged. 4. Male catkin, enlarged. 5. Scale from do., enlarged. 6 and 7. Longitudinal and transverse section of young fruit, enlarged. 8. Immature fruit, enlarged. 9. Spike of ripe fruit, natural size.

V. *Podocarpus spicata*, R. Brown. Specimen with female flowers, natural size.





Ianekaha.
 (PHYLLOCLADUS TRICHOMANOIDES).
 1. Young plant.
 2. Mature state with fruit

[KIRK, DIREXIT

SURVEY DEP'T LINDO 1885



Tanekaha.
 (PHYLLOCLADUS TRICHOMANOIDES)

PHYLLOCLADUS TRICHOMANOIDES, Don.

THE TANEKAHA.

ORDER—CONIFERÆ.

(Plates VI. and VII.)

THE tanekaha is one of the remarkable "celery-topped pines," and was discovered by Banks and Solander during Cook's first voyage. Its general aspect is equally striking and beautiful, so that it is one of the first trees to attract the attention of travellers in the forests of the Auckland District, where it is abundant.

The tanekaha attains the height of from 60ft. to 70ft., with a trunk from 1ft. to 3ft. in diameter, and a smooth dark-grey or blackish bark; in the early stages of the plant the branches are produced in whorls. The true leaves are of two kinds, one resembling minute scales produced near the tips of branches; the second, narrow linear, $\frac{3}{4}$ in. in length, are only found on the stems of seedlings and soon fall away. On older branches they are represented by phyllodia, which are somewhat fan-shaped and entire or lobed, or pinnate. The male flowers are produced in catkins on the tips of the branches; the female flowers are borne on the margins of the phyllodia, which are often reduced to peduncles.

DISTRIBUTION OF THE GENUS.

Three species are found in New Zealand, a fourth in Tasmania and New Caledonia, while a fifth is restricted to the lofty mountains of Borneo.

DISTRIBUTION OF THE SPECIES.

P. trichomanoides is endemic in New Zealand, and is restricted to Auckland and Hawke's Bay Districts in the North Island, and to Nelson and Marlborough in the South Island. It is most abundant and attains its largest dimensions in the forests north of Waikato.

It ranges from the sea-level to 2,500ft.

PROPERTIES AND USES.

The tanekaha is a straight-growing tree, and rarely produces large branches; the logs are consequently sound, straight in the grain, and almost free from defects of any kind. The timber is of great strength, white, dense, and heavy, presenting a considerable resemblance to the best crown memel of Europe, with the advantage of being somewhat finer in the grain. It possesses the valuable quality of shrinking to an inappreciable extent when used without being fully seasoned.

A red dye was formerly extracted from the bark by the Maoris.

A difference of opinion exists as to its absolute durability; it is not possible to determine the point satisfactorily at present, but there is evidence to prove that it is a timber of great value. Squared piles driven in the Waikato coal-mines showed the heart perfectly sound after being down nine years, although the sappy edges had decayed. Tramway sleepers were sound after being in use for five years. Mine-props, struts, and caps were sound after being in use for six years. In 1873 I was informed that watertanks constructed of this timber at the Bay of Islands were sound after being used for eighteen years. Recently I was assured that one or two houses in the same district in which tanekaha was

used for the weatherboards and flooring were in sound and good condition after being erected over forty years. I have had no opportunity of testing these statements, but see no reason to doubt them.

A quantity of railway-sleepers split at the commencement of the Auckland and Drury Railway in 1865 were stacked on the line at Papakura, where they remained, in consequence of the discontinuance of the works, till 1873, when the stacks were taken down. The bottom layer of one of the stacks consisted of tanekaha sleepers which had been placed directly on the ground, and, although in this trying position for eight years, had remained perfectly sound, with the exception of some small patches of sap which had decayed without affecting the heartwood.

It has been extensively used on the Thames Goldfield and in the Waikato coal-mines for sleepers, mine-props, struts, caps, piles, &c., also for marine piles, railway-sleepers, and occasionally for building purposes.

In addition to the uses already enumerated, the timber appears to be especially suitable for planking for bridges, wharves, and jetties, for beams and flooring for warehouses, and for the manufacture of threshing-machines and other agricultural implements in which wood is employed.

The young plants may often be found by thousands, forming slender rods from 3ft. to 5ft. long, with numerous whorls of slender branches. In this stage they would find ready sale in the London market for walking-sticks, stocks for gig-whips, &c., if they could be supplied at a moderate price. Bushmen occasionally manufacture handsome mottled walking-sticks from this tree by taking a fresh sapling and striking the bark at close intervals with any blunt-edged instrument, such as the back of a table-knife. Owing to the dyeing properties contained in the bark the white wood becomes permanently mottled with clouded brownish markings.

The bark contains from 23 to 28 per cent. of tannin, and is therefore highly valued by the tanner. It possesses a special value as an organic mordant in the preparation of basils for kid-gloves, and has realised from £30 to £50 per ton in London for this purpose; but the demand is intermittent, as it is dependent on the caprice of fashion with regard to particular shades of colour.

DESCRIPTION.

Phyllocladus trichomanoides, Don.

P. trichomanoides, Don., Hook., *Icones Plantarum*, t. 549, 550, 551.

A monœcious tree 60ft. high or more; trunk 1ft.—3ft. in diameter; branches whorled, branchlets slender; young leaves $\frac{3}{8}$ in. long, narrow linear, crowded; phyllodia, developed on each side of a short branchlet, coriaceous, fan-shaped, obliquely rhomboid, lobed or toothed. Flowers: Male catkins in terminal clusters of from five to ten, shortly pedicelled; female, solitary on the margins of the phyllodes, which are often reduced to mere peduncles; one-flowered, consisting of a naked ovule with a membranous cup-shaped envelope at the base, seated in a deep cup formed by two united fleshy scales; nut compressed.

The flowers are produced in October.

EXPLANATION OF PLATES VI. AND VII.

VI. *Phyllocladus trichomanoides*, Don. 1. Young plant, natural size. 2. Fruiting branch of a mature plant, natural size.

VII. *Phyllocladus trichomanoides*, Don. Flowering branch, natural size. 1. Male catkin. 2. Lower surface of scale. 3. Upper surface of scale. 4. Female flowers. 5. Young fruits. 6. Mature fruits. 7. Ovule. 8. Longitudinal section of ovule. 9. Nut detached from its cup, showing the membranous envelope at its base. 10. Longitudinal section of nut. All magnified.



Tainui.
(POMADERRIS APETALA).

POMADERRIS APETALA, Vahl.

THE TAINUI.

ORDER—RHAMNEÆ.

(Plate VIII.)

THE tainui of the Maoris is a comparatively recent addition to our flora, having been discovered by Sir James Hector, Director of the Geological Survey Department, near the south head of the Mokau River in December, 1878, when it was described by him as a new species under the name of *Pomaderris tainui*.*

It is of special interest on account of its legendary character: the Natives state that its habitat near the Mokau River is the site of the camp pitched by their ancestor on first landing in New Zealand, and that the plant itself originated from the rollers, or skids, and the green boughs that were brought as a flooring to the great canoe "Tainui." As, however, the genus *Pomaderris* is absolutely restricted to Australia and New Zealand, the legend, like many others, appears to be without foundation.

The tainui attains the extreme height of 20ft., with a trunk rarely exceeding 5in. or 6in. in diameter; sometimes much branched from the base, and invariably much branched above; bark smooth, brown; young branches densely clothed with white hairs. Leaves from 2in. to 3in. long, oblong-obtuse, shortly stalked, the upper surface wrinkled, under-surface clothed with appressed white hairs, veins prominent beneath. Flowers numerous, produced in rather large terminal panicles, and destitute of a corolla; the buds are clothed with dense white hairs, and the capsules are subsequently studded with small patches of white hairs.

PROPERTIES AND USES.

The wood is white, hard, and compact, adapted to the purposes of the turner; but, as the plant occurs in very limited quantity, it is not likely to be of economic value.

DISTRIBUTION OF THE GENUS.

Eastern and Southern Australia, and the North Island of New Zealand.

DISTRIBUTION OF THE SPECIES.

New South Wales, Victoria, Tasmania, and South Australia.

I was informed by Sergeant Gilbert, of the Armed Constabulary, that it occurred by the sea in Kawhia Harbour, in the Auckland District; also that he had observed a solitary plant growing near the sea between Kawhia and Mokau. The first-named habitat was confirmed by Mr. Jones, a settler at the Mokau. It covers fully an acre of ground between the Mokau and Mohakatina Rivers, Taranaki. Under cultivation this species is of rapid growth when the conditions are favourable, attaining the height of 12ft. in four years; after that its rate of growth is evidently slower. It is very common in some districts of Victoria, where it attains the same height as with us, and is known as "hazel."

* Trans. N.Z. Inst., xi., p. 428.



L. J. G. G. G.

Tainui.
(POMADERRIS APETALA).

POMADERRIS APETALA, Vahl.

THE TAINUI.

ORDER—RHAMNEÆ.

(Plate VIII.)

THE tainui of the Maoris is a comparatively recent addition to our flora, having been discovered by Sir James Hector, Director of the Geological Survey Department, near the south head of the Mokau River in December, 1878, when it was described by him as a new species under the name of *Pomaderris tainui*.*

It is of special interest on account of its legendary character: the Natives state that its habitat near the Mokau River is the site of the camp pitched by their ancestor on first landing in New Zealand, and that the plant itself originated from the rollers, or skids, and the green boughs that were brought as a flooring to the great canoe "Tainui." As, however, the genus *Pomaderris* is absolutely restricted to Australia and New Zealand, the legend, like many others, appears to be without foundation.

The tainui attains the extreme height of 20ft., with a trunk rarely exceeding 5in. or 6in. in diameter; sometimes much branched from the base, and invariably much branched above; bark smooth, brown; young branches densely clothed with white hairs. Leaves from 2in. to 3in. long, oblong-obtuse, shortly stalked, the upper surface wrinkled, under-surface clothed with appressed white hairs, veins prominent beneath. Flowers numerous, produced in rather large terminal panicles, and destitute of a corolla; the buds are clothed with dense white hairs, and the capsules are subsequently studded with small patches of white hairs.

PROPERTIES AND USES.

The wood is white, hard, and compact, adapted to the purposes of the turner; but, as the plant occurs in very limited quantity, it is not likely to be of economic value.

DISTRIBUTION OF THE GENUS.

Eastern and Southern Australia, and the North Island of New Zealand.

DISTRIBUTION OF THE SPECIES.

New South Wales, Victoria, Tasmania, and South Australia.

I was informed by Sergeant Gilbert, of the Armed Constabulary, that it occurred by the sea in Kawhia Harbour, in the Auckland District; also that he had observed a solitary plant growing near the sea between Kawhia and Mokau. The first-named habitat was confirmed by Mr. Jones, a settler at the Mokau. It covers fully an acre of ground between the Mokau and Mohakatina Rivers, Taranaki. Under cultivation this species is of rapid growth when the conditions are favourable, attaining the height of 12ft. in four years; after that its rate of growth is evidently slower. It is very common in some districts of Victoria, where it attains the same height as with us, and is known as "hazel."

* Trans. N.Z. Inst., xi., p. 428.

DESCRIPTION.

Pomaderris apetala, Vahl.

A shrub or small tree; branchlets and under-surface of leaves clothed with white stellate tomentum. Leaves alternate, petioled, obtuse, 3in.-4in. long, wrinkled above, with a few scattered stellate hairs, white beneath; ribs prominent; clothed with buff-coloured tomentum. Flowers small, numerous, in loose terminal panicles; buds tomentose. Calyx-tube short, clothed with stellate hairs. Petals, none; stamens, five. Anthers with a small gland at the apex. Style deeply divided; capsule obtuse, sparingly dotted with stellate hairs; cocci opening with a valve.

EXPLANATION OF PLATE VIII.

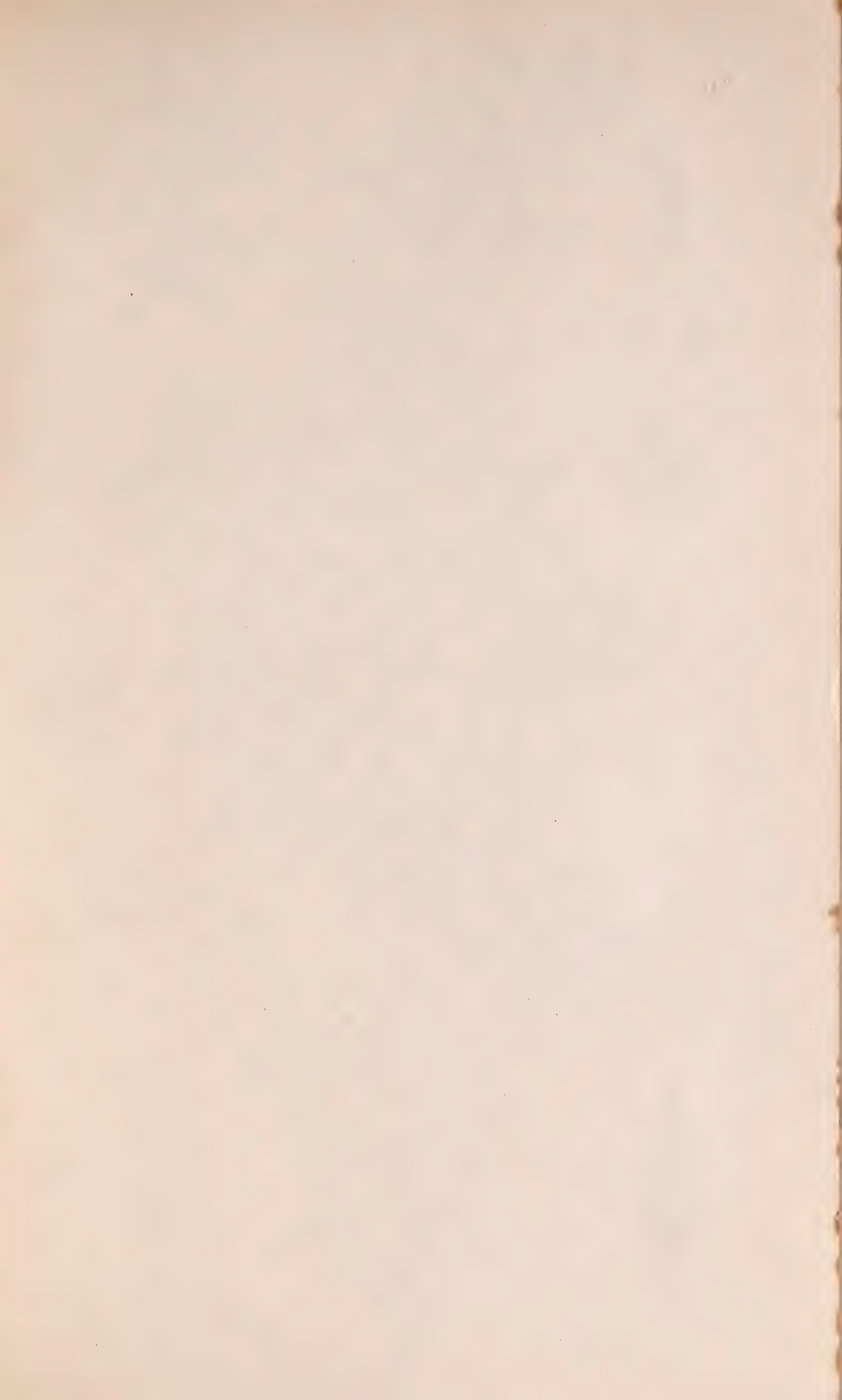
Pomaderris apetala, Vahl, natural size.

NOTE.—Since the preceding was written Major Gudgeon has, at my request, kindly forwarded recent specimens of the plant to the officer in command of the Armed Constabulary station at Kawhia, and instructed him to ascertain if the plant still exists in that locality. He reports that he can find no trace of it, although on showing the specimens to the chiefs Hone te One and Te Huki, and other old Natives, they recognised it as a plant which formerly grew between the present township and the mouth of the river, but was killed by goats, which were very numerous many years ago. They stated that it was termed "whariki" or "tainui," and that it grew from the "whariki" which was thrown out of the great canoe when it landed there. They state that the "Tainui" landed at Kawhia (not near the Mokau, as stated by the Natives living on that river), and point to two rough stones standing in a patch of manuka about a mile from the township, going towards the mouth of the river, which, according to their statement, mark the length of the canoe on the spot where it was hauled up and left to decay.



HUGH BOSCHWEN.

Dwarf Totara.
(*PODOCARPUS HALLII*).





Hall's Totara. (*Podocarpus Hallii*)

PODOCARPUS HALLII, n.s.

LARGE-LEAVED TOTARA.

ORDER—CONIFERÆ.

SECTION—PODOCARPEÆ.

Plates IX. and IXA.

UNTIL last year this tree was considered identical with *Podocarpus Totara*, its distinctive characters having escaped the notice of botanists, chiefly on account of the difficulty of procuring good specimens of the flowers and fruit for examination—a difficulty somewhat aggravated by the fact that in all the species of the genus the male and female flowers are produced on different trees. Hitherto it has been impossible to account for the difference in durability exhibited by totara from different localities in the same district, apparently of the same age, and grown under the same conditions of soil, aspect, and altitude; but the existence of two species closely resembling each other in external characters, yet differing in the quality of the timber, at once disposes of the greater portion of the difficulty.

Podocarpus Hallii, when fully developed, forms a large dioecious tree, sometimes 60ft. high, with a trunk from 2ft. to 3ft. in diameter, clothed with thin papery brown bark. In young plants the branches are slender and give off branchlets at right angles to the main axis; the leaves are arranged in two rows, and are frequently 1½in. in length. As the tree approaches maturity the branches and leaves become more erect, while the latter are arranged in several rows and densely crowded on the branchlets; they are invariably less than an inch in length: the mid-rib is prominent beneath.

The male flowers are developed in solitary catkins, which are shortly stalked, and produced in the axils of the leaves: when the anthers are fully developed the yellow tinge of the pollen attracts attention, but the female flowers are of the same hue as the leaves, and can only be found by close search. This species differs from the true totara in the thin papery bark, the larger leaves, and the pointed fruits.

The minute female flowers are produced in the axils of the leaves, and are of very simple structure. They are solitary and carried on short peduncles, each flower consisting of two carpellary leaves with an ovule attached near the apex of each or of one only. After fertilisation the ovule develops into a nut, which contains the seed. The carpellary leaves become swollen and pulpy, and at length assume a bright-red colour.

The existence of two kinds of totara, although now determined for the first time, has long been suspected. When investigating the botany of the Thames Goldfield in 1869 I collected specimens of the present plant, some of which I forwarded to Kew for examination; but, in the absence of flowers or fruit, it was not possible to separate them from the ordinary kind. But, in order to determine the question, Mr. J. W. Hall, of Shortland, obtained a few young plants of each form from the ranges, and cultivated them in his shrubbery:

neither species has produced flowers, but, owing to the peculiar habit of the larger leaves, the present species presents a very different appearance from the true *Podocarpus Totara*. Mr. Hall has contended for its specific distinction for the last ten or twelve years, and, as the characters derived from the fruit support his contention, I have great pleasure in attaching his name to the species. The Maoris on Stewart Island are the only Natives known to me who consider it distinct from the ordinary kind.

PROPERTIES AND USES.

Although not attaining the largest dimensions of *P. Totara*, specimens of *P. Hallii* may occasionally be found 60ft. high, with a trunk 4ft. in diameter; most frequently, however, the diameter of the trunk does not exceed 3ft. The timber is of a dull-red colour, close in the grain, and of firm texture. It is excellent for marine piles, as it resists the attacks of the teredo for a considerable period, although not absolutely proof against that destructive mollusc. It is largely employed for buildings of a superior class, and is extensively used in the construction of bridges, wharves, and other works of a similar character, but for these purposes it is not equal to *P. Totara*, being less durable when exposed: but, notwithstanding its lack of durability under certain conditions, it must be considered a timber of great value.

The bark is easily detached in large sheets, and is sometimes used for the roofing of temporary huts. The inner layers are used by the Maoris for packing mutton-birds.

On the little island of Ulva, in Paterson's Inlet, five ancient trees of this species, with trunks fully 4ft. in diameter, are still to be seen, although large portions of bark were removed from their trunks in all probability more than a century ago. I was assured that their existence was unknown to the present Natives until they were discovered by C. Traill, Esq., in 1870.

DISTRIBUTION OF THE SPECIES.

This species occurs in lowland situations from the Bay of Islands to the South Cape, and is frequently associated with *P. Totara*. Although plentiful in many localities in the North Island, it is more abundant in the South, especially on Stewart Island, where *P. Totara* has not been observed. It ascends from the sea level to 2,800ft. at Waimarino, in the centre of the North Island.

DESCRIPTION.

Podocarpus Hallii, T. Kirk.

A dioecious tree 60ft. high; trunk 2ft. to 4ft. in diameter, with thin reddish-brown papery bark; leaves of young plant 1in. to 1½in. long, lanceolate, two-ranked and spreading; in the mature tree ¾in. to 1in. long, in several series, close-set, erect, narrowed at the base into a very short flat petiole, mid-rib prominent beneath, tips pungent. Male flowers, catkins axillary, shortly stalked, with a four-leaved involucre at the base; connective obtuse. Female flowers solitary, axillary, shortly stalked; ovules one or two. Fruit: a nut seated on a fleshy red base; nut obtuse, abruptly narrowed at the apex, slightly furrowed when ripe.

EXPLANATION OF PLATES IX. AND IXA.

IX. *Podocarpus Hallii*, T. Kirk. Branchlets from a young tree, natural size.

IXA. *Podocarpus Hallii*, T. Kirk. Branchlet from a mature tree, natural size.

1. Male catkin, natural size.
- 2, 3. Front and back views of scales, enlarged.
4. Bracts at base of catkin, enlarged.
5. Immature fruits, natural size.
6. Immature fruit, enlarged.



E. J. GRAY

Tangiao — *Litsea calycaris*.
(*Tetranthera calycaris*.)

LITSEA CALICARIS, Bentham and Hooker f.

THE MANGEAO.

ORDER—LAURINEÆ.

Plate X.

THE mangeao or tangeao, as it is termed indifferently by the Maoris, was discovered by Sir Joseph Banks and Dr. Solander during Cook's first voyage, and at a later date was described by Allan Cunningham under the name of *Laurus calicaris*; it is most generally known in the colony as *Tetranthera calicaris*, the name adopted by Sir Joseph Hooker in the original "Flora of New Zealand." The genus *Tetranthera* having been merged in *Litsea* by Bentham and Hooker f., the latter name is adopted in this work.

Litsea calicaris is an erect evergreen tree peculiar to the Auckland District, and attains from 30ft. to 40ft. in height, with a trunk 1½ft. to 2½ft. in diameter, clothed with brownish-grey bark, and giving off rather short branches, which form a small round head when growing under conditions which allow of their free development, but when growing in woods the trunk is nearly naked and the head very small.

The leaves are from 3in. to 4in. long, and at first of a delicate brown tint, which gradually passes into a dull green: their texture is thin, and firm, although not coriaceous: they are sometimes white or glaucous beneath. The male and female flowers are produced on separate trees, often in great profusion; their cream-coloured perianths render the tree somewhat conspicuous during the months of September and October.

PROPERTIES AND USES.

From experiments made in Sydney the specific gravity of this timber appears to be .621, and its weight per cubic foot 38.70lb.; it is white, firm, strong, and of great elasticity, and is suitable for a great variety of purposes requiring strength, toughness, and elasticity, with a light weight. From the earliest period of settlement it has been highly valued for coopers' ware and bullock-yokes, and for the last ten or twelve years has been extensively used in the manufacture of ships' blocks, for which it is esteemed superior to English ash. It is now largely employed for coach-panels, shafts, light felloes, and wheelwrights' bent-stuff generally; but for some time past the demand has exceeded the supply, which has led to the use of taraire as a substitute: a course which is not unlikely to bring mangeao into disrepute.

The mangeao is of exceptionally slow growth, but the delicate tints of its foliage when first expanded render it worthy of a place in all collections of ornamental trees.

DISTRIBUTION OF THE GENUS.

As now constituted *Litsea* includes about 140 species distributed through tropical and eastern Asia, the Malay Archipelago, Japan, Australia, New Caledonia, and North America. *L. calicaris* is the only species found in New Zealand.

DISTRIBUTION OF THE SPECIES.

Litsea calicaris is restricted to New Zealand, and is found only in the limited area between the North Cape and Rotorua, being often sparsely scattered or very local.

DESCRIPTION.

Litsea calicaris, Benth. and Hook. f.

Laurus calicaris, A. Cunn.

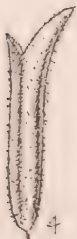
Tetranthera calicaris, Hook. f.

An erect diœcious evergreen tree, 30ft.-40ft. high; leaves alternate, 3in.-4in. long, on short stalks, ovate or oblong, sometimes abruptly narrowed towards the apex, obtuse, entire, smooth, green, or sometimes glaucous beneath. Flowers in small stalked umbels springing from the axils of the leaves. Involucral leaves four, broadly ovate, inflated; flowers, four to five, on short silky pedicels. Male flowers: Perianth of five ovate or linear-ovate leaves; stamens, twelve to fourteen; filaments with two shortly-stalked glands. Female flowers rather smaller; perianth leaves shorter, the central flower having the broadest leaves; style short; stigma with three small fan-shaped lobes; ovary one-celled. Berry ovoid, one-seeded, red.

The structure of the stamens is remarkable: the filament carries a pair of round glands on short curved pedicels; the anthers are basifixed, and the pollen is discharged through four round or oblong pores, two on each side. The female flowers have numerous short, flattened, abortive stamens, each with a pair of pedicellate glands as in the male.

EXPLANATION OF PLATE X.

Litsea calicaris, Benth. and Hook. f. Specimen showing male flowers, natural size. 1. Umbel of male flowers, front view. 2. Umbel of male flowers, back view. Both enlarged.



Hinau.
(ELEOCHARPUS DENTATUS)

ELÆOCARPUS DENTATUS, Vahl.

THE HINAU.

ORDER—TILIACEÆ.

(Plate XI.)

THE hinau grows to a height of from 40 to 60ft., with a trunk seldom exceeding 25ft. in length and from 1ft. to 3ft. in diameter, clothed with grey bark. In open places the tree forms a large, round, much-branched head; the branchlets are often naked except at the tips. The evergreen coriaceous leaves vary in shape from linear-oblong to lanceolate, and are clothed with white silky down beneath. The white pendulous flowers are produced in racemes, which spring from the axils of the lower leaves or from the naked parts of the branchlets, and develop purple fruits closely resembling small damsons in colour, form, and structure, but the stone is deeply furrowed. The ovary is two-celled, each cell containing four ovules, but during the process of maturation one cell is obliterated or nearly so, and all the ovules except one are absorbed, only a single seed being perfected.

PROPERTIES AND USES.

The timber is of a light dull brown colour; the heartwood darker, often nearly black in old specimens: it is tough, strong, and durable; as a general rule it is easily split. "Black hinau" is specially valued by settlers in the southern parts of the North Island on account of its great durability.

In the Auckland District this timber is almost entirely neglected; but elsewhere it is used for bridges, culverts, sleepers, piles, posts, rails, survey-pegs, and other purposes requiring durability, with the happiest results.

Usually the heartwood is sharply defined, and easily distinguished from the sap. Hinau burns with difficulty even when dry, and might therefore be advantageously employed for flooring and other purposes in situations where it is necessary to take special precautions against fire.

The bark is of great value for tanning purposes, as it contains over 20 per cent. of tannin; it is, however, rarely utilised. A black dye was obtained from the bark by the Natives, who also used the fruit for food.

DISTRIBUTION OF THE GENUS.

Elæocarpus comprises about fifty species, occurring in tropical Asia, the Pacific Islands, and Australia. Two species are found in New Zealand.

DISTRIBUTION OF THE SPECIES.

Elæocarpus dentatus occurs from the North Cape southwards to Catlin's River. It is more plentiful in the Wellington Provincial District than in other parts of the colony. In many districts it is but thinly scattered.

DESCRIPTION.

Elæocarpus dentatus, Vahl.

E. dentatus, Vahl. Hook., Icones Plantarum, t. 602.

E. Hinau, A. Cunn.

A round-headed tree; trunk rarely exceeding 3ft. in diameter. Leaves coriaceous, alternate, shortly stalked, 2in. to 3in. long, linear-oblong or lanceolate, or obovate; obtuse or acute, silky beneath, margins slightly serrate. Racemes silky, about eight- or ten-flowered; sepals five, linear, spreading; petals five, erect, margins toothed or lobed; stamens ten to twelve; filaments very short; anthers tetragonous, hispid, tipped with a short gland; anthers long, with a flat recurved tip. Ovary silky, two-celled; ovules four in each cell. Fruit a drupe $\frac{1}{2}$ in. to $\frac{3}{4}$ in. long, purple; stone furrowed.

The leaves of the young state are rather longer than those of the mature plant; much narrower and acute.

DESCRIPTION OF PLATE XI.

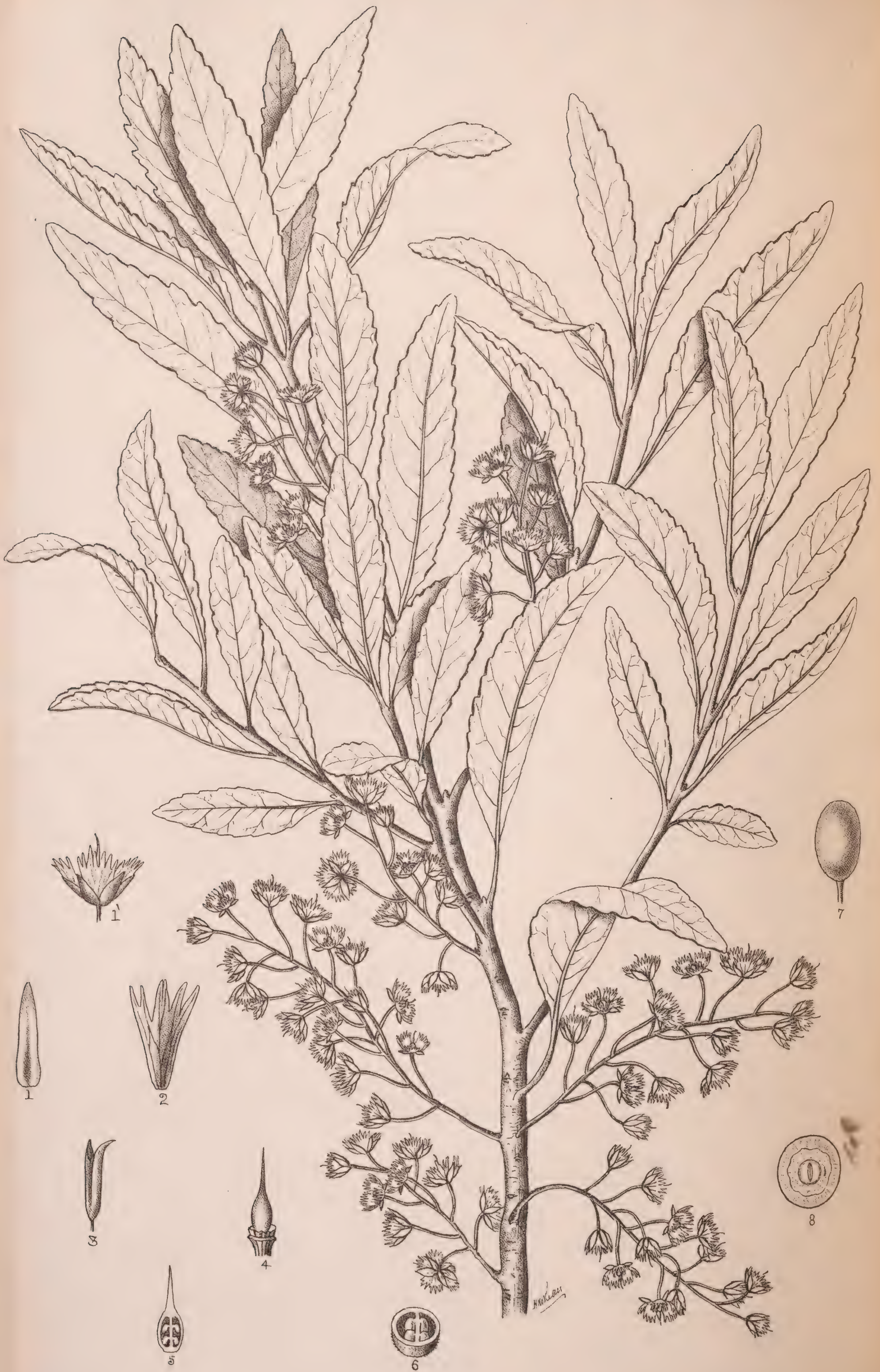
Elæocarpus dentatus, Vahl. Flowering specimen. 1. Sepal. 2. Petal. 3. Stamen. 4. Ovary and torus. 5. Longitudinal section of ovary. 6. Transverse section of ovary. 7. Fruit. 8. Longitudinal section of fruit. All except 7 more or less magnified.



J. H. JOHNSON

Pokaka.
(ELÆOCARPUS HOOKERIANUS).
Young state





Pokako.
(*ELÆOCARPUS HOOKERIANUS*)

ELÆOCARPUS HOOKERIANUS, Raoul.

THE POKAKA.

ORDER—TILIACEÆ.

(*Plates XII. and XIII.*)

IN some respects the pokaka bears considerable resemblance to the hinau, but may be readily distinguished on examination; it is usually of smaller dimensions, but often attains a height of over 50ft., with a trunk 3ft. in diameter and white bark. Its branches are less numerous and spreading than those of the hinau, and the head is much narrower, so that it has a more picturesque effect.

This tree presents widely different aspects at different stages of growth. In its young state the branches are tortuous and interlaced; the leaves are linear, waved, and deeply lobed. In the mature state the branches are straight, and the coriaceous leaves are uniform in shape, linear-oblong, sometimes very narrow, at other times elliptic. A curious feature is sometimes exhibited by old trees which develop branches bearing leaves characteristic of the young state, lobed or partially divided in such a way as to present some resemblance to the leaf of the English oak: occasionally numerous short branchlets, bearing curiously-lobed leaves, form a compact mass of irregular shape, causing the tree at a distance to present a singular appearance.

The flowers are developed in racemes, and are of a greenish-white colour, resembling those of the preceding species in form, but smaller and less attractive: the petals are more deeply cut into narrow obtuse lobes, and the ovary is also two-celled with four ovules in each cell. The ovoid fruit is one-seeded, and resembles a small plum. The drawing is taken from a narrow-leaved specimen collected at Catlin's River.

PROPERTIES AND USES.

The timber has been utilised only to a limited extent at present, although I am informed that it is occasionally converted at the Southland sawmills. It is of a whitish colour, tough, and compact, but lacks durability. It has been used in the construction of earth-wagons in Southland with satisfactory results, and is now used for railway sleepers after being impregnated with creosote. It might be advantageously used for inside work in house-building, more especially for beams, joists, rafters, &c., while its toughness and compactness render it available for brakes for wagons and coaches, also for the backs of brushes and similar purposes.

The bark has been tested by Mr. Kingsland, of Invercargill, for tanning purposes, and found to produce good firm leather; it contains 10 per cent. of tannin.

DISTRIBUTION OF THE SPECIES.

This species is restricted to New Zealand, and occurs from the North Cape district to Stewart Island. North of the Waitemata it is rare and local; in many cases only a solitary tree is to be found for miles. In the Lower Waikato

it is more plentiful, also in the Taupo district. It is most plentiful and attains its largest dimensions in the Southland district. It occurs at the sea-level, and ascends to fully 3,500ft. on the mountains of Canterbury.

DESCRIPTION.

Elæocarpus Hookerianus, Raoul.

An evergreen tree, 30ft. to 50ft. high, with white bark. In the young state with tortuous interlaced branches and narrow linear or lobed leaves: when mature with leaves shortly stalked, $1\frac{1}{2}$ in. to $2\frac{1}{2}$ in. long, entire, obtuse, linear-oblong or elliptic, coriaceous, with crenate margins. Racemes spreading, from ten- to fourteen-flowered; flowers drooping; sepals five, narrow-linear; petals erect, wedge-shaped, the upper margin divided into from three to six narrow-linear obtuse lobes; stamens ten to twelve, filaments very short, anthers tipped with a short gland. Ovary glabrous, two-celled, each cell containing two ovules. Fruit a drupe half an inch long, purple; nut rugose and furrowed.

EXPLANATION OF PLATES XII. AND XIII.

XII. *Elæocarpus Hookerianus*, Raoul. Young state, natural size.

XIII. *Elæocarpus Hookerianus*, Raoul. Flowering specimen, natural size.
1. Sepal. 2. Petal. 3. Stamen. 4. Ovary and torus. 5. Longitudinal section of ovary. 6. Transverse section of ovary. 7. Fruit. 8. Transverse section of fruit. All except 7 more or less magnified.





T. KIRK DIXIT.

Karo.
(PITTOSPORUM CRASSIFOLIUM)

SURVEY DEP. LITHO. 1885

PITTOSPORUM CRASSIFOLIUM, Banks and Solander.

THE KARO.

ORDER—PITTOSPOREÆ.

(Plate XIV.)

THE karo was discovered during Cook's first voyage by Banks and Solander, who gave it the name by which it is known to systematists. It is a handsome evergreen shrub or small tree, rarely more than 30ft. high, with a strict habit of growth, and is only found in littoral situations.

The bark is black, even in the young branches; the leaves are from 2in. to 3in. long, very coriaceous, quite entire, deep-green above and whitish beneath. The flowers are chocolate-coloured, carried on short slender stalks, springing from a common point, and forming clusters at the tips of the branches. The fruit is a pendulous capsule about the size of a small walnut, and consists of three or sometimes four valves; the black seeds are embedded in a viscid secretion.

The young branchlets, leaf-stalks, peduncles, and fruit are white with downy hairs.

The flowers are developed in September, and the fruit becomes mature the following February.

This species is of very easy cultivation.

PROPERTIES AND USES.

The wood is white and very tough; but so far as I am aware nothing is known as to its durability. It is frequently used for inlaying. It is difficult of combustion. In the North Island the tree is of great value for shelter, especially in places near the sea, as it resists the fiercest gales, and may be seen growing in places where it is exposed to the influence of the spray.

DISTRIBUTION OF THE GENUS.

Pittosporum comprises about fifty species, occurring in India, the Pacific Islands, Australia, New Zealand, and Africa. About nine species are found in Australia, and sixteen in New Zealand.

DISTRIBUTION OF THE SPECIES.

Pittosporum crassifolium is peculiar to New Zealand, and occupies a very limited area, being restricted to the coast-line between the North Cape and Poverty Bay, but is often very local. It occurs on most of the outlying islands, as well as on the islands in the estuary of the Thames.

DESCRIPTION.

Pittosporum crassifolium, Banks and Sol.

An erect shrub or small tree, 30ft. high; branches strict, ascending; bark black; the young branchlets, leaf-stalks, under-surface of leaves, peduncles, sepals, and fruit white with downy hairs. Leaves alternate, 2in. to 3in. long,

on short petioles, narrow obovate, obtuse, very coriaceous; margins recurved. Flowers in terminal three- to six-flowered umbels; pedicels slender. Sepals, five, linear; petals, five, recurved; stamens, five; carpels, three or four. Fruit, pendulous, nearly globose or slightly angled, $\frac{3}{4}$ in. to 1 in. in diameter; three- to four-valved.

Var. β. Peduncles erect in the ripe fruit.

I have seen this variety on the east side of the Little Barrier Island only.

EXPLANATION OF PLATE XIV.

Pittosporum crassifolium, Banks and Sol. Fruited specimen, natural size.
1. Flower. 2. Flower laid open to show stamens and pistil. 3. Pistil.
4. Dehiscing fruit. All more or less enlarged except 4.





Tipau.
(MYRSINE SALICINA).

MYRSINE SALICINA, Heward.

THE TORO.

ORDER—MYRSINÆ.

(Plate XV.)

THIS handsome tree was originally discovered by Allan Cunningham in the Bay of Islands district, and described in the "Flora Novæ Zelandiæ" under the name of *Suttonia salicina*, but in the "Handbook" it was placed under *Myrsine*, as suggested by Mr. R. Heward.

It attains the extreme height of 40ft., with a trunk 2ft. in diameter; the head is usually small, the branches being somewhat distant and ascending. The leaves are usually restricted to the tips of the branchlets, the lower part being naked; they are from 4in. to 6in. long, and rarely exceed half an inch in breadth; numerous pellucid oblong glands are imbedded in their substance. The flowers are whitish, and are produced in great profusion on the naked parts of the branchlets; they are succeeded by red fruits, which are fully half an inch in length.

This species prefers cool soils, and, although generally distributed within its limited area, never forms any large proportion of the forest. It is easily cultivated in cool soils.

DISTRIBUTION OF THE GENUS.

Myrsine contains about eighty species, the greater number being natives of tropical Asia, Africa, and America; a few are found in temperate countries, extending to Japan; four species occur in Australia, and six in New Zealand, the Chatham and Auckland Islands: one species is restricted to the Chatham Islands and Stewart Island.

DISTRIBUTION OF THE SPECIES.

Myrsine salicina occurs from the North Cape to the Awatere and Westland in the South Island. It ascends from the sea-level to 2,400ft.

PROPERTIES AND USES.

The timber is of a deep-red colour and beautifully marked, straight in the grain, and of great strength, but is not durable when in contact with the ground. It is used by the cabinetmaker, both in the solid and as veneers, and would be extensively employed if it were freely placed on the market. It makes good fencing-rails, and might be advantageously employed for chisel-handles, &c.; it is also suitable for rafters, beams, joists, and other inside work, and affords excellent firewood.

DESCRIPTION.

Myrsine salicina, Heward, MSS. Handbook of the N.Z. Flora.

Suttonia salicina, Hook. f., Fl. N.Z., i. 172, t. 44.

A glabrous tree, rarely exceeding 40ft. in height, with black bark. Leaves alternate, shortly petioled, linear-oblong, obtuse, 4in.—6in. long, $\frac{1}{2}$ in. to $\frac{2}{3}$ in. broad,

with numerous pellucid glands. Flowers close-set, in dense fascicles on the naked parts of the branchlets; pedicels $\frac{3}{4}$ in. in length; calyx five-lobed, lobes ciliated, corolla cleft nearly to the base; stamens with short filaments inserted on the corolla lobes; ovary one-celled. Fruit ovoid, red, $\frac{1}{2}$ in. long, two-seeded.

EXPLANATION OF PLATE XV.

Myrsine salicina, Heward, natural size. 1. Fascicle of flowers. 2. Flower. 3. Calyx. 4. Corolla laid open to show the stamens. 5. Ovary. 6. Young fruit. 7. Fruit. 8. Longitudinal section of fruit. 9. Transverse section of fruit. 10. Seed. All more or less enlarged except 6.

NOTE.—This species is sometimes erroneously called "tipau," but, Mr. Colenso informs me, that name is rightly applied to *M. Urvillei* alone.



Mapau.
(MYRSINE URVILLEI).
fruited branch

26

MYRSINE URVILLEI, A. DeCandolle.

THE MAPAU OR MAPOU.

ORDER—MYRSINÆ.

(Plate XVI.)

THE mapau is also known as the tipau and matipou; it is closely related to the preceding species, the toro, but is of lower stature, and presents a very different appearance. It is usually a small erect tree, from 12ft. to 20ft. high, with numerous short ascending branches, forming a narrow but compact head. The leaves are shortly stalked, and rarely exceed an inch and a half in length; they are dotted with round pellucid glands, and have waved or undulated margins; the general tint of the foliage is a pale reddish-brown, quite unlike any other native tree with leaves of a similar shape.

The small white flowers are produced in great profusion, and are succeeded by small globose black fruit.

This species often occurs in large quantity to the exclusion of other trees.

DISTRIBUTION OF THE SPECIES.

Myrsine Urvillei is restricted to New Zealand, where it is generally distributed, from the North Cape to Stewart Island, ranging from sea-level to 2,800ft.

PROPERTIES AND USES.

The wood of this species resembles that of the preceding in its marking, but is of a paler colour: it is applied to the same purposes, but is not so highly valued, although from its great abundance it is more generally used. It is of great strength, and considerable durability when not in contact with the ground. It is extensively used for firewood in many districts.

DESCRIPTION.

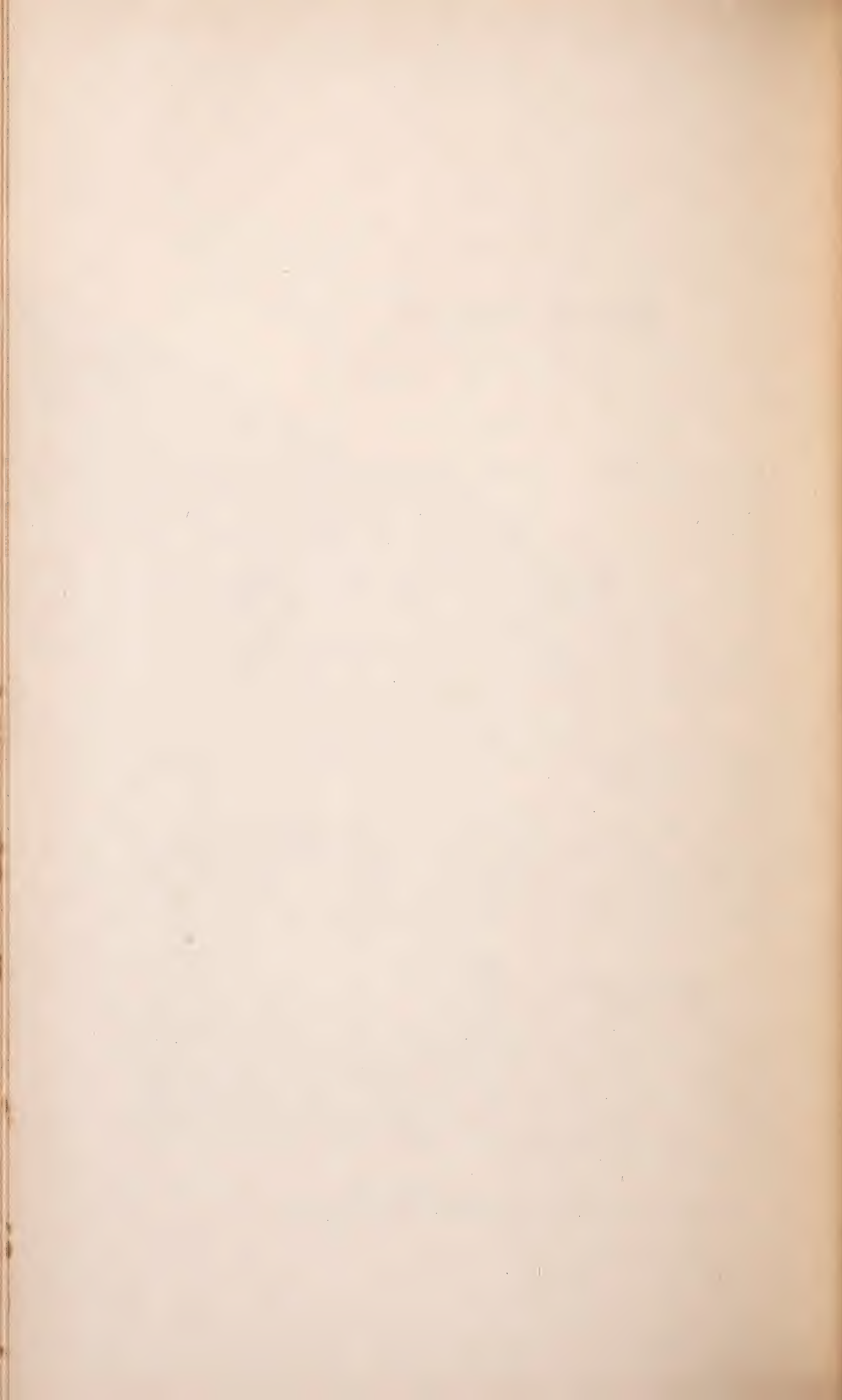
Myrsine Urvillei, A. DC.

Suttonia australis, A. Richard.

A small tree 12ft. to 20ft. high, trunk 4in. to 9in. in diameter, bark dark-brown or black. Young twigs and leaf-stalks red. Leaves alternate, oblong or obovate, waved at the margins, and dotted with round pellucid glands. Flowers crowded in small fascicles on the naked portions of the branchlets, or in the axils of the leaves. Calyx four-toothed, or the teeth sometimes wanting. Corolla lobed. Stamens adherent to the petals. Stigma sessile. Fruit, a round berry, black, one-sixth of an inch in diameter.

EXPLANATION OF PLATE XVI.

Myrsine Urvillei, A. DC. Fruited specimen, natural size.





H. B. BOGART.

T. KIRK DREWITT

Ake Ake.
(DODONEA VISCOSA).

SURVEY DEP'T LITHO 1885.

DODONÆA VISCOSA, Linné.

THE AKE.

ORDER—SAPINDACEÆ.

(Plate XVII.)

FEW New Zealand plants exhibit a greater amount of variation in habit and stature than the ake, or the akeake as it is more frequently termed by settlers: plants less than a foot in height may be found producing fruit in profusion; usually, however, it is from 6ft. to 20ft. high, and occasionally attains the extreme height of 30ft., with a trunk rarely exceeding 1ft. in diameter. The young branches and leaves are extremely viscid, and when growing near the sea are often covered with wind-blown sand to such an extent that the plant becomes stunted, gradually ceases to develop leaves, and dies. The bark is a reddish-brown, and rather thin, somewhat resembling the bark of the fuchsia in colour, but deeper; the branches are erect; the leaves are entire, narrow-obovate in shape, with the tips rounded or slightly notched. The male and female flowers are produced on separate trees, and form small panicles at the tips of the branchlets; both alike are destitute of corollas, but the male flowers, from their great profusion and the red colour of their anthers, present an attractive appearance; the female flowers are insignificant, and may easily be overlooked. The fruit is conspicuous, being surrounded with rather broad membranous wings. The flowers are produced in October and November. The plant is easily cultivated.

DISTRIBUTION OF THE GENUS.

Dodonæa contains about forty-three species, of which no fewer than thirty-eight are restricted to Australia; one species occurs in the Sandwich Islands, another in South Africa, two in Mexico, and one over the entire area of the genus, extending to tropical America and Asia.

DISTRIBUTION OF THE SPECIES.

From the North Cape to Banks Peninsula, chiefly on the coast or in dry woods; Chatham Islands. Outside the colony it occurs in tropical America, Africa, Asia, the Pacific islands, and Australia.

PROPERTIES AND USES.

The heartwood is black variegated with streaks or patches of white; it is remarkably dense and heavy, and was formerly used by the Natives for the manufacture of clubs and weapons of war. It is valued for many purposes of the cabinetmaker, picture-frames, inlaying, &c., and has been employed as a substitute for brass for machine-bearings with good results.

DESCRIPTION.

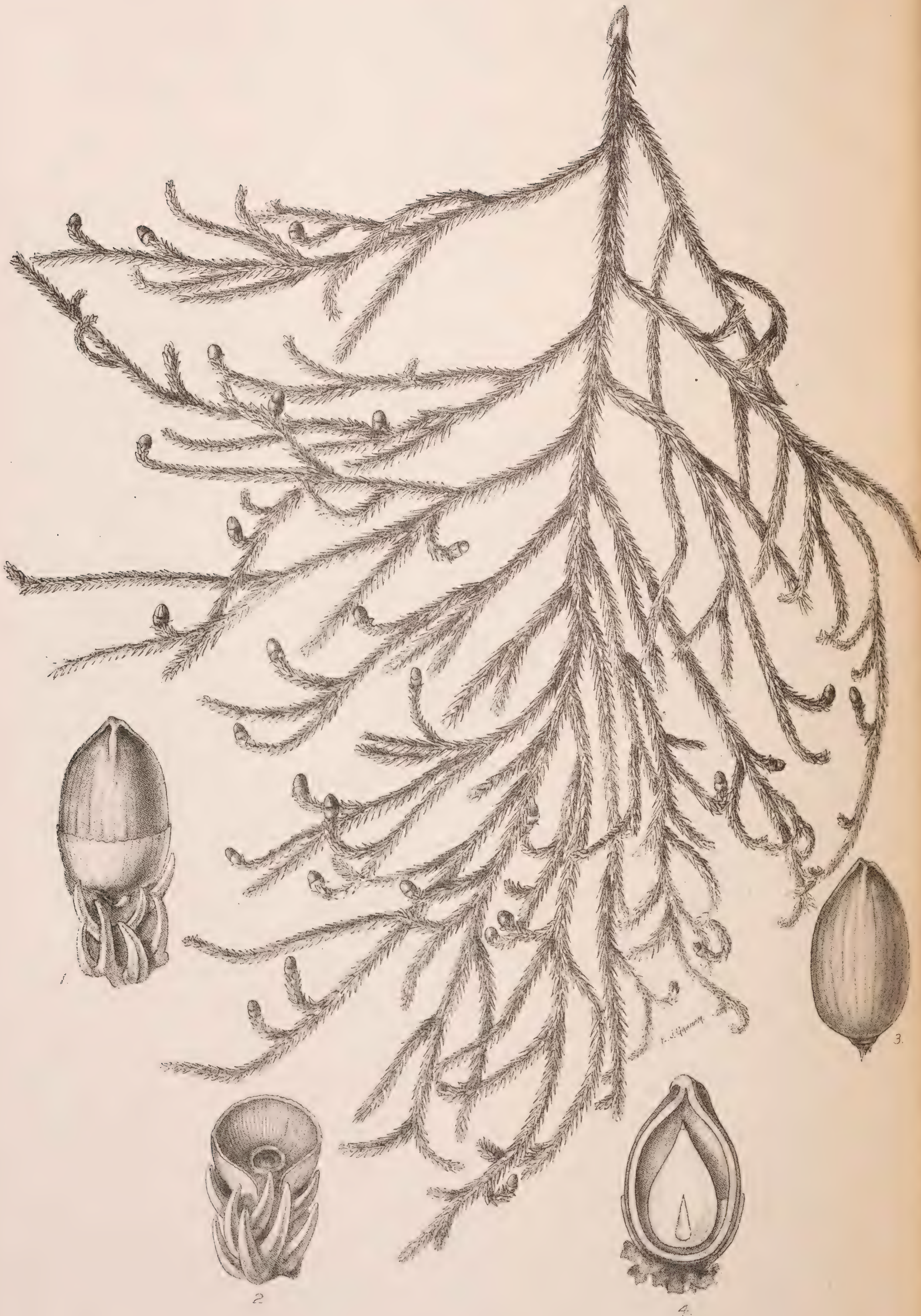
Dodonæa viscosa, Linné.

A dioecious evergreen tree, 6ft. to 30ft. high, with thin reddish-brown bark; branchlets viscid; leaves 2in. to 3in. long on short petioles, linear-obovate or

spathulate, entire, obtuse or slightly notched at the tip. Flowers in terminal panicles. Sepals, five. Male, stamens with short filaments; female, on short pedicels; ovary two-celled; stigmas, two. Fruit two- to three-valved; each valve with a broad wing-like margin.

EXPLANATION OF PLATE XVII.

Dodonæa viscosa, Linné. Fruited specimen, natural size.



Rimu:— Red Pine.
 (LACRYDIUM CUPRESSINUM).
 Mature state with fruit.

T. KIRK DEL.

SURVEY DEPT. 1864

Rimu.
(DACRYDIUM CUPRESSINUM)





L. J. Graham. lith.

Felling Matai and Red Pine in Seaward Forest.
From a photograph by Dougall, Invercargill.

F. KIRK. DIREXIT

1871. 10. 20. 266



In Howard Forest, Southland
from a photograph by Donald Invermay.



Saw-mill Tramway in the Seaward Forest.
 from a Photograph by Douglas Invercauld.

1 New Street

E. J. Graham lith.
 Survey Dep. Litho. 1886

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DACRYDIUM CUPRESSINUM, Solander.

THE RIMU OR RED-PINE.

ORDER—CONIFERÆ.

TRIBE—TAXEÆ.

(*Plates XVIII., XIX., XX., XXI., and XXII.*)

THE rimu, or red-pine as it is most frequently termed by the settlers, occupies a larger area of the New Zealand forests than any other timber-tree, and affords remunerative employment to a larger number of workers. Although of less intrinsic value than kauri or totara, it is adapted to a larger number of important uses, and is easily converted: these advantages, together with its wide distribution and great abundance, render it the most important commercial timber of the colony.

The rimu is a fine tree, varying in height from 40ft. to 80ft., with a trunk from 2ft. to 4ft. or even 5ft. in diameter; the dark-brown or grey bark falls away in thick heavy scales, exactly as in the Scotch firs and other pines of the Northern Hemisphere. From its remarkable weeping habit it is the most easily recognised and the best known of all New Zealand timber-trees. In the seedling state the young leaves are awl-shaped, and attached by a rather broad base, being equally distributed on all sides of the stem: in this stage they are about half an inch long, lax, and open. As the plant increases in height the leaves gradually decrease in length, and become roughly three-sided; at the same time they become more rigid and close-set, at length overlapping; they are now reduced to one-tenth of an inch in length, or even less. When growing in moderately open situations the rimu assumes a conical habit; the branches are pendulous, but the leader is erect, and the tree is extremely beautiful; its weeping habit is unique amongst New Zealand pines: in fact, no other known pine approaches it in beauty. In open places in forests this condition is permanent for many years; but most frequently the rimu is closely surrounded by trees of its own or other kinds, so that the young spreading branches die off, and the tree forms a comparatively small round head, with drooping branches.

The male and female flowers are produced on separate trees, from October to December, the female on short recurved branchlets as shown in Plate XVIII. The fruit consists of a nut seated on a red fleshy receptacle clothed with green scales, and requires a year and a quarter to attain maturity, ripening from January to March. During wet cold seasons the fleshy portion of the fruit is but imperfectly developed; when germinating the fruit develops two cotyledons as in ordinary deciduous trees.

It was discovered during Cook's first expedition, and the genus *Dacrydium* was constituted by Dr. Solander for its reception.

PROPERTIES AND USES.

Rimu logs can be obtained of any dimensions up to 4ft. in diameter, and afford a handsome timber of a deep-red colour, with dark or light, sometimes yellow, streaks and markings, forming a good figure.

The specific gravity of rimu varies from .550 to .644, and its weight from 34.28lb. to 40.11lb. per cubic foot.* Mr. Blair states† that it requires a weight of 350.88lb. to break a piece 2ft. long and 1in. square supported at both ends and loaded in the centre,‡ so that it is equal to English oak in strength.

The proportion of sapwood varies to a considerable extent. Fully matured trees 4ft. in diameter sometimes exhibit less than 4in. of sap, while in smaller trees the sapwood may form one-fourth or even one-third of the diameter: this, however, depends chiefly on the age of the tree. Well-ripened small trees may be found with a very small quantity of sapwood. The heart of old trees is often excessively resinous, and affords timber of great durability for certain purposes; usually, however, it is not a durable timber when exposed, especially if in contact with the ground.

During the period of growth the rimu is liable to a partial separation of the concentric rings of the trunk, the shakes or cavities thus formed being filled with a white resin; occasionally the shake is sufficiently extensive to cause a considerable percentage of waste in conversion. Specimens with a twisted and uneven grain are not uncommon, and afford timber of special value for ornamental work, although not adapted to purposes where strength is required.

Rimu is applied to a great variety of purposes, and a fairly unanimous opinion has been formed as to its merits and value. It is the chief timber employed for general building purposes over fully two-thirds of the colony, sometimes conjointly with other timbers, but most frequently alone: it is used alike for framing, joists, flooring- and weather-boards, doors, sashes, mantelpieces, &c. Its handsome figure renders it very effective when worked up into doors and mantelpieces, as, if well grown, it takes a high finish when polished. It is also largely used for dadoing in public and private buildings, and for panel-work, office-fittings, &c. It has been extensively used in the construction of bridges, but for the most part with unsatisfactory results. In the Waikato, bridges built of this timber had to be re-erected within seven years: the same experience has been realised in various parts of the South Island. Decay speedily commences at the joints, owing to the retention of water, or rain may gain access to an unnoticed shake, when the affected timber speedily becomes a mass of corruption. At Invercargill I examined some large hewn stringers, 16in. square, used in the construction of a railway bridge, without cross-beams or road-planking, so that the conditions were unusually favourable to durability; but it had been found necessary to replace them within ten years, owing to their unsafe condition from decay, which appeared to have been caused primarily by rain-water which had been retained in the concavities of the upper hewn surface, and caused surface-cracks which allowed water to find its way to the heart. In Taranaki, however, it is frequently used in bridge-building, but exposed joints are carefully cemented and otherwise protected from the action of moisture: the life of a bridge thus constructed is estimated at fourteen years. The rimu of Taranaki is unusually straight-grained, even in old trees, and very resinous.

Rimu has been used for the keels of ships of considerable tonnage, and for other purposes in ship-building. About eighteen years ago, a large brig was built at Port Pegasus, Stewart Island, entirely of rimu, with the exception of the framing, which was obtained from the southern rata (*Metrosideros lucida*).

* See Balfour's Table of Results of Experiments on New Zealand Woods for the Commissioners of the New Zealand Exhibition, Otago, 1865. Mr. Blair states the weight of rimu in the green state to be from 43.117lb. to 71.136lb. per cubic foot; when seasoned, 34.294lb. to 42.775lb. (Blair: Building Materials of Otago, p. 224.)

† Blair: Building Materials of Otago, p. 225.

‡ In Balfour's Table the weight required to break good specimens 1ft. long and 1in. square, supported at one end and loaded at the other, is stated to be from 109lb. to 178lb.

The heartwood has been used to a large extent for railway sleepers. When obtained from old trees, without any admixture of sap, it has been found sound and in good condition after being in use for six or seven years. Heartwood from young trees is less durable, and sapwood perishes very quickly. When saturated with creosote it will doubtless afford satisfactory results.

On account of its great abundance rimu is often used for fencing purposes, but the results are not encouraging. Posts split entirely from the heartwood of old trees remain in a sound condition from four to eight years, but usually decay begins within three years. Rails continue sound for a longer period, but soon become brittle. It should not be used for this purpose when other kinds can be procured.

It is extensively used by the cabinetmaker in the manufacture of furniture of all degrees of excellence. Large knots and burrs and pieces with exceptionally fine markings are converted into veneers.

Rimu bark is often used by the tanner, and is valued for certain qualities of leather, although it imparts a red colour to the skin. Its percentage of tannin is low, being only 4·3 per cent.; but in Southland and other districts, where the timber is extensively converted, the bark can be delivered at the tan-yards for little more than the cost of cartage. There can be but little doubt that the manufacture of an extract from this and other common tannin-barks would speedily afford a profitable article for export and home use alike; while another opening would be afforded for the remunerative employment of labour.

The tops of the young branches were used by Captain Cook to manufacture spruce beer for his sailors, but, so far as I am aware, it is not used by the settlers for this purpose. Mr. Colenso states that the ripe fruit was eaten by the Maoris.

Rimu is of very slow growth. Specimens planted in the Auckland Domain in 1867 do not exceed 18ft. in height, although growing under favourable conditions.

DISTRIBUTION OF THE GENUS.

Dacrydium comprises about twelve species, of which no fewer than seven are restricted to New Zealand; one, the famous Huon pine, is found in Tasmania. The others are distributed through New Caledonia, Fiji, the Malay Archipelago, and Borneo.

DISTRIBUTION OF THE SPECIES.

Dacrydium cupressinum is found throughout the colony, extending to Stewart Island, but does not occur either on the Auckland or Chatham Islands. It is less plentiful in the Auckland District than in other parts of the colony; and is especially abundant in the northern parts of Marlborough, the south-western portion of Nelson, in Westland, Southland, and Stewart Island, extending to the South Cape.

It ascends from sea-level to 2,500ft.

DESCRIPTION.

Dacrydium cupressinum, Solander.

An evergreen dioecious tree, 50ft. to 80ft. high or more, with weeping branches; trunk, 2ft. to 4ft. in diameter, with reddish-brown or grey bark, which falls off in large scales. Leaves rigid, awl-shaped or trigonous, closely overlapping all round the branches, $\frac{1}{2}$ in. to $\frac{3}{4}$ in. long. Male flowers in inconspicuous green catkins at the tips of erect branchlets. Females solitary at the tips of

curved branchlets. Nut, about $\frac{1}{8}$ in. long, invested at its base by a membranous cup, and seated on a fleshy receptacle clothed with rather distant overlapping green scales. The receptacular scales are acute, and spring from remarkably broad bases, whilst the receptacle itself varies much in size, and in damp seasons is not developed, the nut being simply invested at its base by the membranous cup or sheath, which is split on one side.

EXPLANATION OF PLATES XVIII. AND XIX.

XVIII. *Dacrydium cupressinum*, Solander. 1. Fruiting specimen before the full development of the fleshy receptacle, natural size. 2. Cup showing the split portion. 3. Nut. 4. Longitudinal section of nut: all magnified.

XIX. *Dacrydium cupressinum*, Solander. 1. Branchlet of young plant. 2. Branchlet from older plant. 3. Male catkins: all natural size. 4. Male catkin, enlarged. 5 and 6. Scales from the lower part of catkin, back and front views. 7 and 8. Scales from the upper part of catkin, back and front views: all magnified. 9. Specimen with fully matured fruit: natural size. 10. Ripe fruit. 11 and 12. Receptacular scales: all magnified.

ON THE CONVERSION OF RIMU.

Rimu occurs in comparatively small quantity in the Auckland District, and is rarely used for building purposes, kauri superseding all other timbers in the North; but in Hawke's Bay, Taranaki, Wellington, the northern portion of Marlborough, the south-west parts of Nelson, Westland, Southland, and Stewart Island it occurs in vast quantities, and is the chief timber employed for building and general purposes in those districts, as well as in Otago and Canterbury,* which obtain their supplies from Southland and Marlborough.

It is not easy to obtain precise returns of the total quantity of rimu converted yearly in the above districts, as it is usually mixed with miro, matai, totara, kamai, and other kinds; but the annual output may be safely estimated at 80,000,000 superficial feet of inch thickness.

The most important centres of conversion are Southland and Wellington. In Southland the timber-supply is obtained almost entirely from State forests; in Wellington, from private forests.

In Southland small mills are furnished with a breaking-down bench and twin circular saws, working one above the other, to cut deep logs, a circular saw with rack-bench to cut ordinary boards and scantling, a small circular saw for cutting palings, &c., and a small American planing-machine, fitted with revolving cutters. In larger mills conversion is effected by similar machinery worked by more powerful engines; they are also furnished with moulding and other machines for special purposes. The breaking-down frame-saw common in other districts is almost unknown in Southland; most of the logs being of small dimensions, the converters have been content with the double circular saw for this work, but the adoption of a frame-saw for this purpose would result in a saving of power and diminution of waste. The use of frame-saws for converting wide planking for cabinetwork would be still more beneficial, as the boards would be better manufactured, and the waste of good paying material greatly reduced.

The tramway forms an important part of the sawmiller's plant. It is constructed of split or sawn sleepers placed from 24in. to 30in. apart from centre to centre, and sawn rails 3in. by 4in., which are laid in notches cut in the ends

* A small quantity is converted at Catlin's River, in Otago, and Banks Peninsula, Canterbury.

of the sleepers, and secured by wooden wedges driven home. The material being obtained along the line of tramway, and the forests being usually of a flat character, the construction of tramways in Southland is very easy. In the absence of special difficulties, the cost ranges from 16s. to 19s. 6d. per chain.

Wooden tramways are worked by horse-power; but in some instances light iron rails are used, so as to allow of haulage being effected by a steam motor. The cost of rails is estimated at £300 per mile.

In felling, a small scarf is cut with the axe on one side of the tree, which is then felled by the saw. This method has come into general use since 1877, and is found more economical than felling with the axe. The trunk is cut into suitable lengths for the mill, and the logs are hauled by bullocks or horses to a raised loading-place by the side of the tramway. It is not considered profitable to haul logs from a greater distance than ten chains on each side of the tramway: this fixes the maximum proportion of tramways required at half a chain per acre.

In some cases both mill and forest are worked by day-labour only, but most frequently the work is done by contract to a greater or less extent. The entire plant and forest may be placed in the hands of a contractor, who engages to perform all the work of conversion at a fixed rate per 100 superficial feet; or the felling, logging, and hauling to mill may be let in a separate contract. The entire cost of production, from felling to delivery on the railway trucks, need not exceed 3s. per 100 superficial feet. To this must be added royalty on logs, percentage for interest on cost of machinery and plant, depreciation from wear-and-tear, accidents, loss of time, and bad debts.

First-class rimu for building purposes is now being loaded in the railway trucks at 4s. per 100 superficial feet. This can only be done under thoroughly systematic management.

The average yield of timber per acre varies considerably in different districts. Good virgin forest in Southland yields over 20,000ft. In some parts of Westland and Nelson, where the trees are unusually dense and attain exceptionally long lengths, the return often exceeds 80,000ft. per acre.

In State forests a royalty of 3d. per 100 superficial feet is charged on rimu, the timber being measured before felling. On payment for an area of 200 acres, the department reserves 600 acres additional for the use of the sawmiller. In private forests the royalty varies from 3d. to 6d. per 100ft. on the sawmiller's return. Sometimes the timber is purchased at an acreage rate.

In the Wellington District the Crown forest is often purchased from the Government and cleared by the sawmiller, who is usually able to dispose of it at a profit after clearing, so that his raw material is obtained free of cost.

With the single exception of the kauri, no other tree affords employment to so large a number of men as the rimu.

PLATES XX., XXI., AND XXII.

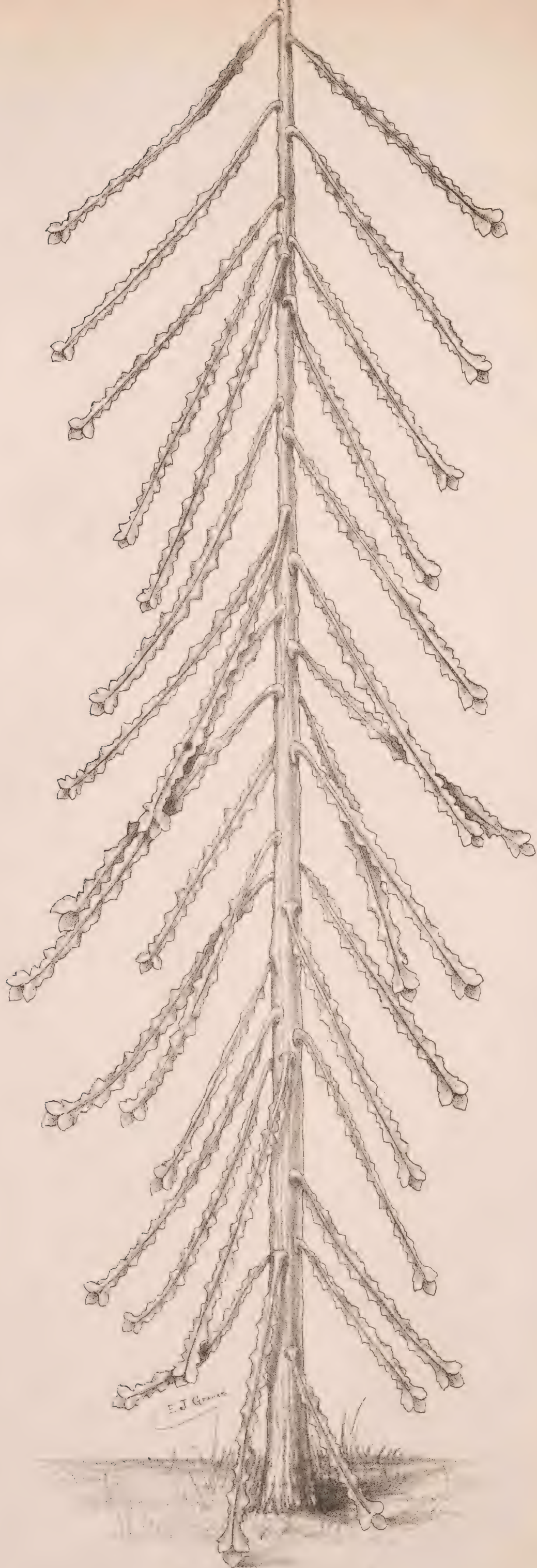
XX. Felling matai and rimu in Seaward Forest.

XXI. Bush scene in Seaward Forest.

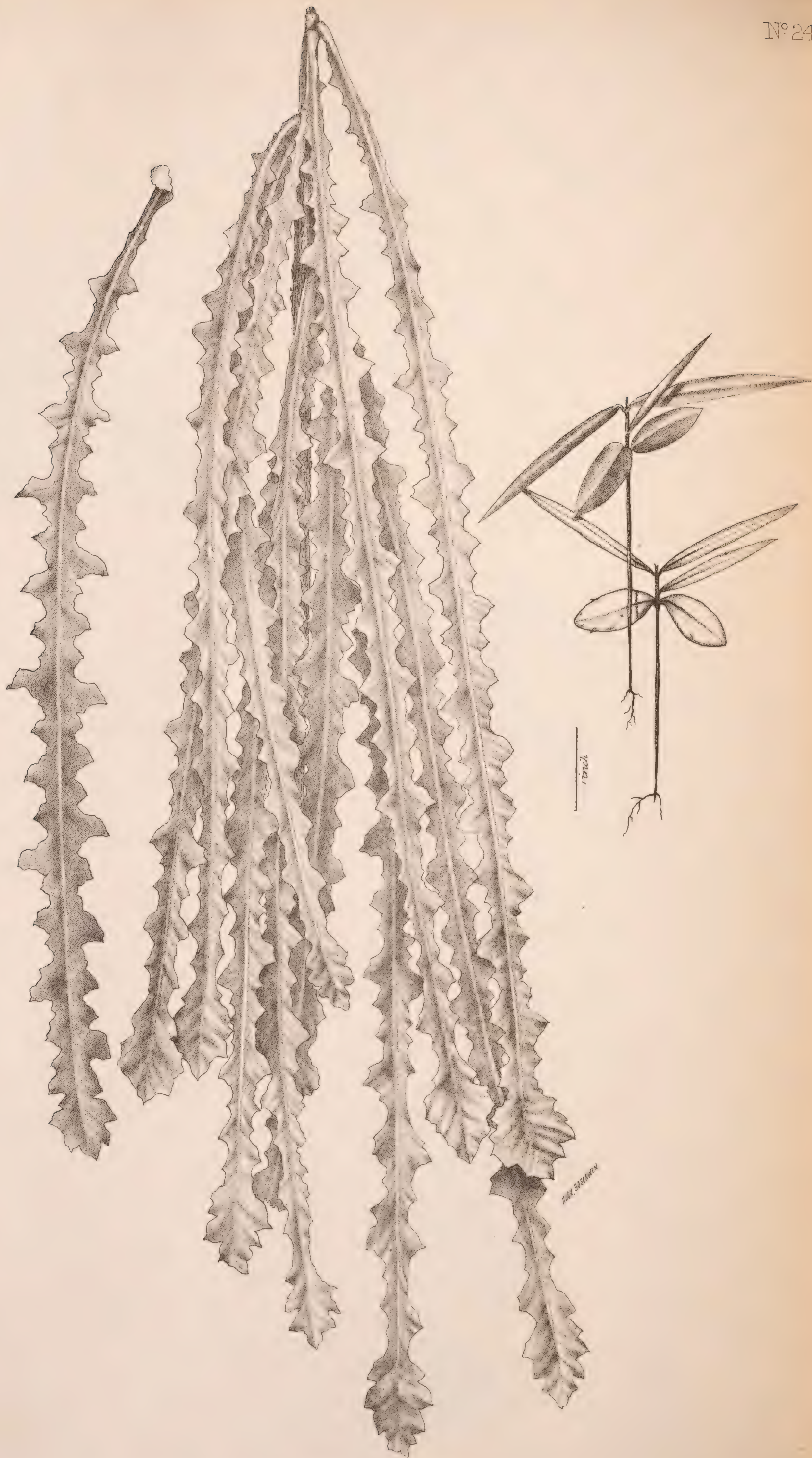
XXII. Bush tramway and log-train on Mr. J. Murdoch's area, Seaward Forest.

The above are from photographs taken for this work by Mr. J. Dougall, of Invercargill, and kindly presented by him.

NOTE.—The fruit is termed "koroi" in the North.



Toothed lance-wood
(PSEUDOPANAX FEROX).
Young tree with deflexed leaves.



Toothed lancewood.
(PSEUDOPANAX FEROX)
Deflexed leaves.



Wm. B. Wood.

Toothed lance-wood.
(PSEUDOPANAX FEROX).



PSEUDOPANAX FEROX, T. Kirk.

THE TOOTHED LANCEWOOD.

ORDER—ARALIACEÆ.

(Plates XXIII., XXIV., XXV., and XXVI.)

THIS remarkable tree is a comparatively recent addition to the New Zealand flora, having been discovered by Mr. John Buchanan, F.L.S., in Otago, and erroneously considered by him to be the true *Panax crassifolium* of Decaisne and Planchon; in 1876 he described it in "The Transactions of the New Zealand Institute"* under that name, and gave an excellent drawing of the male flowers and toothed leaves.

In its mature state it forms a handsome tree 30ft. high, with a trunk rarely exceeding 15in. in diameter. The remarkable changes of foliage through which it passes in its progress to maturity, and the different aspects which it presents, are of great interest, and must be briefly described.

The cotyledons, the first leaves developed on the germination of the seed, are oval, flat, and membranous; they are quickly succeeded by narrow-linear leaves, $\frac{3}{8}$ in. broad, toothed, and of harsh texture (Pl. XXIV.): as the stem increases in height the leaves retain their linear form, but increase in length, and become slightly expanded at the apex. At first they are given off at a right angle with the unbranched stem, but ultimately become deflexed, the lower surface of the leaf forming an acute angle with the stem. As they attain a length of 18in. with a breadth of $\frac{1}{2}$ in., these thick, rigid, linear leaves pointing to the ground present a strange appearance, which has only a single parallel in the New Zealand flora (Pl. XXIII.). In this stage their texture is extremely coriaceous and rigid; the stout midrib is conspicuous along the entire length of the leaf, the surface is blotched and mottled, and the margins are furnished with large lobulate-hooked teeth, capable of inflicting a severe wound if incautiously handled (Pl. XXIV.). The exact duration of this stage is unknown, but plants have been observed to exhibit no change for thirty years or more; some of the leaves are persistent for twenty years. On approaching the period of maturity the simple stem branches at or near the apex, the new leaves are shorter, and gradually assume an erect position, the texture becomes thicker and more rigid, but the spinous teeth entirely disappear; new branches are developed, and the plant forms a round-headed tree with the lower parts of the branches naked, but exhibits absolutely no trace of the remarkable form of leaf which characterized its intermediate stage. Male and female flowers are now produced on separate trees (Pl. XXV.), and the latter are succeeded by ovoid fruits (Pl. XXVI.), at first covered with a delicate glaucous bloom, which gradually disappears, when they shrink and become wrinkled.

This species differs essentially from the common lancewood (*P. crassifolium*, Decaisne and Planchon) in the spinous leaves of the intermediate stage, the smaller leaves of the mature state, the racemose male flowers, and the small umbels of fruit.

DISTRIBUTION OF THE GENUS.

Six species are included under *Pseudopanax*, four of which are restricted to New Zealand and two to South Chili.

* Trans. N.Z. Inst., ix., p. 529, pl. xx.

DISTRIBUTION OF THE SPECIES.

Pseudopanax ferox is restricted to New Zealand, and, although extending over a considerable area, is decidedly rare. In the North Island the only habitat known to me is the Kauacoruruwahine Forest, where I observed a few specimens in 1885. In the South Island it was observed by Sir James Hector and myself at the Wairoa, Nelson, in 1873, and subsequently by myself at the Lower Moutere, the junction of the Matukituki with the Buller, and one or two other localities in that district; also at Lake Forsyth, Canterbury. Stated by Mr. Buchanan to occur at Anderson's Bay and other localities near Dunedin.

Ascends from sea-level to 700ft.

PROPERTIES AND USES.

The wood of this tree is of a dull-brown colour, and might be employed by the cabinetmaker for special purposes. It appears to have been used conjointly with an allied species, *P. crassifolium*, for jetty-piles at Dunedin, but no attempt was made to discriminate between the two trees. The results were satisfactory with regard to both. When newly felled the wood has a strong and most unpleasant odour.

The mid-ribs of the linear leaves are of great strength and toughness; they are used by forest settlers as bootlaces, and for mending bridles, harness, &c.

This species is suitable for planting in shrubberies and ornamental plantations, where its singular habit of growth will always arrest attention. It is not known what period is required for it to attain the flowering condition, but a specimen planted in the North-East Valley, Dunedin, by Mr. J. Buchanan, F.L.S., in 1856, had not attained 10ft. in height in 1876, and at present (January, 1888) exhibits no appearance of the mature leaves.

It is easily propagated by seeds.

DESCRIPTION.

Pseudopanax ferox, T. Kirk.

Panax ferox, T. Kirk, Trans. N.Z. Inst., x., appendix, p. xxxiv.

Panax crassifolium, J. Buchanan (not of Decaisne and Planchon), Trans. N.Z. Inst., ix., p. 529, pl. xx.

A small dioecious tree, 20ft. to 30ft. high; leaves of two kinds, simple in all stages: on young plants, linear, 12in. to 18in. long, on short petioles, deflexed, rigid and coriaceous, slightly expanded at the tips, irregularly lobulate-dentate; teeth acute, hooked: on mature trees 3in. to 5in. long, $\frac{1}{4}$ in. to $\frac{3}{8}$ in. broad, linear-obovate, apiculate, excessively thick and coriaceous, gradually narrowed to the base, forming a short petiole. Flowers in terminal umbels, pedicelled; male umbels of from six to ten simple racemes, petals four, stamens four; female umbel compact of six to nine one- to three-flowered rays about 1in. long; styles five, connate into a column, tips scarcely recurved. Fruit ovoid, five-celled, glaucous.

EXPLANATION OF PLATES XXIII., XXIV., XXV., AND XXVI.

XXIII. *Pseudopanax ferox*, T. Kirk. Young tree with deflexed leaves, greatly reduced.

XXIV. *Pseudopanax ferox*, T. Kirk. A. Apex of young tree, deflexed leaves, three-fourths natural size. B. Seedling plant, natural size.

XXV. *Pseudopanax ferox*, T. Kirk. Male flowers, natural size.

XXVI. *Pseudopanax ferox*, T. Kirk. Fruiting specimen, natural size. 1. Fruit. 2. Longitudinal section. 3. Transverse section.



OLEA AFFINALIS.



Broad leaved olive (*Olea apetala*).
Mature leaves with young fruit.

T. KIRK MACAIG.

SHAWVEY DEP. LITHO. 1885.

OLEA APETALA, Vahl.

THE BROAD-LEAVED MAIRE.

ORDER—JASMINEÆ.

(Plates XXVII. and XXVIII.)

ALTHOUGH *Olea apetala* has long been known to botanists as a native of Norfolk Island, it is only twenty years since it was added to the New Zealand flora, when it was discovered on the Great and Little Barrier Islands, and subsequently on the Taranga Islands, near Whangarei Heads.

The Native name, "maire," is applied not only to the Olives, of which there are four species, but also to *Fusanus Cunninghamii*—the sandal-wood—and other trees which afford dense heavy timber of even texture. This indiscriminate application of the Native name has led to much confusion amongst bushmen and settlers.

The New Zealand Olives constitute a well-marked section of the genus, characterized by the male and female flowers being destitute of petals and produced on separate plants. Another striking feature is the variation in the shape of the leaves exhibited at different stages of growth: in the present species the leaves of the young plant, especially if growing in the shade, are fully twice the breadth of those of the mature state; but in the other species the leaves of young plants are much narrower and longer than those of fruit-bearing specimens.

Olea apetala is a much-branched shrub or small tree, but rarely attaining the height of 20ft., and when growing in rocky, exposed situations reduced to a mere bush. In old specimens the branches are spreading and often tortuous; the bark of the trunk deeply furrowed, rugose, and corky; in young specimens it is brown or brownish-grey, and thinly studded with small wart-like excrescences. The twigs are more or less flattened and twisted between the nodes.

In the young state the leaves are broadly ovate in shape, from 3in. to 6in. long, 2½in. to 3in. broad, narrowed into short leaf-stalks; the blade is of thick texture and of a deep glossy green tint, quite entire. In the mature state the leaves are much narrower in proportion to their length,—1½in. to 3in. long, and rather more than 1in. broad,—sharply narrowed into the leaf-stalk below, and into a point at the apex, with the midrib distinct on both surfaces; brownish, and rough to the touch beneath.

The female flowers are produced in racemes which spring from the axils of the leaves. Each raceme bears from twelve to eighteen flowers, and is perfectly smooth in all its parts—a peculiarity which is exhibited by no other species found in the colony. The calyx is deeply cut into four unequal lobes; and the ovary is two-celled, each cell containing two ovules. Gradually one cell becomes nearly obliterated, and only a single ovule becomes a perfect seed. The male flowers have not been observed in the colony.

The fruit is about one-third of an inch in length, one-seeded, red.

The flowers are produced in October and November; in all probability the fruit ripens during the following June or July. I have only seen one or two fruits,

and these had remained on the tree several months after they had attained maturity.

The specific name is given on account of the absence of petals, but this character is common to all the New Zealand species.

PROPERTIES AND USES.

The wood is of even texture, compact, heavy, and of great strength. It was utilised at the copper-mine on the Great Barrier Island for mine-props, machine-bearings, and other purposes; but, as the mine has been abandoned for many years, it is not possible to state results.

It is adapted to many purposes of the millwright and wheelwright, and for turners' work; but it is too local and restricted in its habitats to prove of commercial value.

In Norfolk Island, where it is more abundant and attains larger dimensions than in New Zealand, it is highly valued for its strength and durability, and is locally termed "ironwood."

DISTRIBUTION OF THE GENUS.

The genus *Olea* comprises thirty-five species, distributed through the Mediterranean region, tropical and temperate Asia, tropical and south Africa, the Mascarene Islands, and New Zealand. One species is found in Australia and New Caledonia.

The four New Zealand species belong to a section of the genus termed *Gymnelæa*, characterized by dioecious flowers destitute of a corolla, as well as by dimorphic foliage.

DISTRIBUTION OF THE SPECIES.

Olea apetala evinces a marked preference for situations in the vicinity of the sea: it has been collected on the Great Barrier Island, Nelson Island, Arid Island &c., Little Barrier Island, Hen and Chickens Islands, Bream Head, &c. It ascends from sea-level to nearly 800ft.

It is also found on Norfolk Island.

DESCRIPTION.

Olea apetala, Vahl. (Not of Cunningham.)

A shrub or small tree, never exceeding 20ft. in height, glabrous in all its parts. Bark on old specimens furrowed and corky; on young plants brown or grey, warted. Leaves shortly petioled, opposite or sub-opposite: on young plants broadly ovate or orbicular-ovate, 3in. to 6in. long, 2½in. to 3in. broad, acute or obtuse, narrowed at the base, acuminate, coriaceous, glossy, entire; on mature plants lanceolate or elliptic-lanceolate, 1½in. to 3in. long, 1in. to 1¼in. broad; with the midrib distinct on both surfaces. Flowers in axillary racemes; male not seen; female, 1½in. long, pedicels slender, perianth unequally four-lobed, ovary two-celled; ovules, two in each cell, pendulous. Fruit an ovoid drupe, ½in. long.

EXPLANATION OF PLATES XXVII. AND XXVIII.

XXVII. *Olea apetala*, Vahl. Leaves of young state. 1. Raceme of female flowers, natural size. 2. Female flower, magnified.

XXVIII. *Olea apetala*, Vahl. Mature state, with newly-formed fruit.



Narrow-leaved Maire.
(OLEA MONTANA).
Pistillate flowers.



Narrow leaved maire. (*Olea montana*).
With immature fruit

OLEA MONTANA, Hook. f.

THE NARROW-LEAVED MAIRE.

ORDER—JASMINEÆ.

(Plates XXIX. and XXX.)

THIS species appears to have escaped the notice of the older botanists, and was first observed at the Bay of Islands by Allan Cunningham in 1826. Although it bears the specific name "montana" it shows a decided preference for low-land situations, and, so far as I am aware, does not ascend above 2,500ft., and must be regarded as rare at elevations exceeding 2,000ft. Its favourite habitat appears to be deep river-valleys, such as the Ruamahunga and others in the Wairarapa and adjacent districts, where it attains larger dimensions and occurs more plentifully than in any other locality known to me. North of the Waitemata it is frequently solitary, only a single specimen being found in a large area, as, for instance, at Great Omaha, where a female plant has long been known on a rocky point but little above sea-level, rarely producing one or two fruits. A solitary tree is known also in the Titirangi Ranges. At Whangaroa (North), Whangape, and in the Hokianga forests occasional specimens are met with, but it can scarcely be considered plentiful outside the Wellington District.

Olea montana forms a round-headed evergreen tree, 20ft. to 50ft. high or more, with a profusion of slender twiggy branchlets and bright-green leaves. The trunk is from 1ft. to 2ft. in diameter, and is clothed with brown or brownish-grey bark. In the young state the leaves are narrow-linear, sometimes less than 1/8in. in breadth, and differing from those of the mature state only in their greater length, 3in. to 4in. In the mature state the branchlets are very slender; the leaves vary from 1 1/2in. to 2in. in length, rarely exceeding 1/2in. in width; they are usually acute at the apex, and the nerves are very obscure. The male and female flowers are produced on different trees; they are destitute of petals, and from their green or light-brown hue do not attract the attention of casual observers: they are produced in slender axillary racemes, each bearing from six to ten flowers. The racemes of female flowers are longer and more slender than those of the male. Each flower is carried on a slender pedicel, and has a minute calyx at the base. In the male there are two stamens (which are destitute of filaments) and an abortive ovary. The female has a two-celled ovary with two pendulous ovules in each cell, and, not unfrequently, abortive stamens at the base of the ovary. During the ripening of the fruit one cell becomes obliterated, and three of the ovules absorbed, so that the fruit is one-seeded, forming a bright-red drupe. Traces of the obliterated cell may sometimes be found after the fruit is fully ripe.

The extremities of the branchlets are often clothed with a fine coat of downy pubescence, and the bark is of a reddish brown.

A solitary specimen at Karori is fully 60ft. high, with a trunk 40ft. in the clear: its circumference at the base is 9ft. 1in., tapering to 7ft. 4in. at 6ft. from the ground, but above that holding its girth well up towards the crown. I have

been assured that specimens are found on the lower slopes of the Rimutaka Mountains fully equal in dimensions to the largest specimens of *O. Cunninghamii*.

PROPERTIES AND USES.

The timber is even in the grain, dense, compact, heavy, and strong. It is extremely durable, and it is to be regretted that its merits are but little known.

It has been used for machine-beds, cart-shafts, and other wheelwrights' work, also for the teeth of gearing-wheels, fencing-rails, &c. It is occasionally used by the cabinetmaker, and is valued for ornamental turnery. It seems well adapted to the purposes of the wood-engraver.

This species would in all probability afford a valuable stock for the varieties of the cultivated olive (*Olea Europæa*).

DISTRIBUTION OF THE GENUS.

See under *Olea apetala*, ante, p. 38.

DISTRIBUTION OF THE SPECIES.

Olea montana is restricted to the North Island. It ranges from Whangaroa (north of the Bay of Islands) southwards to Cape Palliser. It is rare and local to the north of the Waikato, but is more plentiful in the southern part of the Island. It ascends from sea-level to 2,500ft.

DESCRIPTION.

Olea montana, Hook. f., Fl. N.Z., i., p. 176, t. 46.

A round-headed dioecious evergreen tree, 50ft. high or more; branchlets numerous, slender, crowded. Leaves opposite, on short petioles, narrow-linear, obtuse or acute: on young plants, 3in. to 4in. long; on mature plants, 1½in. to 3in. long, ½in. to ¾in. wide; glabrous. Tips of branchlets sometimes puberulous. Flowers minute, in slender axillary racemes, six- to ten-flowered, pubescent; pedicels slender, each with a minute bract at its base. Calyx membranous, unequally four-lobed. Male, stamens two, longer than the calyx. Female, ovary two-celled, glabrous; stigmas, two; ovules, two in each cell, pendulous. Fruit a drupe, linear-oblong, red.

EXPLANATION OF PLATES XXIX. AND XXX.

XXIX. *Olea montana*, Hook. f., with female flowers. 1. Raceme of male flowers. 2. Calyx. 3. Stamens. 4. Longitudinal section of ovary. 5. Transverse section of ovary. 6. Longitudinal section of a young fruit, showing the two cells. 7. Transverse section of a fruit further advanced, with one cell partially obliterated. 8. Young fruit. All except 1 more or less magnified.

XXX. *Olea montana*, Hook. f., with immature fruit.

Kahikatea — White Pine.
(PODOCARPUS DACRYDIODES)

1. Leaves of young plant.
2. Mature state with male flowers.
3. D^o D^o young fruit.





Kahikatea. — White Pine.
(TOTOCARPUS DACRYLIOIDES)

1 W. H. D. 1867

Survey Dep^t 1867

PODOCARPUS DACRYDIOIDES, A. Richard.

THE KAHIKATEA.

ORDER—CONIFERÆ.

SECTION—PODOCARPEÆ.

(Plates XXXI. and XXXII.)

THE kahikatea or "white-pine" of the timber merchants is a noble tree, often forming dense forests in swampy districts, although by no means unfrequent in dry or hilly situations below 1,500ft. It was originally discovered by Captain Cook in the great forest between the Thames and Piako Rivers: a tree measured by him was found to be 19ft. 8in. in circumference at 6ft. from the ground, and 89ft. to the first branch. He states, "It was straight as an arrow, and tapered but little in proportion to its height; so I judged there were 356 cubic feet of solid timber in it, exclusive of the branches. As we advanced we saw many others that were still larger." The forest in which it was first discovered is probably the largest kahikatea forest in the colony, and I am informed by Mr. Bagnall, of the Turua Sawmills, that he has discovered a tree which he believes to be the one actually measured by Cook.

A virgin kahikatea forest affords one of the most striking sights in New Zealand forest scenery. Straight unbranched trunks rise one after the other in endless series, and in such close proximity that at a short distance no trace of foliage is visible except overhead, or in the immediate vicinity of the observer: the naked symmetrical shafts, tapering almost imperceptibly, appear to form dense walls which completely shut out every glimpse of the outer world.

The kahikatea attains the extreme height of 150ft., but usually ranges from 60ft. to 100ft., with a trunk from 1ft. to 4ft. or even 5ft. in diameter. The bark is of a greyish-brown, thin and even in immature trees. Old specimens, especially when growing in swamps, often develop large fluted buttresses, but in the majority of cases these are wanting, and the trunk is symmetrical from base to apex.

The leaves are of two forms: in young trees about $\frac{1}{4}$ in. long, flat, but slightly bent at the tip, of a rich deep-bronze colour, and arranged in a single row on each side of the branchlets. On mature trees they are green, and resemble small scales, about $\frac{1}{12}$ in. long, awl-shaped, and closely appressed to the twig, resembling some kinds of cypress. The male flowers are produced in small catkins, which are solitary on the tips of the branchlets; they are about $\frac{1}{6}$ in. in length when the pollen is matured, but elongate as it is liberated. The female flowers are of singular structure, and almost unique amongst the New Zealand pines: like the male, they are sessile at the tips of branchlets, and consist of three or four, rarely two or five, white carpellary leaves, $\frac{1}{10}$ in. long, bent like a sickle, and usually carrying a naked ovule on the inner face. After fertilisation the carpellary leaves become coalescent at the base, but make little growth until one of the ovules has attained its full size, when they increase rapidly until they form a rounded or ovoid crimson pulpy receptacle, fully $\frac{1}{4}$ in. in

diameter, with the shining black nut partly imbedded at its apex, and one or more of the abortive ovules much enlarged somewhat below it.

When laden with its crimson fruits the tree presents a most attractive appearance if growing in an open situation.

The male and female flowers are produced in vast profusion on separate trees: the flowers are developed in October and November, and the fruit requires nearly a year to arrive at maturity.

PROPERTIES AND USES.

The wood is usually white, but sometimes it assumes a pale-yellow tint; it is firm, compact, tough, strong, straight in the grain, and of fairly even texture, but is not durable when in contact with the ground. Its specific gravity varies from .459 to .557.* Mr. Blair states the weight of two specimens in the green state at 38.921lb. and 43.899lb. respectively per cubic foot; when seasoned, 28.636lb. and 29.505lb.† Balfour gives as the mean weight of four specimens from Wellington 31.54lb., and of six specimens from Banks Peninsula 29.11lb. per cubic foot.* These figures may be accepted as approximately correct for seasoned timber, but further experiments are required to determine the weight in the green state. Many logs have the same specific gravity as water, and will only float when fully immersed; others will not float at all, and are termed "sinkers" by the bushmen. Where flotation is employed to convey the timber to the sawmill, casks are attached to logs of this kind to afford some degree of buoyancy. The result of four experiments by Mr. Blair shows that a weight of from 308lb. to 358lb. is required to break pieces 2ft. long and 1in. square, supported at both ends and loaded in the middle.‡ According to Balfour, the breaking weight for pieces 12in. long and 1in. square, supported at one end and loaded at the other, ranges from 90lb. to 155lb.

The alburnum or sapwood in kahikatea is large in proportion to the heart, and in many cases is not well defined: it is evident that a lengthened period is required for the complete maturation of the timber after the tree has attained its maximum growth. In trees 3ft. in diameter the heart is sometimes less than 6in.; even in mature trees the sapwood often equals or exceeds the heart. Logs in which the sapwood is less than one-fourth of the whole diameter are decidedly rare. As a general rule kahikatea logs are remarkably sound, ring-shakes are extremely rare, and heart-shakes are very small; consequently the waste in conversion is much less than in rimu.

The kahikatea rarely produces large branches, and, as the trunks are frequently of great length, sometimes exceeding 100ft. when felled, perfectly sound straight logs can be obtained of any length required. In many logs both heart and sap are white, the former being only distinguished by its greater hardness and density; but usually the heartwood is of a yellowish-brown. Trees are often met with which produce a yellowish timber with a stouter grain than usual, and of more durable quality when exposed. When grown in dry situations it is generally considered more durable than when grown in swamps; but in Marlborough the sawmillers contend that the swamp timber lasts longer than that grown on the hills.

While readily admitting that kahikatea is greatly inferior to kauri, totara, and matai in durability, I am fully convinced that its actual durability is much greater than is generally supposed. At the Turua Sawmills, on the River Thames, where kahikatea is the only timber converted, Mr. J. L. Bagnall drew my attention to several cottages erected in 1868, in which kahikatea was exclu-

* Balfour's Experiments.

† Blair: Building Materials of Otago, p. 224.

‡ Ibid., p. 225.

sively used for the framing and weather-boarding: at the date of my inspection they had been standing sixteen years, and had never been painted, but ground-plates, studs, and weather-boards were thoroughly sound and in good condition: so far as could be seen there was no reason why they should not last for many years longer. It was evident that the timber had not been selected, several of the studs being sappy, and in some cases showing the bark on one face. In 1870 I visited Mr. Thorpe's house at Ohinemuri; it was built of kahikatea in 1850, and was in good condition at the date of my visit, although not equal to the cottages at Turua.

In attempting to form a correct estimate of the durability of this timber it must be remembered that it speedily decays in damp situations or when in contact with the ground, and especially that, when under cover, it is liable to be attacked by a small boring beetle, the larvæ of which drive their minute galleries through it in all directions, so that rafters and flooring-joists are unable to sustain the weight of roof or floor. This pest is troublesome in all parts of the colony, but is least injurious in Auckland and Otago. I have never seen it attack boards or scantling when exposed: its ravages are always effected under cover. In houses built of kahikatea, if the insects are allowed to remain undisturbed, the floor may sometimes be found partially covered with minute conical heaps of wood-dust, showing the activity of the destructive worker in the ceiling above. There can be no question that the action of the borer is greatly facilitated by the use of unseasoned timber, especially if the boards have been closely stacked immediately after leaving the saw. On the other hand, there are good grounds for believing that timber felled during the winter months, and properly seasoned before being worked up, would be free from its attacks. It may be worth while to add that the insect may be destroyed by washing the affected timber with carbolic acid.

In a report on the durability of native timber laid before the General Assembly of the colony in 1874 I stated that kahikatea occupied a similar relative position towards kauri and totara to that held by Baltic white deal (*Picea excelsa*) to the red or yellow deal of Europe (*Pinus sylvestris*); and will only add that, after wider observation, I consider it fully equal to that timber in all respects except durability, while it possesses the advantages of being more easily worked and taking a higher finish.

When felled in the winter, and properly seasoned, kahikatea is suitable for all inside work, and for the framing of houses—studs, braces, partitions, ceiling- and flooring-boards, &c. It is largely employed in the manufacture of white-wood furniture, and for large panels, dado-work, &c. Its toughness renders it valuable for the covering-boards of boats, for which purpose it is preferred before kauri. Immense quantities are used in all parts of the colony for packing-cases, &c.; also for tallow-casks and other coopers' ware. It is frequently used for fence-rails, which usually last from seven to eight years, if free from sap.

The bushmen sometimes assert that the male tree affords more durable timber than the female; at others the wood of the female is said to be superior in this respect. In Marlborough I was repeatedly informed that the more durable kind with yellowish heartwood, which is there termed "sugar-loaf pine," was the male plant, while that with the white heart was the female. There is, however, no ground for either assertion.

Under cultivation the spreading leaves are retained for eight or ten years; in the young state the annual vertical growth rarely exceeds 12in., and is usually less.

The root-fibres carry numerous globular bodies, which present a singular appearance; their structure is not fully determined, but, according to Hooker, they contain cells with spiral markings.

The wood of the kahikatea is specially suitable for conversion into pulp for the manufacture of paper; as the raw material can be obtained in vast quantities in situations offering natural advantages for carrying out the process, it may become an important industry, although the current rates of labour are somewhat too high to allow the remunerative utilisation of secondary forest-products at present.

DISTRIBUTION OF THE GENUS.

See *Podocarpus spicata*, p. 6, *ante*.

DISTRIBUTION OF THE SPECIES.

Podocarpus dacrydioides is restricted to New Zealand, and is distributed throughout the colony, either scattered amongst other trees or forming extensive forests on low ground by river-sides, or in other swampy situations. It is more plentiful and attains a greater height on the western side of the South Island than the eastern. It is abundant in Southland, but is extremely rare in Stewart Island, where *Dacrydium intermedium* is converted at the sawmills, and sold as "white-pine."

It is most plentiful at the sea-level or very low elevations, but ascends to fully 2,300ft.

DESCRIPTION.

Podocarpus dacrydioides, A. Richard.

A lofty tree, 80ft. to 150ft. high; trunk, 2ft. to 5ft. in diameter; leaves of two kinds: on young trees arranged in a single row on each side of the branchlet, $\frac{3}{4}$ in. long, flat, acute, of a bronzed hue; on old trees, minute, green, scale-like, subulate, imbricating, $\frac{1}{12}$ in. to $\frac{1}{10}$ in. long. Male catkins, terminal, about $\frac{1}{6}$ in. long before the pollen is discharged. Female, terminal, of from three to five incurved white carpellary leaves, each carrying a single ovule. Fruit, sessile, rounded, pulpy, bright crimson, with the black nut seated on the apex.

EXPLANATION OF PLATES XXXI. AND XXXII.

XXXI. *Podocarpus dacrydioides*, A. Rich. 1. Branch from young plant. 2. Mature branch, with male catkins. 3. Mature branch, with young fruit. All natural size.

XXXII. *Podocarpus dacrydioides*, A. Rich. 1. Mature branch, with ripe fruit, natural size. 2. Male catkin before dehiscence. 3. The same after dehiscence. 4 and 5. Front and back view of anther: all magnified. 6. Female flower, natural size. 7. Tip of a branchlet, with female flower. 8. Another flower further advanced. 9 and 10. Female flowers still further advanced: all magnified. 11. First stage towards maturation: the carpellary leaves coherent, the ovules increasing in size. 12. The second stage: one ovule has rapidly increased in size, while the others are almost stationary. 13. Third stage: the growing ovule has nearly attained its full growth, and the carpellary leaves are slightly thickened. 14. Fourth stage: the growing ovule fully developed, and two abortive ovules at its base. 15. The ripe fruit, with the carpellary leaves developed into a receptacle, and partially investing the abortive ovules. 16. The same. 17. Longitudinal section of seed. Figs. 11 to 15 are drawn of the natural size, with a magnified representation of each. Figs. 16 and 17 are also magnified.



Whau.
 (ENTELEA ARBORESCENS)

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ENTELEA ARBORESCENS, R. Brown.

THE WHAU.

ORDER—TILIACEÆ.

(Plate XXXIII.)

THE whau, or, as Mr. Colenso informs me it is sometimes termed by the Maoris, the hauama, is the only representative of its genus, and was discovered by Banks and Solander, who gave it the name of *Corchorus sloanoides*; but owing to their MSS. and drawings being inedited it was first described by Robert Brown in "The Botanical Magazine" under the name of *Entelea arborescens*. It is termed cork-wood by the settlers on account of its light specific gravity: the weight of some specimens scarcely exceeds one-half the weight of a piece of cork of equal bulk.

This handsome plant forms a much-branched shrub or small tree, sometimes 25ft. high, with a trunk from 4in. to 9in. in diameter. The foliage and flowers are striking and attractive, presenting an appearance widely different from that of any other native plant. The young shoots and leaves beneath are covered with a fine white down, the leaves being of a soft deep-green above, and in outline bearing some resemblance to those of the black mulberry: they are sometimes 9in. in length, including the petiole, which varies from 1in. to 3in., and are furnished at the base with a pair of narrow stipules. The blade is drooping, produced into a rounded lobe on each side of the base, and is narrowed into a long point at the apex. It varies from 2in. to 6in. in breadth, and the margin is cut into a vast number of small irregular blunt teeth or crenatures. The flowers are developed in panicles or cymes, on very long stalks, springing from the axils of the uppermost leaves: the branches of the inflorescence, the pedicels, and the narrow bracteoles are white with fine down. The large flowers are snowy-white; the petals present a wrinkled appearance, and the stamens are very numerous. The fruit is very singular, about $\frac{3}{4}$ in. in diameter, and clothed with hard brittle spines, sometimes an inch long, so that it bears some resemblance to a small Spanish chestnut. It is from five- to seven-celled, each cell containing numerous seeds.

Owing to the progress of settlement, and the practice of setting fire to the scrub growing on the open land, the whau has become comparatively rare in many northern districts where it was plentiful within the last fifteen years, and, although there is no reason to anticipate its extinction, there can be no doubt that in another fifteen years it will become extremely rare, and practically confined to situations inaccessible to sheep and cattle.

The whau is easily raised from seed, and may be cultivated without difficulty in situations sufficiently sheltered to prevent injury from frost.

PROPERTIES AND USES.

The wood is porous, very open in the grain, and of rather uneven texture. It is one of the lightest woods known, its weight per cubic foot varying from 8.29lb. to 11.76lb. It is chiefly used by the Maoris for floats of fishing-nets,

&c., and for fenders for boats. It might be employed for life-belts and similar purposes, and possibly for some of the uses to which granulated cork and cork-refuse are now applied, as, for instance, the formation of foot-pavements. Should a demand arise for it, cultivation must be resorted to, as the native supply would soon be exhausted. The minute structure of the wood has not been made out, but the cells are very large, and have very thin walls.

DISTRIBUTION OF THE GENUS.

Entelea is a monotypic genus, and is absolutely restricted to the North Island of New Zealand, with the exception of a single habitat in the South Island.

It usually occurs on the margins of woods and thickets, and evinces a marked preference for the vicinity of the sea. It is most plentiful to the north of the Auckland Isthmus, and is found on nearly all the outlying islands, as well as those in the Hauraki Gulf. It extends to the northern portion of Hawke's Bay, but I have never seen it on the coast between Cape Turnagain and Port Nicholson, nor on the West Coast between the Mokau and Wellington, with the exception of a single habitat near Paikakariki.

In the South Island it is confined to a single station in the Collingwood district, in the north-western corner of the Island. Its distribution is therefore somewhat remarkable, although not more so than that of *Dracophyllum latifolium*, *Lomaria Fraseri*, and other plants. It attains its largest dimensions at the sea-level. I have not seen specimens growing at a greater altitude than 700ft.

DESCRIPTION.

Entelea arborescens, R. Brown, "Botanical Magazine," t. 2,480.

Apeiba australis, A. Rich. Fl. N.Z., p. 304, t. 34.

A much-branched shrub or small tree, 6ft. to 25ft. high, with stout branches. Branchlets, petioles, and leaves beneath clothed with fine stellate hairs. Leaves alternate, 3in. to 9in. long, 2in. to 6in. broad, with linear stipules at the base of the petiole; blade drooping, oblique, broadly ovate-cordate, acuminate, margins twice or thrice crenate; veins prominent, primary five to seven, springing from the apex of the petiole. Flowers in umbellate cymes, drooping; peduncles axillary, 2in. long or more; pedicels 1in. long, elongating in fruit; peduncles, bracteoles, pedicels, and sepals clothed with white pubescence. Sepals, three to five, broad, acuminate; petals, three to five, snowy-white, crumpled. Stamens very numerous, forming a dense ring surrounding the ovary; ovary globose, hispid, five- to seven-celled, ovules in two rows in each cell; stigma toothed. Fruit, globose, five- to seven-celled, $\frac{3}{4}$ in. in diameter, clothed with straight spines 1in. long; seeds numerous; embryo imbedded in oily endosperm.

EXPLANATION OF PLATE XXXIII.

Entelea arborescens, R. Br. Flowering specimen, natural size. 1. Flower with calyx and corolla removed. 2. Stamen before, and 3 after, dehiscence. 4. Ovary. 5. Transverse section of ovary. 6. Fruit. 7. Transverse section of fruit, to show the position of the seeds. 8. Seed. 9. Longitudinal section of seed. 10. Embryo. All more or less magnified except 6 and 7.



Ake Ake.
(OLEARIA TRAVERSH)

T. KIRK, DREXEL

WELLS, GEO. 1890. 285

OLEARIA TRAVERSII. F. Mueller.

THE AKEAKE.

ORDER—COMPOSITÆ.

(Plate XXXIV.)

OLEARIA TRAVERSII was originally discovered in the Chatham Islands by Diefenbach in 1840, but was mistaken by that traveller for the mangrove (*Avicennia officinalis*, Forst.),* to which it exhibits a certain general resemblance, but is never found growing in tidal mud, the invariable habit of that plant. It was rediscovered by Captain Gilbert Mair in 1862, and by Mr. H. H. Travers in 1863; the specimens collected by the latter gentleman were described by Sir Ferd. von Mueller, in his "Vegetation of the Chatham Islands," under the name of *Eurybia Traversii*; but, as *Eurybia* cannot be separated from *Olearia*, it was formally described under the name of *Olearia Traversii* by Sir Joseph Hooker in "The Handbook of the New Zealand Flora" (p. 731).

Captain Mair informed me that it is termed akeake by the natives of the Chatham Islands—a name applied also to other species of the genus in different parts of New Zealand. Mr. H. Travers states that it is called "bastard sandalwood-tree" by the settlers on Pitt Island.

This species forms a small tree 25ft. to 35ft. high, often with a trunk over 3ft. in diameter at the base, but usually smaller. Branches strict in the young state, somewhat spreading when mature, opposite. Branchlets, under-surface of leaves, panicles, and involucre white, with close silky down; branchlets irregularly angular. Leaves opposite, about 2in. or more in length, oblong or ovate, on short leaf-stalks, acute. Flowers in much-branched panicles, 1in. to 3in. long, springing from the axils of the leaves. Flower-heads small, very numerous, but not showy. The florets are of two kinds: the outer florets are abortive and tubular, with an oblique mouth, but without a ray; inner florets perfect; mouth of corolla five-lobed.

Olearia Traversii forms an attractive tree, although the flowers are not remarkable for their beauty. The coriaceous leaves, of a bright-green on their upper surface, and white with silky down below, the white branches and involucre, afford continuous changes of colour when the tree is agitated by the wind. It is the only New Zealand species of *Olearia* with opposite leaves.

PROPERTIES AND USES.

The wood is dense, heavy, firm, and compact, with a satiny lustre when worked up. In old trees the outer portion is usually more or less mottled, and is readily purchased by cabinetmakers for ornamental work: unfortunately, it is but rarely to be obtained, owing to the infrequent communication with the Chatham Islands. The late Mr. Seuffert, cabinetmaker, of Auckland, received small parcels at various times, and valued it highly for inlaying and special work.

* See *post*, Plate CXIII.

It has, however, come into general cultivation as an ornamental tree, and flourishes in all parts of the colony: its power of resisting wind renders it of great value where shelter is required, especially in places near the sea, as but few trees are able to stand against the force of gales laden with saline matter.

It was introduced into cultivation by Mr. Seed, late Commissioner of Customs, who brought living plants to Wellington in 1861.

DISTRIBUTION OF THE GENUS.

Olearia as now constituted comprises about ninety-five species, of which nearly seventy are peculiar to Australia, and twenty-five to New Zealand. Of the latter, one is restricted to the Great Barrier Island, three others to the North Island, seven to the South Island, one to Stewart Island, two to Chatham Islands, one to Stewart and Auckland Islands. The genus is absolutely restricted to Australia and New Zealand, although not a single species is common to both countries.

DISTRIBUTION OF THE SPECIES.

Olearia Traversii is restricted to the Chatham Islands.

DESCRIPTION.

Olearia Traversii, F. Mueller. Hooker f., "Handbook of the N.Z. Flora," p. 731.

Eurybia Traversii, F. Mueller, "Vegetation of the Chatham Islands," p. 19, t. II.

A small tree 30ft. high or more; trunk 2ft. to 3ft. in diameter; bark greyish-brown, furrowed. Branchlets opposite, tetragonous, clothed with white down. Leaves petioled, opposite, coriaceous, 2in. to 3in. long, narrowed into a short petiole below, white with close down beneath, oblong or ovate, acute or apiculate. Flowers in much-branched panicles, 1in. to 3in. long, springing from the axils of the leaves. Heads small, numerous; involucral leaves in two series, narrow-linear, white with appressed down. Outer florets oblique at the mouth, ray not produced; disc-florets perfect, corolla five-lobed; arms of the stigma very small. Achene faintly striated, hairy; pappus brown.

EXPLANATION OF PLATE XXXIV.

Olearia Traversii, F. Mueller. 1. Flowering specimen, natural size. 2. Flower-head. 3. Involucre. 4. Perfect floret. 5. Outer floret. 6. The same with the pappus removed. All magnified.



Rewa Rewa — Honeysuckle.
(KNIGHTIA EXCELSA).

KNIGHTIA EXCELSA, R. Brown.

THE REWAREWA.

ORDER—PROTEACEÆ.

(Plate XXXV.)

THE rigid branches of the rewarewa, combined with its lofty stature, render it one of the most striking trees of the New Zealand flora; its fastigate habit renders it unique in our forests: when growing amongst a number of ordinary round-headed trees it produces the same effect in the landscape as that exhibited by the Lombardy poplar when growing amongst oak or ash, to which it affords a pleasant relief and a welcome contrast.

The rewarewa attains the height of from 70ft. to 100ft., with a trunk from 1½ft. to 3ft. in diameter. The bark is smooth and even, usually of a dark-brown colour, but in some specimens nearly black. The branches are rigid and erect, forming a spiry fastigate head, and the leaves are carried on short leaf-stalks, the blades being from 5in. to 8in. long, rigid, hard, and blunt, with coarse teeth. The branchlets, the under-surfaces of the leaves, and even the flowers are clothed with a fine velvety down, which, in the flowers, is of a deep reddish-brown, and renders them very conspicuous.

The flowers are arranged singly or in pairs in cylindrical racemes, 2in. in diameter, springing from the axils of the leaves or from naked parts of the branches, and are very shortly pedicelled: a raceme consists of from fifty to eighty flowers. Each flower is a narrow tube, about 1½in. long, slightly dilated at the base and apex, consisting of four leaves or segments, which, before expansion, cohere for their entire length. A single anther, destitute of a filament, is carried near the apex of the inner face of each segment, so that the four anthers form a ring surrounding the thickened extremity of the style. The ovary is one-celled, with a long rigid style, which is club-shaped at its upper extremity, but is stigmatiferous at the apex only. At the base of the ovary are four small glands, which secrete honey in considerable quantity. The process of expansion is very interesting: the apex of the perianth separates into four very short lobes, which open sufficiently to allow the extremity of the style to be seen, but all further expansion is from the base upwards; the perianth gradually splits from below into four narrow segments, the last portion to be set free being that which immediately surrounds the thickened portion of the style. Each segment of the perianth becomes tightly rolled back on itself, forming a compact spiral, so that when expansion is complete the raceme presents a singular appearance: the rigid styles, with their swollen extremities, appear to spring from a confused mass of red spiral filaments. During the process of expansion most of the pollen is deposited on the sides of the club-shaped extremity of the style, although not in contact with the stigmatiferous apical portion, so that self-fertilisation is next to impossible; the pollen appears to be transferred to other flowers by insects or birds visiting the plants in search of honey.

The fruit is woody, 1½in. long, opening along a single line, and is tipped with the long style; when expanded to liberate the seeds it resembles a

miniature boat. The seeds are narrow-linear, and winged at the tip. The flowers are produced in December and January, but the fruit does not ripen until October. After the seeds are liberated, the pericarp remains on the tree until the seeds of the following year are nearly matured.

The rewarewa is often termed "honeysuckle" by the settlers, but it is not easy to imagine any reason for the application of the name, which is also given with equal lack of meaning by Australian settlers to the closely-related *Banksias* or "bottle-brush" trees.

PROPERTIES AND USES.

The mean specific gravity of rewarewa is .785, its weight per cubic foot 48.92lb., and its mean ultimate strength 161lb.: *i.e.*, a piece 12in. long and 1in. square, supported at one end and loaded at the other, will carry 161lb. before breaking.* Rewarewa affords an ornamental timber of great strength, but is not durable when exposed; it is usually of a deep-red colour, straight in the grain, and beautifully mottled; the "silver grain" varying remarkably in size and distribution, so that it is in some request for the purposes of the cabinetmaker and for decorative fittings generally. It has been employed for the saloon-fittings of one or two of the small coastal steamers trading from Auckland, but, owing to its somewhat dark hue, requires to be relieved by light-coloured woods. It is highly valued for inlaid work generally, tables, writing-desks, stationery-cases, &c., as well as for all kinds of ornamental turnery; it is also employed for inside work in houses, occasionally for flooring-boards, or even for upper weather-boarding. It is, however, somewhat wasteful to use it for purposes of this kind when other timbers can be procured. If a constant supply could be placed on the English market, it would meet with a ready sale. At present large quantities of this fine timber are destroyed yearly by settlers who are ignorant of its value, or who have no means of getting it to market.

It might prove of value for special purposes in which it is desirable to minimise the risk of fire, as it is a timber very difficult of combustion. This may be frequently seen in settlers' clearings after burning off, trunks of rewarewa 60ft. or 80ft. long very often being little more than scorched.

DISTRIBUTION OF THE GENUS.

Knightsia consists of two species, one of which is peculiar to New Zealand, the other to New Caledonia.

DISTRIBUTION OF THE SPECIES.

Knightsia excelsa extends from the North Cape, through the lowland wooded districts of the North Island, and crosses Cook Strait. In the South Island, it was formerly plentiful in Pelorus Sound and other parts of Marlborough, but has gradually been converted by the sawmiller, so that, except in a few localities, it is now rare and local. It occurs sparingly in Croixelles Harbour, in the Nelson District, but is of small size.

It ascends from sea-level to 2,600ft.

DESCRIPTION.

Knightsia excelsa, R. Brown. "Transactions of the Linnean Society," Vol. x., t. 2.

An erect close-branched tree, 100ft. high; trunk, 2ft. to 3ft. in diameter; branches ascending. Branchlets and inflorescence clothed with velvety down.

* Balfour's Experiments.

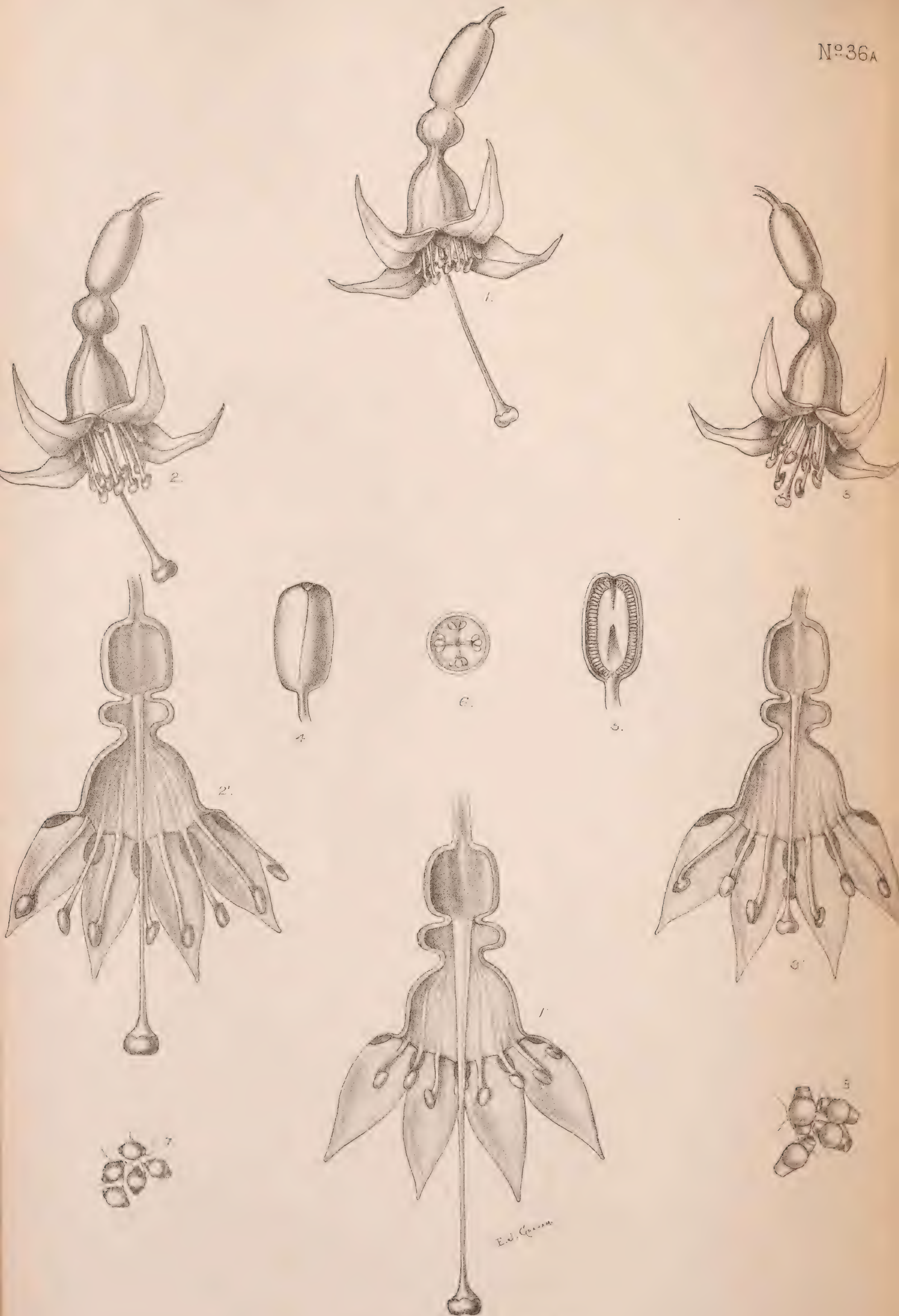
Leaves 5in. to 8in. long, $1\frac{1}{2}$ in. broad, hard and rigid in texture, coarsely toothed; obovate-oblong, obtuse. Flowers in sessile cylindrical racemes, 2in. to 4in. long and exceeding 2in. in diameter, springing from the axils of the leaves or naked parts of the branches. Flowers, $1\frac{1}{2}$ in. long, tubular before expansion, shortly pedicelled, in pairs or solitary. Perianth-leaves four; revolute when expanded. Stamens four, with short filaments inserted near the tips of the perianth-leaves. Ovary hirsute, one-celled; style rigid, with a clavate tip, the apical portion stigmatiferous. Fruit a woody follicle, narrow-oblong, downy, narrowed into the persistent style. Seeds three or four, winged at the apex.

EXPLANATION OF PLATE XXXV.

Knightia excelsa, R. Brown. 1. Perianth-leaf, with attached stamen. 2. Bifid perianth-leaf, with ovary at base. 3. Ovary. 4. Portion of raceme, with expanding flowers. 5. Perianth in early stage of expansion.



Kotukutuku.
(FUCHSIA EXCORTICATA).



Fuchsia excorticata
(KOTUKUTUKU)

54

FUCHSIA EXCORTICATA, Linné f.

THE KOHUTUHUTU.

ORDER—ONAGRARIÆ.

(Plates XXXVI. and XXXVIA.)

THIS is the largest species of the genus, and was discovered by Banks and Solander during Cook's first voyage, when it received from them the manuscript name of *Agapanthus calyciflorus*. It was first described under its present name by the younger Linné. Forster named it *Skinnera excorticata*, separating it from *Fuchsia* chiefly on account of the remarkable constriction near the base of the calyx.

Mr. Colenso informs me that it is the kohutuhutu and the kotukutuku of the Maoris, the fruit being known as konini, especially in the South Island and the southern part of the North Island. The settlers sometimes term it kotukutuku or konini, but more generally fuchsia.

It is of irregular growth, varying from a much-branched shrub to a small tree 45ft. high, with a short trunk often gnarled, from 1ft. to 3ft. in diameter, and thin bark of a bright reddish-brown hue, which on old specimens divides into numerous paper-like flakes or layers.

It is characterized by ascending branches and alternate leaves from 1½in. to 4in. long, on slender petioles, lanceolate or broadly lanceolate, usually narrowed into long straight points; they are of soft texture, green on the upper surface and silvery beneath. The flowers are solitary, pendulous on slender peduncles springing from the axils of the leaves, and varying from ¾in. to 1in. in length. At first they are greenish, streaked or blotched with a dull deep purple, passing at length into a dull red. The tube of the calyx is constricted immediately above the ovary, after which it becomes funnel-shaped and divided into four acute segments, which are ultimately curved backwards. The petals are four in number, minute, and inserted at the throat of the calyx; they are at first black, which passes through various shades of colour into a bright purple. The stamens are eight in number, and vary greatly in length on different trees: but it will be necessary to refer to this further on. The ovary is four-celled, with numerous ovules, and matures into an egg-shaped blackish-brown or black berry.

Fuchsia excorticata is remarkable for the different forms of flower which it exhibits, the difference depending chiefly upon the relative length of the stamens and style. Three principal forms may be distinguished, although, as in other trimorphic flowers, it is not easy to define them by hard-and-fast lines. In the first, which may conveniently be termed the long-styled form, the style is twice the length of the calyx-tube, but the filaments are very short, and the anthers scarcely project beyond the throat of the calyx; they are, moreover, abortive, or produce perfect pollen but rarely.* In the second or mid-styled form the style is less than twice the length of the calyx-tube, but the filaments are much longer

* Enlarged drawings of each form are given on Plate XXXVIA., and numbered 1, 2, 3, respectively.

than in the preceding form, and show a tendency to form two series, one shorter than the other. Usually they reach to within a quarter of an inch of the stigma. In the third or short-styled form the style is slightly shorter than in the mid-styled form, but the stamens have much longer filaments, which show a marked tendency to become arranged in four pairs, the longest pair being but slightly shorter than the stigma.

In most trimorphic flowers each form is fertile on the application of pollen from either of the other forms, although sterile on the application of its own pollen, but in *Fuchsia excorticata* the entire work of fertilisation is effected by two forms only; the long-styled form rarely produces pollen capable of effecting fertilisation, and therefore can exercise no influence on the fertilisation of other flowers; it is a female flower, and therefore must receive pollen from the mid- or short-styled form or from both. It is therefore remarkable that long-styled flowers produce fruit in greater profusion than the mid- or short-styled. In the absence of experiment it would be rash to assert that the short- and mid-styled flowers are incapable of self-fertilisation, but there can be no doubt that the application of the pollen of either form to the stigma of the other would result in the formation of the largest number of perfect seeds.

In the mid- and short-styled forms the pollen is of a beautiful mazarin blue, and is bound together by delicate viscid threads running through its mass: the pollen-grains are easily excited to growth, and when fully ripe extrude their delicate tubes on the slightest application of moisture. The short-styled form may occasionally be self-fertilised, as detached pollen-grains falling from its stamens may come in contact with the sides of its stigma. Birds are the usual agents for the transfer of pollen from one form to another. The tui and the korimako frequent these plants in quest of honey, and must necessarily transfer the pollen from one plant to another. It is interesting to watch them poising on the wing, and dexterously inserting their beaks into the slender tube of the fuchsia.

In another New Zealand species the flowers are trimorphic, but differ only in the length of the style in each form, the stamens being of the same length in all. In the long-styled form the style greatly exceeds the stamens, in the mid-styled form it equals the stamens, and in the short-styled form is much shorter than the corolla-tube. Under cultivation the mid- and short-styled forms are certainly self-fertilised, and although as a rule the fruits are few in number or even solitary, yet in some cases they are produced freely.

PROPERTIES AND USES.

The fuchsia affords one of the strongest and most durable timbers in the colony; but as its trunk is often curved or gnarled it is very difficult to procure logs exceeding 8ft. or 9ft. in length, so that its commercial value is greatly diminished. The wood is hard, dense, compact, and even; its colour is a deep brown, relieved with broad streaks of a paler shade, and short narrow wavy black markings. When much wavy it is of a highly ornamental character.

The wood is extremely difficult of combustion, and like the rewarewa is often termed "bucket-of-water wood" by the bushman; even when thoroughly dry it can scarcely be burned in an open grate.

It is used for house-blocks and fencing-posts, which seem almost indestructible either by the passive lapse of time or the active ravages of fire. House-blocks in Dunedin showed no traces of decay after being down upwards of twenty

years. During the great fire of 1885-86 in the Taranaki District, when miles of fencing were destroyed, fuchsia posts were untouched, or at most were scorched but never charred.

It is prized for ornamental cabinetwork, inlaying, picture-frames, inkstands, and ornamental turnery in general.

The wood contains 5.3 per cent. of tannin, according to an analysis made at the Colonial Museum.

DISTRIBUTION OF THE GENUS.

Fuchsia comprises about fifty species, confined exclusively to South America and New Zealand; but only three species are found in the colony. In South America they are plentiful from Mexico to Magellan Strait.

DISTRIBUTION OF THE SPECIES.

Fuchsia excorticata occurs from the North Cape to Stewart Island, and ascends from the sea-level to 3,000ft.

OTHER NEW ZEALAND SPECIES OF FUCHSIA.

F. excorticata and *F. Colensoi* are alike characterized by pendulous flowers with the calyx-tube constricted so as to form a rounded portion immediately above the ovary, and minute, almost inconspicuous, petals. *F. Colensoi* is a small species often procumbent or sub-erect, and frequently climbing amongst shrubs by means of its long simple shoots. It occurs from the Waikato to Stewart Island. *F. procumbens* is a small procumbent species with orbicular leaves, and erect flowers destitute of petals. It is confined to a few littoral habitats north of the Waitemata, and is one of the most charming plants in the flora.

DESCRIPTION.

Fuchsia excorticata, Linné f.

A shrub or small tree, sometimes 45ft. high; trunk, 1ft. to 3ft. in diameter, clothed with brown papery bark. Leaves alternate, glabrous, 1½in. to 4in. long, lanceolate or ovate-lanceolate, acute or acuminate, with minute distant serratures; petioles slender. Flowers axillary, solitary, ¾in. to 1in. long, pendulous, on long slender peduncles. Calyx-tube constricted above the ovary, funnel-shaped; segments, four, acute, reflexed or recurved; petals, four, minute, inserted at the mouth of the calyx. Stamens, eight, varying in length in different plants. Ovary, four-celled; style varying in length. Fruit, a pendulous berry. The flowers are produced from August to December.

Var. β , *intermedia*. An erect shrub or small tree. Leaves on slender petioles, ovate, acuminate, ¾in. to 1in. long, margins minutely toothed, silvery beneath, and extremely membranous.

EXPLANATION OF PLATES XXXVI. AND XXXVIA.

XXXVI. *Fuchsia excorticata*, Linné f. 1 and 2. Mid-styled and short-styled forms, natural size.

XXXVIA. *Fuchsia excorticata*, Linné f. 1. Flower of long-styled form. 2. Flower of mid-styled form. 3. Flower of short-styled form. 1', 2', 3'. Diagrammatic drawing, showing the corolla laid open and the relative lengths of the styles and stamens of each form. 4. Fruit. 5. Longitudinal section of fruit. 6. Transverse section of fruit. 7 and 8. Pollen-grains; to show the tubes breaking through their walls. All magnified.



Bidwill's Pine.
(DACRYDIUM BIDWILLII.)

DACRYDIUM BIDWILLII, Hook. f.

THE MOUNTAIN-PINE.

ORDER—CONIFERÆ.

TRIBE—TAXEÆ.

(Plate XXXVII.)

THIS charming mountain-pine has until recently been confused with other species of *Dacrydium*, and was first described by the present writer in "The Transactions of the New Zealand Institute" for 1877,* the specific name being attached at the suggestion of Sir Joseph Hooker, who stated that specimens collected in the Nelson District by Bidwill were preserved in the herbarium at Kew.

Dacrydium Bidwillii is a small species forming a handsome conical or dome-shaped shrub, from 2ft. to 12ft. high, with a very short trunk rarely exceeding 1ft. in diameter, and usually only a few inches, with spreading, often horizontal, branches. The mountain-pine is remarkable for the great difference exhibited by its leaves at different periods of growth. In the young state they are linear, flat, crowded, and spreading, $\frac{1}{3}$ in. long, but in the mature state they resemble minute, close-set green scales, keeled on the back, and overlapping each other like the scales of a fish. There is no resemblance between the leaves of the early and mature states, so that, while the first resemble those of the mountain totara, the second might easily be mistaken for those of a cypress.

The male and female flowers are produced on separate trees. The male catkins are carried on the tips of the branchlets, and are from $\frac{1}{10}$ in. to $\frac{3}{20}$ in. in length, but differ considerably from those of *Dacrydium cupressinum* in structure: instead of the green anther-scales with long points, the scales are short, obtuse, brown, and the catkins ovate. The female flowers are solitary or in twos, below the tips of the branchlets. The nuts are very small, compressed, and the involucrel cup sometimes becomes fleshy, white, and smooth.

This species exhibits two principal forms, which are so closely connected that they can scarcely be kept apart even as varieties. In α , *erecta*, the plant has a conical outline, the flat leaves are obscurely ribbed, and the fruiting branchlets very slender: in β , *reclinata*, the plant is prostrate or with spreading horizontal branches, and the flat leaves have a distinct mid-rib, the fruiting branches being rather stout.

The linear flat leaves are green when fresh, but change to a light-brown in drying, or, in some cases, to a reddish-black.

In the Te Anau district, where this species is plentiful, it is termed "bog-pine" or "tar-wood" by the shepherds, but does not seem to have received a distinctive name elsewhere.

On flats by the Thomas River, Canterbury, a number of remarkable specimens of var. *reclinata* occur, forming rounded clumps from 2ft. to 5ft. high, and from 10ft. to 20ft. in diameter, growing in a regular and symmetrical manner:

* Trans. N.Z. Inst. x., p. 388.

there are also densely-crowded rings of young plants, with open centres of similar diameter. In the oldest specimens the stem is found to branch at the surface of the ground, the main branches being prostrate, 5ft. to 10ft. in length, and from 5in. to 6in. in diameter, rooting at their extremities. If the trunk is injured or decays from age, the branches gradually die, leaving their rooted tips to form a ring of young plants; but more frequently erect secondary branches are given off along their entire length, and a compact symmetrical clump is formed. This remarkable habit is occasionally exhibited by various pines, even by the Scandinavian spruce, *Picea communis*, but under any circumstances must be regarded as exceptional. Where development is prevented by the density of the surrounding vegetation, the plant soon becomes straggling and unattractive.

PROPERTIES AND USES.

Dacrydium Bidwillii, owing to its small size, is of little economic value except for firewood. It is of great durability; dead branches are frequently to be met with in a sound condition after protracted exposure.

Its symmetrical habit of growth and attractive character will render it a favourite plant wherever ornamental planting is required.

DISTRIBUTION OF THE GENUS.

See under *Dacrydium cupressinum*, p. 31, *ante*.

DISTRIBUTION OF THE SPECIES.

Dacrydium Bidwillii is restricted to New Zealand. In the North Island it occurs sparingly in several localities in the Taupo country, near Rotoaira. I believe it is found also on the Ruahine and Tarawera Mountains, but have seen no specimens from these localities. In the South Island it is not uncommon in mountain situations in Nelson, Canterbury, and Otago, extending to Stewart Island, where it descends to the sea-level. It ascends to 4,500ft. in the Alps of Canterbury.

DESCRIPTION.

Dacrydium Bidwillii, Hook. f. T. Kirk, Trans. N.Z. Inst., x., p. 338.

A dioecious shrub, 2ft. to 12ft. high. Leaves of young state linear, $\frac{1}{4}$ in. to $\frac{1}{3}$ in. long, flat, coriaceous, sessile, crowded, ascending; on mature plants, arranged spirally in four rows, imbricating, coriaceous, triangular, keeled, obtuse, attached by broad bases. Male catkins terminal, solitary, $\frac{1}{10}$ in. long, connective obtuse; female, solitary or two together, near the tips of branchlets. Nut striate, compressed, keeled, obtuse; involucrel cup sometimes tumid, fleshy, white.

a, erecta. Erect, main branches ascending, forming a pyramidal or conical tree. Mid-rib of linear leaves obscure; fruiting branches very slender.

β , reclinata. Branches prostrate or horizontal; linear leaves with a distinct costa; fruiting branches stouter.

EXPLANATION OF PLATE XXXVII.

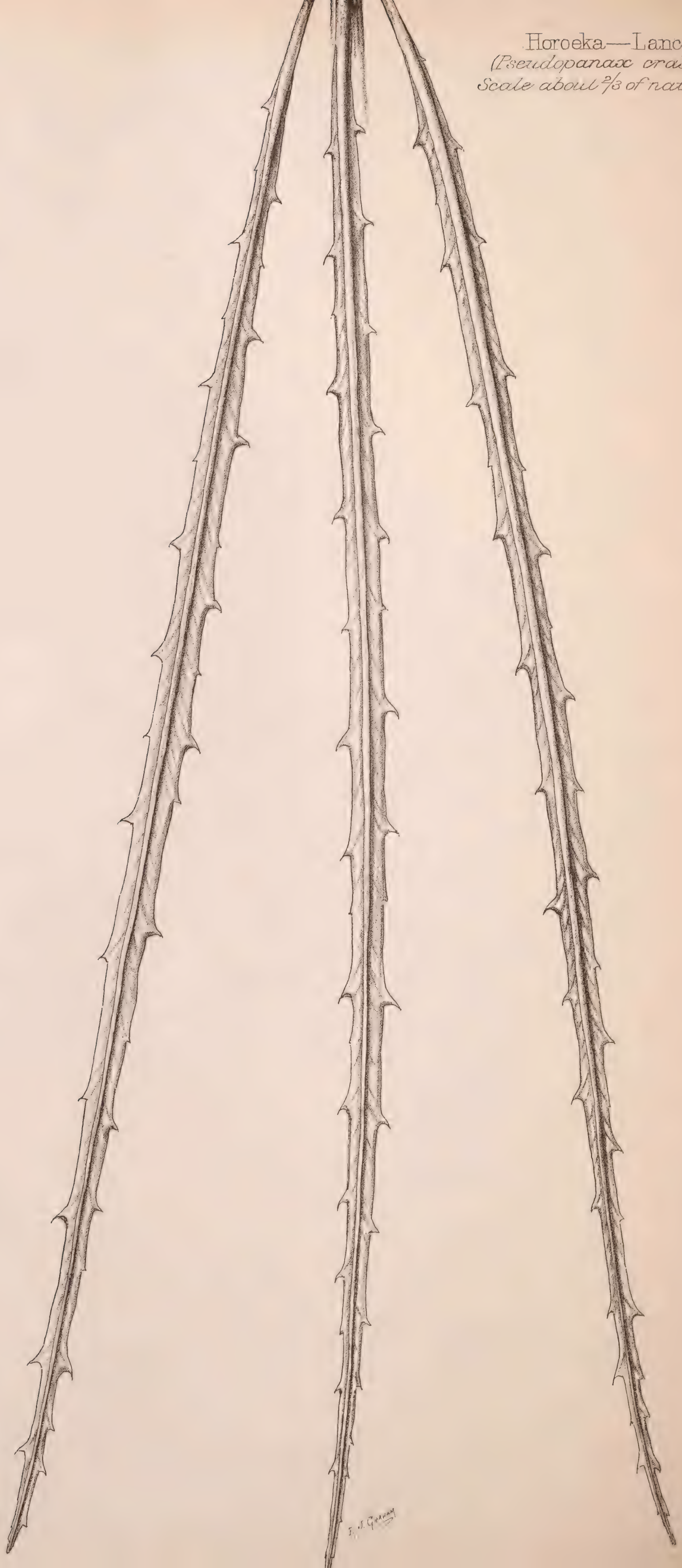
Dacrydium Bidwillii, Hook. f. 1. Mature state, with male flowers. 2. Mature state, with female flowers. 3. Young plant, with linear leaves. 1'. Fruit, natural size. 2', 3'. Fruit, magnified. 4'. Longitudinal section of fruit.



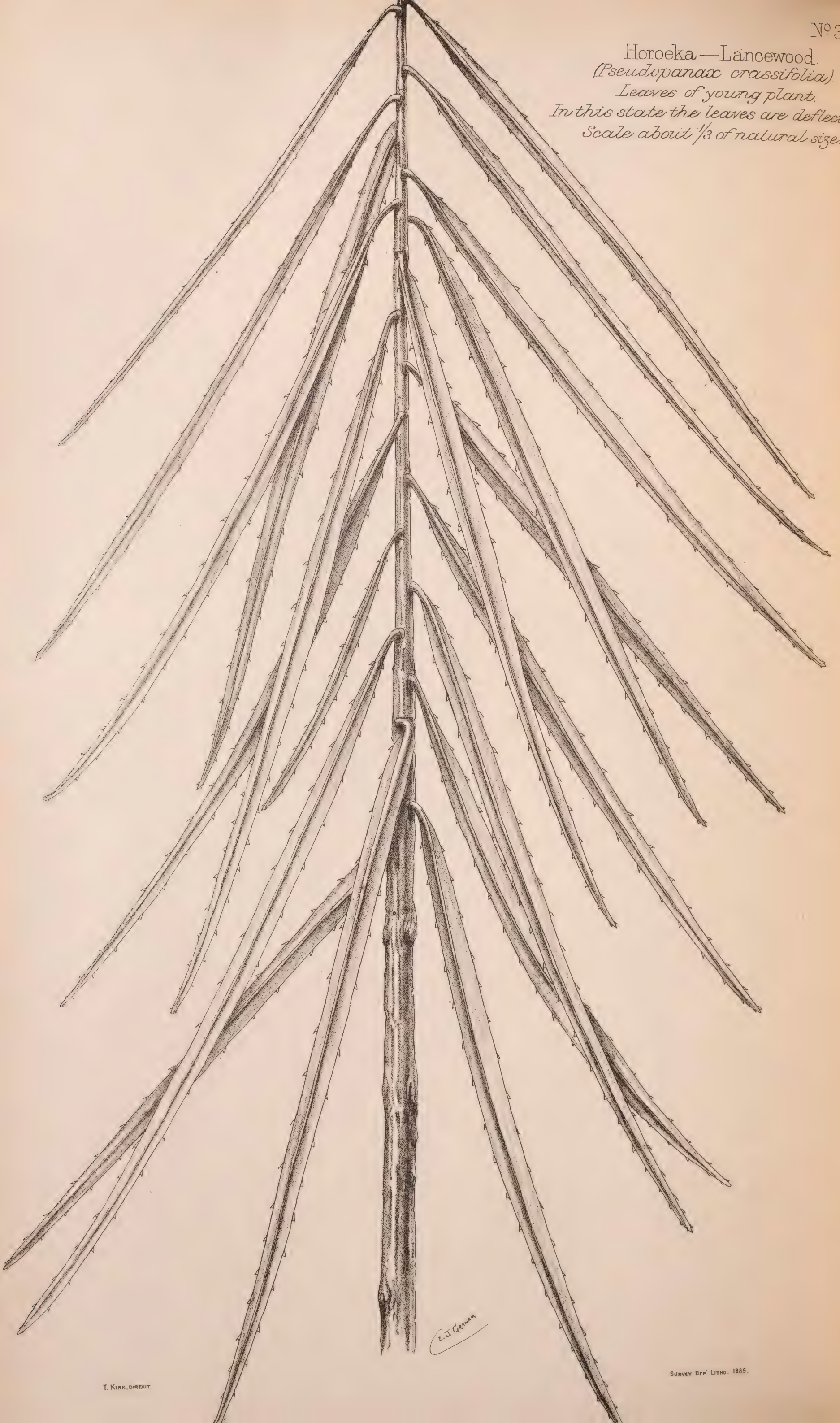
Horoeka

(PSEUDOPANAX CRASSIFOLIA)

Horoeke—Lancewood.
(*Pseudopanax crassifolia*).
Scale about $\frac{2}{3}$ of natural size.



Horoeka — Lancewood.
(*Pseudopanax crassifolia*).
Leaves of young plant.
In this state the leaves are deflected
Scale about $\frac{1}{3}$ of natural size.



E. J. GRIMAL



Horoeka-Lancewood.
 (PSEUDOPANAX CRASSIFOLIA).
 Mature leaves and fruit.

T. KIRK, DREXEL

SURVEY DEP. LITHO. 1885



Horoea.
(*PSEUDOPANAX CRASSIFOLIUM.*)

PSEUDOPANAX CRASSIFOLIUM, Seemann.

THE HOROEKA.

ORDER—ARALIACEÆ.

(Plates XXXVIII., XXXVIII_A., XXXVIII_B., XXXVIII_C., and XXXVIII_D.)

MR. COLENZO informs me that this tree is termed horoeka by the Maoris; and I learn from the Ven. Archdeacon Williams that it is also known as hohoeka, a name which is stated by Dr. Lyall to be used in the South Island. It is commonly termed lancewood by the settlers in the North Island, and grass-tree by those in the South.

This species was discovered during Cook's first voyage, and it need cause no surprise to learn that the remarkable difference between the young and mature states led so able a botanist as Dr. Solander to consider them distinct plants: the young flowerless state received the MS. name of *Xerophylla longifolia*, and the mature state was named *Aralia crassifolia*. It was subsequently described under the latter name by A. Cunningham in his "Prodromus of the Botany of New Zealand," and in 1843 was figured by Sir William Hooker in "Icones Plantarum," t. DLXXXIV. In 1853 it appeared under the same name in the "Flora Novæ-Zelandiæ." In 1865 it was referred to *Pseudopanax* by Seemann; and in "The Handbook of the New Zealand Flora," published in 1867, it was divided into two species, the mature state being described as *Panax crassifolium*, and the young state with deflexed leaves as a new species, under the name of *P. longissimum*. Sir Joseph Hooker was led to this conclusion from a young plant, under cultivation at Kew, having exhibited its peculiar character unchanged for fifteen years: the error was corrected in the Supplement to the Handbook.

A fruiting specimen, with the young leaf, was figured by Mr. Buchanan, F.L.S., in the ninth volume of "The Transactions of the New Zealand Institute," t. xx., under the name of *Panax longissimum*; while an account of its chief variations was published by the writer in "The Transactions of the New Zealand Institute," vol. x., p. xxxi., Appendix.

In its mature state it forms a round-headed tree, having an extreme height of 50ft., and a trunk of about 18in. in diameter. Larger specimens are extremely rare. In its progress to maturity it passes through a series of changes still more remarkable than those of *P. ferox*, to which it is closely related.* It is one of the first trees to attract the attention of the traveller in forest districts.

Its seed-leaves do not differ widely from those of *P. ferox*; but the leaves next produced are very different: they are distinctly stalked, 1in. to 2in. in length, rhomboid or elongate-rhomboid in shape, and sharply toothed or deeply lobed, bearing some resemblance to those of the common hawthorn. Succeeding leaves become longer and of uniform width, until they sometimes attain the length of 43in., while they scarcely exceed $\frac{1}{2}$ in. in width, and are invariably deflexed: in this stage the leaves are thick and leathery in texture, and acute at the apex,

* See ante, Pl. XXIII. to Pl. XXVI.

with distant sharp marginal teeth (Pl. XXXVIII A.). The midrib is excessively stout, and the surface of the leaf is occasionally blotched. The stem is invariably simple in this stage of development, ranging from 6ft. to 20ft. in height before branching, and, with the leaves, presenting a curious conical shape and metallic appearance (Pl. XXXVIII B.). These simple linear leaves are succeeded by compound leaves, composed of three or five leaflets from 8in. to 12in. long, carried on petioles from 1in. to 5in. in length: the leaflets are not so stiff as the linear leaves, and rarely exceed $\frac{1}{2}$ in. in breadth; the margins are sharply toothed (Pl. XXXVIII.). These are followed by similar leaves with longer petioles, and broader leaflets of thicker texture, with the margins cut into coarse distant teeth. Flowers are sometimes produced in this stage, but not unless the stem has given off one or two branches. In the commencement of the mature stage the leaves become simple, but otherwise exhibit no great divergence from the leaflets of the preceding stage; succeeding leaves become excessively thick and hard; the teeth gradually diminish in size until the final stage, when they disappear, and the mature leaf is developed, from 4in. to 6in. in length, jointed to a short stout petiole, linear, quite entire, or with a few obscure serratures or coarse teeth.

On the Chatham Islands the long deflexed leaves do not appear to be developed, the plant passing almost directly from the early-leaf state to the mature stage. The state with compound leaves appears to be restricted to the Auckland District and the northern part of Hawke's Bay, while the large toothed simple leaves pass more gradually into the mature state in the South Island generally than in the North.

The male and female flowers are produced on different trees. In both alike the flowers are pedicelled; they are arranged either in much-branched terminal umbels, or in racemes branched in an umbellate fashion. The male flowers have the calyx-limb divided into five minute teeth; petals, five, free; stamens, five; pistil, none. The female flower consists simply of the pistil,—calyx-teeth, petals, and stamens being absent: the ovary is four- or five-celled, each cell containing a single ovule. Fruit globose, black, becoming furrowed when dry; seeds four or five.

The flowers are produced in March and April, and the fruit ripens in November and December.

PROPERTIES AND USES.

The timber is dense, even, compact, and of a lightish-brown, sometimes of a satiny lustre. It is not of extreme durability, but has been applied to various purposes in exposed situations with fairly good results. Small piles used by the settlers in the construction of the first jetty erected at Port Chalmers lasted for thirty years, and were untouched by the teredo: the jetty was removed in the year 1882 or 1883.* It is occasionally employed for fencing-posts, struts, props, sleepers, and similar purposes, especially in the Otago District, where its value is better appreciated than in other parts of the colony.

The leaves and wood alike exhale a peculiar and most unpleasant odour, and would in all probability afford a valuable insecticide.

It is of considerable value for ornamental planting: a group of plants with linear deflexed leaves affords a striking contrast to the habit of most ornamental trees and shrubs, which is only approached by the corresponding state of *Pseudopanax ferox*. Young plants are easily raised from seed, and usually commence flowering from their fifteenth to twentieth years.

* Blair: Building Materials of Otago, p. 162.

DISTRIBUTION OF THE GENUS.

See under *Pseudopanax ferox*, p. 35, ante.

DISTRIBUTION OF THE SPECIES.

This species is only found in New Zealand, but the form with trifoliolate leaves is practically restricted to the Auckland District and the northern part of Hawke's Bay. Mr. J. Buchanan states that it occurs in Otago, but gives no locality: it does not appear to have been found in that district of late years.

Var. *unifoliolata* occurs in forest districts from the southern parts of Auckland and Hawke's Bay to Stewart Island, often in great abundance.

DESCRIPTION.

Pseudopanax crassifolium, Seemann, "Journal of Botany," 1865, p. 178.

Aralia crassifolia, Banks and Solander. MS., Cunningham. "Pro-dromus of the Botany of New Zealand." Hook., "Icones Plantarum," t. DLXXXIV. Flora Nov.-Zel., p. 96.

Xylophylla longifolia, Banks and Sol., MS.

Aralia heterophylla, A. Cunn., MS.

Panax crassifolium, Decaisne and Planchon, "Revue Horticole," 1854, p. 105. Hook. f., "Handbook of the New Zealand Flora," p. 101. T. Kirk, Trans. N.Z. Inst., t. xxxiii., Appendix.

Hedera crassifolia, A. Gray, "Botany of United States Exploring Expedition," p. 719.

A round-headed diœcious tree, with spreading or straggling branches; height 50ft.; trunk 10in. to 18in. in diameter. Leaves alternate, petiolate, of several forms:—

Var. *α*, *unifoliolatum*. 1. In the seedling state membranous, rhomboid or rhomboid-acuminate, sharply toothed or lobed, deeply incised. 2. In the unbranched state, simple, coriaceous, linear, sometimes over 3½ft. long, ½in. wide, deflexed, with distant acute teeth; upper surface blotched; midrib stout; petioles very short and stout. 3. Leaves shorter, broader, on longer petioles, often coarsely toothed; when mature, teeth small, excessively coriaceous. Flowers in compound terminal umbels, shortly pedicelled. Male, calyx with five minute teeth; petals, five, free; stamens, five. Female, calyx-limb obsolete; ovary, four- or five-celled, with a single seed in each cell. Fruit, globose, furrowed when dry.

Sub-var. 1. Terminal rays of panicle umbellate.

Sub-var. 2. Terminal rays of panicle racemose.

β, *trifoliolatum*. Leaves of the third stage compound, three- or five-foliolate; leaflets, 6in. to 12in. long, ⅓in. to ½in. wide, shortly petioled, acute or obtuse.

EXPLANATION OF PLATES XXXVIII., XXXVIII A., XXXVIII B., XXXVIII C., XXXVIII D.

XXXVIII. *Pseudopanax crassifolium*, Seemann. *β*, *trifoliolatum*. 1. Early trifoliolate stage. 2. Later trifoliolate stage, natural size. 3. Male flower. 4. Fruit. 5. Transverse section of fruit. All magnified. (Drawn from specimens collected at Great Omaha.)

XXXVIII A. *Pseudopanax crassifolium*, Seemann. Leaves of second stage, reduced.

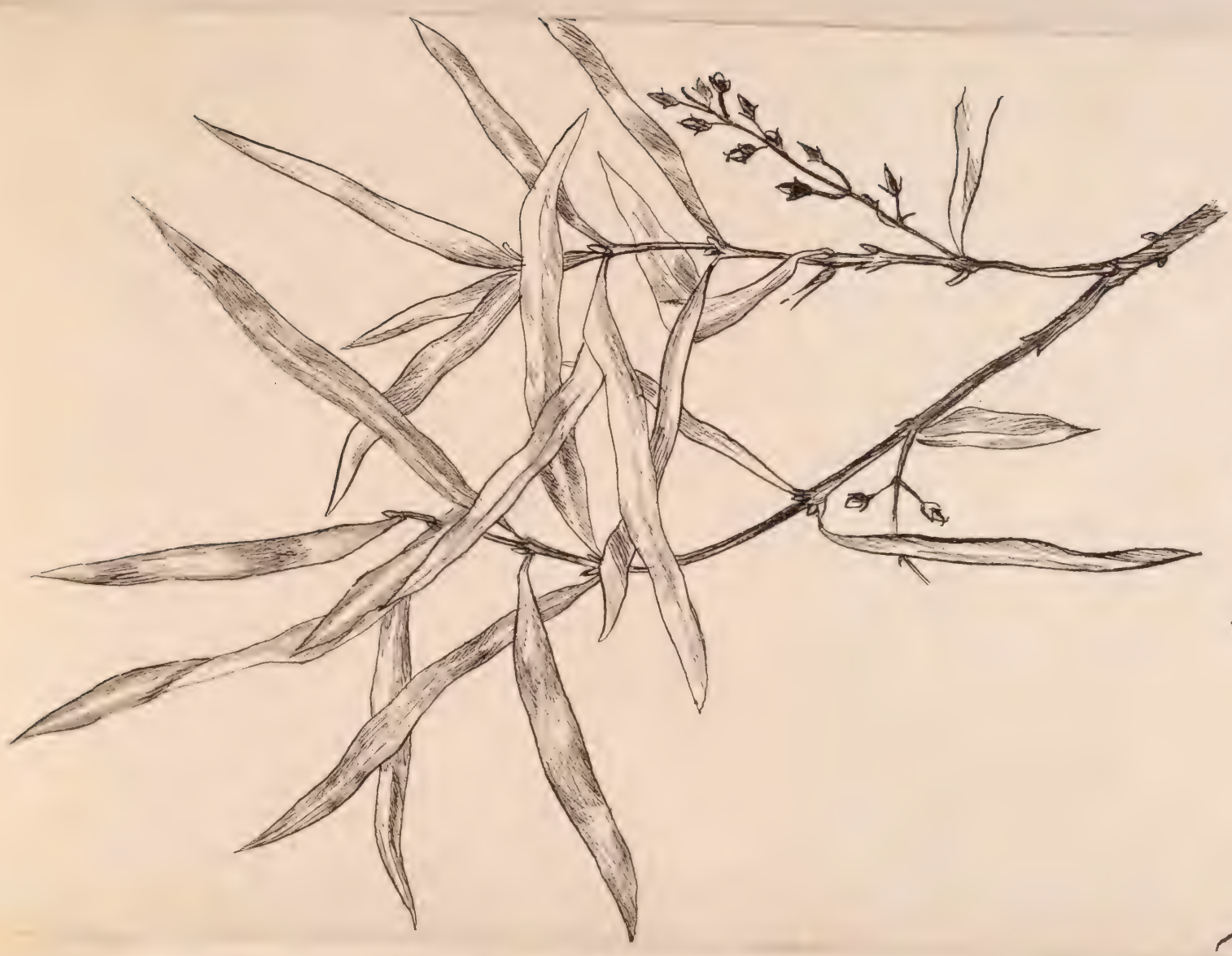
XXXVIII B. *Pseudopanax crassifolium*, Seemann. Young plant.

XXXVIII C. *Pseudopanax crassifolium*, Seemann. Var. *trifoliolatum*. Fruiting specimen before attaining the fully-mature-leaf stage. (Drawn from a specimen collected at Great Omaha.)

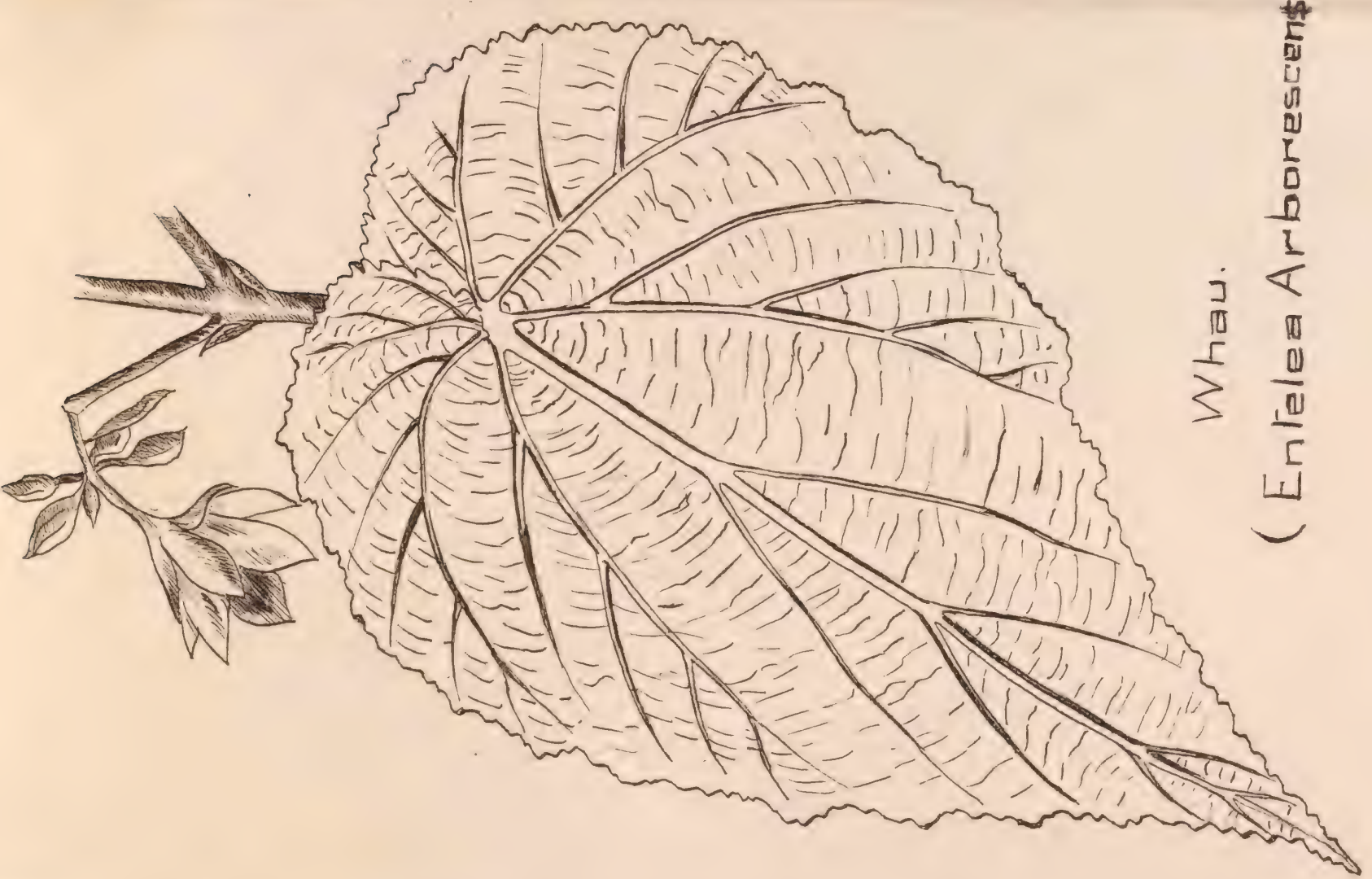
XXXVIII D. *Pseudopanax crassifolium*, Seemann. Var. *unifoliolatum*. Fruiting specimen, natural size. 1. Seedling plant. 2. Fruit. 3. Transverse section of fruit. (Drawn from specimens collected by the Ruamahanga River.) All magnified.



Acute leaved Totara.
(*PODOCARPUS ACUTIFOLIUS*.)



Narrow leaved Maire
 (*Olea montana*)
 (Pistillate Fruit)



Whau.
 (*Enfelea arborescens*)

* Trans. N.Z. Inst., xvi., p. 370, t. xxvi.



Acute leaved Tctara.
(*PODOCARPUS ACUTIFOLIUS.*)



43

PODOCARPUS ACUTIFOLIUS, T. Kirk.

THE ACUTE-LEAVED TOTARA.

ORDER—CONIFERÆ.

TRIBE—PODOCARPEÆ.

(Plate XXXIX.)

THE acute-leaved totara is a recent addition to the New Zealand flora, and was first observed by the writer near the source of the Buller River, in the South Island, in 1874, and described by him in "The Transactions of the New Zealand Institute" for 1883.*

Podocarpus acutifolius is an erect-branched shrub, from 3ft. to 6ft. in height, with pungent leaves. When growing in exposed places the branches are short and rigid, and the leaves close-set; but when in sheltered situations the branches are slender, with the leaves laxly arranged and spreading. Leaves green, $\frac{3}{4}$ in. or more long, narrow-linear, coriaceous, pungent, making the plant very prickly to handle. The male catkins are about 1in. in length, very slender, and may be solitary or in clusters of from two to five on a short peduncle. Female flowers solitary in the axils of the leaves. Fruit, a brown nut seated on a crimson pulpy receptacle. The flowers are produced in December and January, and the fruit is mature in April and May. The properties and uses of this species are unknown.

DISTRIBUTION OF THE GENUS.

See under *Podocarpus spicata*, p. 6, ante.

Podocarpus acutifolius belongs to the section Eupodocarpus, of which other species are found in New Zealand, as well as in New Caledonia, Tasmania, Fiji, and Columbia.

DISTRIBUTION OF THE SPECIES.

Podocarpus acutifolius is confined to mountain districts in the South Island, and appears to be local. At present it has only been collected in the Marlborough District by Mr. Rutland; on the high land between Tophouse and Rotoiti, and about the lake, also in the valley of the Hope, and other places in the Buller Valley, by Mr. T. F. Cheeseman and myself.

DESCRIPTION.

Podocarpus acutifolius, T. Kirk.

A much-branched erect shrub, 2ft. to 6ft. high; branches lax or slender; leaves scattered, $\frac{3}{4}$ in. to 1in. long, green, coriaceous, straight, linear, acuminate, spreading, pungent, mid-rib prominent beneath. Male catkins solitary or in fascicles of from two to five, on peduncles $\frac{1}{2}$ in. to 1in. long, extremely slender; each catkin with an involucre of four scarious acuminate bracts at the base, connective obtuse. Female flowers solitary on short peduncles, invested with a

* Trans. N.Z. Inst., xvi., p. 370, t. xxvi.

loose membranous sheath in the young state: each flower consisting of two carpellary leaves, one of which bears an ovule. Fruit, a small ovoid nut, seated on a crimson pulpy receptacle.

EXPLANATION OF PLATE XXXIX.

Podocarpus acutifolius, T. Kirk. Specimen with male flowers, natural size. 1. Fascicle of male flowers. 2 and 3. Upper and lower faces of an anther. All magnified. 4. Specimen with female flower. 5. Specimen with immature fruit. Both natural size. 6. Fruit, magnified.



Alpine Totara.
PODOCARPUS NIVALIS.

65

PODOCARPUS NIVALIS, Hook. f.

THE ALPINE TOTARA.

ORDER — CONIFERÆ.

TRIBE—PODOCARPEÆ.

(Plate XL.)

THIS small species was originally discovered near the limits of perpetual snow on Tongariro by Mr. Bidwill, and described by Sir William Jackson Hooker, in "Icones Plantarum,"* under its present name, although the genus was considered doubtful, the fruit being unknown. It was subsequently discovered by Mr. Colenso, F.R.S., on the Ruahine Mountains, and has been found in numerous localities in the mountains of the South Island.

In sheltered situations, such as the upper margins of beech-forests, it forms an erect or sub-erect shrub, 2ft. to 6ft. high, with numerous close-set rigid branches; but in exposed places it is little more than a low bush with spreading prostrate rigid branches, which give off roots from the under-surface. New branches constantly grow outwards, so that in course of time broad masses are formed from a few inches to 2ft. or 3ft. in height, and many yards in diameter. Very rarely the central stem may be 9in. or 10in. in diameter on the surface of the ground, but usually it is not more than 4in. or 5in.

The leaves are brown and crowded, rarely exceeding $\frac{3}{8}$ in. in length, and are sometimes less than $\frac{1}{4}$ in. : they are perfectly smooth, linear, sessile or narrowed at the base into an extremely short stalk, less than $\frac{1}{10}$ in. in width, obtuse, with the mid-rib slightly produced beyond the apex, forming a short point or apiculus. Male catkins rather longer than the leaves, solitary or in fascicles of from two to four on short peduncles. The female flowers are solitary, and are carried on very short peduncles. Fruit, an ovoid nut borne on a pulpy swollen base formed of two carpellary leaves, crimson. The flowers are produced in December and January.

PROPERTIES AND USES.

This plant is of considerable value from its spreading and rooting habit, as it serves to bind the loose shingle and soil of steep mountain-slopes, thus preventing landslips. The wood is very durable, but of too small dimensions to be generally utilised, although in all probability tar might be extracted from it.

In "The Handbook of the New Zealand Flora" this plant is stated to be from 1ft. to 20ft. high, with a stem 3ft. in diameter. I have seen no specimens approaching these dimensions.

DISTRIBUTION OF THE GENUS.

See under *Podocarpus spicata*, p. 6, ante.

Podocarpus nivalis belongs to the section Eupodocarpus, which also includes the following New Zealand species: *Podocarpus Hallii*, T. Kirk; *Podocarpus Totara*, Don; *Podocarpus ferruginea*, Don; *Podocarpus acutifolius*, T. Kirk.

* Icones Plantarum, t. DLXXXII.

DISTRIBUTION OF THE SPECIES.

The alpine totara is restricted to alpine and subalpine localities in the North and South Islands, but has not been observed on Stewart Island. Its northern limit appears to be on the Kaiwaka Mountains, Hawke's Bay, where it was collected by Mr. A. Hamilton: it is, perhaps, most plentiful on the Alps of Canterbury, but occurs throughout Otago at suitable elevations. Its altitudinal range is from 2,000ft. to 5,500ft.

DESCRIPTION.

Podocarpus nivalis, Hook. f.

A much-branched prostrate or sub-erect shrub, 1ft. to 6ft. high. Leaves crowded, very coriaceous, curved or spreading, $\frac{1}{4}$ in. to $\frac{2}{3}$ in. long, rarely erect, linear, narrowed into a very stout petiole, obtuse, apiculate, mid-rib prominent below. Male catkins solitary or in fascicles of two to four, terminating abortive branches, connective obtuse. Female solitary, axillary; ovule solitary. Fruit, a nut, seated on a pulpy receptacle.

EXPLANATION OF PLATE XL.

Podocarpus nivalis, Hook. f. Specimen with male flowers. 1. Ripe fruit.
2. Nut. Both magnified.



PUKA
 (GRISELINIA LUCIDA)
 1 Staminate panicle
 2 Pistillate

GRISELINIA LUCIDA, Forster.

THE PUKA.

ORDER—CORNEÆ.

(Plate XLI.)

MR. COLENSO informs me that the Native name "puka" is correctly applied to this species as well as to *Meryta Sinclairii*. In the Auckland District it is termed by the settlers "paukatea" or "poukater." The latter name is stated by Raoul to be the Native name for *G. littoralis*.

It attracts the attention of the traveller in the northern forests by its remarkable epiphytic habit: the fruits are eaten by birds, and often ejected amongst the asteliads and orchids growing in the forks or on the branches of some lofty tree, where the seed germinates, and the plant grows vigorously until its luxuriant glossy foliage mingles with that of the tree on which it grows, and to which its large leaves of the richest green usually offer a marked contrast. This is especially the case when the rata (*M. robusta*) is the supporting tree: the small size of its crowded leaves is strongly brought out when they show amongst the large leaves of the puka.

Although frequently found growing on other trees, the puka is often terrestrial, and even when epiphytic not unfrequently sends an aerial root down the side of the supporting trunk until it reaches the ground, from which the plant at once derives an increased supply of nourishment.

This species does not attain the large dimensions of *G. littoralis*, but specimens may be found 30ft. or more in height, although it is frequently reduced to a mere bush. On Rangitoto Island, at the entrance to the Waitemata, specimens less than 2ft. high, growing on almost naked rock, may be seen flowering profusely, and exhibiting the utmost luxuriance of foliage, notwithstanding their dwarfed stature. The trunk rarely exceeds 1ft. in diameter, and is usually much less, but specimens are known with trunks 2ft. through. Branches and trunk are usually crooked, which detracts from the value of the timber. The bark on old specimens is furrowed and uneven. The leaves are from 4in. to 6in. long, and are quite entire, but vary in shape. Usually they are obliquely ovate or oblong, rounded at the apex, the leaf being usually broadest above the middle: one side of the leaf is much narrower at the base than the other, so that the leaf is unsymmetrical. The leaves are carried on short rather stout leaf-stalks, and the veins are prominent on the under-surface.

The male and female flowers are produced on different trees, and are usually developed in panicles springing from the axils of the leaves. The male panicles are usually longer than the leaves; the female are usually shorter. The male flowers are yellow, and present a showy appearance when fully expanded: they have a minute calyx, five yellow petals, and five stamens. The female flowers are green and inconspicuous, being destitute of petals, and are succeeded by large blackish-purple fruits.

The flowers are carried on short pedicels, which are jointed to the branches of the panicle, so that, unless great care is taken in drying specimens for the herbarium, the flowers are apt to fall away.

Luxuriant shoots on young epiphytic plants sometimes develop very large leaves almost orbicular in shape, and having the lobes at the base greatly developed.

PROPERTIES AND USES.

The wood is of a rather light brown colour, dense, compact, and very durable. Although but seldom found of large dimensions, it is used for fencing-posts, millwrights' work, and other special purposes. It is often perforated longitudinally by the larvæ of a large green moth, *Charagia virescens*.

DISTRIBUTION OF THE GENUS.

As now constituted, *Griselinia* comprises eight species, occurring in Brazil, Chili, and New Zealand. Two species are found in New Zealand, both endemic.

DISTRIBUTION OF THE SPECIES.

Griselinia lucida occurs from the North Cape, but is rare and local in many districts. In the North Island it ascends from the sea-level to 2,000ft. It is plentiful on the hills about Wellington, where it frequently attains a large size.

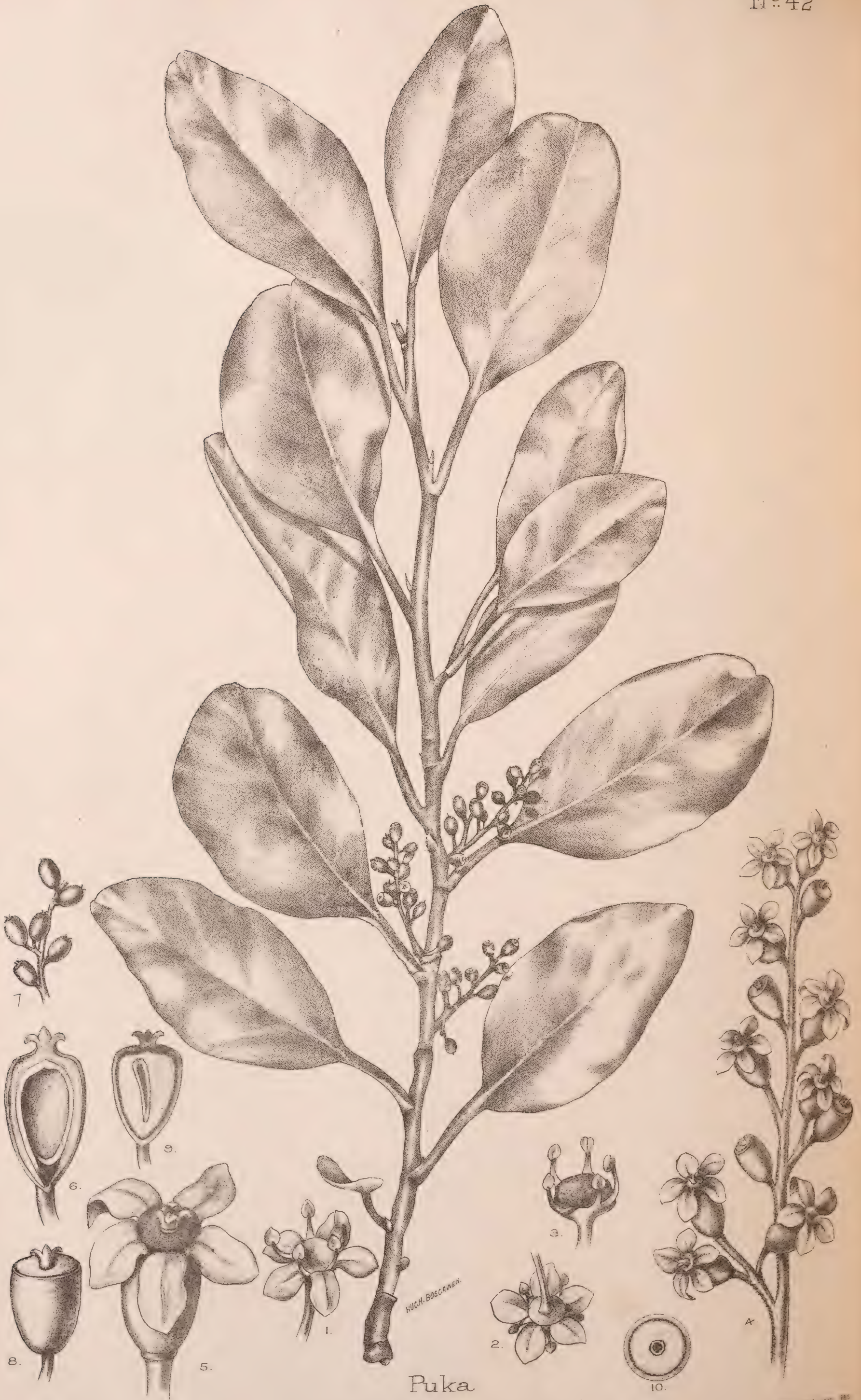
DESCRIPTION.

Griselinia lucida, Forster.

An erect much-branched shrub or small tree, 3ft. to 30ft. high. Leaves alternate, glabrous, entire, 4in. to 6in. long, obliquely ovate or oblong, unequal at the base; petioles short, stout, articulated with the blade. Flowers on short pedicels in terminal much-branched panicles, 3in. to 6in. in length; branches covered with fine hairs; pedicels short. Male, calyx-teeth five, minute; petals, five, broadly ovate; stamens, five; ovary, none. Female, calyx adherent to the ovary; teeth, five; petals, none; stamens, none; styles, three. Fruit, fleshy, purple, one-celled, one-seeded.

EXPLANATION OF PLATE XLI.

Griselinia lucida, Forst. 1. Male panicle. 2. Female panicle. Both natural size. 3. Male flower, front view. 4. Male flower, back view. 5. Female flower. 6. Longitudinal section of the same. 7. Transverse section. 8. Fruit (immature). 9. Longitudinal section. 10. Transverse section. All magnified.



Puka
 (GRISELINIA LITTORALIS)

69

GRISELINIA LITTORALIS, Raoul.

THE PĀPAUMA.

ORDER—CORNEÆ.

(Plate XLII.)

THIS handsome tree is known as the puka in many districts, but, in Mr. Colenso's opinion, the name is applied erroneously. The Ven. Archdeacon W. L. Williams informs me that in the East Cape district its native name is papauma: Mr. C. Traill states that it is called kapuka on Stewart Island, and I have heard that name applied in Southland. It is usually termed "broad-leaf" by the settlers.

This species appears to have been first observed by M. Raoul, the medical officer of the French frigate "L'Aube," during the stay of that vessel at Akaroa in 1840 and 1841, and was described under its present name in the "Annales des Sciences Naturelles" (Vol. II., p. 113, Series iii.), by MM. Raoul and Decaisne. Subsequently a fine plate was given by M. Raoul in "Choix de Plantes de la Nouvelle-Zelande."

Usually it forms a handsome evergreen tree, from 40ft. to 60ft. high, with a conspicuous spreading head: it differs from the last species in being almost invariably terrestrial. The trunk is often crooked and gnarled, from 2ft. to 4ft. in diameter, with light-brown rugged bark. The leaves are from 1in. to 3in. long on rather long footstalks, ovate or oblong-ovate, slightly wedge-shaped at the base, yellowish-green; veins obscure on the under-surface. The flowers are produced in axillary panicles, which are less than half as long as the leaves, with very short branches, or often reduced to a single raceme. The male and female flowers are produced on different trees, and resemble those of the preceding species in general appearance, except that petals are developed in the female flowers. The fruit is $\frac{1}{4}$ in. in length, and of a blackish-purple. The flowers are produced in October and November; the fruit is ripe in May.

Griselinia littoralis differs from *G. lucida* in its terrestrial habit and larger dimensions; in the smaller leaves, which are more symmetrical in shape and less glossy in appearance; in the smaller panicles, which have few and short branches; and in the female flowers being furnished with petals.

PROPERTIES AND USES.

The great durability of this timber renders it of considerable value, notwithstanding its small dimensions: it is dense, firm, compact, and, although of great strength, slightly brittle; it is of a reddish colour, with faint markings, and shrinks to a very slight degree. Owing to the crooked and irregular habit of the trunk, it is rarely possible to obtain straight logs exceeding 12ft. in length, while those of the largest diameter are almost invariably hollow. The crooked habit detracts from the value of the timber for certain purposes, but renders it specially suitable for the purposes of the ship-builder. It is of extreme durability, and splits with great readiness, notwithstanding its distorted habit of growth. It is

much used for house-blocks, fencing-posts, sleepers, boat-timbers, and similar purposes, but has not been thought worthy the attention of the cabinetmaker; except for inlaying.

It attains larger dimensions than the preceding species, and is generally used throughout the South Island, but its value has not been recognised in the North Island.

It forms a valuable addition to the shrubbery, and is easily cultivated.

DISTRIBUTION OF THE SPECIES.

Griselinia littoralis is most abundant in the South Island, where it attains its largest dimensions. Its northern limit, so far as is known to me, is the Cape Colville Peninsula, where it is very local and confined to the crests of the ranges.

It is much more frequent in the Wellington District, and is plentiful in all forest districts in the South Island, crossing Foveaux Strait to Stewart Island, where it extends to the South Cape.

DESCRIPTION.

Griselinia littoralis, Raoul, "Choix de Plantes de la Nouvelle-Zelande, t. xix.

A small diœcious tree, 40ft. to 60ft. high, with trunk 2ft. to 5ft. in diameter. Bark, brown, furrowed. Leaves alternate, on rather long foot-stalks, ovate or oblong-ovate, rounded at the apex, often cuneate at the base; veins obscure beneath. Flowers in axillary panicles, from one-fourth to one-half the length of the leaves; branches of the panicle very short, finely pubescent. Male flowers, calyx scarcely toothed; stamens, five; petals, five; broadly ovate, sub-acute. Female flowers, calyx-tube adherent with the ovary, teeth obsolete; petals, five, narrower and longer than in the male; stamens, none; styles, three. Fruit, one-celled, one-seeded.

EXPLANATION OF PLATE XLII.

Griselinia littoralis, Raoul, with immature fruit, natural size. 1. Male flower, front view. 2. Male flower, back view. 3. Male flower, with stamen removed. 4. Panicle of female flowers. 5. Female flower. 6. Longitudinal section of ovary. 7. Fruit, natural size. 8. Fruit. 9. Longitudinal section of fruit. 10. Transverse section of fruit. All magnified, except 7.



Taraire
(BEILSCHMIEDIA TARAIRE.)

71

BEILSCHMIEDIA TARAIRI, Bentham and Hook. f.

THE TARAIRE.

ORDER—LAURINEÆ.

(Plate XLIII.)

THE taraire was discovered during Cook's first voyage to New Zealand by Banks and Solander, and was subsequently named *Laurus Tarairi* by A. Cunningham. In the "Flora Novæ-Zelandiæ" it was described as *Nesodaphne Tarairi*; but that genus was included in *Beilschmiedia* by Bentham and Hooker in the third volume of their "Genera Plantarum."

Beilschmiedia Tarairi is a handsome tree, restricted exclusively to the Auckland District, and most plentiful in its northern portion. It has a straight erect trunk, 60ft. to 80ft. high, with but few branches. The trunk is from 1½ft. to 3ft. in diameter, with brown even bark. The leaves are widely different from those of any other New Zealand tree, of a dull brownish-green above and whitish beneath; the young branchlets and leaf-stalks are clothed with rusty-coloured pubescence, which also appears on the upper surfaces of the young leaves. The leaves are broadly obovate, rounded at the tips, and from 3in. to 6in. in length, with prominent veins. The flowers are inconspicuous, and are produced in short panicles, with stout branches; stamens and pistils are found in the same flowers, which are destitute of petals, and are succeeded by the handsome purple fruits, from 1in. to 1½in. in length, and one-seeded: the seeds are without endosperm.

This tree is one of the most distinctly marked in the New Zealand flora.

PROPERTIES AND USES.

The wood is remarkably straight in the grain, close, but rather brittle and easily split; it is frequently white throughout, but usually the heart is red. When split it speedily assumes a uniform reddish-brown tint. It is not durable when exposed. Its specific gravity is .888, and its weight per cubic foot 55.34lb.*

The wood is used sparingly for cheap furniture, and as a substitute for mangeao in the manufacture of ships' blocks, and the construction of light carts, &c., but it is wanting in toughness and elasticity for purposes of this kind. As it is plentiful in many places north of Auckland, it is largely used for firewood, but fetches a low price on account of its burning away too quickly.

DISTRIBUTION OF THE GENUS.

Beilschmiedia comprises about twenty species, which are distributed through Africa, tropical Asia, Australia, New Zealand, and tropical America. The genus is divided into three sections, of which *Nesodaphne* contains three species, one being restricted to Australia, the others to New Zealand.

* Balfour: Results of Experiments on New Zealand Woods at the Otago Exhibition, 1865.

DISTRIBUTION OF THE SPECIES.

The taraire is endemic in the North Island, and occurs in forests from the North Cape to Mercer on the western side, and to Poverty Bay on the eastern side.

DESCRIPTION.

Beilschmiedia Tarairi, Benth. and Hook. f.

Laurus Tarairi, A. Cunn.

Nesodaphne Tarairi, Hook. f.

A lofty evergreen tree, 50ft. to 80ft. high. Trunk, 1½ft. to 3ft. in diameter. Bark, greyish or brown. Leaves alternate, 3in. to 6in. long, coriaceous, obovate-oblong, rounded at the apex, smooth on the upper surface, glaucous beneath, and more or less clothed with rusty pubescence; veins prominent on the lower surface. Flowers in axillary panicles, 1½in. to 2½in. across; branches rusty-pubescent. Flowers on short pubescent pedicels, small; perianth, six-lobed; stamens, twelve, in two series, the outer series with perfect anthers opening towards the pistil; of the inner series, only three are perfect, the anthers opening towards the perianth: a gland is situate opposite the base of each filament. Pistil with a very short style. Fruit, 1in. to 1½in. long, ovoid, narrowed at both ends; one-seeded; seed without endosperm.

EXPLANATION OF PLATE XLIII. AND PORTION OF PLATE CXXVI.

XLIII. *Beilschmiedia Tarairi*, Benth. and Hook. f. Flowering specimen.
1. Fruit. 2. Longitudinal section of fruit. 3. Transverse section. All natural size.

CXXVI. *Beilschmiedia Tarairi*, Benth. and Hook. f. Figs. 5 to 8.
5. Flower with bract. 6. Leaf of perianth and stamen. 7. Stamen after the liberation of the pollen. 8. Ovary. All magnified.



Raukawa.
(PANAX EDGERLEYI.)



Rauraua
(PANAX EDGERLEYI)



PANAX EDGERLEYI
Var. SERRATA

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PANAX EDGERLEYI, Hook. f.

THE RAUKAWA.

ORDER—ARALIACEÆ.

(*Plates XLIV., XLV., and XLVA.*)

THE raukawa is a small but handsome evergreen tree, rarely exceeding 40ft. in height, with glossy foliage which emits an agreeable odour. It was discovered by Mr. Colenso and Mr. Edgerley. The foliage of the young state bears but a slight resemblance to that of the mature tree, and the male and female flowers are produced on different trees.

In the young state the leaves are compound, consisting of three or five leaflets, 2in. to 9in. long, springing from the top of a common leaf-stalk from 3in. to 5in. in length. The margin of each leaflet is more or less cut into large blunt teeth or deep lobes, which in some instances extend nearly to the mid-rib. In the mature state the leaves are carried on jointed leaf-stalks, and reduced to a single leaflet, the margins of which are usually quite entire; the leaves are a bright glossy green, presenting a most attractive appearance.

The flowers, which are produced in panicles, are green or greenish-yellow, and unattractive. The male flowers have well-developed petals and five stamens, while the female flowers are destitute of both stamens and petals: the female flowers have a three- or four-celled ovary, and the same number of recurved styles. The fruit is spherical, mottled, three- or four-seeded.

The flowers are produced in November and December, and the fruit becomes mature in May and June.

PROPERTIES AND USES.

The wood is white, even, and compact, with small silver grain, but is of little value, although occasionally used by cabinetmakers for inlaying, and by settlers for fence-rails.

The raukawa is prized by the Natives on account of its perfume: Mr. Colenso states that they rub their limbs and bodies with the fresh leaves, and I have been informed that the leaves are also used for scenting oil. It seems probable that the perfume might be extracted and form a profitable article of commerce.

The tree is highly ornamental, and may be easily cultivated.

DISTRIBUTION OF THE GENUS.

Panax as now limited comprises nearly thirty species, of which seven are restricted to Australia, and eight to New Zealand. The remaining species are found chiefly in tropical and eastern Asia, Mantchuria, tropical Africa, and the Pacific Islands.

DISTRIBUTION OF THE SPECIES.

The raukawa is most plentiful in hilly forests, and is to be found in most forest districts, from the Bay of Islands and Hokianga southward to Stewart Island, ascending from the sea-level to upwards of 2,000ft.

The variety *serrata* appears to be restricted to Stewart Island.

DESCRIPTION.

Panax Edgerleyi, Hook. f.

A small dioecious tree, 20ft. to 40ft. high, with smooth bark. Leaves alternate, 3in. to 9in. in length, on long petioles, glossy, dimorphic: on young plants, three- to five-foliolate, leaflets broadly lanceolate, acute, lobulate or pinnatifid; on mature plants, simple, entire, broadly lanceolate or oblong-lanceolate, on rather long, jointed petioles. Flowers in numerous small lateral umbels, arranged in racemose panicles. Male, calyx-teeth five, minute; petals, five, acute; stamens, five; pistil, none. Female, calyx-teeth none; petals, none; stamens, none; styles, three or four, recurved; ovary, three- or four-celled, one seed in each cell. Fruit, spherical, small, mottled, three- or four-celled.

Var. *serrata*. Leaves of the mature state with serrated or lobulate margins.

EXPLANATION OF PLATES XLIV., XLV., AND XLVA.

XLIV. *Panax Edgerleyi*, Hook. f. Young state, natural size 1. Upper portion of a fruited panicle, natural size. 2. Male flower, in bud. 3. Male flower, expanded. 4. Female flower. 5. Longitudinal section of fruit. 6 and 7. Transverse sections of fruit. 8. Seed. All magnified.

XLV. *Panax Edgerleyi*, Hook. f. Mature state, natural size.

XLVA. *Panax Edgerleyi*, Hook. f. Var. *serrata*, natural size.



Tawhiwhi.
 PITTOSPORUM TENNIFOLIUM

PITTOSPORUM TENUIFOLIUM, Banks and Solander.

THE TAWHIWHL.

ORDER -PITTOPOREÆ.

(Plate XLVI.)

PITTOSPORUM TENUIFOLIUM is an extremely variable plant, and includes several forms to which specific rank has been given—*P. Colensoi*, *P. fasciculatum*, *P. intermedium*, and *P. Buchanani*—all of which may be regarded as forms of one variable species; but the present description will be confined to the plant bearing this name in the Auckland District, and especially characterized by small leaves of a pale or whitish-green tint.

The tawhiwhi of the Maoris was discovered during Cook's first voyage by Banks and Solander, who gave it the name by which it is generally known. It is a small round-headed tree, which, in its best-developed state, attains the height of from 30ft. to 40ft., but is often much smaller. The trunk rarely exceeds 15in. in diameter, although larger specimens are occasionally met with. The bark is smooth, even, and black. The leaves are alternate, broadly oblong in shape, from 1in. to 1½in. in length, obtuse or acute, on short leaf-stalks. The chocolate-coloured flowers are produced freely in the early spring, and are usually solitary in the axils of the leaves. The calyx-leaves are narrow, pubescent, and the petals are spreading; the stamens and styles about equalling the petals in length. The fruit is broadly egg-shaped, covered with fine pubescence when young, but ultimately forming a woody capsule the size of a hazel-nut and opening by three valves: the black seeds are imbedded in a viscid transparent gluten, from which the name of the genus is derived. The flowers are expanded in September and October.

By the settlers it is frequently called "black mapou" on account of the colour of the bark. Mr. Colenso, however, informs me that "mapou" is rightly applied to *Myrsine Urvillei* only (Pl. XVI.). With still less excuse it is sometimes called "black maple," an obvious corruption of the preceding.

DISTRIBUTION OF THE GENUS.

See *ante*, *Pittosporum crassifolium*, p. 21.

DISTRIBUTION OF THE SPECIES.

Pittosporum tenuifolium occurs from the North Cape to Stewart Island; the smaller-leaved forms are most frequent north of the East Cape, but forms with larger leaves are most abundant in southern districts, especially in the South Island.

PROPERTIES AND USES.

The wood is brownish-white, very firm, straight-grained, and of even texture. It is very strong, tough, and elastic, but not durable when in contact with the ground, although it is frequently used for fencing-rails. Its specific gravity

ranges from .959 to .972, and its weight per cubic foot from 59.79lb. to 60.57lb. A weight of 243lb. would be required to break a piece 1in. square and 12in. long, supported at one end and loaded at the other.* It has therefore nearly twice the strength of English oak.

It is occasionally used by cabinetmakers, chiefly for inlaying, but for this purpose has no special advantage over tawa and many other timbers. It is valuable for inside work requiring great strength and elasticity in positions which do not admit the use of scantling of large dimensions.

DESCRIPTION.

Pittosporum tenuifolium, Banks and Sol.

A small round-headed tree, 20ft. to 40ft. high. Leaves alternate, 1in. to 2in. long, shortly petioled, oblong-ovate or obovate, acute or obtuse, membranous or slightly coriaceous, margins waved. Flowers on short peduncles, solitary, axillary or forming small terminal fascicles; calyx inferior, consisting of five linear-oblong or ovate sepals, pubescent or silky; petals, five, free, the upper portion reflexed; ovary, silky, three-celled. Fruit, a woody capsule, opening by three valves; pubescent when young, glabrous and black when ripe.

EXPLANATION OF PLATE XLVI.

Pittosporum tenuifolium, Banks and Sol. 1. Flowering specimen. 2. Fruiting specimen, natural size. 3. Flower. 4. Flower with calyx removed. 5. Flower with petals removed. 6. Pistil. 7. Fruit with valves opening.

* Balfour: Results of Experiments on New Zealand Timbers.



Putaputa-weta.
(CARPODETUS SERRATUS).

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CARPODETUS SERRATUS, Forster.

THE PUTAPUTA-WETA.

ORDER—SAXIFRAGÆ.

(Plate XLVII.)

THIS interesting plant was originally discovered by Banks and Solander in 1769, and in 1772 was collected by Forster, who described it in his "Nova Genera Plantarum" under its present name. It is frequently termed "piripiri-whata," but Mr. Colenso considers this to be an error: I am indebted to the Ven. Archdeacon W. L. Williams for the correct Native name, "putaputa-weta." The former name is frequently applied by settlers, who also term it "mapau," "white mapau," "white maple," and "white birch," so that it affords a good instance of the misuse of both Native and common names.

The genus *Carpodetus* consists of a single species only, which is generally distributed through the length and breadth of New Zealand, but does not occur elsewhere. In its most highly developed state it forms a small tree, rarely exceeding 30ft. in height, with a trunk from 6in. to 9in. in diameter; but more frequently it is reduced to a much-branched shrub, the branches spreading in a fan-shaped manner. Its white flowers bear some resemblance to those of the hawthorn, although of very different structure, and, as they are produced in great profusion, the tree presents an attractive appearance during the flowering season. In young specimens the branches are few and very slender, with the leaves small, distant, and varying in shape, but in the mature state the branches are somewhat stiff, the leaves much closer, and of thicker texture: the branches are more or less hairy, especially when young.

The leaves are alternate, and are carried on short leaf-stalks; they are frequently mottled or variegated with brown or dull-yellow dots and patches. They vary in length from $\frac{3}{4}$ in. to $1\frac{1}{2}$ in., but never exceed 1in. in breadth; the apex is obtuse, and the margins are cut into rather distant sharp teeth. The flowers are white, arranged in short broad panicles, springing from the axils of the leaves, the branches of the panicle and the pedicels being clothed with long hairs. Petals, five or six; stamens, five or six. Fruit small, almost fleshy, three- to five-celled. Seeds small.

The flowers are produced from November to January, and the fruit requires nearly a year to ripen. Flowers and ripe fruit may frequently be found on the tree at the same time.

PROPERTIES AND USES.

The wood of *Carpodetus serratus* is white, rather open in the grain, but strong, tough, and elastic: some specimens are prettily marked. It is prized by bushmen and settlers for the handles of axes and other tools, fence-rails, and similar purposes, but is not durable when in contact with the ground: it is occasionally utilised by the cabinetmaker. Its mean specific gravity is .822, its weight per cubic foot 51.24lb., and its breaking weight 177.6lb.*

* Balfour: Experiments on the Strength of New Zealand Timbers.

Although a common plant in most districts, it rarely occurs in large quantities, and does not enter into commerce.

DISTRIBUTION.

Carpodetus is a monotypic genus, absolutely restricted to New Zealand. The only species is generally distributed through the colony, from Mongonui to Stewart Island. It is usually found on the open banks of rivers, or on the margins of forests, thickets, &c.

DESCRIPTION.

Carpodetus serratus, Forster. Hook.

“Icones Plantarum,” t. 564.

A shrub or small tree, rarely more than 30ft. high; branches rather stiff, commonly spreading in a fan-shaped manner. Leaves alternate, shortly petioled, $\frac{3}{4}$ in. to $1\frac{1}{2}$ in. long, ovate-oblong, obtuse or acute, margins with short rather distant teeth. Flowers in broad axillary cymes, shorter than the leaves; branches and pedicels hairy; calyx-teeth, five or six; petals, five or six, white; stamens, five or six; ovary, four- or five-celled; stigma capitate. Fruit globose, the size of a small pea, indehiscent, coriaceous or almost fleshy, invested by the calyx-limb round the middle, four- or five-celled; seeds numerous, small, pitted; embryo minute, with copious endosperm.

EXPLANATION OF PLATE XLVII.

Carpodetus serratus, Forster, natural size. 1 and 2. Flowers. 3. Fruit. 4. Transverse section of fruit. 5. Longitudinal section of fruit. 6. Seed. All magnified.



Tawari.
(IXERBA BREXIOIDES)

IXERBA BREXIOIDES, A. Cunningham.

THE TAWARI.

ORDER—SAXIFRAGEÆ.

(Plate XLVIII.)

IXERBA BREXIOIDES is one of the most striking and beautiful plants in the colony, remarkable alike for the beauty of its flowers and the elegance of its foliage: like *Carpodetus serratus*, to which it is nearly related, it is the only species of the genus; but unlike that plant it is confined to a very restricted area, in which, moreover, it is often rare and local.

It forms a shrub or small tree, attaining the extreme height of from 50ft. to 70ft., with a trunk nearly 2ft. in diameter; but most frequently it is reduced to a large shrub, with ascending branches. The leaves are destitute of stipules, and carried on short leaf-stalks; they may be opposite, alternate, or whorled; they are coriaceous in texture, but not rigid, from 4in. to 6in. long, and $\frac{1}{2}$ in. broad; narrow-lanceolate in shape, with serrated margins, which are sparingly glandular.

The flowers are developed in terminal panicles, forming a dense mass, 2in. to 4in. in diameter. Each flower is from 1in. to $1\frac{1}{2}$ in. in diameter, with silky calyx-teeth, spreading white petals, and five stamens, with singular anthers, deeply two-lobed at the base, and forming an acute point at the apex. The ovary is conical, five-celled, narrowed into a long awl-shaped style with acute stigmas. The fruit forms a tough leathery five-celled capsule, with the conical style projecting from the centre: the style is long, twisted, sharp-pointed, and has five longitudinal furrows. When fully ripe the fruit opens at the side and top by five valves, and the style splits along the furrows: when completely separated each valve carries two projecting awns formed by portions of the style: the black or clouded seeds project above the open valves before they are completely separated. The flowers are produced from November to January.

It attains its largest dimensions at elevations above 1,500ft.

PROPERTIES AND USES.

The wood of *Ixerba* is white, with a pale-brown or reddish heart. It is even, dense, and heavy, but nothing is known as to its durability, although it has been used for mine-props in some of the highest mines on the Thames Goldfield.

DISTRIBUTION OF THE GENUS.

Ixerba is a monotypic genus, entirely restricted to New Zealand. It extends from Whangaroa (North) to the northern portion of Hawke's Bay, but is very local. I have collected it at Whangaroa, the Bay of Islands, Whangarei, Whangape, Hokianga, Great and Little Barrier Islands, and the highest portions of the Cape Colville Peninsula and Thames Goldfield. It has been collected by Mr. A. Hamilton in the northern part of Hawke's Bay, and is said to have been

found by the late Mr. Bidwill in the Wellington District, but has not been observed in this locality of late years.

It ascends from the sea-level to fully 3,000ft., but is most frequent in situations between 1,000ft. and 2,000ft.

DESCRIPTION.

Ixerba brexioides, A. Cunn.

“Icones Plantarum,” t. 577, 578.

A large shrub or tree 70ft. high, with trunk 2ft. in diameter. Leaves opposite or verticillate, glabrous, coriaceous, shortly petioled, lanceolate or linear-lanceolate; 3in. to 5in. long, $\frac{3}{4}$ in. broad, rather coarsely toothed, each tooth tipped with a gland. Flowers in terminal panicles; branches of the panicle, pedicels, and sepals silky; pedicels articulated to the branches. Calyx inferior; sepals, five, arranged in two series; petals, five, large, free; stamens, five, erect; anthers broadly lobed at the base, acute at the apex. Ovary, five-celled; ovules, two in each cell; style long, subulate, twisted, with five longitudinal furrows. Fruit, a coriaceous capsule, five-celled; seeds oblong, compressed, black or clouded. Embryo large, with scanty endosperm.

EXPLANATION OF PLATE XLVIII.

Ixerba brexioides, A. Cunn. Flowering specimen, natural size. 1. Flower.
2. Capsule.



Tarata
PITTOSPORUM EUGENIODES

PITTOSPORUM EUGENIOIDES, A. Cunningham.

THE TARATA.

ORDER—PITTOSPORÆ.

(Plate XLIX.)

THE tarata is the largest of the New Zealand species of *Pittosporum*, and, although most commonly known by its proper Native name, is also called by the settlers "white mapau," "turpentine," and "maple."

It forms a small evergreen tree, 20ft. to 40ft. high, with a trunk 1ft. to 2ft. in diameter, clothed with white bark, which is resinous. Its handsome light-green foliage and fragrant flowers, which are produced in great profusion, render it a general favourite.

Large specimens are somewhat round-headed, the branches and branchlets, although slender, being rather stiff. The leaves are alternate, quite entire, and vary in shape, some being elliptical, others broadly ovate; the broader forms especially are narrowed into the slender leaf-stalk: they are from 2in. to 4in. in length, and from $\frac{3}{4}$ in. to fully $1\frac{1}{2}$ in. in breadth, and in many cases crisped or waved at the margins. The flowers are arranged in much-branched panicles at the tips of the branchlets, and are of a yellow colour: the branches of the panicle are about 1in. in length, and the very slender pedicels about $\frac{1}{4}$ in.

The sepals are five in number, small; the petals are yellow, linear, and spreading or recurved; stamens, five; ovary, two-celled. Fruit, a capsule; seeds few.

In this species the flowers are in many specimens practically unisexual: although both stamens and pistil are invariably present, one or other is abortive. The perfect stamens have longer and more slender filaments, and produce abundance of pollen: the imperfect stamens are carried on shorter, less slender filaments, and produce but little pollen. The pistil exhibits but little variation. Flowers with perfect and imperfect stamens may be produced on different trees, or both forms may be found on the same tree associated with perfect flowers: in the former case the trees are practically diœcious. Other New Zealand species of *Pittosporum* exhibit the same phenomenon.

The flowers are produced in October and November, and, as the fruit requires nearly a year to arrive at maturity, both fruit and flowers are often found on the tree at the same time.

PROPERTIES AND USES.

The wood of *Pittosporum eugenioides* is white, tough, elastic, and of considerable strength, but soon perishes when exposed. It is frequently used by the wood-turner, and might be employed for the handles of carpenters' tools, &c. It is extremely difficult of combustion, and therefore useless for firewood.

The resinous exudation afforded by the bark was formerly used by the Maoris to perfume oil: the leaves and flowers are bruised and mixed with fat to anoint their bodies.

This species is frequently planted for ornamental purposes on account of its attractive appearance and its great hardiness, while the fragrance of its flowers is an additional recommendation. It is sometimes employed as a hedge-plant, and bears clipping freely.

DISTRIBUTION OF THE GENUS.

See under *P. crassifolium*, p. 21, *ante*.

DISTRIBUTION OF THE SPECIES.

Pittosporum eugenioides is generally distributed through the colony from the North Cape to Southland, but I am unable to state the exact southern limit. It prefers the banks of streams, the margins of woods, thickets, the slopes of hills, &c., but is rarely found in dense forest.

It ascends from sea-level to fully 2,000ft., but is most plentiful in lowland situations.

DESCRIPTION.

Pittosporum eugenioides, A. Cunningham.

A small evergreen tree, 20ft. to 40ft. high, branches and leaves glabrous. Leaves alternate or sometimes verticillate, shortly petioled, 2in. to 4in. long, $\frac{3}{4}$ in. to $1\frac{1}{2}$ in. broad, elliptical or broadly-ovate, acute. Flowers pale-yellow, numerous, in terminal branched corymbs; branches hairy, diverging, with minute linear bracteoles; pedicels slender. Calyx inferior; sepals, five, one-third the length of the petals; petals, five, linear, spreading or recurved; stamens, five, filaments slender; ovary two-celled, silky. Fruit, a two- or rarely three-valved capsule; $\frac{1}{4}$ in. long, glabrous.

EXPLANATION OF PLATE XLIX.

Pittosporum eugenioides, A. Cunn. Flowering specimen, natural size.
1. Flower, magnified. 2. Fruit, natural size.



Kowhai.
SOPHORA TETRAPTERA.
VAR. GRANDIFLORA.





Kowhai.
 (SOPHORA TETRAPTERA).
 Var. *microphylla*.





Mountain Kowhai.
SOPHORA TETRAPTERA VAR. PROSTRATA.

SOPHORA TETRAPTERA, Aiton.

THE KOWHAI.

ORDER—LEGUMINOSÆ.

(Plates L., LI., and LII.)

THE kowhai was collected by Banks and Solander in 1769, and was subsequently described by Aiton under the name of *Sophora tetraptera*, chiefly on account of its pods being four-angled or -winged. It was separated from *Sophora* at a later period by Salisbury, and, with other species from the Isle of Bourbon and the Sandwich Islands, formed into a genus under the name of *Edwardsia*; but, as it has been found that *Sophora* comprises plants showing a complete transition from rounded or flat pods to species with angled or winged pods, *Edwardsia* has been merged in *Sophora*, although sometimes used to denote a section of the genus characterized by the short standard, stamens longer than the petals, and angled or winged pods.

It is interesting to find that it was introduced into England by Sir Joseph Banks and Dr. Solander, the illustrious naturalists who accompanied Captain Cook during his first circumnavigation of the globe. Many old specimens are still to be found growing in England; but it usually requires the protection of a wall, when it produces flowers in profusion.

The kowhai is a variable plant in its habit of growth, and in the relative length of the petals. On the mountains it forms a prostrate shrub, but in favourable situations it is an erect tree, 30ft. to 50ft. high, with a trunk from 6in. to 3ft. in diameter: most frequently it is a much-branched shrub less than 20ft. high. Its bright yellow flowers and light airy foliage render it a favourite plant: its flowers, moreover, afford one of the first indications that midwinter has been passed, and spring is close at hand. The leaves are alternate, and on different varieties vary from $\frac{1}{2}$ in. to 6in. or 7in. in length; they consist of a single row of leaflets on each side of a leaf-stalk, and the leaflets may vary in number from four pairs to forty, in all cases with a solitary terminal leaflet: the leaflets may be round or oblong, acute, obtuse, or slightly notched at the apex, and vary in length from $\frac{1}{16}$ in. to $1\frac{1}{4}$ in.: they are more or less silky. The old leaves remain on the branches until they are pushed off by the swelling of the new buds; but the flowers are usually produced on naked branches.

The flowers form pendulous racemes developed in the axils of the leaves; the peduncle of the raceme is very short, but the slender pedicels vary from $\frac{1}{2}$ in. to $1\frac{1}{2}$ in. in length; the peduncles, pedicels, and calyx are clothed with silky hairs. The calyx forms a deep cup with five teeth. The corolla consists of five petals of different shapes: the uppermost is termed the vexillum or standard; the two lateral petals, the alæ or wings; the two lower petals form the carina or keel, and are usually coherent for the greater part of their length, although they can be easily separated; the other petals are free. The relative length of the petals varies in the different varieties; but in all the forms the standard is short and broad, attached to the calyx by a short broad claw, the upper portion bent

slightly upwards; the wings and keel-petals are oblong, somewhat pointed near the apex, and the claw of each is narrow.

The stamens are ten in number and perfectly free—an exceptional condition amongst plants of this section. The ovary is shortly stalked and very silky, one-celled. The fruit is a flat pod, from 4in. to 6in. long, constricted between the seeds so that it seems beaded or jointed; the margins are produced into four narrow longitudinal wings; seeds, five to ten. The number and shape of the leaflets, and the relative lengths of the petals, have been used to differentiate varieties which are enumerated under the technical description, and an illustration is given of each; but there is no hard-and-fast line separating any two forms: in habit, in the form and dimensions of the leaflets, and in the relative lengths of the standard and wings, there is a wide amount of variation. No two plants of the same variety are exactly alike, and it would not be difficult to collect a series of specimens showing a gradual transition from one form to another.

Young plants bear only a slight resemblance to the mature state; the branches are slender, flexuous, and interlaced, forming a somewhat compact mass; the bark is orange-coloured, and the distant leaves rarely consist of more than six pairs of orbicular leaflets.

After the petals have fallen, the ovary increases rapidly in length, and, while retaining its white silky hairs, becomes contorted and bent in different directions. As the ovaries are produced in large numbers, and are pendulous, they move by the slightest breath of wind, and present a singular appearance for a few days until obscured by the rapid growth of the leaves.

The kowhai flowers from August to October.

PROPERTIES AND USES.

The wood of the kowhai is of a pale-brown colour, and bears considerable resemblance to laburnum. It is compact, dense, heavy, and of great strength, toughness, and elasticity. Its specific gravity varies from .667 to 1.037, its weight per cubic foot from 41.57lb. to 64.66lb., and its breaking weight from 170lb. to 275lb.* It is of extreme durability, and in many respects is of high value.

Logs of large dimensions are rarely to be obtained, especially north of the Auckland Isthmus, where trunks even 1ft. in diameter are decidedly rare: the largest specimens are found in Southland, and rarely exceed 2ft. in diameter.

It is used for small piles and bracing in the construction of wharves, bearings for shafts and machinery, swingle-trees, and many similar purposes; also for cabinetwork and ornamental turnery, &c.

Mr. Blair states that “a good proof of its elasticity and straightness of fibre is given in the teeth and bows of hay-rakes: the bows are turned to the diameter of $\frac{1}{2}$ in. and bent into a semicircle of 9in. without showing any signs of giving way.”†

It is a decided acquisition to the shrubbery or pleasure-ground; its bright flowers are produced on naked branches at a time when ordinary garden-flowers are difficult to obtain, and are quickly followed by silvery drooping foliage, forming an agreeable relief to the sombre tints of most native trees.

DISTRIBUTION OF THE GENUS.

Sophora comprises about twenty-three species, which are generally dis-

* Balfour: Experiments on the Strength of New Zealand Timber.

† Blair: Building Materials of Otago, p. 154.

tributed through warm climates, extending to Chili and New Zealand. Two species are found in Australia, one of which is endemic.

DISTRIBUTION OF THE SPECIES.

Sophora tetraptera is confined to New Zealand, Chili, and Juan Fernandez. The varieties *grandiflora* and *prostrata* are restricted to New Zealand. In the colony the variety *prostrata* is confined to mountain districts; the other varieties are generally distributed from Mongonui to Southland, β , *microphylla*, being the most common: α , *grandiflora*, is somewhat local, and is most plentiful in the eastern and central portions of the North Island.

Var. β ascends from the sea-level to 2,000ft.

DESCRIPTION.

Sophora tetraptera, Aiton.

A shrub or small tree, 30ft. to 40ft. high. Leaves alternate, unequally pinnate, 1in. to 6in. long; leaflets in from four to forty pairs, sessile or very shortly petioled, silky or hairy, orbicular, obcordate, or linear-oblong, $\frac{1}{16}$ in. to $1\frac{1}{4}$ in. long. Flowers solitary or in axillary pendulous racemes, two- to eight-flowered. Calyx inferior, gibbous, mouth broad, oblique; teeth, five. Standard scarcely reflected, short, obtuse; keel straight. Stamens, ten, free, longer than the keel. Pod, 1in. to 5in. long, flat, constricted between the seeds, the margins produced into four linear wings; seeds, three to seven, yellow or brown, oblong.

Var. α , *grandiflora*. Leaflets in ten to thirty pairs, linear-oblong, usually large, entire or emarginate. Flowers large, deep-coloured. Standard one-fourth shorter than the wings, obviously reflected. *S. tetraptera*, Curtis, "Botanical Magazine," t. 167. *Edwardsia grandiflora*, Salisbury.

Var. β , *microphylla*. Branches more slender. Leaflets in thirty to forty pairs, oblong or obcordate. Standard equalling the wings or very nearly, scarcely reflected. *S. microphylla*, Jacq.; *Edwardsia microphylla*, Salisbury, "Botanical Magazine," t. 1442. *E. Macnabiana*, Graham, "Botanical Magazine," t. 3735.

Sub-var. *parviflora*. Leaflets in about thirty pairs, broadly ovate or orbicular, $\frac{1}{8}$ in. in diameter. Flowers very small.

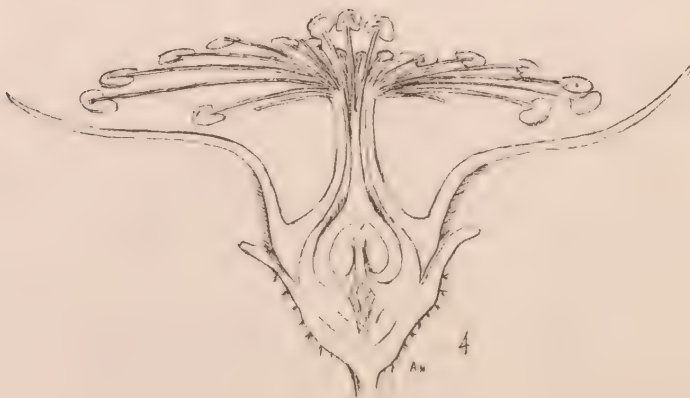
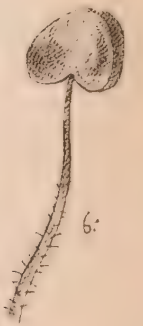
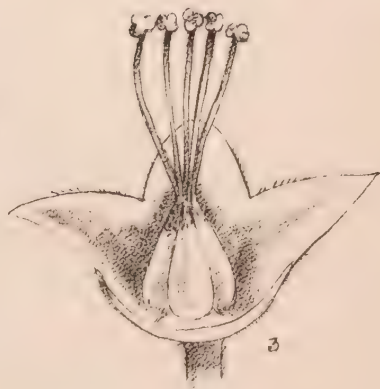
Var. γ , *prostrata*. Stems prostrate. Leaves, $\frac{1}{2}$ in. long, trifoliolate, or leaflets in from two to four pairs, $\frac{1}{16}$ in. broad. Flowers small, solitary or in pairs. Standard scarcely shorter than the wings. Pod unknown. *S. prostrata*, J. Buchanan, "Transactions of the New Zealand Institute," Vol. xvi., p. 395, t. 36.

EXPLANATION OF PLATES L., LI., AND LII.

L. *Sophora tetraptera*, Aiton. Var. α , *grandiflora*: foliage and flowers, natural size. 1. Standard. 2, 2. Wings. 3, 3. Keel.

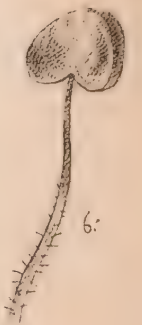
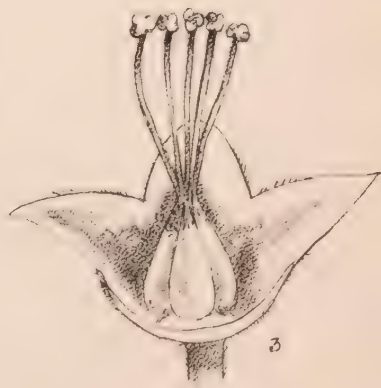
LI. *Sophora tetraptera*, Aiton. Var. β , *microphylla*. 1. Foliage. 2. Raceme. 3. Flower. 4. Longitudinal section of flower: petals and portion of the stamens removed. 5. Standard, wings, and keel-petals. 6. Section of calyx, showing the stipitate base of the pod. 7. Pod. 8. Longitudinal section of a portion of a pod. 9. Back and 10, side view of seed. 11. Inner face of a cotyledon, showing the plumule and radicle. All of the natural size, except 4, 5, 6, 9, 10, and 11, which are magnified.

LII. *Sophora tetraptera*, Aiton. Var. γ , *prostrata*: flowering specimen, natural size. 1. Standard. 2, 2. Wings. 3, 3. Keel. 4. Longitudinal section of flower.



HOHERIA POPULNEA.





HOHERIA POPULNEA.



Houhere.
(HOHERIA POPULNEA).
VAR. LANCEOLATA.



HESPERIA POPULNEA.
Var. lanceolata.



HOHENBERGIA POPULNEA.
1 Var lanceolata 2 Var angustifolia.



(HOHERIA POPULNEA)
VAR. ANGUSTIFOLIA

HOHERIA POPULNEA, A. Cunningham.

THE HOHERE.

ORDER—MALVACEÆ.

(Plates LIII., LIV., LIV_{A.}, LIV_{B.}, and LV.)

IN one or other of its varied forms the houhere is found in nearly every district in the colony, although it does not extend to Stewart Island. It is everywhere admired for its handsome foliage, and the beauty of its pure-white flowers, which are produced in vast profusion during the early winter months. In the North of Auckland the typical form is commonly known as houhere; but Mr. Colenso informs me the varieties are termed "houi" and "whauwhi" in the South: Archdeacon W. L. Williams states that the type is also known as "hoihere." I have heard the large-leaved forms termed "houhere" by the Natives in both the North and South Islands; indeed, it is difficult to distinguish between the typical form and large-leaved states of the variety *lanceolata*. By settlers all the forms are termed "ribbon-wood," or less frequently "lace-bark"—names which are applied to other plants: they are also termed "thousand-jacket."

Hoheria populnea is an extremely variable plant, especially with regard to the shape and size of the leaves; the difficulties of identification arising from this cause are increased by the remarkable variations exhibited by two of the principal forms at different periods of growth, the foliage of which might almost be described as polymorphic. All the varieties form small trees 20ft. to 45ft. high or more, but the trunk rarely attains a diameter of 2ft., and in the majority of cases is less than 1ft.: frequently the plant is a mere shrub, and flowering specimens may occasionally be seen less than 5ft. in height. The bark is dark-brown or black, and is capable of division into a number of layers, which may be used for the same purposes as the bark of the lime-tree in Europe.

The leaves vary in length from $\frac{1}{4}$ in. to 5in., and from $\frac{1}{8}$ in. to 2in. in breadth. In shape they vary from broadly ovate or lanceolate to linear-oblong: the margins may be cut into small regular teeth, or the teeth may be irregular and very large, obtuse or acute, or even spinulose; the base may be broadly rounded or gradually narrowed, or sharply wedge-shaped, with the apex acute, or tapering into a long point, or obtuse.

The flowers are usually produced in fascicles in the axils of the leaves, each fascicle consisting of from three to ten flowers; occasionally the flowers are solitary, especially in the small-leaved forms; the flower-stalks and calyx may be clothed with a dense coat of short hairs, or may be nearly smooth, and the former are invariably jointed, usually below the middle. The calyx forms a wide cup, with five broad triangular teeth, silky or with scattered tufts of short hairs: the petals are five in number, oblique in the upper margin, and usually with a curious notch above the middle, and white hairs on the outer surface. The stamens are of singular structure, the filaments being united below to form a column or tube, which encircles the pistil for half its length or more, when it divides into five sets or bundles, each containing from five to eight stamens, the column and the

lower portion of the free filaments being more or less hairy: the anthers are kidney-shaped. The ovary is five- or rarely six-celled, conical in outline, with five or six longitudinal furrows, the upper portion clothed with silky hairs; styles, five, slender, usually exceeding the free portion of the stamens in length, with capitate stigmas. Fruit dry, consisting of five or six carpels arranged around a central axis; each carpel crested with an oblique wing, and containing a single seed.

In common with many other New Zealand trees the houhere exhibits a large amount of variation in its leaves at different stages of growth. In the typical form this tendency is absent—the leaves of young plants differ from those of the mature state in their smaller size only; but in the varieties *lanceolata* and *angustifolia* it is strongly developed. The young shoots are very slender and flexuous, bearing solitary or fascicled leaves, $\frac{1}{4}$ in. to $\frac{3}{8}$ in. long, which are usually rounded or wedge-shaped, with two or three sharp or obtuse teeth in the upper portion. In var. *lanceolata* these are succeeded by ovate, irregularly and deeply toothed or lobed leaves, which bear considerable resemblance to those of the hawthorn: these are gradually succeeded by the lanceolate leaves which are specially characteristic of this form. In var. *angustifolia* the early leaves are similar, but smaller, and the transition to the linear spinulose leaves is more gradual.

Although the typical form does not exhibit this variation in a state of nature, it may be artificially produced by cutting back large branches or heading the upper branches, when in many cases the first leaves are deeply toothed or lobulate, resembling the intermediate leaves of var. *lanceolata* although larger: this state has been described as a distinct variety, termed *cratægifolia*. The long flexuous shoots with small leaves are given off from the trunk of old specimens of varieties β and γ under cultivation long after they have reached maturity.

The var. γ , *angustifolia*, was originally described by Raoul in his "Choix de Plantes de la Nouvelle-Zélande" as a distinct species, although he had no knowledge of the remarkable leaves of the young state. That he should have come to this conclusion is no matter for surprise, as a glance at the plates will show the great difference in the shape of the leaves of the typical form in this variety; but the leaves afford the only character in which diversity can be found. There is no difference in the structure of the flowers or fruit, which vary only in size. A complete series could be collected showing the most gradual transitions from the serrated broadly-ovate leaves of the typical form through the lanceolate dentate leaves of β , *lanceolata*, to the linear-oblong form of γ , *angustifolia*.

This almost insensible transition from one leaf-form to another renders it impossible to draw any hard lines of separation. I have therefore preferred to retain the different forms as varieties, on the lines originally laid down, rather than raise them to specific rank. Mr. Colenso, whose views are entitled to careful consideration, informs me on the other hand that he has always considered the varieties named to be good and valid species. He has recently described another form under the name of *Hoheria hexastyla*,* of which I have not seen specimens, but, judging from his description, it seems very close to var. γ .

PROPERTIES AND USES.

The houhere affords a white fissile timber of a compact even grain, great strength and toughness, but, unfortunately, speedily perishing when exposed. It is occasionally figured, and is frequently employed by the cabinetmaker for

* Trans. N.Z. Inst., xvii., p. 238.

inlaying. It was formerly split for shingles, but has fallen into disuse on account of its perishable nature. All the varieties afford excellent firewood. The bark is of great strength and toughness, so that it is often used as a substitute for cord or rope. It is demulcent, and was made to afford a demulcent drink by the Maoris: in all probability it might be advantageously used in all cases where the bark of slippery-elm (*Ulmus fulva*) is employed by the druggist for demulcent drinks, cataplasms, &c.

The wood is well adapted for conversion into pulp for the manufacture of paper.

DISTRIBUTION.

Hoheria contains only a single species, which is absolutely restricted to New Zealand, and in one or other of its forms is generally distributed from Mongonui to Southland. It is especially frequent by the sides of streams and watercourses and on the margins of cool woods.

The typical form occurs from Mongonui to the Upper Waikato, and is almost the only form found in that district, although the variety β , *lanceolata*, occurs sparingly at Whangarei and Omaha.

Var. β , *lanceolata*, is rare north of the Waikato, but becomes plentiful in Hawke's Bay and Taranaki, continuing through the Wellington District to Nelson, Westland, and Canterbury. Var. γ , *angustifolia*, finds its northern limit in the Hawke's Bay District, and extends southward to Otago and Southland, where it is the only representative of the species. This plant is not found in Stewart Island.

It ascends from sea-level to 1,500ft.

DESCRIPTION.

Hoheria populnea, A. Cunn.

Hook., "Icones Plantarum," t. 565, 566.

A small tree, 20ft. to 45ft. high. Young shoots, leaves, pedicels, and calyx more or less clothed with short hairs. Leaves alternate, glabrous in the mature state, varying from 1in. to 5in. in length and from $\frac{1}{4}$ in. to 2in. in breadth, and in shape from broadly ovate or lanceolate to linear-oblong; base broadly rounded or cuneate, acute or obtuse; margins serrate or doubly serrate, or dentate, or spinulose, rarely almost crenate. Flowers fascicled in the axils of the leaves, 1in. in diameter; pedicels jointed about the middle. Calyx inferior, cup-shaped, with five broad teeth, pubescent or silky; petals oblique, with a notch in the middle of the upper margin; stamens numerous, pentadelphous; ovary, five- or six-celled; styles, five or six; stigmas capitate. Fruit consisting of five or six one-seeded carpels radiating from a central axis, and crested with an oblique membranous wing.

EXPLANATION OF PLATES LIII., LIV., LIV_A., LIV_B., AND LV.

LIII. *Hoheria populnea*, A. Cunn. α , *vulgaris*: flowering branch, natural size. 1. Flower-bud. 2. Flower. 3. Pistil. 4. Diagrammatic transverse section of flower, showing position of staminal tube. 5. Fruit. 6. Free portion of stamen.

LIV. *Hoheria populnea*, A. Cunn. β , *lanceolata*. The lower drawing represents a form with small leaves; the upper drawing a transition form with leaves approaching γ , *angustifolia*.

LIV_A. *Hoheria populnea*, A. Cunn. β , *lanceolata*. 1. Flowering specimen, with doubly-serrate acuminate leaves. 2. Fruiting specimen of a similar form. 3. A form with serrated leaves. 4. A fruit with six carpels. All natural size.

LIVB. *Hoheria populnea*, A. Cunn. 1. β , *lanceolata*: leaves of young state. 2. γ , *angustifolia*: flowering specimen; leaves with spinulose teeth. Both natural size.

LV. *Hoheria populnea*, A. Cunn. γ , *angustifolia*. 1. Flowering specimen; leaves with large acute teeth. 2. Leaves of young state, natural size. 3. Two carpels attached to the receptacle. 4. A single carpel. Both magnified.



Entire Leaved Beech
(*FAGUS SOLANDRI*)

FAGUS SOLANDRI, Hook. f.

THE ENTIRE-LEAVED BEECH.

ORDER—CUPULIFERÆ.

(Plate LVI.)

ALL the New Zealand beeches belong to the section of *Fagus* characterized by evergreen leaves, and the presence of curious transverse membranous or glandular plates on the leaves of the involucre which contains the female flowers. Mr. Colenso informs me that all the New Zealand species are termed tawhai by the Natives, the present species being sometimes termed "tawhairauriki." Like all small-leaved forest trees it is termed "birch" by the bushman. In the Wellington District it is generally known as "black-birch." In Canterbury it is termed "black-birch," "white-birch," "red-birch," and "brown-birch." In Nelson it is usually known as "white-birch." In Otago it is known as "white-birch," "black-birch," and "black-heart birch." It is not too much to say that the blundering use of common names in connection with the New Zealand beeches, when the timber has been employed in bridges and constructive works, has caused waste and loss to the value of many thousands of pounds. As the first step towards preventing these blunders in the future, I have proposed the name of "entire-leaved beech" for this species, the Native name being applied too vaguely to be of any real value.

Fagus Solandri was discovered by Banks and Solander, in Queen Charlotte Sound, in 1769, and received the MS. name of *Myrtilloides cinerascens*, which was subsequently altered by Dryander to *Cliffortioides oblonga*. It was first described and published by Sir William Hooker in 1844 under the name of *Fagus Solandri*, in honour of Dr. Solander, one of its original discoverers.

The entire-leaved beech is a fine evergreen tree, forming continuous forests, which often cover vast areas. It sometimes attains the height of 100ft., but is usually from 60ft. to 80ft. high, with a trunk from 2ft. to 4ft. in diameter or more. In the young state the bark is white and smooth; it ultimately becomes furrowed, rough, and black, but never assumes the peculiar brown tint often exhibited by the tooth-leaved beech. The young branches are more or less clothed with fine pubescence. The leaves are of thick texture, narrow, oblong, quite entire, obtuse, wedge-shaped at the base, and on mature trees densely pubescent beneath; the upper surface is finely reticulated: they are from $\frac{3}{8}$ in. to $\frac{5}{8}$ in. long, and about $\frac{3}{16}$ in. broad, rarely more.

Male and female flowers are produced on the same tree, and are widely dissimilar in appearance. The male flowers are solitary or in fascicles of two or three, carried on a common stalk springing from the axils of the leaves on last year's shoots. Each flower consists of a shallow membranous brown cup or perianth with four or five sub-acute teeth, containing from eight to thirteen stamens on short filaments, springing from a central receptacle, and drooping over the edges of the perianth when fully expanded. The female flowers are minute, axillary, sessile, usually consisting of a cup-shaped involucre divided nearly to the base into three segments, each with three transverse membranous scales or

bracts, finely toothed on the upper margins: each involucre contains three or rarely two flowers. The flower consists of a three-celled ovary with three short styles: each cell contains a single ovule: two of these become absorbed after fertilisation, and only one arrives at maturity. The fruit consists of a woody involucre cup, usually with three seeds, two of which are three-angled, and tipped with the remains of the style, the angles being produced into narrow wings; the middle seed is flat, two-winged, and usually abortive.

In fruits of this species, figured by Sir Joseph Hooker, the involucre cup consists of from seven to nine segments, but I have not seen specimens consisting of more than three.

Reference has been made to the covering of cinereous or brownish hairs on the under-surface of the leaf. This is characteristic of the mature state only: in the young state the leaves are green on both surfaces, and even on old trees when they are protected by trees of greater height. This protective covering is adapted to prevent undue evaporation and injury from sudden variations in temperature: it is only developed on leaves fully exposed to light and air, whether on young trees or old; it is never found in seedling plants, or on branches growing under the shade of taller trees.

Its chief centre of conversion is the Oxford Forest, where numerous saw-mills are still in operation, although the number has been reduced of late years. The greater portion of the timber converted is now obtained from private lands, payment being made by "tithes" or royalty at the rate of 1s. per 100ft. superficial, or at a fixed rate per acre varying from £2 to £6 10s. for the timber only. Formerly higher rates were paid; from £8 to £10 per acre was not infrequent, and in one or two instances it is stated that a rate of fully £15 has been realised.

The most heavily timbered portions of the forest have been cut out; the lower slopes and folds of the hills, however, contain a large amount of good timber, much of which will yield from 14,000ft. to 17,000ft. superficial per acre. The present holders are making a fair profit at the current rate of royalty, especially as the forest contains a small proportion of matai, rimu, and kahikatea, which is of more easy conversion than entire-leaved beech.

The beech forests of New Zealand may be renewed at a minimum cost wherever it is desirable. Whenever trees are felled or a track is cut through the forest, myriads of seedlings spring up, the majority of which are gradually killed off in the struggle for existence, leaving the strongest to form trees. No other forests in the colony could be made to afford a regular crop of timber at fixed periods at so small a cost. All that is required is the exclusion of cattle, and judicious thinning when necessary; transplanting would be rarely called for.

The flowers are produced in November and December.

PROPERTIES AND USES.

The wood of *Fagus Solandri* is of a pale-red colour or greyish, often streaked with black, and sometimes handsomely figured: the heartwood is black, and irregular in outline.

It is heavy, tough, strong, and, if properly selected, durable; but the absolute necessity for rigorous selection tends to detract from its value.

According to Mr. Blair, the weight per cubic foot in the green state is 53·485lb.; when seasoned, 40·292lb.: and the breaking weight of a piece 2ft. long and 1in. square, loaded in the middle, 339·53lb. A board 12in. wide and $\frac{3}{4}$ in. in thickness shrank $\cdot 54$ in. while seasoning.*

* Blair: Building Materials of Otago, pp. 224, 225.

The question of its durability has excited considerable discussion: there need, however, be no question on this head. If felled when fully matured, and before decay commences, it is of high value both for strength and durability; but if felled too early or too late it speedily perishes.

It is very easy to bring forward instances where it has perished in a very short time. The railway between Christchurch and Lyttelton was laid with "black-birch" sleepers from the Oxford Forest, but, owing to rapid decay, they had to be replaced within fourteen months of the opening of the line. Fences in the vicinity of Oxford and Alford Forests erected exclusively of "black-birch" require to be replaced in five or six years. Cases of this kind are much too frequent, but they cannot be allowed to neutralise undoubted instances of great durability, and may frequently be accounted for by the use of immature or faulty timber, or timber felled when the sap has been in active circulation.

Mr. Blair states, on the authority of Mr. Ingram, that the piles of a hut erected at Mr. Pearson's station, Burnt Hill, in 1851, were in good preservation in 1879, and gives several instances of its having been in good condition when used as posts, tramway-sleepers, &c., after from fifteen to twenty years. The Hon. Edward Richardson, late Minister for Public Works, states: "I am quite satisfied that, under certain conditions, the heart of black-birch is almost imperishable, comparatively speaking, and infinitely superior to the black-pine or totara of the Middle Island. The conditions I refer to are—first, that the timber be cut at the proper season of the year; and, secondly, and probably more important, that the timber is grown on tolerably stiff soil and not subject to be flooded."

While attaching full value to the numerous instances adduced in proof of its durability, it must be stated that they are greatly outnumbered by instances of speedy decay; and that in the same localities which afford some of the most striking proofs of its durability equally striking instances of its premature decay may be seen sometimes side by side.

The Oxford and Alford Forests, in the District of Canterbury, consist almost exclusively of entire-leaved beech; it is the only species that has been converted in either, but in many places in the vicinity fences are to be seen falling to pieces before they have been erected seven years, gate-posts and sleepers decaying in a like period. The old settlers are fully aware of the value of the timber if obtained from ripe trees felled at the proper season of the year: this, however, is but seldom done, as the woodmen require a much higher price for felling and splitting old trees on account of the greater hardness of the timber.

C. H. Gorton, Esq., of Burnt Hill, to whom I am indebted for much valuable information respecting this tree, informed me that mature specimens are commonly termed "old-man birch," and are much disliked by the woodmen, as they are very difficult to split. Moreover, they are comparatively few in number, so that a large area has to be worked in order to obtain a given quantity; consequently the cost of obtaining first-class timber is greatly increased, and the selection of ripe trees finds no favour in the eyes of sawmillers, who find it more profitable to clear out all timber of sufficiently large size for conversion, without troubling too nicely about its maturity. As proof of the durability of tooth-leaved beech when properly selected, Mr. Gorton pointed out a sheepyard which had been erected from trees selected by himself twenty-one years ago; it was in excellent condition, and seemed likely to remain in that state for an indefinite period. It cannot be too forcibly stated that it is futile to expect the entire-leaved beech to afford durable timber unless obtained from fully-matured trees; and it is equally important that the trees should not be allowed to stand too long

after reaching maturity, as decay commences at the heart very soon after they have attained their full dimensions. The irregular shape of the heartwood necessarily increases the proportion of waste when timber of first quality is required; it is however largely converted for bridges and other constructive works, railway-sleepers, gate-posts, fencing-stuff, especially for rails, and even building-timber, although with the extension of railways its use for this purpose has become more restricted. It is also used by the wheelwright for spokes. In districts where both tooth-leaved and entire-leaved beech are common, the former is specially in demand for fence-posts, the latter for rails. Owing to its stout grain, newly-converted timber, when exposed to the weather, splits and cracks to a considerable depth in a very short time, so that in many cases it becomes unfit for use from this cause alone. This defect might be partially obviated by stacking it under open sheds until seasoned.

The medullary rays of mature timber are more lasting than the wood formed by the fibro-vascular bundles of the annual cylinder. This is constantly seen in fallen trees in the forest: after the decay of the sapwood the heartwood appears to be divided into numerous interrupted laminæ, running longitudinally, and projecting more or less above the general mass, owing to the early decay of the wood of the greater portion of the cylinder. If the log has been kept from the ground the medullary plates often project from 1in. to 2in. above the undecayed portion of the log, showing thin rounded weather-worn edges, perfectly sound and extremely hard: they are easily broken off by a sharp blow, and vary from $\frac{1}{2}$ in. to $\frac{3}{8}$ in. in thickness at the base. This peculiarity is exhibited only by fully-matured timber.

DISTRIBUTION OF THE GENUS.

The genus *Fagus* comprises about sixteen species, distributed through the temperate and frigid regions of both hemispheres. It is divided into two species, *Eufagus* and *Nothofagus*: the latter, consisting of thirteen species, includes five found in New Zealand, three in Australia, and five in South America.

DISTRIBUTION OF THE SPECIES.

Fagus Solandri is restricted to New Zealand, and occurs in both the North and South Islands. It attains its northern limit on the western slopes of the East Cape, above Cape Runaway, from whence it extends southwards to Otago, but is often restricted and local, although common on both the east and west coasts. It ascends from the sea-level to about 2,500ft.; at higher altitudes it is replaced by *F. cliffortioides*, the mountain-beech. It is the commonest species on the western side of the Nelson District.

It has been reported from the Hokianga district, but the habitat requires confirmation. It is not found on Stewart Island.

DESCRIPTION.

Fagus Solandri, Hook. f.

Hook., "Icones Plantarum," t. 639 and 816.

An evergreen monœcious tree, 60ft. to 100ft. high; trunk, 2ft. to 4ft. in diameter; bark in mature trees furrowed black. Branchlets pubescent. Leaves on very short petioles, alternate, coriaceous, entire, $\frac{3}{8}$ in. to $\frac{5}{8}$ in. long, stipules chaffy, deciduous, linear, oblong, obtuse, wedge-shaped at the base, oblique, finely reticulated above, clothed with white or grey hairs beneath. Male flowers axillary, solitary or in two- to three-flowered fascicles, peduncles short, perianth

shallow, membranous, four- to five-toothed; stamens, eight to twelve, exserted; anthers shortly apiculate. Involucral cup usually three-valved, pubescent, scales eroded or toothed; nuts, two or three, triquetrous, with the margins produced into wings.

EXPLANATION OF PLATE LVI.

Fagus Solandri, Hook. f. 1. Flowering specimen, natural size. 2. Fruit, natural size. 3. Fruit. 4. Involucral cup. 5 and 6. Nuts. (Figures 7 to 10 are illustrations of *F. Blairii*, T. Kirk.)



Blair's beech. (*Fagus Blairii*).

T. KIRK. DELIXIT

SURVEY DEPARTMENT 1880

FAGUS BLAIRII, T. Kirk.

BLAIR'S BEECH.

ORDER—CUPULIFERÆ.

(Plate LVII.)

FAGUS BLAIRII has until recently been confused with *Fagus Solandri*, and was first described in "The Transactions of the New Zealand Institute" for 1884, although observed by the writer ten years earlier.*

It forms a handsome evergreen tree, 40ft. to 60ft. high or more, making some approach to the habit of the European beech (*F. sylvatica*) in its ascending branches and ramification. The leaves are spreading, from $\frac{3}{4}$ in. to $\frac{5}{8}$ in. in length, $\frac{1}{2}$ in. to $\frac{3}{4}$ in. broad, and carried on short leaf-stalks; they are quite entire, of thick texture, rounded at the base, and usually with a minute point projecting beyond the apex of the blade. The under-surface is clothed with a dense coating of yellowish-brown hairs.

The flowers have not been collected, but the involucre is divided nearly to the base into four segments, with broad membranous margins and tips, and carrying one or two small transverse scales near the base. The nuts are three-winged.

It is distinguished from *Fagus Solandri* by the more open habit, the larger, broader leaves, fulvous pubescence, and especially by the larger involucre, which is four-lobed.

The trunk is from 2ft. to 3ft. in diameter.

PROPERTIES AND USES.

The timber bears considerable resemblance to that of the entire-leaved beech, but is less stout in the grain. It has been converted at sawmills on Lake Wakatipu, but there is no evidence respecting its durability.

DISTRIBUTION.

Fagus Blairii has been observed near Waimarino, and in one or two other localities in the central portion of the North Island; in the upper part of the Wairau Valley, near the source of the Buller River, and the valley of the Little Grey, in the Nelson District; mountains above Lake Ohau, Canterbury (J. Buchanan); mountains above Martin's Bay (J. Buchanan); Five Rivers Plain (W. N. Blair); head of Lake Wakatipu and valley of the Dart, Otago (T. Kirk). It does not extend to Stewart Island.

It descends to about 1,100ft. above sea-level, and ascends to about 2,300ft.

DESCRIPTION.

Fagus Blairii, T. Kirk.

An evergreen tree, 40ft. to 60ft. high, with trunk 2ft. to 3ft. in diameter. Young twigs and petioles puberulous. Leaves alternate, shortly petioled,

* Trans. N.Z. Inst., xvii., p. 297, t. xvi.

coriaceous, ovate, entire, $\frac{2}{3}$ in. to $\frac{3}{4}$ in. long or more, $\frac{1}{3}$ in. to $\frac{1}{2}$ in. broad, rounded at the base, usually minutely apiculate, clothed beneath with fulvous appressed pubescence. Flowers not seen. Fruit, involucral cup four-valved, glabrous, valves with broad membranous margins, and one or two small transverse membranous scales near the base. Nuts three-winged.

EXPLANATION OF PLATE LVII. AND DETAILS IN PLATE LVI.

LVII. *Fagus Blairii*, T. Kirk. Fruiting specimen, natural size.

LVI. *Fagus Blairii*, T. Kirk. 7. Fruit, natural size. 8. Fruit. 9. Involucral cup. 10. Nut. All magnified.



Southern Rata
METROSIDEROS LUCIDA

METROSIDEROS LUCIDA, Menzies.

THE SOUTHERN RATA.

ORDER—MYRTACEÆ.

(Plate LVIII.)

THE name rata is applied by the Maoris alike to the present species, which is most abundant in the South Island, and to *M. robusta*, which is most plentiful in the North Island. Although the two plants are easily distinguished, even in the absence of flowers, it may be advisable to term this species the southern rata, and *M. robusta* the northern rata. Persons residing in the South Island would consider the Native name misapplied if used for the rata of the North Island, and the same may be said of the settlers in the North Island with regard to the rata of the South Island. Both species are called "ironwood" by the bushmen.

The genus *Metrosideros* includes species remarkable alike for the splendour of their flowers and the economic value of their timber. The colony has few more magnificent sights to offer than a mountain-slope covered with this species from its base to nearly 4,000ft. above sea-level, when the brilliant scarlet flowers are lighted up by the morning sun. It is only to be seen in its full beauty in such localities as the lower part of the Otira, the deep sounds of the South Island, or on Stewart Island. It is of special interest as forming the chief portion of the arboreal vegetation of the Auckland Islands, and extending even to Campbell Island.

It forms a tree from 30ft. to 60ft. high, with a trunk 2ft. to 6ft. in diameter. When growing at the margin of the sea it is often divided from the base into three or four large arms, and in exposed alpine situations is reduced to a gnarled bush, often with stout branches. The bark is yellowish-brown, often peeling off in large flakes. The twigs are stout or slender, and often obscurely four-sided. The leaves are opposite, 1½in. to 3in. long, thick and glossy; lanceolate, with very long points and slender petioles; the under-surface dotted with oil-glands; in the young state they are clothed with silky hairs. The flowers are produced in great profusion, and are generally arranged in threes, thickly clustered at the tips of the branches, forming cymes sometimes as much as 2in. in diameter, but usually smaller. The calyx forms a deep silky cup with five small petals, and numerous crowded deep-crimson stamens springing from its margin. The ovary is three-celled, seated at the bottom of the cup-shaped calyx, and the style exceeds the stamens in length. The calyx is persistent in fruit, and becomes almost woody; it is longer than the woody capsule, which contains numerous minute seeds, and opens by three valves. The petals are very small, and contribute but little to the brilliant splendour of the flowers, which is exclusively due to the fiery crimson filaments of the innumerable stamens.

A single specimen with lustrous golden-yellow flowers was observed in Arthur's Pass; but any departure from the normal crimson is extremely rare.

The flowers are produced from December to February, or even March at very high altitudes.

PROPERTIES AND USES.

The wood of the southern rata is heavy, compact, tough, and of great strength when straight in the grain, but, as in exposed situations it is often gnarled and contorted, the grain is frequently twisted and uneven. It is of a pale-red colour, closely resembling Honduras mahogany, but it is totally destitute of figure. Its specific gravity varies from 1.010 to 1.146; its weight per cubic foot, from 62.953lb. to 71.429lb.; its breaking weight, 175lb. to 255.4lb.; the weight carried with unimpaired elasticity, 175lb. to 255.4lb.* Mr. Blair states the weight of a cubic foot in the green state to be 72.041lb.; when seasoned, 63.314lb.: he found that boards 12in. wide and $\frac{3}{4}$ in. thick shrank 0.65in. in width while seasoning, although cut out of an old log. He gives 578.5lb. as the mean weight required to break four specimens 2ft. long and 1in. square, supported at each end and loaded in the middle.† The southern rata is largely used in shipbuilding, knees, crooks, and timbers of all sizes being readily obtained; so that it affords a good substitute for the pohutukawa, although not equal to its near ally. It is also used for trenails, for the teeth of geared wheels, and as a substitute for the large metal bearings of shafts. Mr. Blair states that the bearings of a water-wheel at Waikawa are in good condition after being in use eighteen years.‡ It is coming into general use for the framing of railway-wagons and carriages with the best results, only a single indigenous timber, the puriri, showing any superiority. It is also used for the manufacture of agricultural implements, and to a small extent for culverts, bridges, and similar purposes, for which it appears to be well suited when short lengths can be used. It is also used for fencing-stuff and house-blocks, and affords excellent firewood.

It is probable that all the indigenous species of *Metrosideros* would afford a valuable essential oil, possessing similar properties to *Eucalyptus* oil, and of a more agreeable odour.

The southern rata is easily cultivated, and, although of slow growth, is of value for ornamental planting.

DISTRIBUTION OF THE GENUS.

The genus *Metrosideros* comprises about fifteen species, eleven of which are found in New Zealand: one species is found in tropical Australia, one in the Indian Archipelago, one in Southern Africa, and one in the Sandwich Islands.

All the New Zealand species are endemic, except one which is generally distributed through the Pacific Islands. Six are lofty climbers, in some cases developing trunks of considerable dimensions. Nearly all are remarkable for the beauty of their flowers.

DISTRIBUTION OF THE SPECIES.

In the North Island *Metrosideros lucida* is chiefly found in mountain districts: it attains its northern limit in the Hirakimata Range, Great Barrier Island, and occurs in many places on the mountains of Cape Colville and the Thames Gold-field: but it is remarkably local in the North Island generally, and rarely occurs in any large quantity.

In the South Island it is plentiful, especially on the West Coast, where it is one of the commonest trees; it is also frequent in many places in the central mountains, and skirts the sea-margin along the southern side of Foveaux Strait.

* Balfour: Experiments on the Strength of New Zealand Timbers.

† Building Materials of Otago, pp. 224, 225, 226.

‡ Building Materials of Otago, p. 152.

It is plentiful on the Snares and Stewart Island, and forms the chief feature of the arboreal vegetation of the Auckland Islands, but is rare on Campbell Island.

It ascends from the sea-level to nearly 4,000ft.

DESCRIPTION.

Metrosideros lucida, Menzies.

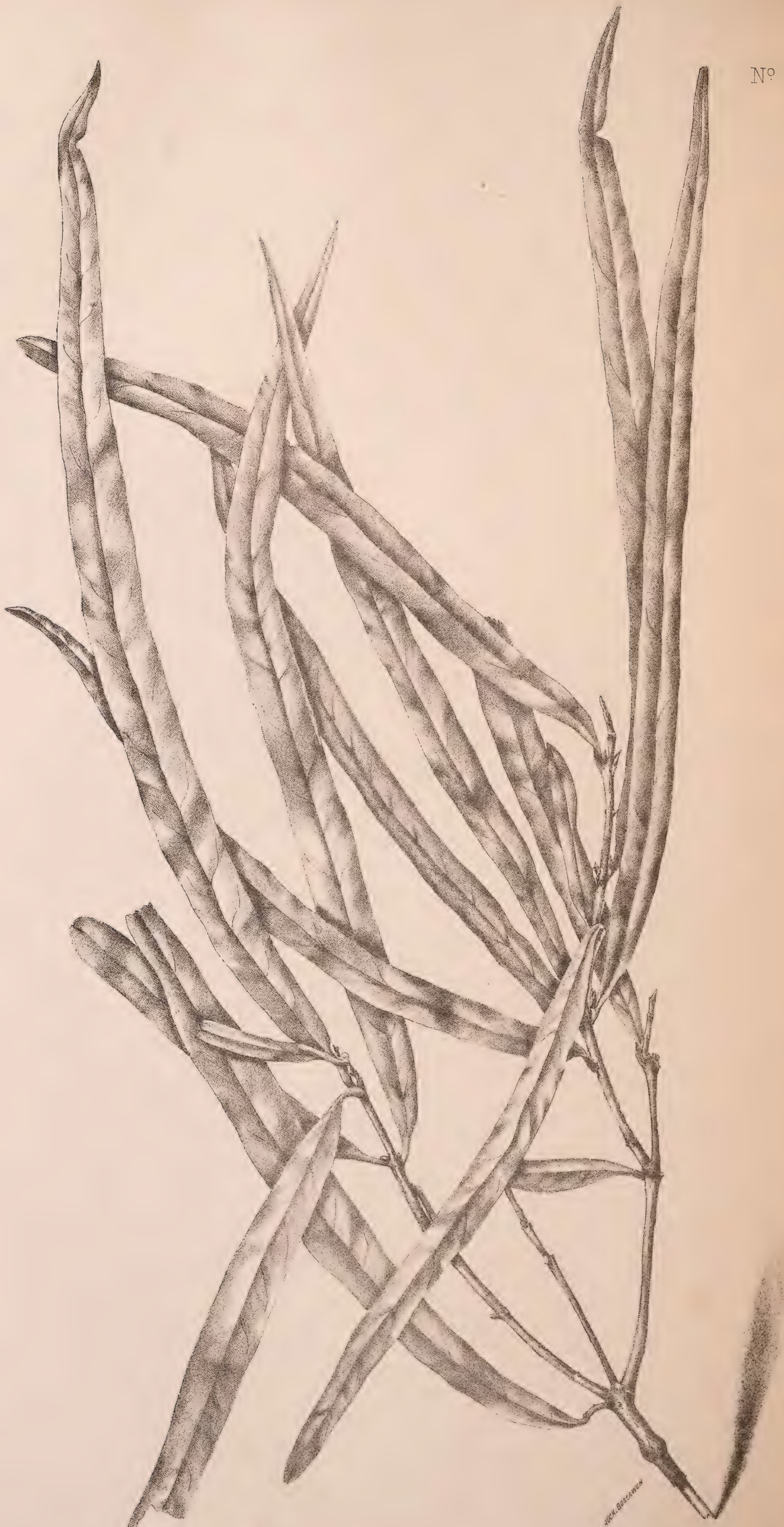
M. umbellata, Cavanilles.

Agalmanthus umbellatus, Hombron et Jacques, "Voyage au Pôle Sud,"
t. 1: Dicot.

An evergreen tree, 30ft. to 60ft. high. Leaves in the young state silky, glabrous when mature, 1½in. to 3in. long, opposite, shortly petioled, lanceolate or elliptic-lanceolate, acuminate, coriaceous, the under-surface dotted with oil-glands. Flowers crimson, in terminal, short, broad cymes. Calyx superior, funnel-shaped, silky, lobes five, persistent; petals, five, small; stamens very numerous, crimson. Ovary sunk in the base of the calyx, three-celled. Calyx at length woody, longer than the woody three-valved capsule; seeds minute, numerous.

EXPLANATION OF PLATE LVIII.

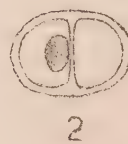
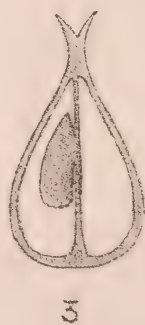
Metrosideros lucida, Menzies. Flowering specimen, natural size. 1. Flower.
2. Longitudinal section of flower. 3. Transverse section of fruit. All magnified.



Black Maire —Large Olive. (*Olea Cunninghamii*).
Leaves of young plant.



Black Maire. (*Olea Cunninghamii*)
Mature state with pistillate flowers



Black Maire
OLEA CUNNINGHAMII

OLEA CUNNINGHAMII, Hook. f.

THE MAIRE-RAU-NUI.

ORDER—JASMINEÆ.

(Plates LIX., LIXA., and LIXB.)

THE maire-rau-nui is one of several trees to which the name "maire" is commonly applied by settlers and the younger Maoris; the older Maoris, however, distinguish it as the maire-rau-nui. It is often called "black-maire" by the bushmen.

It is much the largest and most valuable of the New Zealand olives, and for combined strength and durability is, perhaps, the most valuable timber in the colony. It agrees with the species of *Olea* already described in producing the male and female flowers on different trees, and is the only species that appears to have been observed by Banks and Solander, although it seems to have escaped the attention of later botanists, until wrongly identified by Allan Cunningham with *Olea apetala*, Vahl, which at that time was only known as a native of Norfolk Island.

Olea Cunninghamii forms a large evergreen tree frequently 70ft. high, with a trunk from 3ft. to 6ft. in diameter: the trunk may be straight with but few branches, or several branches of large dimensions may be developed.

There is a remarkable difference in the form and dimensions of the leaves of young and mature trees. In all states the leaves are opposite and rough on both surfaces, but in the young state they are narrow-linear, from 6in. to 10in. in length, and from $\frac{3}{8}$ in. to $\frac{5}{8}$ in. broad, acute, passing by gentle gradations into the mature form, which is broadly lanceolate, from 3in. to 6in. in length, and rather less than 2in. in breadth. In *Olea apetala* the difference in form is reversed, the young state exhibiting leaves which are much broader than those of mature trees.

The male and female flowers are developed on different trees, and are destitute of petals: they are produced in racemes which spring from the axils of the leaves or of leaf-scars; the racemes being stout, from $\frac{3}{4}$ in. to 1 $\frac{1}{4}$ in. long, and bearing from ten to seventeen flowers arranged in pairs, except the terminal flower, which is solitary. The flowers are carried on short pedicels, which are articulated to the axis of the raceme, and the axis itself is articulated at the point where each pair of flowers is given off: the joints of the raceme as well as the flowers are clothed with hairs—a character which is not found in any other New Zealand species.

At the base of each flower a minute concave bract is developed, which speedily falls away. The perianth consists of four unequal lobes, and is clothed with hairs, the male being rather smaller than the female, and containing two stamens with an abortive ovary. In the female two stamens are developed, but never produce pollen; the ovary is oblong, with two cells, each containing two ovules; stigmas, two. Usually three of the ovules become absorbed during the ripening of the fruit, and one of the cells is nearly obliterated, so that the fruit

contains only a single seed; rarely, however, the fruit is two-celled with a seed in each cell. The fruit is ovoid in shape, $\frac{3}{4}$ in. to $\frac{5}{8}$ in. long, narrowed upwards; with the outer coat pulpy, crimson.

This species is easily cultivated, but is of slow growth.

The following measurements of five trees growing within a short distance of each other at Pakuratahi will be of interest:—

No.	Height of Tree.		Trunk to First Branch.		Girth at 5ft. from Base.
	Ft.	...	Ft.	...	Ft. in.
1	70	...	20 7
*2	50	...	13 4
3	60	...	4 8
4	50	...	6 4
5	60	...	2 0

No. 5 is a fine tree: after making all possible deductions for waste it must contain over 500 cubic feet of convertible timber. From about 6ft. above the ground the trunk holds its girth well to the crown, presenting a remarkable columnar appearance.

PROPERTIES AND USES.

Olea Cunninghamii affords the strongest of all New Zealand timbers, with the single exception of the puriri (*Vitex littoralis*). Its wood is of a deep-brown colour, the heartwood being often streaked with black and highly ornamental. It is heavy, dense, compact, straight and even in the grain, easily worked, and takes a good finish, while it is of great durability. It is evidently the "black-maire" of Balfour's list of New Zealand timbers, although he erroneously considered it to be a variety of *Eugenia Maire*, being doubtless misled by the Native name.

The results of four experiments as stated by him are as follow: The specific gravity varies from 1.113 to 1.193; weight per cubic foot, 70.63lb. to 74.40lb.; breaking weight, 327lb. to 335lb.; weight carried with unimpaired elasticity, 290.2lb. to 322.5lb.

In mature trees the proportion of sapwood is extremely small. Although a timber of high value, and occurring in considerable quantity in the central and southern parts of the North Island, its value is comparatively unknown. Its great strength, even grain, and durability render it suitable for bridges, wharves, and other constructive works, although it is but rarely used for these purposes, possibly on account of timbers whose qualities are better known being more readily obtained.

It has been extensively used in the framing of railway-carriages and wagons, with the best results. Settlers have used it in the rough for fence-posts, sleepers, &c., and in the converted state for gates, &c.

Old specimens are often beautifully streaked and figured, and are well adapted to the purposes of the cabinetmaker either in the solid or as veneers, and it is of special value for all ornamental turned-work, napkin-rings, ornamental inkstands, bowls, egg-cups, &c., and should supersede the large importations of ornamental articles manufactured from the European olive.

It is excellent as a substitute for metal bearings for heavy shafts, and for framing for machinery, agricultural implements, &c.: it has also been employed for millwrights' work and for ships' blocks. As it is very even, compact, and of great density, it may be used for the large block-letters required by the printers of large posting-bills. The Hon. W. B. D. Mantell, F.G.S., informed me that in the early days of Wellington a small block of this wood was engraved

* With six large arms averaging from 15ft. to 20ft. long, and 5ft. in circumference at the middle.

for the heading of a newspaper, but, after some years' use, fine horizontal cracks appeared, possibly due to its having been imperfectly seasoned before being engraved.

Logs of large dimensions, with sound bark in contact with the ground, retain sufficient vitality to develop shoots 18in. long two years after being felled: this shows the necessity of having the timber properly seasoned when required for permanent works.

DISTRIBUTION OF THE GENUS.

See under *Olea apetala*, p. 38, ante.

DISTRIBUTION OF THE SPECIES.

Olea Cunninghamii is endemic in New Zealand, being practically restricted to the North Island, with one or two habitats in the north-eastern corner of the South Island. Although not infrequent, it is comparatively rare and local north of the Auckland Isthmus, becoming more plentiful and obtaining larger dimensions in the deep gullies between the Waikato River and the West Coast, also on the Cape Colville Peninsula, Te Aroha, &c., some parts of the Hawke's Bay and Taranaki Districts. It occurs in great abundance in many localities south of Ruapehu, as the Mairepai Forest, Rangatana, and much of the country between Ruapehu and Wanganui, the valley of the Mangaone, some parts of the Rangitikei, the lower slopes of the Rimutaka Ranges, the Ruamahunga, &c., &c.

In the South Island it formerly existed in the Waimea district, but its value was discovered, and the tree speedily cut out. It is still to be found on the Conway River, growing on both banks, the north bank of course being in the Marlborough District. One or two solitary trees are known in the Kairouras and in Pelorus Sound, but it is extremely rare in the South Island.

It ascends from the sea-level to 2,300ft.

DESCRIPTION.

Olea Cunninghamii, Hook. f.

O. apetala, A. Cunn. (not of Vahl).

A lofty diœcious evergreen tree, often 70ft. high, with a trunk 2ft. to 5ft. in diameter. Twigs with white or brown bark, pubescent. Leaves opposite, shortly petioled, very coriaceous, rough on both surfaces, of two forms: on young trees, narrow-linear, 6in. to 10in. long, about $\frac{1}{2}$ in. broad; mature state, 2in. to 6in. long, $1\frac{1}{4}$ in. to $1\frac{3}{4}$ in. broad, oblong-lanceolate or broadly lanceolate, obtuse or acute. Flowers in jointed axillary racemes, destitute of petals, rhachis and pedicels hairy, ten- to seventeen-flowered: Male, calyx unequally four-lobed; stamens, two; ovary abortive. Female, stamens two, abortive; ovary oblong, two-celled, each cell containing two ovules. Fruit, crimson, ovoid, about $\frac{3}{8}$ in. long, narrowed upwards; one- or rarely two-seeded.

EXPLANATION OF PLATES LIX., LIXA., AND LIXB.

LIX. *Olea Cunninghamii*, Hook. f. Young state, natural size.

LIXA. *Olea Cunninghamii*, Hook. f. Mature state, with female flowers, natural size.

LIXB. *Olea Cunninghamii*, Hook. f. Fruiting specimen, natural size.
1. Ovary. 2. Ovary, transverse section. 3. Ovary, longitudinal section. All magnified.







White Maire *Olea lanceolata*
Pistillate flowers.

W. BOSCHEN.



F. KIRBY, SCULPTOR.

OLEA LANCEOLATA

WILLIAM BENTLEY

SCULPTOR

OLEA LANCEOLATA, Hook. f.

THE MAIRE.

ORDER—JASMINEÆ.

(Plates LX. and LXI.)

THIS species, which is usually termed "white-maire" by the Auckland woodmen, in its most developed state forms a round bushy-headed tree with white bark, and rarely exceeds 50ft. in height: the trunk is from 1ft. to 3ft. in diameter. Specimens less than 20ft. in height, with stems not exceeding 6in. in diameter, are frequently found producing fruit in abundance. It appears to have been originally discovered by Mr. Colenso, and to have been first described under its present name in the "Flora Novæ-Zelandiæ," by Sir Joseph Hooker.

The leaves are smooth and glossy in all stages, opposite, shortly petioled; veins prominent on both surfaces. The leaves of the young state are narrow-linear, 3in. to 5in. long; in the mature state they are about 3in. long and about $\frac{1}{2}$ in. broad, with a long sharp point.

As in the other New Zealand species, the male and female flowers are produced on different trees, and are destitute of petals. The racemes are very slender and jointed; the calyx is deeply cleft into four rather narrow membranous lobes. In the male flower the stamens are four in number: in the female flower the ovary is two-celled, with two divergent styles. The fruit is crimson, remarkable for its trigonous shape, and is more pulpy than that of the other species: it is usually one-seeded, but the second cavity is never completely obliterated.

This species varies considerably in the shape of the leaves, but all the varieties may be arranged under two forms, one with the leaves widest near the base, the other with leaves widest at the middle.

It flowers in November and December.

PROPERTIES AND USES.

The wood of this species is very even and compact in the grain, but is rather lighter than that of *Olea Cunninghamii*. In old specimens the heartwood is dark and streaky, but usually it is destitute of figure, and of a dull-brown tint. It is suitable for machine-beds and bearings, for the teeth of cog-wheels, and for many purposes of the cabinetmaker, ornamental turnery, &c. It has been used by settlers for fence-posts, rails, &c. At present it is but little known, and has not come into general use.

DISTRIBUTION.

Olea lanceolata is restricted to New Zealand, and is most plentiful in the northern parts of the Auckland District, but is found also in other parts of the North Island, especially in the southern portion of the Wellington District. It is also found, although very sparingly, in the Kaituna and Rai Valleys in the Marlborough District, and at Wairoa in the Nelson District, South Island.

It ascends from sea-level to fully 2,000ft.

DESCRIPTION.

Olea lanceolata, Hook. f.

“*Flora Novæ-Zelandiæ*,” i., p. 176.

A round-headed evergreen tree, 20ft. to 50ft. high; trunk, 1ft. to 3ft. in diameter. Leaves narrow-linear on young plants; on mature trees linear-lanceolate or ovate-lanceolate, about 3in. long, fully $\frac{1}{2}$ in. broad, acuminate, coriaceous, glossy; veins prominent. Flowers in very slender glabrous racemes, axillary or from the axils of old scars; seven- to thirteen-flowered. Calyx membranous, four-lobed; segments, narrow. Male, stamens four, exerted. Female, ovary two-celled, with two ovules in each cell; stigmas, two, divergent. Fruit crimson, outer layer pulpy, one-seeded.

Var. *a*. Bark of twigs whitish, prominently warted; leaves ovate-lanceolate, acuminate; segments of calyx linear.

Var. *β*. Bark of twigs dark, scarcely warted, leaves linear-lanceolate, racemes more slender than in var. *a*; segments of calyx broader.

EXPLANATION OF PLATES LX. AND LXI.

LX. *Olea lanceolata*, Hook. f. Mature state, with female flowers, natural size.

LXI. *Olea lanceolata*, Hook. f. Fruiting specimen, natural size. 1. Raceme of male flowers, natural size. 2. Male flower. 3. Transverse section of young fruit. 4. Longitudinal section of young fruit. 5. Longitudinal section of mature fruit. 6. Seed. All magnified.



COPROSMA BAUERIANA.

COPROSMA BAUERIANA, Endlicher.

THE NAUPATA.

ORDER—RUBIACEÆ.

(Plate LXII.)

COPROSMA BAUERIANA is a handsome evergreen shrub or small tree exclusively restricted to maritime situations, where it is able to resist the force of the fiercest gales: it develops its beautiful foliage in situations where it is often washed by the spray. Mr. Colenso informs me that it is the naupata of the northern Natives. I have heard it termed "taupata" by Maoris living at Rotorua and in the Wellington District; and the Ven. Archdeacon W. L. Williams states that it is the "mamangi" of the East Cape Natives: it does not appear to have received any distinctive appellation from the settlers.

In exposed rocky places it is a prostrate shrub or small bush, but usually it attains the height of from 12ft. to 25ft., with a short trunk from 6in. to 18in. in diameter, clothed with a pale bark in the young state, ultimately becoming black. The branches are spreading, often horizontal, with stout branchlets, which are more or less angular. The leaves are opposite, and carried on well-developed leaf-stalks, which are connected at the base by a pair of short, broad, triangular stipules: the leaves are coriaceous and glossy, shortly oblong, broadest in the upper part, gradually narrowed into the leaf-stalk, and rounded at the apex, which is often slightly notched: the margins are quite entire, but slightly recurved.

The male and female flowers are produced on different plants, and form dense heads or clusters on common flower-stalks springing from the axils of the leaves. In the male flower the calyx is minute, with four inconspicuous teeth; the corolla is funnel-shaped, with the mouth divided into five lobes; the stamens are five, on slender drooping filaments. In the female flower the calyx is minutely four-toothed or rarely three-toothed, forming a small crown on the rim of the ovary, surmounted by the minute corolla, with two erect or divergent stigmas. The ovary is two-celled. Fruit, a two-seeded berry, at first much flattened, but ultimately more or less oblong; orange-coloured.

The flowers are developed from August to October, and are produced in great profusion.

Owing to its bright attractive foliage and the ease with which it can be cultivated, this species is often met with in gardens and shrubberies, varieties with "gold" or "silver" variegation being much valued for their ornamental effect. Formerly it was frequently planted by the Maoris, and fine specimens are often met with in their old cultivations. A noble specimen well known to tourists in the Rotorua district is situate at the Pa Mourea, on the isthmus between Rotoiti and Rotorua, and is said to have been planted by the chief Hautupatu, who also planted the pohutukawa on the Island of Mokoia.

This species is one of the few indigenous trees which form the subjects of Maori legends. It is said to have originated from the paddles and skids of the

“Arawa” canoe which landed the original Maori immigrants in the Bay of Plenty. A small clump of naupata at Maketu is still pointed out as descendants of the trees originating from the paddles planted on that spot, and it is claimed that the naupata has spread from this grove all round the coast of the North Island. Unhappily for the credit of the legend, the naupata is not known to be indigenous outside New Zealand, except on the coast of Norfolk Island.

PROPERTIES AND USES.

The wood of *Coprosma Baueriana* appears to be of little value, and is but rarely used, except in coast situations where firewood is difficult to procure, when the settlers occasionally utilise it for this purpose. The wood is remarkably straight in the grain, close, but rather brittle, and easily split: it is frequently white throughout, but usually the heart is red: when split it speedily assumes a uniform reddish-brown tint. It is not durable when exposed.

It has been suggested that the seeds would afford a good substitute for coffee, and that their cultivation for this purpose would prove remunerative, but it is not easy to see how such a result could be realised at the current rates of labour.*

The naupata is of great value for ornamental planting and for affording shelter for plantations of timber-trees on the sea-coast, as it is able to resist the force of the most violent gales and the dashing of the spray, which only serves to give a brighter appearance to its fleshy leaves. It will grow on the most rugged rocks, or on pure sand, but requires fairly good soil to enable it to attain its largest dimensions.

It is excellent for hedges, and bears clipping freely.

DISTRIBUTION OF THE GENUS.

Coprosma comprises about forty species, of which at least thirty are found in New Zealand, all of which are restricted to the colony except *C. pumila*, which extends to Australia. Five species are found in Australia, one of which is *C. pumila* mentioned above. A few species occur in the Pacific, Chili, Juan Fernandez, the Sandwich Islands, &c.

DISTRIBUTION OF THE SPECIES.

Coprosma Baueriana occurs on the Kermadec Islands, and on many parts of the coast of the North Island, from the North Cape to Cook Strait, but it is sometimes absent for long distances, especially where the coast is sandy. In the South Island it occurs from the Pelorus westward to the West Coast, and southwards to Point Elizabeth,† in Westland, but is decidedly rare and local.

It is also found on Norfolk Island.

DESCRIPTION.

Coprosma Baueriana, Endl.

C. retusa, Hook. f.

An evergreen dioecious shrub or small tree, 5ft. to 25ft. high. Branches stout, with pale bark, often angular. Leaves opposite, petioled, with short broad triangular stipules connecting the petioles; fleshy, shining, glabrous, quite entire, broadly ovate or oblong, rounded or slightly indented at the apex, narrowed into the petiole below; margins often recurved. Flowers in many-flowered heads,

* J. C. Crawford: Trans. N.Z. Inst., Vol. ix., p. 545. † I have a specimen collected in this locality by Mr. R. Helms.

on short axillary peduncles. Male flowers, calyx minutely five-toothed, corolla funnel-shaped; segments, five, spreading; stamens, five, exserted, drooping. Female flowers usually arranged in threes or fives, calyx shorter than in the male; corolla smaller, with four or rarely three erect segments; ovary, two-celled; stigmas, two, robust, often clavate, erect or divergent. Fruit, a two-celled berry, compressed or oblong, orange-coloured, two-seeded.

EXPLANATION OF PLATE LXII.

Coprosma Baueriana, Endlicher. 1. Specimen with male flowers. 2. Specimen with female flowers. 3. Head of male flowers expanding. Natural size. 4 and 5. Male flowers. 6. Common receptacle of a head of male flowers. 7. Female flowers. 8. Section of ovaries. 9. Fruit. 10. Seeds. All magnified, except 9.



Maka maka.
Aekama rosæfolia.

ACKAMA ROSÆFOLIA, A. Cunningham.

THE MAKAMAKA.

ORDER—SAXIFRAGÆÆ.

(Plate LXIII.)

THE makamaka is one of the fine plants first discovered by Allan Cunningham. Being confined to a small district in the most northern portion of the colony it is but little known.

It forms a handsome shrub or tree from 20ft. to 50ft. in height, with a trunk sometimes 2ft. in diameter. The foliage bears some resemblance to that of the rowan or mountain-ash (*Pyrus aucuparia*, Gært.) of Europe, but is more graceful and of a lighter green.

The branchlets are clothed with stiff brown hairs, which render them slightly rough to the touch. The leaves are opposite, from 3in. to 10in. long, and consist of from three to ten pairs of leaflets with one terminal leaflet. The leaflets are of oblong shape, with the margins sharply toothed. The rhachis of the leaves and the mid-ribs of the leaflets are often hairy.

The male and female flowers are produced on separate trees, or rarely on the same tree; or male, female, and perfect flowers may be found on the same tree: they are arranged in panicles, which spring from the axils of the leaves or the tips of the branches. The branches of the panicle are very slender, clothed with short hairs, and often form a right angle with the axis: the flowers are invariably sessile, $\frac{1}{2}$ in. in diameter. In the male flowers the calyx is cup-shaped, the segments exceeding the petals, which are usually five in number, rarely eight; stamens, ten, erect, in two sets, alternate stamens being slightly longer than those on each side. In the female flower the calyx is similar, but the lobes are rather shorter and more recurved; the ovary is conical, two-celled, clothed with long hairs, and often surrounded by abortive stamens. The fruit is a very small capsule, splitting down the middle into two parts, each of which splits along its inner face. Seeds minute, hairy.

Ackama is closely allied to *Weinmannia*, but differs in the arrangement of the calyx-lobes, which do not overlap each other in the bud, in the flowers being arranged in panicles, and in the shape of the fruit. The foliage of *Ackama rosæfolia* approaches very closely to that of some states of the towhai (*Weinmannia silvicola*), but may be easily distinguished by the leaflets diminishing in size towards the base of the leaf, which is therefore broadest just below the apex: in the towhai they are equal along the entire length of the leaf. The flowers of the latter are arranged in erect racemes.

PROPERTIES AND USES.

Unfortunately nothing is known as to its value, as it is only found in a small district where kauri and other high-class timbers are abundant. The bark has been utilised for tanning purposes, and is probably of similar value to that of its close ally the tawhero.

DISTRIBUTION OF THE GENUS.

Ackama contains two species only, one of which is found in New Zealand and the other in New South Wales.

DISTRIBUTION OF THE SPECIES.

Ackama rosæfolia is found in forests between Mongonui and Whangarei on the East Coast and Hokianga on the West Coast, but is not general through the district, being often local. It is most plentiful in the Bay of Islands district. A fine specimen, the first seen by Allan Cunningham, is still growing at the Kirikiri Falls: large trees were formerly plentiful at the upper part of the Kawakawa.

DESCRIPTION.

Ackama rosæfolia, A. Cunn.

An evergreen tree, diœcious or polygamous, 20ft. to 50ft. high. Leaves opposite, with deciduous stipules, unequally pinnate; leaflets, $\frac{1}{2}$ in. to 2in. broad, in from three to ten pairs, sessile, oblong or narrow-oblong, acute, sharply serrate; rhachis, midrib, and veins pubescent. Flowers very small, sessile, in axillary or terminal panicles, branches very slender. Calyx cup-shaped; segments, five; petals, five, spathulate, minute; stamens, ten, on erect filaments exceeding the petals. Female, calyx inferior, ovary two-celled; styles, two. Fruit, a two-valved capsule; valves boat-shaped; seeds minute, numerous, hairy, with scanty endosperm.

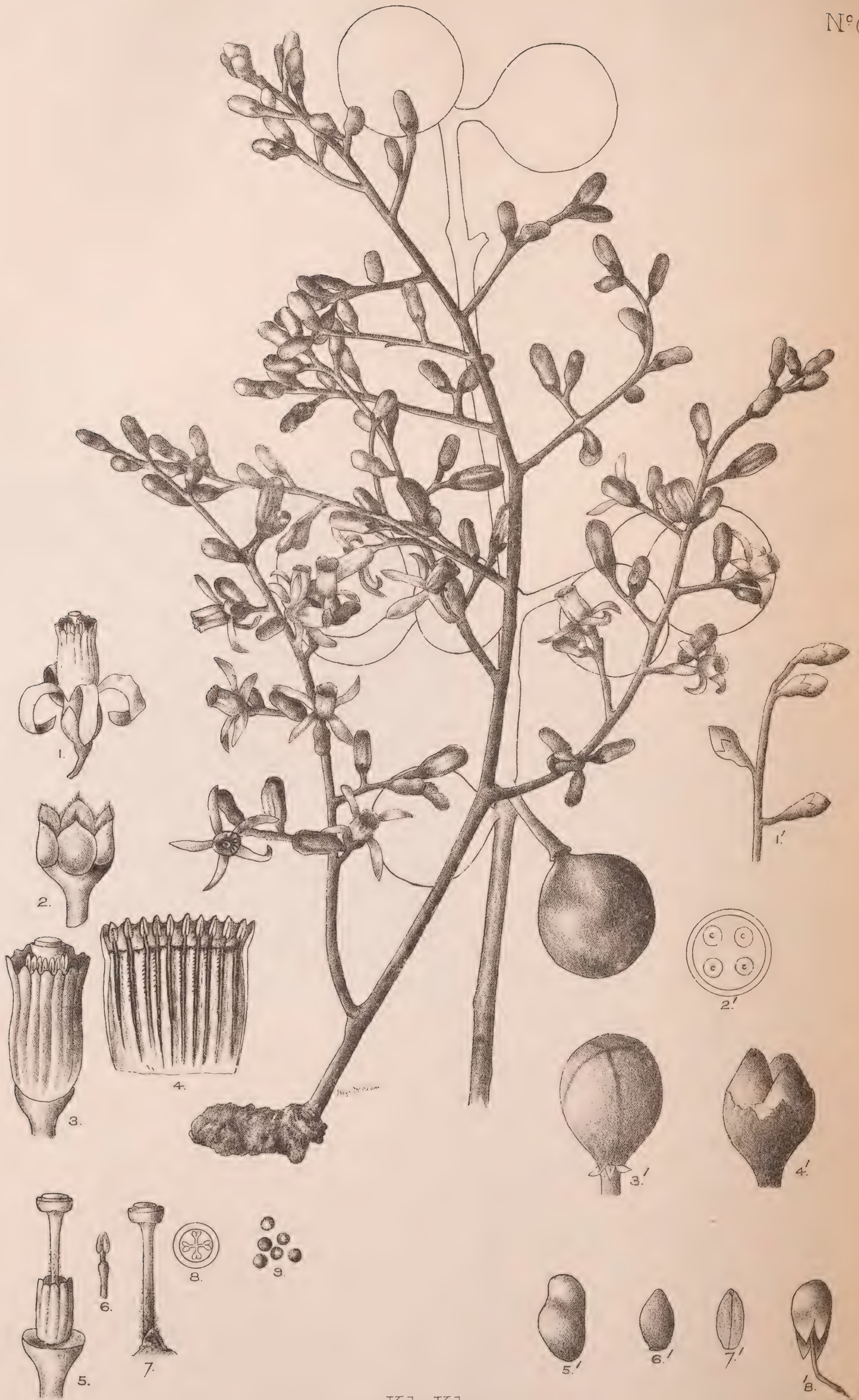
EXPLANATION OF PLATE LXIII.

Ackama rosæfolia, A. Cunn. Flowering specimen, natural size. 1. Male flower. 2. Female flower with the petals removed. 3. Ovary. 4. Capsules. 5. Fruit undergoing dehiscence.

114 B



Kohe Kohe — Cedar.
(DYSOXYLUM SPECTABILE).



Kohe Kohe.
(DYSOXYLUM SPECTABILE.)

T. Kirk. DREHIT

SURVEY DEPT. LINDO 1886

DYSOXYLUM SPECTABILE, Hook. f.

THE KOHEKOHE.

ORDER—MELIACEÆ.

(Plates LXIV. and LXV.)

THE kohekohe was discovered in the North Island during Cook's first voyage by Banks and Solander, who gave it the MS. name of *Trichilia spectabilis*: it was collected by Forster in the South Island during Cook's second voyage. It is one of the most striking trees in the New Zealand flora: its bold foliage, pendulous flowers, and large walnut-like fruits are familiar to all bushmen and travellers in the North Island, to which it is practically restricted.

When isolated it forms a round-headed tree, 20ft. to 50ft. high, with a trunk from 1ft. to 4ft. in diameter, and rather stout branches clothed with pale bark, which is usually smooth. It is however frequently gregarious, when the trunk, although longer, is of smaller diameter, and the branches are short. The foliage is very striking, alike from the size of the leaves and their deep-green hue; they are alternate, perfectly smooth, from 9in. to 18in. long, and consist of four or, rarely, three pairs of entire leaflets with a large terminal leaflet: the rhachis of the leaf is stout, and much thickened at the base, which is from $\frac{1}{4}$ in. to $\frac{1}{2}$ in. in diameter. The leaflets are usually oblong, but are sometimes broader near the apex than at the base; they vary from 3in. to 7in. in length, and from $1\frac{1}{2}$ in. to 3in. in breadth, and are carried on leaf-stalks from $\frac{1}{2}$ in. to 1in. in length: they are usually more or less ascending.

The flowers are produced in slender, drooping, or pendulous panicles, which are from 6in. to 12in. long, and usually spring from naked places on the trunk or branches, rarely from the axils of the leaves. The flowers are carried on pedicels usually less than $\frac{1}{4}$ in. in length; they are of very singular structure, and nearly $\frac{3}{4}$ in. in diameter when expanded (Pl. LXV.). The calyx forms a small cup, with five short broad lobes fringed with hairs (Fig. 2). The petals, five in number, are very narrow, obtuse, spreading or recurved; they are slightly connected at the base (Fig. 1). The stamens are usually ten, rarely eight in number, their filaments being united into a cylindrical tube (Figs. 3, 4), which completely surrounds the pistil, equalling it in length; the anthers are nearly sessile, and rise slightly above the mouth of the tube, which is toothed and somewhat fleshy in texture. The ovary is surrounded at its base by a second cup formed by the disc, which is longitudinally furrowed and toothed at the mouth; it is conical in shape, and with the lower part of the style clothed with silky hairs; it is three- or four-celled, each cell containing two ovules; the style equals or slightly exceeds the staminal tube, and is crowned by the flat stigma, which is surrounded by a thin concentric cup springing from its base (Figs. 5-7).

The fruit forms a pendulous, rounded or pear-shaped capsule, the valves of which are at first thick and leathery, but ultimately become parchment-like, and split from the apex downwards; it is usually three-celled (Fig. 4), each cell containing two seeds enclosed in a scarlet membranous envelope.

PROPERTIES AND USES.

The wood is light, but usually straight and even in the grain, rather soft, strong, and fairly durable; it is of a pale-red colour when seasoned.

It is adapted to the purposes of the cabinetmaker, especially where heavy timbers are ineligible: although usually plain and destitute of figure, waved and curled specimens of great beauty are frequently met with.

Of late years it has come largely into demand for wire-fence posts in loose sand: in situations of this kind it is the most durable of all New Zealand timbers, being greatly superior to totara.

The leaves are bitter and tonic: an infusion is occasionally used by bushmen as a stomachic.

The kohekohe is a valuable tree for ornamental planting.

DISTRIBUTION OF THE GENUS.

Dysoxylum as now constituted contains about thirty species, chiefly natives of tropical Asia: five species are found in Australia, and one in New Zealand.

DISTRIBUTION OF THE SPECIES.

Dysoxylum spectabile is distributed throughout the North Island, being most plentiful and attaining its largest dimensions on good soils, although not uncommon on stiff clays. It is sometimes found in situations where it is washed by the sea-spray. It is rare in the South Island, but occurs in several places in the Marlborough District; also in Croixelles Harbour, and on D'Urville Island, in the Nelson District.

It ascends from the sea-level to nearly 3,000ft.

DESCRIPTION.

Dysoxylum spectabile, Hook. f.

"Icones Plantarum," tt. 616, 617.

A round-headed evergreen tree, 20ft. to 50ft. high, trunk 1ft. to 3ft. in diameter, bark pale, branches stout. Leaves alternate, unequally pinnate, 9in. to 18in. long; leaflets in three or four pairs, petioled, 3in. to 7in. long, oblong or oblong-ovate, entire, slightly oblique at the base, sometimes narrowed into the petiole. Flowers in pendulous panicles, given off from naked parts of the trunk and branches, rarely axillary, perfect, shortly pedicelled. Calyx with five lobes, ciliated, inferior; petals, five, linear, spreading, obtuse; stamens, eight or ten, the filaments forming a tube longitudinally grooved, surrounding the pistil; anthers, eight or ten, nearly sessile, slightly exerted; disc forming a fluted cup around the ovary; ovary three- or four-celled, silky, ovules two in each cell; style rather longer than the staminal tube; stigma capitate, with a membranous cup springing from its base. Fruit, a pendulous capsule, globose or pyriform, three- or four-celled; each cell with two seeds, without endosperm, enveloped in a scarlet aril.

EXPLANATION OF PLATES LXIV. AND LXV.

LXIV. *Dysoxylum spectabile*, Hook. f. Foliage reduced.

LXV. *Dysoxylum spectabile*, Hook. f. Flowering and fruiting panicles, natural size. 1'. Flower-buds. 1. Flower. 2. Calyx. 3. Flower with calyx and petals removed. 4. Staminal tube laid open. 5. Pistil with cup at base. 6. Stamen. 7. Style and stigma. 8. Transverse section of ovary. 9. Pollen-grains. 2'. Diagram to show the position of seeds. 3'. Fruit in the first stage of dehiscence. 4'. Fruit with the upper portion of the pericarp removed. 5'. Two seeds enclosed in an aril. 6'. Seed. 7'. Longitudinal section of a seed. 8'. Germinating seed.



MELICOPE TERNATA.



Wharangi.
 (MELICOPE TERNATA)
 V. MANTELLII.

MELICOPE TERNATA, Forster.

THE WHARANGI.

ORDER—RUTACEÆ.

(Plates LXVI. and LXVII.)

THE wharangi sometimes forms a small evergreen tree, 12ft. to 20ft. high, with stiff branches, smooth in all its parts; but usually it is a large shrub, branched from the base. Its pale yellowish-green foliage and ornamental aspect render it attractive, although its flowers, from their greenish colour, are somewhat inconspicuous.

The leaves are opposite, and consist of three leaflets springing from the top of a common leaf-stalk: the leaflets are from 2in. to 4in. long, and from $\frac{3}{4}$ in. to 1 $\frac{1}{2}$ in. broad, somewhat wedge-shaped below, acute above: the leaf-stalk is rather shorter than the leaflets, which are dotted with pellucid oil-glands. The flowers are produced in small panicles from the axils of the leaves, and are carried on short pedicels arranged in threes; they are usually perfect, although male and female flowers are often developed on the same or on separate trees, or on trees with perfect flowers.

The calyx consists of four sepals, the corolla of four spreading greenish-white petals, both sepals and petals being dotted with pellucid glands. The ovary is small, silky, with a very short style, and the fruit consists of four wrinkled carpels united at the base only, each carpel containing a single shining black seed, which projects from the open suture of the seed-vessel as soon as it opens, and to which it is attached by a slender white process termed the funiculus. The jet-black coat of the seed is extremely brittle, and may be easily rubbed off between the finger and thumb. The ripe carpel consists of two coats, the innermost of which is white, and resembles parchment in texture.

The wharangi exhibits a large amount of variation in the size of the leaves and flowers, which is chiefly caused by temperature, soil, and situation. Specimens collected in the warmer climate of the Bay of Islands and Mongonui are of more luxuriant growth and larger dimensions than those found near Cook Strait;* so also specimens grown on light and alluvial soils are more luxuriant than those grown on clay; but in addition to variations due to the causes stated there are others which appear to be the result of hybridization: they present a series of forms connecting *Melicope ternata* with *M. simplex*. As a rule they are characterized by small leaves composed of three leaflets; but in some specimens many of the leaves are simple, which is probably due to the lateral leaflets having fallen away in an early stage. The leaves of some forms approach *M. ternata* in size; in others they are quite as small as those of *M. simplex*; but all the forms are characterized by the peculiar habit, crowded, erect, or ascending branches with reddish-brown bark, and in both leaves and inflorescence make a closer approach to *M. ternata* than to *M. simplex*, although combining the character of both species in a most remarkable manner.

* A striking exception has been observed on the eastern coast of the Marlborough District, where the leaflets are said to be 5in. in length.

Mr. J. Buchanan, F.L.S., was the first to draw attention to these intermediate forms, which he described as a separate species under the name of *M. Mantellii*, and in his excellent description* stated that he found it associated with *M. ternata* and *M. simplex*, which is in itself significant. I have never seen this form except in situations where these species are found growing, or in their immediate vicinity. It therefore appears preferable to regard it as a variety of *M. ternata*, with which it agrees in the usually compound leaves with petioles channelled above, in the rather large flowers carried on short stout pedicels, in the broad sepals and petals, and especially in the stamens being subulate and shorter than the petals, in the conical ovary, and in the length of the style. On the other hand, it approaches *M. simplex* in the shape of the leaflets, in their margins being more or less crenate, and in the leaflets being jointed to the petioles, as well as in the small cymes, which are usually composed of from three to six flowers, and in the ovary being slightly silky. The fruits do not differ from those of *M. ternata*.

Although hybridization appears sufficient to account for the peculiarities exhibited by this form, it may be argued with great plausibility that the variation to which it is liable affords some proof that it is the product of a gradual transition from *M. ternata* to *M. simplex*, and that the latter plant may be looked upon as a "degraded" form of *M. ternata*—a view which receives support from the curious fact that in the young state *M. simplex* invariably develops trifoliolate leaves, which become unifoliolate in a few months.

PROPERTIES AND USES.

The wood is white, turning to a pale-brown when dry, frequently with a satiny lustre, which has led to its being utilised by the cabinetmaker for inlaying. It is straight-grained, strong, tough, and elastic, but its durability is uncertain. It affords excellent firewood.

The trunk of the variety *Mantellii* sometimes exceeds a foot in diameter.

DISTRIBUTION OF THE GENUS.

Melicope contains about fifteen species, chiefly distributed through the islands of the Pacific. Three species are found in Australia, and two in New Zealand.

DISTRIBUTION OF THE SPECIES.

Melicope ternata is restricted to New Zealand: it is plentiful in the Kermadec Islands, and at low levels through the North Island to Cape Palliser and Cook Strait.

In the South Island it appears to be restricted to the Districts of Marlborough and Nelson, but is confined to the coast: in Nelson it is only found on D'Urville Island.

It is chiefly found on the margins of woods, thickets, &c., and in sheltered rocky situations. Although most frequent at sea-level it ascends to 800ft. or 1,000ft. in the North.

The variety *Mantellii* has been observed in various localities between Mongonui and Wellington.

DESCRIPTION.

Melicope ternata, Forster.

Hook., "Icones Plantarum," t. 603.

A shrub or small evergreen tree, 10ft. to 20ft. high, glabrous in all its parts. Leaves opposite, dotted with oil-glands, trifoliolate, leaflets longer than the

* Trans. N.Z. Inst., Vol. III., p. 212.

petioles, linear-oblong or ovate, cuneate below, acute. Flowers in axillary trichotomous panicles, pedicels short; calyx inferior; sepals, four; petals, four, spreading; stamens, eight, erect, shorter than the petals. Ovary four-lobed, four-celled, each cell containing two ovules; style short; stigma minutely four-lobed. Fruit usually consisting of four one-seeded carpels, wrinkled and punctate, connected at the base only. Seed black, shining; testa crustaceous, endosperm copious.

Var. *Mantellii*. *Melicope Mantellii*, J. Buchanan. Branches slender, erect, with red or dark-brown bark. Leaves dark-green, trifoliolate; leaflets rounded at the point, entire or crenulate; lateral leaflets smaller than the central; petioles shorter than the leaflets; jointed at blade, obtuse or emarginate, deeply channelled above, but not winged. Flowers small, whitish; cymes three- to six-flowered. Ovary silky above.

EXPLANATION OF PLATES LXVI. AND LXVII.

LXVI. *Melicope ternata*, Forster. Flowering specimen, natural size.
1. Flower. 2. Flower-buds. 3. Fruit. 5. Seed.

LXVII. *Melicope ternata*, Forster. Var. *Mantellii*. A small form, natural size.

NOTE.—For *Melicope simplex*, var. *Mantellii*, on Plate LXVII., read *M. ternata*, var. *Mantellii*.





MELICOPE SIMPLEX.

MELICOPE SIMPLEX, A. Cunningham.

ORDER—RUTACEÆ.

(Plate LXVIII.)

MELICOPE SIMPLEX differs widely in general appearance from the preceding species, although some forms of the variety *Mantellii* approach it very closely. It forms a small tree, rarely exceeding 18ft. or 20ft. in height, but is most frequently a shrub branched from the base, or even a mere bush. The branches may be short and rigid, or long, distant, and flexuous. The leaves are alternate or rarely opposite, and are frequently crowded on short abortive branchlets: they are about $\frac{3}{4}$ in. long, and nearly as broad, carried on short leaf-stalks, which have flattened wing-like margins and are suddenly contracted at the base of the leaflet to which they are jointed. The leaf-blade is rounded and dotted with pellucid glands, its margins being cut into shallow rounded teeth or crenatures. In the young state the leaves are composed of three small leaflets carried on a slender leaf-stalk, the leaflets notched at the apex or rounded, and the middle leaflet is larger than the others: they are rarely seen on plants above 1ft. in height.

The flowers are produced in clusters in the axils of the leaves, and are borne on very slender pedicels: three or four flowers usually spring from an axil; most frequently three flowers spring from a common flower-stalk, and a fourth from its base. Male, female, and perfect flowers may be found on the same or on separate plants.

The flowers are white, with the petals more membranous than those of *M. ternata*; the stamens are of unequal length, and longer than the petals; the ovary is very silky, with a remarkably short style, so that the stigma is nearly sessile. The fruit does not differ from that of *M. ternata*. The flowers are produced during the months of September and October.

PROPERTIES AND USES.

The wood is in all respects similar to that of *M. ternata*, although in old specimens it is of a more satiny lustre, and therefore better adapted to the purposes of the cabinetmaker.

DISTRIBUTION.

Melicope simplex is frequent on the margins of woods, especially in cool dry situations, from Mongonui to Otago, but does not extend to Stewart Island.

It ascends from sea-level to 1,500ft.

DESCRIPTION.

Melicope simplex, A. Cunn.

Hook., "Icones Plantarum," t. 585.

An evergreen shrub or small tree. Leaves alternate, sometimes crowded on short aborted branches: in very young plants trifoliolate, but in older plants unifoliolate, petioles rather shorter than the leaves, flattened, deeply channelled

above, and almost winged; leaflets jointed to the petiole, membranous, orbicular, obovate or ovate, rounded at the apex or retuse, or emarginate, crenate or obscurely crenate. Flowers axillary, usually in threes or fours; pedicels very slender, longer than the petioles, with minute bracts at their base; petals linear, spreading; stamens with slender filaments, longer than the petals; ovary ovoid, four-celled, silky; style in the perfect flower extremely short; stigma minutely four-lobed. Fruit of four one-seeded carpels, connected at the base; seed black, shining.

EXPLANATION OF PLATE LXVIII.

Melicope simplex, A. Cunn. A. Flowering specimen. B. Young plant with trifoliolate leaves, natural size. 1. Flowers. 1'. Flower-bud. 2. Flower. 3. Ovary. 4. Fruit. 5. Seed. 6. Leaf. All magnified.



LEPTOSPERMUM ERICOIDES

LEPTOSPERMUM ERICOIDES, A. Richard.

THE MANUKA-RAURIKI.

ORDER—MYRTACEÆ.

(Plate LXIX.)

THIS species is one of the plants commonly called "manuka" by the bushmen, but I believe that name is correctly applied to *Leptospermum scoparium* only. Mr. Colenso informs me that "rawiri," as it is sometimes called in the North Island, is erroneous, and that the proper name is manuka-rauriki, as stated above. I am indebted to the Ven. Archdeacon W. L. Williams for informing me that it is known as "kanuka" and "maru" in the East Cape district.

It is everywhere termed "tea-tree" by the bushmen—a name also given to *L. scoparium*. Young trees are sometimes termed "white tea-tree," as they are supposed to belong to a different plant, owing, I believe, to the wood being whiter and more elastic than in old specimens.

Leptospermum ericoides forms an elegant evergreen tree, with linear leaves and a vast profusion of white flowers, which, although small, are produced in such abundance that the leaves are almost hidden during the flowering season. Its maximum height is from 40ft. to 60ft., with a trunk 1ft. to 3ft. in diameter; but it frequently produces flowers when only a few feet in height, and when growing at high levels it becomes not more than 1ft. or 2ft. in height, or is even prostrate.

As its seeds are matured in immense abundance, when a forest-clearing is made the ground is frequently carpeted with a close growth of seedlings, the weakest of which are gradually killed by the more vigorous growth of their neighbours; the survivors decrease in number year by year, and by the time they have attained the height of from 10ft. to 15ft. many have commenced to produce flowers and seed, but the seedlings produced by the young plants usually die off, except on the outskirts of the patch. The young flowering plant is remarkably graceful and elegant; its slender feathery branches, with the leaves hidden by a multitude of flowers, are most attractive. The plants that flower earliest are the first to succumb in the later struggle for existence, and, although they may endure for a longer period if growing in the open, they never develop into large trees; but those that are late in flowering, if crowded in their growth, form straight stems, and, after killing off their rivals, form well-developed trees. Large groves or forest-patches consisting entirely of this species were not unfrequent in many localities, but the excellence of the timber for firewood, and its value in the arts, have led to their destruction in the vicinity of settled districts. The chief firewood-supply of the City of Auckland was for many years obtained from Crown lands on the Island of Waiheke without payment, the woodcutters not considering it worth while to ask permission to fell timber on the public estate.

The trunk and older branches are clothed with loose, thin, ragged bark, which falls away in narrow ribbons: the main branches are few in number, with light airy spray. The leaves are crowded, and rarely exceed $\frac{1}{2}$ in. in

length by $\frac{1}{12}$ in. in breadth, while they are frequently smaller, sometimes even less than $\frac{1}{10}$ in. wide, acute at the apex, dotted with pellucid glands, but usually quite smooth. The flowers are in reality solitary, and spring from the axils of the leaves, but, owing to the leaves falling away as the flowers are expanded, the latter often appear to be produced in clusters. Each flower is carried on a short peduncle, and when fully expanded is nearly $\frac{1}{2}$ in. in diameter. The calyx is funnel-shaped, and closely invests the ovary; its mouth is divided into five minute teeth, alternating with which are five free petals, rounded at the tip: the stamens are numerous, and vary in length. The ovary is five-celled, and is sunk in the cup of the calyx. The fruit is a five-celled capsule, with numerous minute seeds. In some varieties the young shoots, leaves, and calyces are more or less clothed with fine down or silky hairs. The majority of the flowers are perfect, but not unfrequently flowers are found in which the stamens are not developed, others in which the pistil is wanting; but as a general rule these flowers are altogether abortive, the stamens but rarely producing pollen, and the pistil being incapable of fertilisation.

PROPERTIES AND USES.

Leptospermum ericoides affords a dense, heavy, straight-grained timber, of great strength and durability, tough, and elastic: it is of a red colour, varying in intensity according to the age of the tree. It is a timber of good value, and would be extensively used if it could be obtained of larger dimensions.

Its specific gravity varies from .906 to 1.042, its weight per cubic foot from 56.46 lb. to 64.95 lb., and its breaking weight from 200 lb. to 302 lb.*

It has been largely used for house-blocks, piles for marine jetties, fence-rails, for the cogs of wheels, and especially for spokes and other purposes of the wheelwright.

For some of these uses it is inferior to other timbers: for instance, to puriri, matai, and totara for house-blocks; to the kowhai, rata, and maire-raunui for the teeth of wheels. It is excellent for small marine piles, as it possesses the property of resisting the attacks of the teredo to a considerable extent; and for spokes for coach- or drag-wheels it is scarcely surpassed, but to obtain the best results they should be cleft from trees grown on fairly good soil.

It is highly valued for firewood.

DISTRIBUTION OF THE GENUS.

The genus *Leptospermum* contains about thirty species, of which twenty are found in Australia, and two or three in New Zealand. The others are chiefly found in the mountains of the Malay Archipelago and in New Caledonia.

DISTRIBUTION OF THE SPECIES.

Leptospermum ericoides is endemic in New Zealand, and is found from the Three Kings Islands to Otago, but is rare to the south of Port Chalmers, and does not cross Foveaux Strait.

It ascends from the sea-level to 3,000 ft.

DESCRIPTION.

Leptospermum ericoides, A. Rich.

A small tree, 20 ft. to 60 ft. high, with ragged, papery bark and spreading branches. Leaves crowded or fascicled, very narrow-linear, acute, dotted with

* Balfour: Experiments on New Zealand Timbers.

pellucid glands, $\frac{1}{4}$ in. to $\frac{1}{2}$ in. long, $\frac{1}{40}$ in. to $\frac{1}{12}$ in. broad, usually glabrous. Flowers on short pedicels, axillary, solitary. Calyx superior, five-toothed; petals, five, rounded, spreading; stamens numerous, white; ovary sunk within the calyx-tube, five-celled; style short, stigma capitate. Fruit, a five-celled capsule, completely sunk within the calyx-tube; seeds numerous, minute.

Var. β , *linearis*. Young shoots, leaves, and calyces silky; branchlets densely crowded; leaves linear and pungent, $\frac{1}{40}$ in. wide, margins slightly recurved; calyx with more acute teeth; petals very small, crumpled. Calyx-teeth erect in fruit.

This is probably a distinct species.

EXPLANATION OF PLATE LXIX.

Leptospermum ericoides, A. Rich. A flowering specimen. 1. A form with broad leaves. 2. Variety β , *linearis*, natural size. 3. Leaf. 4. Flower. 5. Transverse section of capsule. 6. Longitudinal section of capsule.



MYRTUS OBCORDATA

MYRTUS OBCORDATA, Hook. f.

THE ROHUTU.

ORDER—MYRTACEÆ.

(Plate LXX.)

THIS charming myrtle is a much-branched evergreen shrub or small tree, 6ft. to 15ft. high, producing its white flowers and red berries in great profusion. Its branchlets are clothed with fine pubescence, and its leaves are opposite or fascicled, from $\frac{1}{4}$ in. to fully $\frac{1}{2}$ in. in length, broadest in the upper portion of the leaf, narrowed into the short leaf-stalk below, and with a deep notch at the tip: they are perfectly smooth, but dotted with pellucid glands.

The flowers are white, solitary, and carried on slender downy peduncles, springing from the axils of the leaves; they are about $\frac{1}{4}$ in. in diameter. The calyx is four-lobed, and the petals are four in number, both calyx and petals being closely dotted with translucent glands. The stamens are very numerous, and spring from the inner rim of the calyx: from their great number they appear to form the chief portion of the flower: the ovary is immersed within the calyx-tube, and the style is longer than the stamens. The fruit is a crimson berry containing two bony seeds: the peduncle elongates during the ripening of the fruit.

This species forms an attractive object during the months of December and January when the white flowers are fully expanded.

PROPERTIES AND USES.

The wood possesses many good qualities; it is strong and compact, even in the grain, tough, and elastic. As it is of a red colour and very prettily marked it is occasionally used by the cabinetmaker for inlaying and ornamental turned-work of small dimensions. It is valued for the handles of chisels, mallets, and other tools used by the joiner, &c.

DISTRIBUTION OF THE GENUS.

Fully one hundred species are comprised in *Myrtus*. *M. communis*, the common myrtle of gardens, occurs in Southern Europe and Western Asia; the others are distributed through the temperate regions of the Southern Hemisphere, the Andes, Mexico, one extending to the West Indies; nine species are found in Australia, six in New Caledonia, and four in New Zealand, all of which are endemic.

DISTRIBUTION OF THE SPECIES.

The northern limit of *Myrtus obcordata* appears to be near the head of the Hauráki Gulf; it has been reported to occur in the neighbourhood of Whangarei, but it is to be feared that an error has occurred. It is found in the northern parts of Taranaki and Hawke's Bay, but never in such abundance as *M. pedunculata*. It is not infrequent near Wellington, and in various parts of the South Island as far south as Otago. I have a single scrap of what appears to

be this species sent from Stewart Island, but hesitate to identify it in the absence of flowers and fruit, as some states of *Myrsine divaricata* present a close resemblance. *Myrtus obcordata* obtains its largest dimensions in deep river-valleys, and may be found in great luxuriance on the banks of the Ruamahanga.

It ascends from sea-level to 1,000ft.

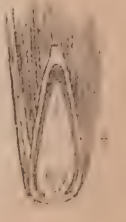
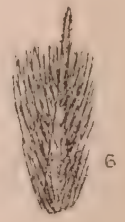
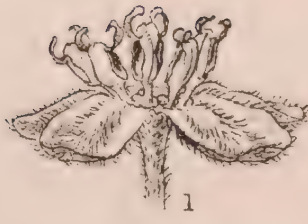
DESCRIPTION.

Myrtus obcordata, Hook. f.

A shrub or small tree with terete pubescent branchlets. Leaves opposite or fascicled, less than $\frac{1}{2}$ in. long, narrowed into a very short petiole, glabrous, slightly coriaceous, obcordate. Flowers axillary, solitary, on slender peduncles equalling the leaves; peduncles and calyx pubescent. Calyx superior, four-lobed, lobes acute; petals four, spreading; stamens very numerous. Ovary wholly immersed in the calyx-tube, two-celled: style exceeding the stamens. Fruit, a crimson berry; seeds two, bony.

EXPLANATION OF PLATE LXX.

Myrtus obcordata, Hook. f. Fruiting specimen, natural size. 1. Flower.
2. Flower with petals and stamens removed. Both magnified.



LAURELIA NOVE-ZELANDIÆ.

LAURELIA NOVÆ-ZELANDIÆ, A. Cunningham.

THE PUKATEA.

ORDER—MONIMIACEÆ.

(Plate LXXI.)

THE pukatea is one of the loftiest trees in New Zealand, and exhibits a decided preference for swampy land, or the banks of streams and gullies. It sometimes attains the height of 150ft., but is usually from 90ft. to 120ft., with a trunk from 3ft. to 6ft. in diameter, clothed with white bark, and flanked with radiating buttresses at the base, which in some cases more than double the diameter of the trunk.

Its glossy foliage and massive trunk give it a noble and attractive appearance, notwithstanding the distant and somewhat naked aspect of its branches: it is one of the best-known trees in the New Zealand forests.

The branchlets and leaves are opposite, and the former are usually clothed with fine pubescence, as are the short leaf-stalks. The leaves are of thick texture, from $\frac{3}{4}$ in. to $1\frac{1}{2}$ in. wide, and are nearly twice as long as broad, the margins being obscurely or coarsely toothed. The male and female flowers are developed on separate plants, and arranged in racemes springing from the axils of the leaves, and about one-third their length, bearing from six to nine flowers; the pedicels and perianth-leaves are densely clothed with silky hairs.

The male flowers consist of a cup-shaped perianth, consisting of five small ovate leaves, surrounding from six to ten stamens, the filaments of which are very short and thick, with a curious glandular protuberance on each side: the anthers open by a broad valve on each side. The female flower is similar to the male in general appearance, the stamens being represented by scales; the pistil consists of from six to eight carpels sunk in the tube of the perianth, the ovary and style of each carpel being clothed with long hairs. After fertilisation has taken place the perianth-tube becomes elongated, and completely invests the pistil: it is fully $\frac{3}{4}$ in. long when fully matured, and splits into four pieces to liberate the ripe carpels, which are one-seeded and clothed with long silky hairs.

PROPERTIES AND USES.

The wood of the pukatea is of a pale-brown colour, sometimes with a slight tinge of yellow; it is cloudy, streaked with deeper shades, and is often very ornamental. Although rather soft, it is of great strength and of extreme toughness, does not split, and is difficult of combustion. It is a timber of great value, but has been sadly neglected, chiefly on account of its not being durable when in contact with the ground. It has been frequently used for boat-building, for which it is valued, as nails may be driven in any direction without causing it to split. In Taranaki it is occasionally used for weather-boards with good results, and has been used for external roofing-boards, which remained in good condition for seventeen years. For common furniture it is excellent, as well as for many kinds of ornamental work. It is gratifying to find that its use is increasing, although but slowly.

DISTRIBUTION OF THE GENUS.

Laurelia contains two species, both restricted to the Southern Hemisphere one is found in South Chili, the other in New Zealand.

DISTRIBUTION OF THE SPECIES.

Laurelia Novæ-Zelandiæ is only found in New Zealand, and is plentiful in swampy woods in the North Island, and in the Marlborough and Nelson Districts of the South Island: it is rare in Westland. A solitary specimen was observed in Preservation Inlet, Otago.

DESCRIPTION.

Laurelia Novæ-Zelandiæ, A. Cunn.

Atherosperma Novæ-Zelandiæ, Hook. f.

A lofty evergreen tree, 80ft. to 120ft. high. Branchlets and petioles pubescent. Leaves opposite, glossy, coriaceous, ovate or oblong-obtuse, obscurely or coarsely toothed, glabrous. Flowers diœcious, in axillary racemes, silky; perianth five-leaved. Males, stamens six to eight. Female, stamens reduced to scales; pistil of six to eight carpels, with long styles, hairy. Fruit urceolate, four-valved, enclosing six to eight hairy achenes.

EXPLANATION OF PLATE LXXI.

Laurelia Novæ-Zelandiæ, A. Cunn. Flowering specimen of the male plant, natural size. 1. Male flower. 2. Stamen. 3. Female flower. 4. Pistil. 5. Fruit. 6. Achene. 7. Longitudinal section of an achene. All magnified, except 5 and 6. The female flower is copied from Hooker f.



Tawhero.
(WEINMANNIA SILVICOLA)

WEINMANNIA SILVICOLA, Banks and Solander.

THE TAWHERO.

ORDER—SAXIFRAGEÆ.

(Plate LXXII.)

THE tawhero is a handsome evergreen tree, from 20ft. to 70ft. in height, and when covered with its erect racemes of white or pale-red flowers presents a most attractive appearance. It is, however, a source of perplexity to persons commencing their acquaintance with the forest flora of New Zealand, on account of its great variability: on the largest specimens the leaves are all simple or nearly so, on others they may be partly simple and partly composed of three leaflets, and on others again the leaves may be furnished with from three to ten pairs of leaflets. These forms were considered to be true species by Allan Cunningham; but in the "Flora Novæ-Zelandiæ" Sir Joseph Hooker described them as varieties, and in "The Handbook of the New Zealand Flora" stated that he found that they did not hold good even as varieties—a conclusion to which most botanists will assent. In fact it seems advisable to unite the two New Zealand species, as there are no permanent characters by which they can be sharply defined. I do not, however, propose to take this step at present.

It is worthy of note that the forms with numerous leaflets are not found south of the Auckland Isthmus: in fact this species is a northern plant, being replaced by *W. racemosa* from the Taupo country southward.

The trunk varies from 1ft. to 3ft. in diameter, but only attains its maximum in suitable situations at altitudes above 1,500ft. The leaves are opposite, and in the young state from 4in. to 10in. in length, and consist of several pairs of narrow sessile leaflets, lanceolate in shape, and coarsely toothed, with a large terminal leaflet: two broad-toothed stipules are developed at the base of each leaf; sometimes this condition is retained for the entire life of the plant, flowers being produced as in other forms; but most frequently the leaflets are reduced to two or three pairs, or to three leaflets, or even to a single leaflet, and not unfrequently simple leaves and compound leaves with a variable number of pairs of leaflets may be found on the same tree. It should be mentioned that the leaflets of large leaves are uniform in size from the apex of the leaf to its base—a character by which this plant is at once distinguished from *Ackama roseifolia*, in which the leaflets gradually diminish in size towards the base of the leaf.

The branchlets, leaves or at least the midribs of the young leaves, and the pedicels of the flowers are all more or less clothed with fine hairs. The leaflets are jointed to the petioles, and vary in shape from lanceolate to broadly-ovate, and may be sessile or narrowed into a short leaf-stalk: they may be membranous in texture, or stout and shining. As a rule the forms with numerous leaflets are usually of a paler colour and more membranous texture; they are also more pubescent.

The flowers are about $\frac{1}{2}$ in. in diameter, and are produced in great profusion: although of extremely small size individually, their vast number renders a

tree a showy object when in full bloom. They are arranged in erect racemes, from 2in. to 6in. long, which are usually developed at the tips of the branches, and may be solitary or may form terminal panicles. The parts of the flower are minute: the calyx forms a cup, the upper portion of which is deeply divided into four lobes, and the corolla is composed of four free white rounded petals. The stamens are eight in number, and are much longer than the petals; the ovary is two-celled, with two divergent styles, and is usually smooth. The fruit is a two-celled capsule containing numerous minute brown seeds with a tuft of spreading hairs at each extremity.

In some specimens five petals and ten stamens are developed in each flower.

PROPERTIES AND USES.

The timber is of a light brownish-red tint, fine, even, and compact in the grain, strong, tough, and elastic, and is applicable to a variety of purposes, although nothing is positively known as to its durability, which may, however, be assumed equal to that of the next species, *W. racemosa*. It has long been famous for its bark, which contains from 10 to 13 per cent. of tannin, and was formerly used to a large extent in the Auckland tanneries: the supply, however, was obtained in a most wasteful manner, the bark being peeled as high as a man could reach, the branches and upper portion of the trunk being left untouched, so that the supply in the immediate vicinity of settlements soon became exhausted.

DISTRIBUTION OF THE GENUS.

Weinmannia comprises about fifty species, which are distributed through the Malay Archipelago, the Pacific Islands, tropical and temperate South America, South Africa, Australia, and New Zealand. One species is found in Australia, but its flowers are unknown; two are endemic in New Zealand.

DISTRIBUTION OF THE SPECIES.

Weinmannia silvicola appears to be confined to the Auckland District, and to the northern part of the Hawke's Bay District, and ascends from the sea-level to 3,000ft. It was formerly supposed to be common throughout the North Island and the northern part of the South Island; but it is found that *W. racemosa* has been mistaken for it.

DESCRIPTION.

Weinmannia silvicola, Banks and Sol.

An erect evergreen tree, 20ft. to 70ft. high: young branchlets, petioles, and midribs beneath more or less pubescent. Leaves opposite, unequally pinnate, with many pairs of leaflets or trifoliolate, or unifoliolate. Leaflets 1in. to 2in. long, coriaceous, lanceolate or ovate, acute or acuminate, coarsely toothed, stipules leafy, lobed or toothed. Flowers $\frac{1}{2}$ in. in diameter, arranged in racemes or on terminal racemose panicles, 2in. to 6in. long, many-flowered; rhachis and pedicels pubescent. Petals, four, white, ovate; stamens, eight, exceeding the petals; ovary conical, two-celled, usually glabrous; styles, two, divergent. Fruit, a capsule with two beaks; seeds numerous, with a tuft of hairs springing from each extremity.

EXPLANATION OF PLATE LXXII.

Weinmannia silvicola, Banks and Sol. Flowering specimen with trifoliolate leaves, and large pinnate leaf with stipule, natural size. 1. Flower. 2. Ovary. 3. A single valve of the capsule; inside view. 4. Capsule after dehiscence. All magnified.



Kamahi.
WEINMANNIA RACEMOSA.

WEINMANNIA RACEMOSA, Forster.

THE TOWAI OR KAMAHI.

ORDER—SAXIFRAGÆÆ.

(Plate LXXIII.)

MR. COLENZO informs me that this species is the towai of the Maoris; and I learn from the Ven. Archdeacon W. L. Williams that it is termed "tawhero" by the East Cape Natives—the name commonly applied to the preceding species, *W. silvicola*. It is, however, generally known as "kamahi" in the South Island and in Stewart Island. In common with other trees characterized by small leaves, it is termed "birch" by the bushman, or "red-birch" or "brown-birch," the names being applied with strict impartiality and without any definite meaning.

It closely resembles *Weinmannia silvicola* in habit and general appearance, as well as in the structure of the flowers and fruit, but attains larger dimensions. The leaves are invariably simple in the mature state, and the ovary is usually clothed with a coat of hairs.

It attains a maximum height of 90ft. or 100ft., with a trunk from 1ft. to 4ft. in diameter: the bark is even, rather thin and light-coloured, whitish or grey. In the seedling state the leaves are thin, membranous, and either simple or with not more than three pairs of leaflets. Long flexuous shoots, bearing simple leaves, mixed with others consisting of three leaflets, are often developed on the trunks of old trees; but the ordinary leaves of mature trees are invariably simple, although they vary in outline: they are from 1in. to 4in. in length, quite smooth, very thick in texture, and with the margins cut into coarse obtuse teeth. The leaves are jointed to the leaf-stalks.

The flowers differ but little from those of *W. silvicola*; the racemes are more robust, and the panicles rarely consist of more than three racemes; the pedicels are stouter, and the flowers larger, $\frac{1}{6}$ in. to $\frac{1}{5}$ in. in diameter: the ovary is usually hairy, and the capsules are larger.

The flowers are produced from October to January.

PROPERTIES AND USES.

The timber of *Weinmannia racemosa* is of a deeper red than that of *W. silvicola*, but the colour varies: it is hard, strong, even, and firm. The numerous close longitudinal streaks which it frequently exhibits have a very ornamental effect, which is heightened by the small "silver grain," so that it is well suited for the purposes of the cabinetmaker and for general ornamental work, ornamental turnery, &c. It is also used for house-blocks, piles, fence-posts, tramway-sleepers, &c., and is suitable for beams and framing as well as for boards used under cover.

Considerable difference of opinion has been expressed with regard to its durability. This has partly been due to two causes: there is but little obvious distinction between heartwood and sap, so that mere sapwood has often been

used, to the prejudice of the timber; and even the heart, when fully exposed to the sun and air, speedily exhibits numerous longitudinal cracks, which admit moisture and cause speedy decay. Logs lying on the surface of the ground become worthless in a very short time. On the other hand, if wholly or partially covered with soil they exhibit great durability, especially if in damp situations. There can therefore be no doubt that it is a timber of great value for sleepers or house-blocks, piles, &c., in damp or moist situations, where other timbers quickly decay. For beams in situations not exposed to the sun it is doubtless superior to the ordinary pine-timbers on account of its greater strength. Its value for marine piles has been demonstrated at Hokitika and Greymouth.

Its mean weight per cubic foot is 61·377lb. when green, 38·717lb. when seasoned, and its breaking weight 314·7lb.*

Its bark is of great value for tanning, as it contains 13 per cent. of tannin: it can be obtained in vast quantities, and, if manufactured into an extract, would afford a remunerative opening for the employment of labour and an important addition to the list of New Zealand exports: it might ultimately rival the export of hemlock-extract from the United States.

DISTRIBUTION.

Weinmannia racemosa is endemic in New Zealand: it attains its northern limit on the Thames Goldfield, and near Hamilton in the Waikato, whence it extends southwards to Stewart Island, and is especially abundant on the west coast of the South Island.

DESCRIPTION.

Weinmannia racemosa, Forst.

Leiospermum racemosum, Don.

An evergreen tree, 50ft. to 90ft. high. Leaves in the young state opposite, membranous, simple or unequally pinnate; in the mature state 1in. to 3in. long, unifoliolate, jointed to the petiole, coriaceous, glabrous, coarsely and obtusely serrate, obtuse or sub-acute, ovate or oblong-ovate or oblong-lanceolate, with a stout marginal nerve, punctate beneath. Racemes, 1in. to 4in. long, axillary or terminal, simple or in small panicles, pubescent, pedicels stout; parts of the flowers as in *W. silvicola*, but larger. Styles often united nearly to the apex; ovary hirsute. Capsule two- to three-celled, hirsute in the young state; seeds numerous.

EXPLANATION OF PLATE LXXIII.

Weinmannia racemosa, Forster, natural size. 1. Young plant with membranous pinnate leaves, natural size. 2. Flower. 3. Capsule. 4. Transverse section of a three-celled capsule. 5. Transverse section of a two-celled capsule. All magnified.

* Blair: Building Materials of Otago, pp. 374, 375.



PERSOONIA TORO, A. Cunningham.

THE TORU OR TORO.

ORDER—PROTEACEÆ.

(Plate LXXIV.)

THIS handsome tree is commonly termed toro by the northern Natives; but Mr. Colenso informs me that it should be toru. Allan Cunningham, by whom it was first described, adopted the Native name toro as the specific name—a practice not to be commended, since, as pointed out by Mr. Colenso, it has led to much confusion in the identification of New Zealand plants. The present species, for instance, is often confused with *Myrsine salicina* (Pl. XV.), “toro” being commonly applied to both plants.

The toru attains the extreme height of 50ft., with a trunk 1ft. to 2ft. in diameter, but is frequently branched from the base. Its elegant foliage and symmetrical habit render it peculiarly attractive. It is, however, restricted to the northern portion of the North Island.

Its leaves are very narrow, and of thick texture, from 4in. to 8in. in length, and about $\frac{1}{2}$ in. broad; they are gradually narrowed into the leaf-stalk, acute or obtuse at the apex, quite entire, and perfectly smooth. The flowers are about $\frac{1}{2}$ in. long, and are produced in racemes developed in the axils of the leaves; each raceme consists of from six to ten flowers, and is about 1in. in length: the flowers are opposite, each being carried on a short stout pedicel with a minute bract at the base: all parts of the raceme are covered with dark rust-coloured hairs. The flower is of very simple structure, being merely a cup or perianth consisting of four leaves, each carrying a short stamen inserted at rather more than half its length from the base, the portion of the leaf above the stamens being sharply bent back: the ovary is one-celled, with a rather long straight style and lobed stigma. The fruit is a nut with a soft fleshy coat, and is usually one-, rarely two-celled, each cell containing a single seed.

PROPERTIES AND USES.

The wood of the toru is of a deep red, beautifully marked; it is of considerable strength, but rather brittle when old, and speedily perishes when exposed. It is used by the Auckland cabinetmakers for ornamental work, inlaying, &c., but is rarely to be obtained in any quantity. It is a valuable tree for ornamental planting in warm districts.

DISTRIBUTION OF THE GENUS.

Persoonia is a large genus, containing sixty species, all of which are restricted to Australia except *P. Toro*, which is endemic in New Zealand.

DISTRIBUTION OF THE SPECIES.

Persoonia Toro is absolutely restricted to the northern part of the North Island of New Zealand, extending from Mongonui to the vicinity of Rotorua; but in many parts of this area it is rare and local.

DESCRIPTION.

Persoonia Toro, A. Cunn.

An erect evergreen tree, 15ft. to 30ft. high. Leaves alternate, glabrous, coriaceous, shining, 4in. to 8in. long, quite entire, acute or apiculate, rarely obtuse, narrow, linear-lanceolate, narrowed into the short petiole. Flowers in axillary racemes 1in. long, pubescent, six- to eight-flowered; pedicels short, stout. Perianth four-leaved, upper portion reflexed; stamens, four, inserted on the perianth-leaves, filaments short; ovary one-celled, ovules one or two. Fruit, a red drupe, $\frac{2}{3}$ in. long, with a one- or two-seeded nut. Embryo with three, rarely two or four, cotyledons.

EXPLANATION OF PLATE LXXIV.

Persoonia Toro, A. Cunn. Natural size.



Sandalwood.
(FUSANUS CUNNINGHAMII).

1. Large leaved form with mature fruit.



Sandalwood — Maire (*Fusanus Cunninghamii*).
Narrow leaved variety, flowering state.

T. KIRK DREXIT.

FUSANUS CUNNINGHAMII, Bentham and Hook. f.

THE MAIRE.

ORDER—SANTALACEÆ.

(Plates LXXV. and LXXVI.)

It has already been stated that the Native name "maire" is applied to several trees, some of which differ considerably in general appearance: in the present case, however, our plant bears a strong general resemblance to the small-leaved olives, and is not easily distinguished at first sight, although widely separated by the structure of the flowers and fruit.

Although it can scarcely have escaped the notice of Banks and Solander, it does not appear that specimens have been preserved in their collections. It was first recorded by Allan Cunningham, who formed a new genus for its reception, and described the chief forms as separate species under the name of *Mida salicifolia*, *Mida eucalyptoides*, and *Mida myrtifolia*.* In 1843 Sir William Hooker referred it to *Santalum*, and figured the first of these varieties in "Icones Plantarum" as *Santalum Mida*, var. *a*; the second as var. *β*. Ten years later it was described under the name of *Santalum Cunninghamii* by Sir Joseph Hooker, who [redacted] specific name by the following remarks, the force of [redacted] [redacted] by the experience of New Zealand botanists: "My own experience in botanical nomenclature has convinced me that the practice of adopting local names for species of plants is highly inadvisable; it has introduced confusion into the botany of every country, and serves no good purpose." It is to be regretted that by the law of priority it will be necessary to revert to the old specific name, although it is not proposed to adopt this course on the present occasion.

In "Genera Plantarum," Vol. III., Bentham and Hook. f. have removed this species from *Santalum*, and placed it in *Fusanus*, of which it constitutes a distinct section under Cunningham's old name "Mida." It is frequently termed "New Zealand sandal-wood" by settlers.

Fusanus Cunninghamii usually forms a small tree rarely exceeding 25ft. in height, with pale-grey bark, slender, somewhat angular branches, and glossy foliage, varying greatly in outline and dimensions. The leaves are alternate or rarely opposite in young plants, shortly petioled, and vary from 1in. to 4in. in length, and from $\frac{1}{4}$ in. to $1\frac{1}{2}$ in. in width: in outline they may be narrow-linear, gradually narrowed into a long point, or broadly egg-shaped with a short point, or ovate, but are always quite smooth, entire, minutely dotted beneath, and carried on short leaf-stalks. Leaves of all intermediate outlines may be found between those named, so that it is impossible to distinguish the different forms even as varieties, especially as leaves of different outline may frequently be found on the same branchlet.

The flowers are of a lurid green or purple, and are freely developed in the axils of the leaves. Sometimes two, three, or more pedicellate flowers form a

* "Annals of Natural History," Vol. I., pp. 376, 377.



Sandalwood — Maire (*Fusanus Cunninghamii*).
Narrow leaved variety, flowering state.

T. KIRK DIXEY.

FUSANUS CUNNINGHAMII, Bentham and Hook. f.

THE MAIRE.

ORDER—SANTALACEÆ.

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The flowers are of a lurid green or purple, and are freely developed in the axils of the leaves. Sometimes two, three, or more pedicellate flowers form a

* "Annals of Natural History," Vol. I., pp. 376, 377.

short raceme or a small cyme; or the inflorescence may be 2in. long or more, consisting of a number of single flowers intermixed with clusters or small cymes: a minute bracteole springs from the base of each flower, and not infrequently one or two are found on each flower-stalk. The flowers are about $\frac{1}{4}$ in. across, and are usually perfect, although separate female or probably abortive flowers are often met with. There is no distinct calyx, but the perianth is broadly cup-shaped, usually with five short spreading lobes having a scale-like patch of yellowish hairs at the middle of the base of each: a stamen with a very short filament is inserted at the base of each perianth-leaf. The ovary is smooth, sunk in the tube of the perianth, one-celled, with a short conical style; the stigma is partially divided into three or four minute lobes; ovules, two to four. Fruit, a red drupe, $\frac{1}{2}$ in. long, crowned with the remains of the perianth, and sometimes longitudinally ribbed.

There is reason to believe that this plant is parasitic on the roots of other plants in the young state.

PROPERTIES AND USES.

The wood of the New Zealand sandal-wood is of a rich deep-brown hue, with darker streaks and markings, and an agreeable odour. It is even, compact in the grain, heavy, of great strength and durability; but, as the trunk rarely exceeds 9in. in diameter, it is only useful for purposes of the cabinetmaker, ornamental turnery, &c. It has been used as a substitute for box-wood, and is commonly used for fence-rails in districts where it is plentiful. If its value for ornamental turned-work were more generally known it would probably be largely utilised for the manufacture of napkin-rings, inkstands, turned vases, &c., both on account of its beauty and agreeable odour.

DISTRIBUTION OF THE GENUS.

Fusanus is an Australasian genus, comprising five species, four of which are endemic in Australia, and one in New Zealand.

The Australian species differ externally from the New Zealand plant in their opposite leaves, terminal flowers, and globose fruit.

DISTRIBUTION OF THE SPECIES.

Fusanus Cunninghamii is endemic in the North Island of New Zealand, where it occurs from Mongonui to Belmont and Cape Palliser. It is most plentiful in the district north of the Hauraki Gulf, being rare and local in the southern districts of the Island.

It descends to the sea-level, and is most frequent at altitudes below 1,000ft., but in rare instances ascends to 2,000ft.

DESCRIPTION.

Fusanus Cunninghamii, Benth. and Hook. f.

Mida salicifolia, A. Cunn.

M. eucalyptoides, A. Cunn.

M. myrtifolia, A. Cunn.

Santalum Mida, Hook., "Icones Plantarum," t. DLXIII. and DLXXV.

Santalum Cunninghamii, Hook. f., "Flora Novæ-Zelandiæ," i., p. 223.

A small evergreen tree, 25ft. high. Leaves alternate, shortly petioled, glossy, 3in. to 4in. long, varying from narrow linear-lanceolate to broadly obovate, acute or acuminate, quite entire, minutely punctate beneath. Perianth superior,

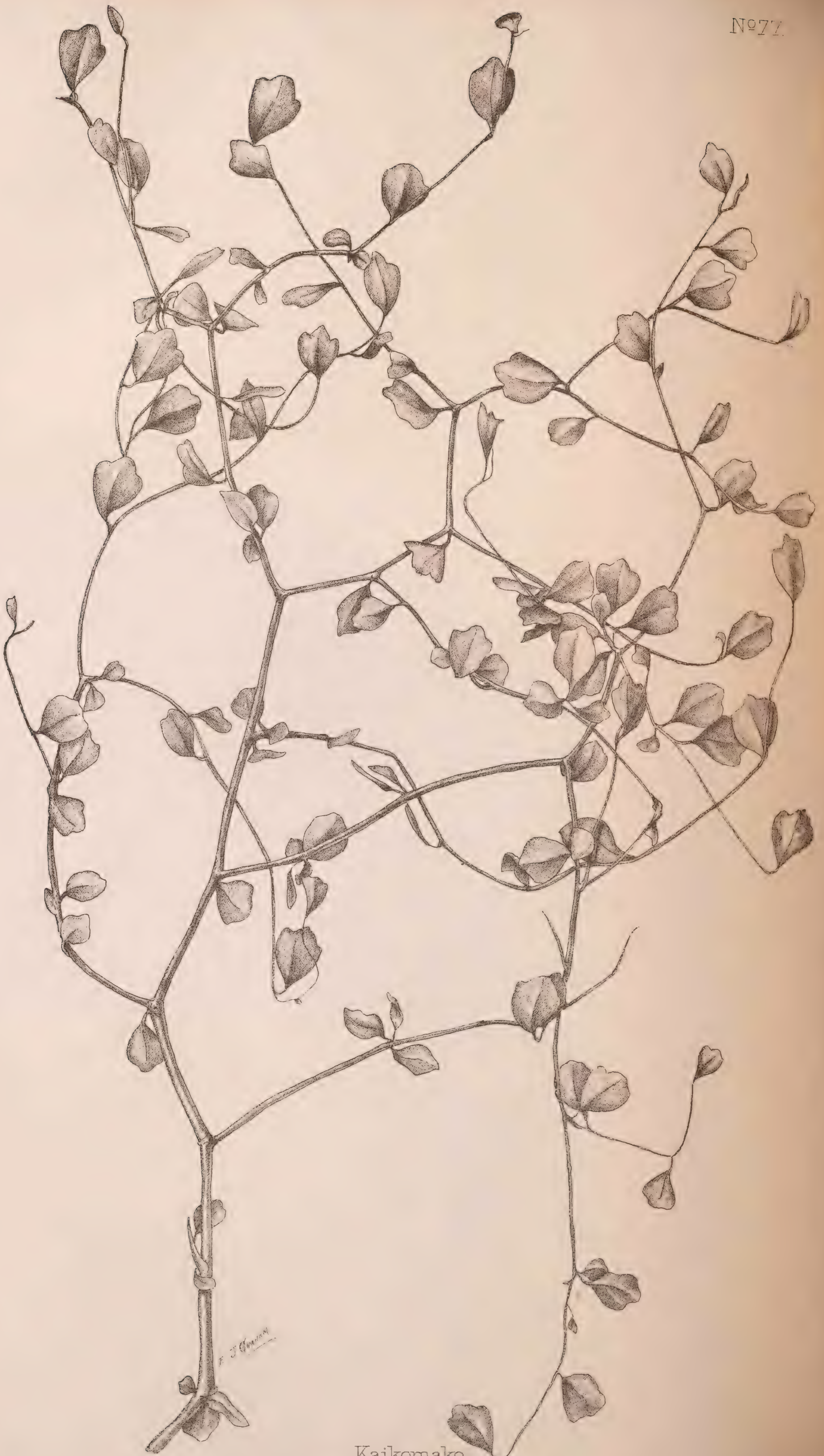
campanulate, five- or rarely four-lobed, lobes spreading, with a tuft of hairs near the base of each; stamens, five, rarely four, inserted at the base of the lobes of the perianth; ovary sunk in the tube of the perianth, one-celled; ovules, two to four. Fruit, a drupe, $\frac{1}{3}$ in. to $\frac{1}{2}$ in. long, inferior, one-seeded, sometimes ribbed longitudinally, bright red. Endosperm copious, fleshy.

EXPLANATION OF PLATES LXXV. AND LXXVI.

LXXV. *Fusanus Cunninghamii*, Benth. and Hook. f. A fruiting specimen of a form with large leaves, natural size. 1. Fruit. 2. Apex of a fruit. 3. Longitudinal section of a fruit. 4. Transverse section of the same. 5. Seed. All magnified.

LXXVI. *Fusanus Cunninghamii*, Benth. and Hook. f. A flowering specimen of a narrow-leaved form, natural size. 1. Flower. 2. Transverse section of ovary, with a portion of the perianth removed. Magnified.





F. J. G. H. M.

Kaikomako.
(PENNANTIA CORYMBOSA)

Young state.





Kaikomako.
(*PENNANTIA CORYMBOSA*)

PENNANTIA CORYMBOSA, Forster.

THE KAIKOMAKO.

ORDER—OLACINEÆ.

(Plates LXXVII. and LXXVIII.)

I LEARN from Mr. Colenso that two names are applied by the Maoris to this handsome plant—kaikomako and kahikomako; the former appears to be more commonly used than the latter. It was discovered by Banks and Solander, who gave it the MS. name of *Meristoides paniculata*: it was again collected by Forster during Cook's second voyage, and described by him under its present name.

In its most luxuriant state it forms an evergreen tree, 40ft. in height, but usually it is much smaller, and often reduced to a mere shrub, with pale bark and pubescent branches. In the young state the branches are very slender, flexuous, and interlaced with rather distant sessile leaves, and the plant is more remarkable for the singularity of its appearance than its attractiveness. In a more advanced state the branches are rigid and stout, while the leaves vary greatly in form and dimensions; but in the mature condition the habit is more graceful, although somewhat stiff, and the leaves are more uniform in shape and dimensions.

The leaves are carried on short leaf-stalks, and vary considerably in shape; most frequently they are broadly-oblong, with irregularly-lobed or coarsely-toothed margins. The male and female flowers are fragrant, and are produced on separate plants; they are arranged in panicles at the tips of the branchlets: the panicles as well as the individual flowers of the male are larger than those of the female. Both the male and female flowers produce stamens, those of the former having long slender flexuous filaments attached to the back of the anthers, so that the anthers appear to hang over the margin of the corolla; those of the female flowers have short erect filaments attached to the base of the anther, but the pollen is usually imperfect. The ovary is crowned with a three-lobed stigma, but consists of a single cell only, containing a single pendulous ovule, with a deep longitudinal groove along one face. The fruit is fleshy, ovoid in shape, $\frac{1}{3}$ in. long, and of a deep-purple colour, ultimately passing into black; it contains a hard nut, with three flattened sides: a curious flat, column-like process runs parallel with one of the faces, and passes inwards through a round aperture immediately beneath the apex, the seed being suspended from its extremity.

The flowers of the male plant are somewhat waxy in appearance, and the branches of the panicle are white; the female is less attractive.

PROPERTIES AND USES.

The wood of the kaikomako is light-coloured, straight in the grain, very hard, compact, and durable. It is suitable for the handles of carpenters' tools, ornamental turnery, &c.: prettily-marked specimens are sometimes used by the cabinetmaker for ornamental work.

It was formerly used by the Maoris to obtain fire by friction. A piece of thoroughly-dried wood was sharpened to a point, and vigorously worked backwards and forwards along a piece of soft wood, pate (*Schefflera digitata*) or mahoe (*Melicytus ramiflorus*) being preferred: a groove was thus formed, and the minute portions worn off by friction became ignited after considerable labour.

It is of great value as an ornamental flowering shrub, and is easily cultivated. Plants may readily be raised from seed, or seedlings obtained from the forests may be successfully transplanted, if protected from the scorching sun and from drying winds during the first season.

DISTRIBUTION OF THE GENUS.

Pennantia is a small Australasian genus, consisting of four species only, two of which are peculiar to Australia, one to Norfolk Island, and one to New Zealand.

DISTRIBUTION OF THE SPECIES.

Pennantia corymbosa occurs from Mongonui to Otago, but is rare and local in certain districts. North of the Waitemata it is decidedly rare, although specimens 40ft. high have been observed at the Bay of Islands, Hotea, &c. It is more plentiful on the western bank of the Waikato, and becomes abundant in the lowland districts of the South: it is especially plentiful on both sides of Cook Strait. It has not been found on Stewart Island.

DESCRIPTION.

Pennantia corymbosa, Forster.

A much-branched dioecious tree, 20ft. to 40ft. high. In the young state the branches are slender, flexuous, and interlaced with alternate distant leaves, often less than $\frac{1}{2}$ in. long, and nearly sessile. In the mature state the leaves are alternate, shortly petioled, 1in. to 4in. long, $\frac{1}{2}$ in. to $1\frac{1}{2}$ in. broad, oblong or ovate or obovate, entire or sinuately lobed or toothed, or with large coarse teeth; branchlets and inflorescence pubescent or downy. Flowers in much-branched terminal cymes. Male, calyx small, five-toothed; corolla of five free petals; stamens, five, versatile, longer than the petals, filaments slender. Female much smaller than the male; stamens, five, erect; anthers basifixed; pollen usually abortive; ovary erect, oblong, one-celled, ovule solitary, stigma trifid. Fruit, a fleshy drupe, $\frac{1}{3}$ in. long, nut trigonous; seed with copious endosperm; embryo small.

EXPLANATION OF PLATES LXXVII. AND LXXVIII.

LXXVII. *Pennantia corymbosa*, Forster. Portion of young plant, natural size.

LXXVIII. *Pennantia corymbosa*, Forster. Flowering specimens, male and female, natural size. 1. Male flower. 2. Female flower. 3. Ovary. 4. Transverse section of ovary. All magnified. 5. Fruits, natural size. 6. Longitudinal section of fruit. 7. Transverse section of fruit. 8. Nut, showing the cord passing along one side. 9. The same with the cord removed, showing the aperture through which it passes. 10. Nut, back view. All magnified.



Kauri at Tararu Creek, Thames Gold Field.
(46 feet in circumference).
From a photograph by Mess^{rs} Foy Brothers, Shortland.



HUGH M'KEAN.

Kauri.
(ACATHIS AUSTRALIS)
Young state.



Kauri
(AGATHIS AUSTRALIS)



Cones in young state.



Fully mature cone.

Kauri — *Agathis australis*. (*Dammara australis*)

AGATHIS AUSTRALIS, Salisbury.

THE KAURI.

ORDER—CONIFERÆ.

TRIBE—ARAUCARIEÆ.

(Plates LXXIX., LXXX., LXXXA., and LXXXI.)

THIS famous pine is generally known by the systematic name of *Dammara australis*, under which it was published by Lambert in the second edition of his "Pinetum." Salisbury, however, had previously constituted the genus *Agathis* for the reception of this species and the dammar-pine of Amboyna, and had described the New Zealand species as *Agathis australis*; his name must therefore take precedence on the ground of priority. A remarkable form of the plant has been doubtfully described by M. Richard in the absence of fruit as ? *Podocarpus zamiaefolius*: it must be admitted that the specific name would be well merited by the specimen represented on our Plate LXXX.

The Native name "kauri" is the only common name in general use. When the timber was first introduced into Britain it was termed "cowrie-" or "kowdie-pine;" but the name speedily fell into disuse, although it still appears as the common name in some horticultural works.

It is the monarch of the New Zealand forests, and, although it does not rival the giant Sequoias of North America in its extreme height and circumference, it excels them in the intrinsic value of its timber, which possesses a larger number of good qualities than any other pine known to commerce.

The kauri frequently grows in rocky or broken situations, and usually forms large clumps or groves, mixed with other trees: although it is often the prevailing tree in extensive forests, it is comparatively seldom that it occupies large areas to the exclusion of other trees. The interior of a large kauri forest affords one of the most impressive scenes in the colony: smooth grey trunks rise on all sides like massive columns, perfectly straight and symmetrical to a height of 80ft. or even 100ft., with a diameter of from 4ft. to 12ft. or upwards. If growing in close proximity to each other they attain a greater height, but the trunk is less massive, and tapers gradually into the small head; if growing some distance apart, the trunk is of large diameter, with but little difference between the base and crown. The head of solitary trees is large and spreading, the main arms being sometimes over 2ft. in diameter. The broad, leathery green leaves have a most refreshing appearance in the driest weather, and bear no resemblance to the needle-like leaves which characterize the pines of the Northern Hemisphere. The glaucous or cinereous hue of the bark under certain atmospheric conditions appears to surround the trunks with an undefined haze—an effect which is only to be found in a kauri forest. The bark scales off in large flat flakes, and, as it decays, forms a mound of humus surrounding the base of each tree, and is highly charged with resin, which exudes from the slightest wound in the trunk or leaves, all parts of the plant being excessively resinous.

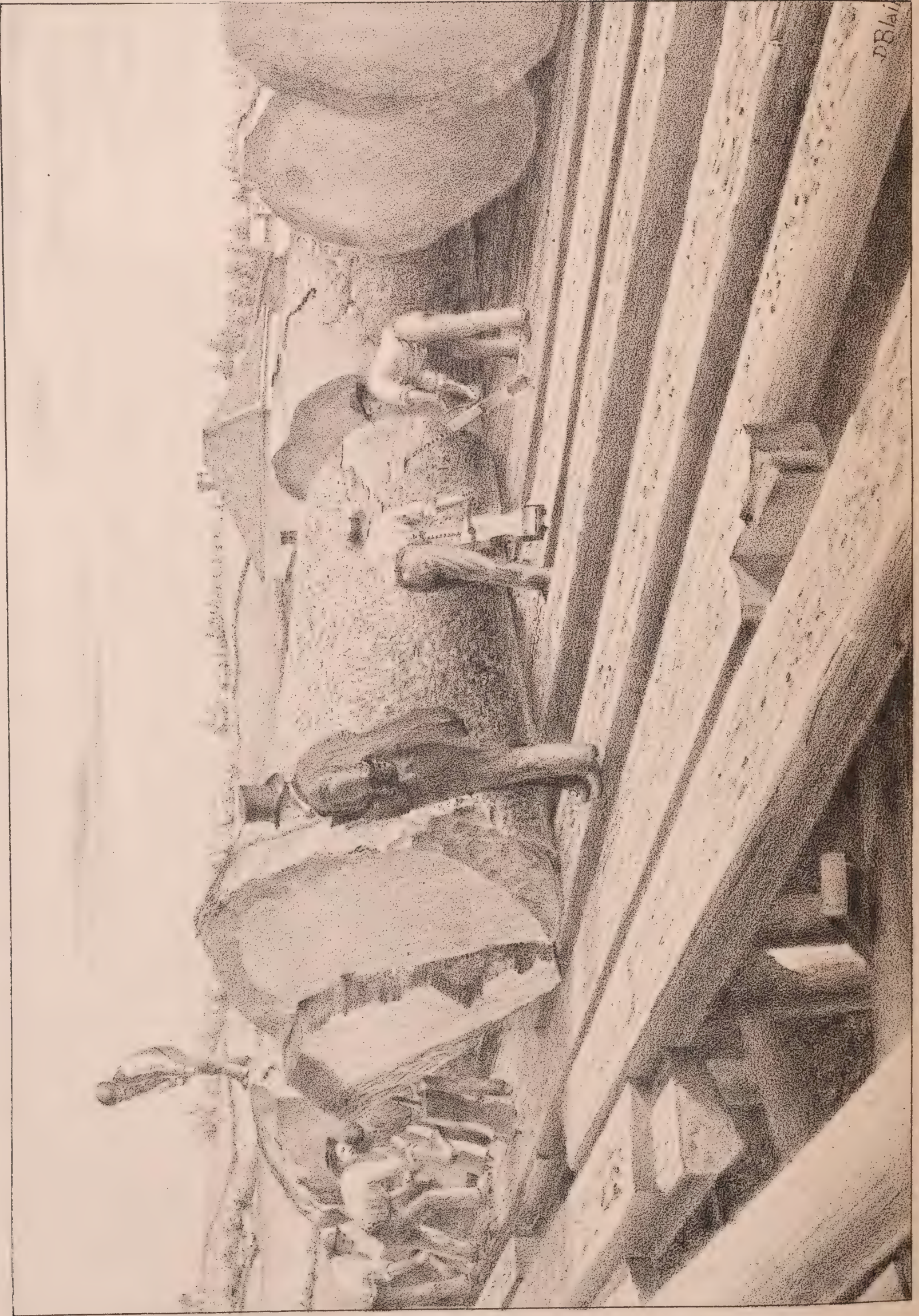
As a rule undergrowth in a kauri forest is less dense than in the ordinary mixed forest: *Alseuosmia macrophylla*, a dwarf evergreen shrub, with fragrant crimson flowers, is abundant, and is commonly termed "honeysuckle;" *Astelia trinervia*, a liliaceous plant, with narrow leaves 6ft. to 8ft. long, and a dwarf tree-fern, *Dicksonia lanata*, with stems from 2ft. to 6ft. high, often form the prevailing undergrowth over large areas. Mention must however be made of the mangemange, *Lygodium articulatum*, a graceful climbing fern, with slender, tough, wiry, branching stems, which ascend shrubs and trees to a great height, binding them together by living network: the stems of this fern are so tough and strong that they cannot be broken, although they may be easily cut.

The kauri is usually from 80ft. to 100ft. high, with a trunk from 4ft. to 12ft. in diameter; but much larger dimensions are often attained, specimens having been seen 150ft. high, while trunks are known with a diameter of from 20ft. to 24ft. In the Tutamoe State Forest a tree named "Kairaru" by the Maoris was measured by Ranger H. S. Wilson, who found it to be 100ft. high to the first branch, with a circumference of 66ft.: another specimen in the same forest is named "Nga-mahangahua," and measures 66ft. in circumference; at the height of 22ft. two branches are given off, and measure respectively 20ft. and 22ft. in circumference. A fine tree at Tarakiakia measures 100ft. to the first branch, with a circumference of 48ft. A tree at Mercury Bay is stated to measure 80ft. to the first branch, and to be 72ft. in circumference. In some forests clumps of trees which would afford logs from 50ft. to 60ft. long and from 48in. to 60in. square are not uncommon.

The bark is thick and excessively resinous. The germinating kauri develops two seed-leaves, which are flat and narrow, bearing no resemblance to those of the pines of the Northern Hemisphere. The early leaves are flat, narrow, thick, and leathery, distant, sometimes 4in. long, with parallel veins, and of a brown or reddish-brown hue: the mature leaves are much shorter, broader, and thicker, close-set, somewhat egg-shaped, and blunt at the apex, but of a bright glossy green. The male and female flowers are produced in separate cones on the same tree: the male cones being carried on short peduncles springing from the axils of the leaves; they are cylindrical, from 1in. to 1½in. long, and from ½in. to ¾in. in diameter: at the base of each is a kind of cup or involucre formed of three narrow green leaves. The scales of the cone are in reality anthers, which are connected with the axis by a process which springs from the centre of the inner face of each; the anther-cells being pendulous, and from ten to twelve or more in number. The female cone is terminal about 1in. long when in flower, and, like the male, has an involucre or cup at its base: it consists of numerous green scales, each of which carries a single ovule on its upper surface. In fruit the scales become woody, and closely overlapping, forming an elegant cone almost spherical and nearly 3in. in diameter, with a single winged seed on each scale. On reaching maturity the scales fall away from the woody axis, and the seeds are widely spread by the wind.

The leaves are persistent for several years, but it is not easy to state the exact period of their duration: occasionally leaves may be seen partially embedded in the stem and still green, in positions which show that they must have been formed more than a quarter of a century, as new leaves are only developed at the tips of the branches. It is uncertain whether the kauri forms only a single cylinder of wood during each year, or more: the balance of evidence is in favour of the latter view.

A cross-section of a kauri felled while in a free-growing condition usually exhibits from seven to thirteen concentric rings to each inch of radius: if we take



Kauri Logs on the Skids.
From a photograph by Burton Bros.

ten rings to the inch as a fair average for growing timber it would give three centuries as the age of a tree with a diameter of 5ft. at the base. This rate of increase is supported by the little we know of the rate of growth of young trees. In the Auckland Domain trees planted twenty-two years ago are now 25ft. high, with a circumference of 26in., which shows greater rapidity of growth, but the trees are growing under very favourable conditions. Another tree planted twenty years ago is 20ft. high, with a diameter of only 20in.

The wood of the kauri remains sound long after it has passed its maximum rate of growth; but the newly-formed wood-cylinders are very thin, while the immense pressure exerted by the outer cylinders consolidates the inner portion of the trunk, so that the number of rings to an inch is greatly increased. I have counted over thirty rings to an inch in some gigantic trunks, so that, assuming each ring to represent only a year's growth, the age of a tree 7ft. in diameter must be twelve hundred and sixty years; the gigantic specimen at Mercury Bay, which is 80ft. to the lowest branch, and 24ft. in diameter, must be considerably over four thousand years; and the fine specimen at the Maunganui Bluff, which is 66ft. in circumference, would not be less than three thousand six hundred years.

The kauri is remarkable for the soundness of its timber: hollow and defective trees are more rare than in any other native tree, and when they occur it is often found that the defects have been caused by some injuries received during early stages of growth, or from their having grown in wet situations: star- or ring-lags or shakes or other defects of a similar character are rare. No other tree has the power of retaining its timber in a sound condition so long after the maximum rate of growth has been passed.

The proportion of sapwood is very small in fully-matured trees, and, as a rule, it is sharply defined; the wood is most deeply coloured at the heart, and becomes gradually lighter towards the circumference, the outer zones consisting of white sapwood, varying in thickness from 1in. to 5in. according to the age of the tree and the conditions under which it was grown. Freely-growing trees, 30in. in diameter, may occasionally be found almost destitute of heartwood; but, if growing on rocky ground, trees 2ft. and upwards in diameter may often be found with the heartwood fully matured, and almost destitute of sapwood.

PROPERTIES AND USES.

Kauri timber varies from yellowish-white to brown in colour; it is straight in the grain, even, compact, firm, clean, and silky, while it is of great strength, toughness, and elasticity. It is of extreme durability, and adapted to a greater variety of uses than any other New Zealand timber. It exhibits a certain degree of variation in colour, density, hardness, and the amount of resin it contains. Mr. E. Bartley, architect, of Auckland, distinguishes four varieties as under:—

1. *Red kauri*, which is close-grained, resinous, and durable, the best general building-timber, and suitable for beams, joists, and heavy framework, but liable to cast and twist, shrinking longitudinally as well as transversely.

2. *White kauri*: This is yellowish-white, and straight in the grain; it is very tough, and will bear a greater strain than the red, but is less durable; it neither warps nor shrinks longitudinally if fairly seasoned before being worked up. It is a splendid timber for mouldings and joiners' work, and is largely used by boat-builders on account of its toughness and elasticity.

3. *Black kauri*: This is of a deep-brown colour, very hard, dense, and heavy, being charged with resin, but is difficult to work. This, however, is compensated for by its extreme durability.

4. *Soft kauri*: This is of a pale-dun colour, straight in the grain, rather soft, and of light specific gravity; it never casts, twists, or shrinks longitudinally even when exposed to the weather: sometimes it is marked with thin longitudinal streaks or veins. It is excellent for joiners' work and mouldings, but should not be used for beams or heavy framing.

Mr. Bartley's paper will repay careful perusal.* I venture to point out, however, that his "red" and "white" kauri may be obtained from the same tree, the red being obtained from the central portions of the log, in which lignification is more complete, the cell-cavities being entirely obliterated. White kauri is afforded by the log next the inner face of the sapwood: in these intermediate rings lignification is not fully completed, although so far advanced that the wood may be considered "heartwood," but less durable than that from the central part of the tree. It need scarcely be pointed out that in trees which have stood for some years after attaining their full dimensions the proportion of "white" or intermediate wood is small. This point will be referred to on another page.

The "black" kauri is heartwood excessively charged with resin—in this point resembling a variety of the rimu†—and the "soft" kind is local, although not restricted to any one district. Similar varieties are found in all pine-timbers, especially in the red-deal of the Baltic, all of which is produced by one species, although the timber from one locality is noted for its durability, from another for its strength, from a third for its silkiness, &c.

Compared with other commercial pine-timbers, the kauri is more silky than Quebec yellow-pine, and takes a higher finish; it is stronger and more durable than the best red-deal of the White Sea and the Baltic; it is tougher and more elastic than American spruce; while it is more easily worked than the red-wood of California, and is without its brittleness. It combines a larger number of good qualities in a high degree of perfection than any other pine-timber in general use.

Mr. Laslett, Timber Inspector to the British Admiralty, who had the advantage of becoming acquainted with the kauri in its native forests, has published the results of experiments made by him to ascertain the transverse and tensile strengths of different timbers. His experiments to determine the transverse strength were made with pieces 7ft. long and 2in. square, each end of which was carried on supports exactly 6ft. apart, when water was poured into a vessel suspended from the middle until the piece broke. To determine the tensile strength, pieces 2in. square, and usually 30in. long, were tested by means of a powerful hydraulic machine, so that the direct cohesion of the fibres was obtained with great exactness. English oak is taken as the standard for transverse and tensile strain, and is valued at 1·000 in each case. I give below the results of his experiments with kauri as compared with other pine-timbers:—‡

Transverse Strength.—(Scantling, 2in. × 2in. × 84in.)

				Relative Strength.	Breaking Weight in lb. per sq. in.	
Pitch-pine	...	...	...	1·109	...	262
Dantzic fir	...	...	...	1·087	...	219
KAURI	...	...	...	·892	...	204
Canada spruce	...	...	...	·831	...	168
Canada red-pine	...	...	...	·810	...	163
Russian larch	...	...	...	·776	...	157
Riga fir	...	...	...	·744	...	150
Canada yellow-pine...	...	...	...	·665	...	134

* Trans. N.Z. Inst., Vol. xviii., p. 37.

† *Dacrydium cupressinum*, p. 30, ante.

‡ "Timber and Timber-Trees," by T. Laslett, pp. 298-327.

Tensile Strength.—(Scantling, 2in. × 2in. × 3oin.)

				Relative Strength.	Breaking Weight in lb. per sq. in.	
Pitch-pine	..	...	...	·616	...	4,666
KAURI	...	...	...	·600	...	4,543
Russian larch	...	...	...	·555	...	4,203
Riga fir	...	...	...	·535	...	4,051
Canada spruce	...	...	...	·520	...	3,934
Dantzic fir	...	...	...	·427	...	3,231
Canada red-pine	...	...	...	·357	...	2,705
Canada yellow-pine...	...	...	...	·267	...	2,027

It will be seen from the above that kauri is excelled in transverse strength by the American pitch-pine and Dantzic fir—the former a timber not suitable for general building purposes; while the superiority of Dantzic fir is very slight, and it is decidedly inferior in tensile strength as well as in durability when exposed.

Special experiments made by Mr. Laslett to determine the relative strength of pieces taken from different parts of the same tree show that sections taken from butt lengths give the highest results, and that specimens taken from the latest-matured portions of the trunk were superior to those taken from the centre: this portion of the trunk corresponds to the “white kauri” of Mr. Bartley, so that his conclusions with regard to its great strength are amply corroborated. The greatest tensile strength was exhibited by specimens taken from the central portion of the trunk, the position in which the greatest cohesion of the fibres might fairly be expected: in one set of experiments, however, the highest results both for transverse and tensile strength alike were obtained from specimens taken from the lately-matured wood. The specific gravity of the specimens tested by Mr. Laslett ranged from ·498 to ·595. In Mr. Balfour's specimens it was much higher, ·575 to ·700. As Mr. Laslett's specimens were tested in England they must have been well seasoned, which, doubtless, accounts for the discrepancy.

There is, however, some difference between the results as to transverse strength obtained by Mr. Balfour from twelve specimens, and by Mr. Blair from thirty specimens: the former gives the breaking weight as 165·50lb., the latter as 137·17lb.* No details are given respecting Mr. Blair's experiments, but Balfour's conclusions make a close approximation to those obtained by Laslett.

Some difference of opinion exists respecting the relative strength of kauri and other native pines. Although not equal to matai (*Podocarpus spicata*) and miro (*P. ferruginea*), it is, I think, superior to rimu (*Dacrydium cupressinum*), kahikatea (*Podocarpus dacrydioides*), and totara (*P. totara*). As there is, however, a diversity of opinion on the subject, I append the mean breaking weight as stated by Balfour and Blair respectively:—

	Balfour:			Blair:		
	No. of Specimens.	Breaking Weight.		No. of Specimens.	Breaking Weight.	
Miro	5	197·2 lb.	...	7	220·1 lb.	...
Matai	18	190·0 "	...	28	192·0 "	...
KAURI	12	165·5 "	...	34	137·1 "	...
Rimu	21	140·2 "	...	25	175·4 "	...
Kahikatea†	10	136·0 "	...	4	166·6 "	...
Totara	17	133·6 "	...	10	142·5 "	...

It is very desirable that a more extended series of tests should be made with all New Zealand timbers.

* Blair: Building Materials of Otago, pp. 213–226.

† Excluding one specimen the identification of which appears doubtful.

WAVED AND MOTTLED KAURI.

Mention has already been made of a variety marked with longitudinal streaks: this variety has but little to recommend it as an ornamental timber, the streaks often being little more than lines, sometimes not exceeding 1 in. in length. Waved or feathered kauri is however a beautiful timber, and often occurs in large quantities; the variations in tint are probably caused by lignification having progressed more rapidly in some portions of the wood than in others. Feathers or curls, which appear to owe their origin in part at least to the same cause, are often of great beauty: in some cases this may be due to unequal compression during growth, and it is not infrequent in trees which are "bark-bound." The large "feather" often developed immediately below the point where two main branches diverge is but rarely utilised, possibly on account of the waste which attends its conversion into veneers.

Mottled kauri is the most striking and ornamental of all the varieties, and is the most highly prized; it is most frequent in rocky situations, and may be afforded by the greater portion of the tree or only by the outside layers, or one side of the tree may be more or less mottled while the other is but sparingly mottled. In some cases the mottling is caused by the excessive development of short branchlets, but most frequently it is due to the growth of the bark not keeping pace with the development of the woody tissue, so that flakes or small portions of bark are enclosed by the sapwood, and, becoming indurated under excessive pressure, ultimately form dark points or patches on a light ground. Sometimes the enclosed fragments form regular wavy streaks 2 in. to 6 in. long, making a kind of "figure;" sometimes large dark masses are formed: very often the effect is intensified by the deposit of a thin film of translucent resin on the portion enclosed. In course of time the sapwood becomes lignified, and assumes a deeper tint, which increases in depth as new deposits of woody tissue are formed over it. In many instances large portions of mottled trees are beautifully figured.

At the present time mottled kauri sells at £5 per 100 superficial feet, of 1 in. in thickness, but the supply is not equal to the demand.

DURABILITY.

In many localities, as at Papakura and in the Waikato, kauri forests have been buried from unknown causes, and the kauri is continually dug up, and used for railway-sleepers, house-framing, weather-boarding, shingles, fencing, &c., with the most satisfactory results. A still more satisfactory proof of its durability came under my notice at Hokianga in 1877. I was shown a number of large logs, felled over forty years before, and left in the forest through some disagreement with the Native owners. At the date of my visit the logs were completely overgrown by vegetation; in some cases they were covered with a dense growth of ferns and mosses, amongst which small trees were growing; but, on clearing away the rich plant-growth, the heartwood was found to be perfectly sound in every case, although the sap was decayed. The durability of kauri is so thoroughly proved that it is needless to offer further evidence on the subject.

USES.

Kauri is unquestionably the best timber in the colony for general building purposes, ground-plates, beams, framing, rafters, joists, flooring, and weather-boards; also for open roof-work, dadoing, panelling, mouldings, sashes, doors, and all kinds of joiners' work, as well as for decorative fittings, whether in public



Kauri Logs on a Rolling Road.
From a photograph by Foy Brothers.

or private buildings. It is largely used for railway-sleepers, bridges, wharves, and constructive works generally; for telegraph-posts, mine-props, caps, struts, &c.; for the masts and deck-planking of ships, for which it is unsurpassed, being regular in the grain, free from large knots, of smooth even surface, and able to resist a large amount of wear. It is also largely used for the outer and inner planking of coasting craft and boats.

It affords the best timber for seats in churches and other public buildings, as it takes a high polish: it is of equal value for bank counters and fittings. Kauri is adapted to all the purposes of the cabinetmaker where a light-coloured wood is required: ordinary wood is excellent for common furniture, or for framing as supports for veneer: figured and mottled varieties are highly prized for ornamental work. It is highly valued for coopers' ware.

It is largely used for fencing-posts and rails, palings, and shingles, both sawn and split, and for tramway-rails.

A large quantity of second-class timber is utilised for packing-cases, tallow-casks, shedding, and other temporary purposes.

It may safely be stated that no other New Zealand timber is capable of being applied to such varied uses.

When felled during the growing season kauri is subject to considerable shrinkage, especially if the log is converted at once: when felled during the dormant season and properly seasoned the shrinkage is extremely trifling, and the timber stands remarkably well, even under trying conditions. It has been stated that it shrinks longitudinally, and is liable to warp and twist; but these defects are mainly, if not entirely, caused by its being felled during the spring and summer months, and to its having been used in an unseasoned state.

All the commercial timbers of New Zealand are commonly used in the green state: it is very rare to learn that timber has been properly seasoned before being worked up even for buildings of some importance. So generally is this the case that builders plead "it is according to custom" to use green timber, even when it is specified that seasoned timber alone shall be used. Such treatment is obviously calculated to bring our native timbers into disrepute.

DISTRIBUTION OF THE GENUS.

Agathis comprises about ten species, which are distributed through the Malay Archipelago, Fiji, eastern tropical Australia, New Caledonia, and New Zealand.

DISTRIBUTION OF THE SPECIES.

Agathis australis, the only New Zealand species, has a very limited distribution. With the exception of a few isolated trees on the West Coast, it is confined to the area between the North Cape and the thirty-eighth parallel of south latitude.

A few trees occur between the North Cape and Cape Maria van Diemen, but it is found in large quantity between Whangape and Whangaroa, and between Hokianga, the Bay of Islands, and Whangarei: these districts, with the Northern Wairoa, contain the largest kauri forests north of the Auckland Isthmus. Although found in numerous localities between Whangarei and Auckland it is in small quantity when compared with its abundance in the North.

Large forests formerly existed on the shores of the Manukau, but they have been exhausted by the sawmillers, and for some years past the chief portion of the logs converted in that district has been obtained from the Kaipara and Hokianga districts. A few trees or small clumps are occasionally found on the

west coast between Port Waikato and Kawhia Harbour, where it attains its extreme southern limit.

On the East Coast it is found on the Great and Little Barrier Islands, and in vast abundance on the Cape Colville Peninsula, especially on the eastern side as far south as Mercury Bay; on the inland side it is less abundant, and the last patch of forest is found in the vicinity of Te Aroha. It attains its southern limit on the East Coast a few miles from Maketu, where a clump of small trees is found in dense forest.

It is a lowland tree, becoming rare at elevations exceeding 1,500ft., although solitary specimens were observed on the slopes of Mount Wynyard at 2,500ft., or perhaps higher.

DESCRIPTION.

Agathis australis, Salisbury.

Dammara australis, Lambert, "Pinetum," Ed. 2, t. 55.

A lofty monœcious tree, 80ft. to 120ft. high, with a massive trunk clothed with smooth cinereous bark. In the young state, leaves spreading, distant, 1in. to 3in. long, $\frac{1}{4}$ in. to $\frac{3}{8}$ in. wide, narrow-lanceolate, very thick and coriaceous; branches whorled. On old trees, leaves sessile, oblong or obovate, green, often close-set. Male catkins axillary, cylindrical, 1in. to 1 $\frac{1}{2}$ in. long, obtuse, connective peltate, imbricated; anther-cells ten, twelve, or more, pendulous. Female, terminal, 1in. long, ovoid, scales numerous; ovule inverted, solitary at the base of each scale. Fruit, a woody ovoid or globose cone. Seed with a membranous wing.

EXPLANATION OF PLATES LXXIX., LXXX., LXXXA., AND LXXXI.

LXXIX. *Agathis australis*, Salisbury. Tree at Tararu Creek, Thames Goldfield. From a photograph presented by Foy Brothers.

LXXX. *Agathis australis*, Salisbury. Branch from young plant, natural size.

LXXXA. *Agathis australis*, Salisbury. 1 and 2. Male catkins, natural size. 3. Connective after the anther-cells have fallen. 4. Pollen-grains. 5. Female cone. 6. Scales of fruit. 7. Seeds. 8. Longitudinal section of a young cone. 10. Seedling plant. All natural size, except 3 and 4.

LXXXI. *Agathis australis*, Salisbury. Young and mature cones, natural size.

THE CONVERSION OF KAURI.

The chief difficulties in the conversion of kauri arise from the broken and difficult country in which it is usually found, and the large size of the logs, which render them difficult to move by ordinary methods.

If the trees are growing on the banks of a deep stream they are simply felled, cross-cut into suitable lengths, and the logs rolled into the water. When growing at any considerable distance from a creek or river it is necessary to form rolling-roads: these are broad tracks from 30ft. to 60ft. wide, in which every advantage is taken of the natural incline of the surface, all inequalities are levelled, holes filled up, and stumps cut level with the surface. The logs are propelled along these roads by "timber-jacks" until they reach the water. The work of moving such heavy masses is, of necessity, very laborious, but long practice enables the bushmen to use their "jacks" with great intelligence and dexterity, and the logs are propelled with a rapidity which astonishes any one who witnesses it for the first time. Owing to the smaller size of the chief commercial timbers, in other parts of the colony the "jack" is but rarely required for moving logs, and is nowhere used so dexterously as in the kauri districts.

Many streams in kauri districts do not contain sufficient water to float the logs, so that it is necessary either to increase the supply of water, or to construct a tramway to deep water or to the mill direct. The depth of water is increased by the construction of one or more dams to enable a large quantity of water to be stored at high levels: taking advantage of the first "fresh" caused by continuous rain, the sluices of the dams are opened, and the logs, which are often piled high in the bed of the stream, are "driven" to the booms by the volume of water suddenly liberated. The booms are formed by large logs secured to each other and to the bank by strong chains: they often enclose an area of several acres, which, after a successful "drive," is crowded with thousands of logs. The construction of dams often involves a vast amount of labour in excavating, puddling, and construction: the outlay varies from £250 to £1,000. Large sums of money are also spent in removing boulders and snags from the beds of creeks, and in rounding sharp angles, &c. In many cases the logs are conveyed to the mill by tramways, especially when the mill is situated in the neighbourhood of the forest: these tramways are often of a substantial character, and involve a much heavier outlay than tramways in the extreme southern districts, owing to the broken character of the country, which often renders it necessary to excavate deep cuttings and construct embankments. They are worked by horse-power or steam. On the Northern Wairoa immense rafts of logs obtained from the banks of its numerous tributaries are towed to the saw-mill by steam-tugs.

In back-country where the mills depend upon driving for the supply of logs, a protracted period of dry weather, or a scanty rainfall, may prevent conversion being carried on for several months, the entire plant and machinery being rendered unproductive for that period, although thousands of logs may be lying in the dry bed of the stream. Excessive rain, causing high floods, forms another source of loss, the logs being brought down with such impetuosity that the booms are broken, and hundreds of logs are swept out to sea.

As a general rule the trees are felled, cross-cut, and the logs rolled into the stream by contract, the cost varying from 1s. to 2s. per 100 superficial feet, according to situation: higher prices are occasionally paid, and in some situations the work is done by day labour. Although kauri timber is remarkably sound, it often becomes greatly damaged in transit over broken country, or when driven along the beds of rocky creeks; not infrequently the logs are rolled over cliffs 20ft. to 50ft. high into the stream below: treatment of this kind necessarily results in an enormous amount of waste, the ends of the logs being split or spalted to a great extent, so that the discrepancy between the original measurement of the logs when rolled into the creek and the converted timber is often very great indeed, and cannot be estimated at less than 30 per cent., while in extreme cases it will range from 40 to 45 or even 50 per cent. As a general rule logs obtained in the Wairoa basin, unless growing very far back from tidal water, are less injured during flotation than logs obtained in the Hokianga district and on the Cape Colville Peninsula, the beds of the streams being less rocky in the former district than in either of the latter.

The kauri saw-mills are by far the best in New Zealand, and are not surpassed by any mills south of the equator: some of the largest are able to convert from 8,000,000 to 10,000,000 superficial feet per annum. The machinery is generally of the best, and is specially adapted to the conversion of large timber. A vertical frame-saw for breaking-down work is invariably in use: in one or two instances horizontal frame-saws are employed for this purpose, but the

results are not satisfactory. Frame-saws for cutting wide boards are generally employed, but weatherboarding is usually cut by the circular saw. Planing- and moulding-machines are attached even to the smallest mills, and in the larger establishments all machines required for the manufacture of converted timber into doors, sashes, gates, boxes, and a thousand other articles are found, of the best patterns, with the latest improvements added. The average cost of conversion into ordinary boards and scantlings may be stated at 2s. per 100 superficial feet. In logs of average quality the proportionate yield is fully two-thirds of first quality to one-third second quality. Many of the mill-owners obtain their supply of logs from freehold land, others from land leased from the Natives. Some mills are supplied by contractors, who obtain their logs from any convenient source. Some of the best kauri forest was purchased years ago at from 2s. 6d. to 5s. per acre, but the present price is much higher: land covered with good kauri would sell readily at from £10 to £15 per acre, but there is none for sale. On the Thames Goldfield a fee of £1 5s. is charged for every kauri felled by the miners, but the privilege of cutting ordinary timber free of charge is conferred by the miner's right.

In a few cases the supply of logs is obtained from Natives on payment of a royalty varying from 3d. to 1s. per 100 superficial feet, according to situation. The royalty levied on kauri felled in the State forests is 1s. 3d. per 100 superficial feet.

The great depression which has affected all branches of colonial trade during the past four or five years has been severely felt by the kauri industry: prices have been unremunerative, and many mills ceased working for a time. The total output has, without doubt, been greatly reduced, but in all probability it has not fallen below 80,000,000 superficial feet, of which 30,000,000 are exported, including logs and spars. The importance of the kauri industry may at once be seen by comparing the export of kauri from Auckland ports alone with the total export of other timbers from all ports of the colony for the year 1887:—

	Quantity.	Value.
	Superficial Feet.	£
KAURI	30,230,084*	124,347
All other timbers	1,404,380	4,475

Rather more than three-sevenths of the total amount of kauri is exported from the Kaipara, and nearly one-fifth is exported direct from Auckland. Considerably over one-half of the total export of other timbers is shipped at Invercargill and the Bluff. Owing to the kauri being in many cases thinly scattered amongst other trees—sometimes only one or two trees being found on an acre—it is not easy to form a correct idea of the average quantity per acre. The returns from large blocks actually cut out are often very small, as low as between 3,000 and 4,000 superficial feet per acre. On the other hand, patches containing from 40,000 to 70,000 superficial feet per acre are not uncommon. For good kauri forest 20,000 superficial feet per acre would be a low estimate. At least 100,000,000 superficial feet, log measurement, would be required to furnish the total output.

A large quantity of hewn kauri logs or "balk" was annually exported for conversion in the Australian Colonies, and caused a feeling of irritation amongst the woodmen in the kauri districts, who called loudly for the imposition of an export duty, on the ground that the logs ought to be converted in New Zealand so as to employ home labour. The balk trade has, however, become reduced to

* Including 477,000 superficial feet of kauri shipped on board vessels which cleared from Lyttelton. I have been unable to ascertain the quantity shipped from other southern ports.



Kauri Logs at the Booms, Whangaroa.
From a photograph presented by M. F. Roe, Onehunga.

DR/air

small dimensions from economic causes, so that the supposed necessity for legislative interference has been obviated. In 1878 the total value of balk, logs, piles, and spars exported was only £10,092; in 1883 the export of balk alone had increased to £24,198, when it reached its maximum. The following statement will show its fluctuations since that date:—

Year.				Number of Logs.			Value.
1883	...	...	...	6,040	...	...	£24,198
1884	...	...	...	5,014	...	...	23,370
1885	...	...	...	3,655	...	...	16,005
1886	...	...	...	1,489	...	...	5,603
1887	...	...	...	463	...	...	1,621

It has evidently been found more economical to import kauri into the Australian Colonies in the converted state than in balk. The small quantity imported in 1887 was in all probability required to meet the demand for extra-wide boards and exceptional-size scantling. The average price of smooth-hewn balk is about 5s. 6d. per 100 superficial feet, and of rough-hewn or "octagon" 5s. During 1887 prices ruled 1s. per 100 superficial feet lower for each kind.

The kauri is the only timber generally used for building purposes in the Auckland District; excellent rimu and kahikatea could readily be obtained, but they are not valued for building. On the other hand the superior qualities of kauri cause it to be largely in demand from Auckland to Invercargill: the greater portion is shipped in a converted state, but large quantities of balk are also shipped for conversion in southern sawmills. A firm in Wellington converts from 1,000,000 to 1,400,000 superficial feet yearly, most of the logs being obtained from the Hokianga district.

It is difficult to estimate the number of men employed in the sawmills and forests, but it probably ranges from 2,000 to 2,500, according to the state of the market, and the amount expended in wages probably varies from £200,000 to £250,000 per annum. Benchmen usually receive from 8s. to 10s. per day; bushmen from 6s. to 8s., or, when boarded by the contractor, £1 per week. It must not be forgotten that the freight of provisions and cost of packing are heavy items.

The total capital invested in the kauri industry may be estimated at £650,000.

In 1885 Mr. S. Percy Smith, Surveyor-General, estimated the area of kauri likely to pay for working at 138,470 acres. If we suppose the area to be even 200,000 acres, it will be seen that we are within measurable distance of its exhaustion, especially considering the rapid increase in the foreign demand: in 1876 we exported 5,072,627 superficial feet of sawn or hewn timber; in 1887 the quantity exported had risen to 30,230,084 superficial feet, not including spars in either case. It may fairly be expected that the foreign demand will increase in a still greater ratio during the next ten years, and that it will be attended with a corresponding increase of the home consumption.

An important factor in estimating the period required for the exhaustion of the kauri supply is the destruction of forests by fire. Few dry seasons occur without the destruction of large areas of valuable timber arising from preventable causes, often from carelessness, but occasionally from design. Damage is frequently caused by gum-diggers setting fire to scrub, to clear ground for their operation: if high winds occur the fire may be carried for miles, as was the case last summer, when some thousands of acres of kauri were burned in the northern districts and on the Cape Colville Peninsula. The only remedy for this state of things is to insist upon a license being taken out by all gum-diggers, and to prohibit the

burning of scrub or bush during the dry months. This subject is assuming greater importance year by year with the decrease of the kauri.

The average selling price of kauri for the last three years has been about 10s. per 100 superficial feet for cargoes at the mills.

A cargo sold by auction on the Clyde in May last realised from 2s. 7d. to 2s. 9d. per cubic foot—say, from 21s. to 23s. per 100 superficial feet.

KAURI-RESIN.

It has been already stated that all parts of the tree are charged with resin, which exudes from the slightest wound, at first as a colourless turpentine, which speedily solidifies on exposure to the atmosphere and assumes a dull-white colour: even the leaves of felled trees usually exhibit several small white patches when they begin to shrivel. Not unfrequently the turpentine exudes and forms large masses of solid resin in the forks of branches; or it may exude on the underside of a branch, especially at its junction with the trunk, forming rounded masses usually termed “tears.” This resin forms the “kauri-gum” of commerce.

But the quantity of resin collected in a fresh state is extremely trivial when compared with the quantity of fossil resin dug up year by year on ground formerly covered by kauri-forest, and not unfrequently out of swamps which cover buried forest. In this state it usually occurs in irregularly-shaped pieces, varying from a few ounces to many pounds in weight. After being dug up it is carefully scraped to free it from dirt, and when sorted according to quality it is packed in cases for the English and American markets. The scrapings and dust are usually sold for the manufacture of “fire-kindlers.”

It is not easy to account for the aggregation of this resin in masses, lying sometimes as much as 6ft. or 7ft. below the surface of the soil. It is commonly supposed to be due to old forests having been destroyed by fire; but this would involve the destruction of the resin, or at least the greater part of it. Fresh resin is of a dull-white colour, but fossil resin is of a rich-brown varying greatly in depth of tint, some specimens being translucent, or even transparent: on the other hand Waikato resin is very dark or almost black. Usually it is perfectly clear and homogeneous, but rarely specimens may be found in which portions of leaves or even small insects are preserved. Most of the East Coast resin is of fine quality, and fetches the highest price in the market.

Transparent or semi-transparent pieces are highly valued, and fetch the highest price. They are used as a substitute for amber in the manufacture of mouthpieces for pipes, and for carving various small ornaments, which find a ready sale to visitors. The ordinary kinds are chiefly used as a substitute for copal and mastic in the manufacture of varnishes. It is somewhat remarkable that this manufacture should have been so long neglected in the colony: until recently the resin has been sent to England or the United States, manufactured into varnish, and returned to the colony, notwithstanding the encouragement to the local producer afforded by double freights, and a protective duty of 15 per cent. on the manufactured article. It is gratifying to add that the manufacture appears to be fairly established in Auckland, and affords good promise of adding varnishes to our list of exports, and erasing them from our list of imports.

The price of kauri-resin varies to a great extent: the digger sometimes receives as low as £20 per ton, rarely more than £40, so that, although the work

is rough, it is by no means unremunerative. In England the price varies from £40 to £80 per ton, the latter for very choice samples.

“Gum-digging” is a standing resource for the unemployed, or, rather, for the industrious section of that class in times of depression, and has enabled Auckland to tide over bad times with less difficulty than has been experienced in other districts. The digger pays no fee or only a nominal fee for digging on open Crown lands: he selects a likely place wherever he thinks fit, his only tools being a light iron rod or “gum-spear” to test the ground, and a spade to dig out the “gum” when found. Of late years licenses have been granted to dig in kauri-forests during the winter months—a step which has already proved disastrous, and should be promptly revoked. A growing forest should never be disturbed by digging operations.

A royalty of £1 per ton is usually charged to diggers working on private land. Sometimes a storekeeper will lease a block of kauri-gum land, and give permission to dig free of charge to all who will sell their resin to him and purchase their provisions at his store; or he may charge royalty. The cost of packing gum out of the forest, and in some cases along miles of muddy road, to the nearest point of shipment for Auckland is very heavy. In many cases the storekeeper is simply the agent of an Auckland firm, buying, selling, and packing on account of the house.

A remarkable fact in connection with gumfields is that in many cases, after they have been so exhausted as to prove unprofitable, new resin has been formed after they have been allowed to rest for a few years.

With all drawbacks the Auckland gumfields have proved far more beneficial to the district than its goldfields. The quantity of resin exported during 1887 was 6,790 tons, valued at £362,434, averaging nearly £54 per ton. Of this sum the diggers and packers received not less than from one-half to two-thirds. While the goldfields would prove unremunerative unless hundreds of thousands of pounds were invested in fixed machinery and buildings, the gum-digger requires no capital beyond that necessary to purchase his gum-spear and spade; and, if he does not realise the large gains which occasionally fall to the lot of the gold-digger and miner, he can always make a living, and, if a steady, persistent worker, can make fair provision for the future.

The following statement shows the fluctuation in the quantity and value of kauri-gum exported during the five years ending 1887:—

			Quantity. Tons.		Gross Value. £		Average Value per Ton. £ s. d.		
1883	...	...	6,518½	...	336,606	...	51	12	10
1884	...	...	6,393	...	342,151	...	53	10	4
1885	...	...	5,875¾	...	299,162	...	51	0	3
1886	...	...	4,920¾	...	257,653	...	52	7	1
1887	...	...	6,790	...	362,434	...	53	7	6
			<u>30,498</u>	...	<u>£1,598,606</u>	...	<u>£52</u>	<u>7</u>	<u>7 (mean).</u>

I am indebted to Messrs. Brown and Campbell, of Auckland, for the following statement of the maximum and minimum prices for the last three years:—

				1886.		1887.		1888.
Ordinary—				£		£		£
Maximum	...	...	...	46	...	48	...	42
Minimum	...	...	...	32	...	36	...	29
East Coast—								
Maximum	...	...	...	56	...	61	...	51
Minimum	...	...	...	52	...	51	...	42

If packed in cases ready for shipment, the additional cost will be from £8 to £9 per ton.

The number of persons returned as obtaining their livelihood by collecting or distributing kauri-resin in 1886 was 1,297, as under:—

Diggers	1,230
Labourers, packers, sorters, scrapers, &c.	51
Kauri-gum merchants	16
	<hr/>
	1,297
	<hr/>

This return scarcely conveys a fair idea of the number of persons who obtain the whole or a portion of their livelihood by gum-digging, as many settlers engage in it for a few weeks at a time when work may be slack on their farms; also labourers and others from the lack of their usual employment. It may, however, be fairly assumed to show the actual number engaged in digging at any period of the year: if compared with the quantity of resin exported during 1886 it shows that each digger averaged four tons, for which he received from £80 to £100 at least. When camped on the gumfield he would be at no expense for rent and fuel, but would have to pay higher rates for provisions and clothing. It is well known that not a few prosperous settlers date the commencement of their prosperity from working on the gumfields, and there can be no question that the village settlements recently established in the northern districts have already derived great benefit from the same industry.

ON THE UTILISATION OF KAURI WASTE.

All parts of the kauri, tops and large branches, leaves and bark, are alike charged with resin, which has hitherto been allowed to waste without any attempt being made to utilise it.

There can be no doubt as to the possibility of extracting the resin not only from the tops and leaves and other forest-waste, but even from the mill-waste,—the sawdust, slabs, and bark,—thus affording another opening for the remunerative employment of labour.

The concentration of the kauri industry under one management, which is now being effected, seems to afford a favourable opportunity for again drawing attention to this opening for utilising waste products. I am convinced that persistent attempts in this direction would be rewarded by success, and result in a material addition to the annual returns.

EXPLANATION OF PLATES LXXXIA., LXXXIB., AND LXXXIC.

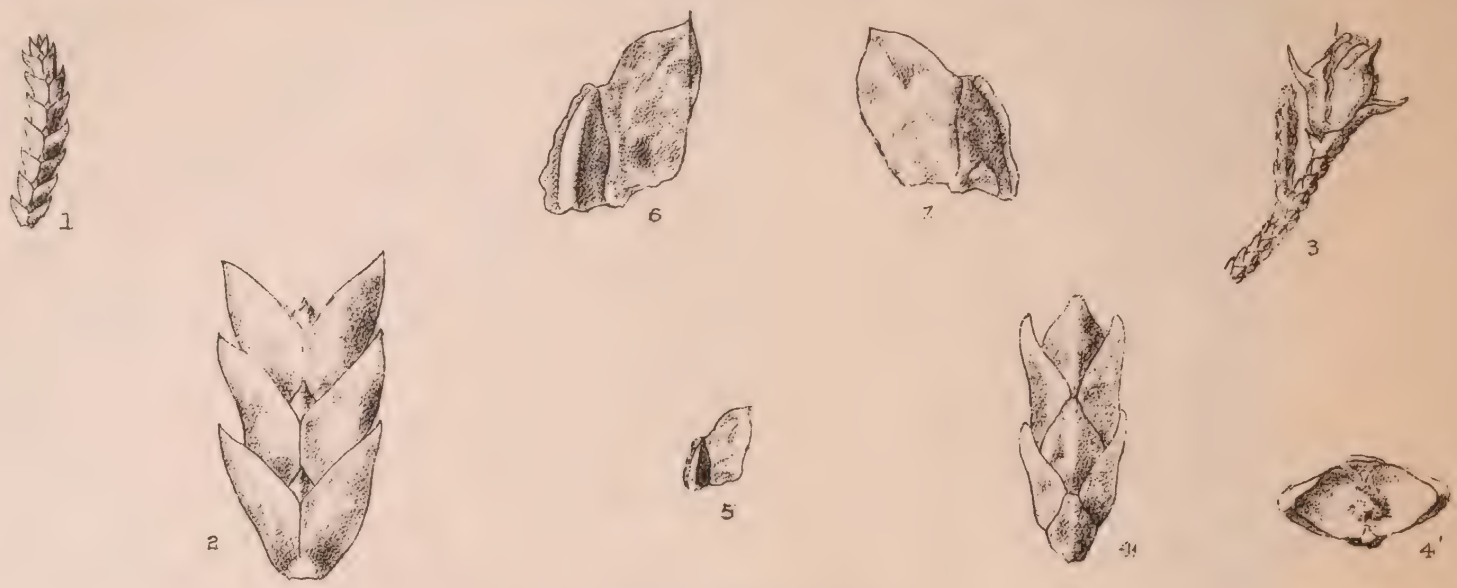
LXXXIA. Kauri logs at the booms. From a photograph presented by M. H. Roe, Esq., Onehunga.

LXXXIB. Kauri logs on a rolling-road. From a photograph presented by Foy Brothers, Shortland.

LXXXIC. Kauri logs on the skids, Onehunga. From a photograph presented by Burton Brothers, Dunedin.



Kawaka (North Island)
 (LIBOCEDRUS DONIANA)
 1. Leaves of young plant.
 2. Mature state with fruit.



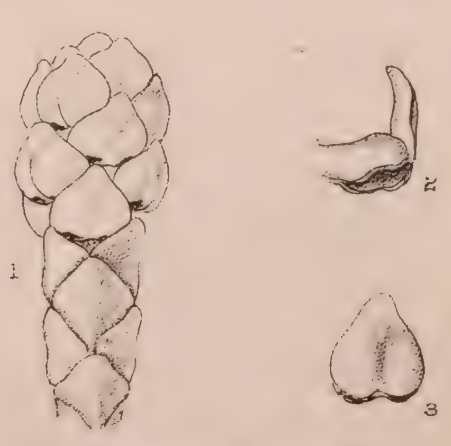
LIBOCEDRUS DONIANA.



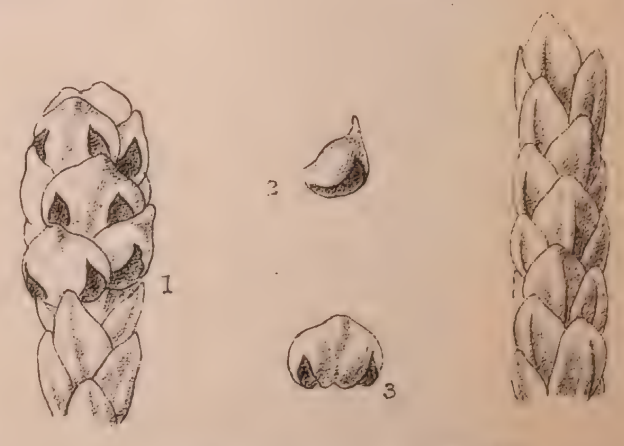
LIBOCEDRUS BIDWILLII.



PODOCARPUS FERRUGINEA.



DACRYDIUM KIRKII.



DACRYDIUM COLENSOI.

LIBOCEDRUS DONIANA, Endlicher.

THE KAWAKA.

ORDER—CONIFERÆ.

TRIBE—CUPRESSINÆ.

(Plates LXXXII. and LXXXIIA. in part.)

MR. COLENZO informs me that this fine tree is termed kawaka and kaikawaka by the Maoris: it is somewhat unfortunate that the latter name is generally applied to the next species, *Libocedrus Bidwillii*, by surveyors and bushmen, especially in the central and southern parts of the North Island. It is often termed "the New Zealand arbor-vitæ" by the settlers.

It was originally discovered by Robert Cunningham at the Bay of Islands, and received the name of *Dacrydium plumosum*, the fruit being unknown at the time. Sir William Hooker described it under the name of *Thuja Doniana*, but Endlicher referred it to his genus *Libocedrus*. It is a noble tree, with a straight naked trunk, sometimes 100ft. high, and from 2ft. to 5ft. in diameter: it may be distinguished from all other pines in the northern districts by the old bark falling away in long thin ribbons, somewhat like that of the manuka (*Leptospermum scoparium*), but the flakes are much longer and broader, being frequently 5in. or 6in. wide. The branches are few, but are usually larger and more spreading than in the next species, although retaining a conical outline. In the young state the plant is remarkably handsome: the branchlets, being much flattened and crowded, have a plumose appearance, which led to its receiving the trivial name "*plumosum*," although it was then supposed to be a *Dacrydium*. The leaves vary in form and arrangement at different stages of growth: in very young plants they are uniform, about $\frac{1}{2}$ in. long, very narrow-linear and spreading; but in older states they are of two forms, arranged in four rows, the lateral rows consisting of flattened acute leaves, about $\frac{1}{3}$ in. long, attached by broad bases: the upper and lower rows consist of minute rhomboid acute leaves, about $\frac{1}{30}$ in. in length, inserted at right angles to the lateral leaves. In the mature state the branchlets are less flattened, but are not obviously four-sided, as in the next species: the leaves are still in four rows, and differ but slightly in shape, although the lateral leaves are larger than the others, about $\frac{3}{5}$ in. long, keeled at the back, the base of each being overlapped by the tip of the leaf below it; the smaller leaves are rhomboid, about $\frac{1}{20}$ in. long, and are also keeled.

The male and female flowers form short catkins at the tips of branchlets; their structure will be described under the next species. The fruit is a small woody cone, consisting of four woody scales, each with a curved spine at the back; seeds, two, or, rarely, four, each with a membranous wing.

This species differs from *L. Bidwillii* in the larger size of all its parts, in the mature branchlets being compressed but never tetragonous, and especially in the larger seeds with shorter, broader wings.

PROPERTIES AND USES.

The wood is of a dark-red colour, with dark streaks, and is often of great beauty; it is straight and even in the grain, of greater strength than the wood of the next species, which it rivals in durability. It is easily split into very thin sections, and is often used for posts, rails, shingles and palings, &c. It is an excellent timber for general building purposes, but, on account of its comparative rarity, it is too highly valued for the purposes of the cabinetmaker and for ornamental work generally to be extensively used for ordinary purposes.

DISTRIBUTION OF THE GENUS.

Libocedrus contains eight species, of which two are found in Chili, one in New Caledonia, one in China, one in Japan, one in California, and two in New Zealand.

DISTRIBUTION OF THE SPECIES.

Libocedrus Doniana is endemic in New Zealand, and appears to be restricted to the northern portion of the North Island; it is, however, extremely rare in many districts, being represented by a single tree, and it never forms any large portion of the forest.

It is recorded by Mr. Buchanan, F.L.S., from Mount Egmont, which appears to be its most southern locality.

Unless some mistake has occurred, the two species overlap in the Taranaki District, as I have seen specimens of *L. Bidwillii* said to have been collected on the southern side of Mount Egmont.

DESCRIPTION.

Libocedrus Doniana, Endlicher.

Thuja Doniana, Hook., "London Journal of Botany," i., t. 18.

Dacrydium plumosum, Don.

A lofty tree, 60ft. to 100ft. high; trunk from 2ft. to 4ft. or more in diameter. Branches distichous, flat. Leaves of two kinds, arranged in four rows: in young plants the lateral leaves are $\frac{1}{5}$ in. long, with broad bases; upper and lower leaves $\frac{3}{10}$ in. long, rhomboid. In the mature state the lateral leaves are $\frac{3}{5}$ in. long, obtuse and keeled at the back, imbricating; smaller leaves, $\frac{1}{10}$ in. long. Male and female catkins solitary, terminating branchlets. Fruit, a woody cone, consisting of four scales, each with a spine projecting from the back. Seeds, two, each with a membranous oblique wing.

EXPLANATION OF PLATES LXXXII. AND LXXXIIA. (IN PART).

LXXXII. *Libocedrus Doniana*, Endl. 1. Branch from a young plant.
2. Mature state, with fruit, natural size.

LXXXIIA. 1. Leaves of young plant, natural size. 2. The same magnified.
3'. Leaves of mature state and fruit. 4. Leaves of mature state, magnified.
4'. Transverse section of a mature branchlet, magnified. 5. Seed, natural size.
6 and 7. Upper and lower surfaces of the same, magnified.



Kawaka—Cedar (*Libocedrus Bidwillii*).

1. Leaves of young plant.

2. Mature leaves with fruit.

LIBOCEDRUS BIDWILLII, Hook. f.

THE PAHAUTEA.

ORDER—CONIFERÆ.

TRIBE—CUPRESSINÆ.

(Plates LXXXIII. and LXXXIIA. in part.)

As stated under the preceding species, *Libocedrus Bidwillii* is generally known as "kaikawaka" by surveyors and bushmen, although Mr. Colenso states that the correct Native name is "pahautea." It has been stated that this tree is called "totarakirikotukutuku," but Mr. Colenso says emphatically that "no old Maori would have thought of such a thing." It is commonly termed "cedar" in the South Island.

It bears a close resemblance to the last species, *Libocedrus Doniana*, and cannot be separated by any marked distinctive characters. It is smaller in all its parts, being usually from 50ft. to 70ft. high, with a trunk from 1½ft. to nearly 3ft. in diameter: trunks 80ft. long and 4ft. in diameter are occasionally met with. On the other hand, when growing on peaty soil it is often less than 12ft. high. In all cases it tapers rapidly, and forms a cone-shaped head with short branches, the habit closely approaching that of *Sequoia gigantea*. The bark is loose and flaky, resembling that of the kawaka, but is rather more fibrous. The leaves are similar to those of the preceding species, both in the young and mature states, so that it is not necessary to describe them at length; but the ultimate branches with the appressed leaves are always four-sided. The longer leaves in the young state are about $\frac{3}{16}$ in. long, and in the mature state from $\frac{1}{15}$ in. to $\frac{1}{10}$ in. The male and female flowers are produced on the same plant, the male being arranged in short cylindrical cones $\frac{1}{4}$ in. long, seated between the terminal leaves at the tips of branchlets: the male flowers consist of from seven to nine pendulous anthers, each with four cells: the anther-scale (or connective) is ovate, narrowed into a sharp point, and is attached to the axis of the cone by a process springing from its centre. The female flowers also spring from the tips of branchlets, and are about $\frac{3}{10}$ in. long; they consist of four green leaves of thick texture, broad at the base and tapering to a point, which are arranged in opposite pairs. At the inner base of each leaf is a fleshy ovate scale, which is sterile on the two outer leaves, but bears two ovules on the inner leaves.

After fertilisation the fleshy scales speedily increase in size and become woody; but the growth of the outer pair is arrested before they attain the length of the leaf which adheres to the back of each, and ultimately forms a straight or curved woody spine projecting beyond the scale. The same process is exhibited by the inner pair of fleshy scales and their adherent leaves, except that the scales become longer than the leaves, and the curved spine springs from the back of the scale below its apex. Two of the ovules in each flower are usually abortive; each of the others develops a membranous wing.

I regret not to have had the opportunity of examining the flowers of the preceding species for the sake of comparison.

Libocedrus Bidwillii differs from *L. Doniana* in its lower stature and narrow conical habit, in its tetragonous branchlets, in the smaller size of its leaves, and especially of the fruit.

PROPERTIES AND USES.

The wood of this species is of a red colour, remarkably straight in the grain, but rather light and somewhat brittle: it is of great durability in all kinds of situations. It is extremely uniform, and never presents the beautiful appearance often exhibited by the wood of the preceding species.

According to Mr. Blair its weight per cubic foot when seasoned is from 26·306lb. to 28·611lb., and in the green state from 47·750lb. to 61·405lb. Its breaking weight is given at 99·98lb., so that it is the weakest of all the New Zealand pines.*

It has been used in the construction of bridges, also for piles and house-blocks, fence-posts, and rails, railway-sleepers; for weather-boards, shingles, palings, telegraph-posts, and many other purposes in which its durability has been severely tested. It appears to surpass totara in durability, and may be used for all the purposes to which totara is usually employed, unless great strength is required.

It should not be used for beams except where a very short bearing is required, nor should it be employed for flooring-joists.

It might be advantageously used for the manufacture of cottage furniture, although not equal to kauri for this purpose.

In structure it greatly resembles the Californian red-wood (*Sequoia sempervirens*), and has similar qualities and defects. Bleached logs usually referred to this species are found lying on many bare mountain-slopes in the Districts of Otago and Canterbury: as they are still sound and in good condition a more striking proof of the great durability of the timber could not be desired.

NOTE.—The tree usually called “cedar” in the North Island is *Dysoxylum spectabile* (Plates LXIV. and LXV.): care must be taken not to confuse the two.

DISTRIBUTION.

Libocedrus Bidwillii is endemic in New Zealand, and attains its northern limit at the head of the Hauraki Gulf, from whence it extends southwards to the forest between Catlin’s River and Waikawa, the most southern forest of the colony. It exhibits a marked preference for mountain or hilly districts, descending to within 700ft. above sea-level on the west coast of the South Island, and ascending to 3,800ft. or thereabouts.

In many districts it is rare and local, being found only in small clumps or single trees; in others it forms a large proportion of the forest: it is most plentiful and attains its largest dimensions between 1,200ft. and 2,500ft.

DESCRIPTION.

Libocedrus Bidwillii, Endlicher.

A monœcious tree, with a straight trunk 50ft. to 80ft. high, clothed with flaky bark. Leaves in the young state in four rows; the lateral leaves being much larger than those on the upper and lower surfaces of the branch; flat, acute, with broad bases. In the mature state the branchlets are tetragonous, about $\frac{1}{16}$ in. across; leaves nearly uniform, triangular, shortly subulate, imbricating. Male catkins terminal, $\frac{1}{16}$ in. long; anthers four-celled. Female, terminal,

* Blair: Building Materials of Otago, pp. 224-226

consisting of four fleshy scales, each adnate with a coriaceous leaf: the two inner scales have a pair of ovules at the base of each. Fruit less than $\frac{1}{4}$ in. long, of four woody valves, each with a curved spine at its back. Seeds, two or, rarely, four, each with an unequal membranous wing.

EXPLANATION OF PLATES LXXXIII. AND LXXXIIA.

LXXXIII. *Libocedrus Bidwillii*, Endl. 1. Branch from young plant. 2. Mature specimen, with ripe fruit. Natural size.

LXXXIIA. 1. Male catkin, natural size and magnified. 2. Connective, magnified. 3. Female flowers, natural size and magnified. 4. Outer leaf of female flower, with sterile scale. 5. Inner leaf with ovuliferous scale. Both magnified. 6. Fruits, natural size and magnified. 7. Seed, natural size. 8. Seeds, magnified. 9. Leaves of young plant, natural size and magnified. 10. Branchlet from mature plant with fruit, natural size and magnified. 11. Transverse section of mature branchlet, magnified.





Miro.
(*PODOCARPUS FERRUGINEA*).
1. Mature state with male flowers.
2. With young fruit.

PODOCARPUS FERRUGINEA, Don.

THE MIRO.

ORDER—CONIFERÆ.

TRIBE—PODOCARPEÆ.

(Plates LXXXIV. and LXXXIIA. in part.)

THE miro is a valuable tree, common in all parts of the colony except the Kermadec and Chatham Islands, which appear to be totally destitute of any kind of pine. It is usually distinguished by its ordinary Native name, but is commonly termed "black-pine" in Otago, and is frequently confused with the matai (*Podocarpus spicata*). Mr. Colenso informs me that it is also termed "toromiro" by the Natives: I believe this name is chiefly used by the Maoris of the East Cape district.

It is usually from 50ft. to 90ft. high, and from 1ft. to 3ft. in diameter, with a greyish or blackish bark, which is occasionally deeply furrowed, but usually scales off in large flat flakes. The leaves are arranged in two rows: in the young state they are nearly 1in. in length, very narrow, and pointed at the tip; in the mature state they are equally narrow, from ½in. to ¾in. long, and acute, with a distinct mid-rib; when dry they are of a deep-brown colour. In the recent state they are green, and bear considerable resemblance to those of the English yew (*Taxus Europæa*).

The male and female flowers are produced on separate trees, the male catkins being solitary in the axils of the leaves: the female flowers are solitary, and produced in the same manner, each consisting of a single ovule carried on a short stalk, ¼in. to ½in. long, clothed with minute scale-like leaves. The fruit is handsome, of a bright-red colour, and, when fresh, covered with a delicate bloom; the outer layer is pulpy, and surrounds a hard nut, which contains a single seed. The fruit is ¾in. long.

The flowers are produced during October and November, and the fruit is ripe in July and August.

PROPERTIES AND USES.

The timber of miro bears considerable resemblance to that of matai, from which, however, it is easily distinguished in cross section by the dark colour of the central portion of the heartwood. It is straight and even in the grain, compact, hard, elastic, and of great strength, but is not durable in situations where water can gain access to joints, or when in contact with the ground.

Its timber exceeds all New Zealand pines in strength. Its mean specific gravity is .787; weight per cubic foot, 49.07lb.; breaking weight, 197.2lb., the greatest weight borne by a single specimen being 201.6lb.* Mr. Blair states that the weight in the green state ranges from 70.189lb. to 73.321lb., when dry from 42.827lb. to 47.482lb.; and gives the breaking weight as 220.14lb.† The heartwood is dark, and irregularly shaped when seen in cross-section, so that, when cut on the quarter, much of the timber is beautifully figured. In the

* Balfour's Experiments on the Strength of New Zealand Timbers.
† Blair: Building Materials of Otago, pp. 224, 226.

seasoned state it is apt to split when nails are driven into it without boring, and in other respects it is less easily worked than kauri or rimu, which is probably the chief cause of its unpopularity. The proportion of sapwood is larger than in matai.

Figured specimens are adapted to the purposes of the cabinetmaker, and may also be used for ornamental turned-work. It is also suitable for house-framing, except ground-plates, flooring-boards, and weather-boards, for all of which it has been sparingly used with the best results. For weather-boards it is probably superior to rimu so long as it is not allowed to come in contact with the ground.

It seems of especial value for beams required to carry a great weight, if under cover, and for this purpose is superior to the beeches and to all other New Zealand pines.

For marine piles it is of high value, as it is not readily attacked by teredo. It is already coming into demand in Southland for this purpose, and its value will be increasingly appreciated. Specimens used for marine piles in Southland, known to have been driven from twelve to twenty-seven years, are still sound and good: in view of the growing scarcity of totara, its value for this purpose cannot be too widely known. Although this timber has been undervalued and neglected in the past, there can be no doubt that it will be rightly appreciated in the course of a few years: its general utilisation would be of special advantage to sawmillers in the South.

DISTRIBUTION OF THE GENUS.

See under *Podocarpus spicata*, p. 5, *ante*.

DISTRIBUTION OF THE SPECIES.

Podocarpus ferruginea is generally distributed throughout the colony, but is less plentiful in the North Island than in the South. It occurs in great abundance in the southern part of the South Island, and forms a large proportion of the forest on Stewart Island.

In the Wellington District it is very common on the crests of the ranges at an altitude of about 2,000ft., usually forming a spreading round-headed tree, with a short stout trunk rarely more than 15ft. long, and with close-set gnarled branches.

It ascends from the sea-level to 3,000ft.

DESCRIPTION.

Podocarpus ferruginea, Don.

Hook., "Icones Plantarum," t. 542.

A lofty, round-headed diœcious tree, 50ft. to 90ft. high. Leaves distichous, narrow-linear, $\frac{1}{2}$ in. to $\frac{3}{4}$ in. long, falcate, acute, mid-rib prominent, becoming reddish-brown when dry. Male catkins solitary, axillary, equalling or exceeding the leaves, sessile. Female flowers consisting of a single ovule, solitary, axillary on a short scaly peduncle. Fruit, a drupe, $\frac{3}{4}$ in. long, red, glaucous.

EXPLANATION OF PLATES LXXXIV. AND LXXXIIA. (IN PART.)

LXXXIV. *Podocarpus ferruginea*, Don. 1. Specimen with male flowers. 2. Specimen with female flowers. Natural size.

LXXXIIA. 3. 1. Male catkin, natural size. 2. The same magnified. 3. Side view of a connective. 4 and 4'. Upper and lower faces of a connective. 5. Female flower. All magnified. 6. Mature fruit. 7. Seed. 8. Longitudinal section of a seed. 9. Seedling. All natural size.



Westland Pine.
DACRYDIUM WESTLANDICUM.

DACRYDIUM WESTLANDICUM, T. Kirk.

THE WESTLAND PINE.

ORDER—CONIFERÆ.

TRIBE—TAXEÆ.

(Plate LXXXV.)

THE Westland pine is frequently termed "silver-pine" or "white silver-pine," but does not appear to have been specially distinguished by the Maoris. It is a recent addition to the New Zealand flora, having been described in 1876, although the great value of its timber had been recognised on the west coast of the South Island from its earliest settlement.

It is usually a conical tree, from 40ft. to 50ft. high, with lax slender branches; trunk from 1½ft. to 2½ft. in diameter, clothed with light-grey even bark: trunks from 3ft. to 4ft. in diameter are occasionally met with: the branches are short, but the branchlets are excessively numerous, and are often arranged in a fan-shaped manner. The leaves are of varied forms: in the young state they are from ½in. to ⅓in. long, linear or three-sided, and of soft texture: these become gradually shorter, triangular, and flat (Fig. 5), and pass by almost insensible gradations into the mature state, when they are minute, rigid, and broadly triangular, slightly overlapping each other, and the branchlets are about the thickness of fine whipcord.

The male and female flowers are alike developed at the tips of branchlets: the former are arranged in short catkins ⅓in. to ½in. long, solitary, each consisting of from five to eight anthers. The female flowers are usually solitary or in pairs, each consisting of a single ovule at the base of a coriaceous receptacle, by which it is completely surrounded. After fertilisation the ovule grows rapidly, so that it soon rises above the receptacle, which becomes still thicker, but is always green, and at length forms a shallow cup split on one side. When ripe the fruit is cylindrical, about ⅓in. long, black and shining, but without any trace of a membranous envelope at the base.

PROPERTIES AND USES.

Although not of large dimensions, the Westland pine is one of the most valuable timbers in the colony on account of its extreme durability. It is straight and even in the grain, dense, firm, and compact, yet of low specific gravity: it is of great strength, toughness, and elasticity: it is highly resinous, and shrinks but little while seasoning. It is at first white, but assumes a yellowish tint with a satiny lustre, and takes a high finish.

Specimens with "mottled" wood are occasionally found, and approach the highly-prized mottled kauri of the North in beauty: waved or figured wood is not infrequent.

It is used extensively by the cabinetmaker, and seems suitable for the manufacture of agricultural implements, as it shrinks but little, even if used before being fully seasoned. It has been used in bridges, wharves, and other

constructive works with the best results. For marine piles it seems almost imperishable, and, notwithstanding its small dimensions, is fully equal to totara in durability.

It is equally well suited for general house-building, and is specially valuable for weather-boards. It has also been used for fence-posts, rails, &c., tramway rails and sleepers, mine-props, caps, struts, &c. It is invaluable for any purpose in which durability is required.

DISTRIBUTION OF THE GENUS.

See under *Dacrydium cupressinum*, p. 31, *ante*.

DISTRIBUTION OF THE SPECIES.

Dacrydium Westlandicum is endemic in New Zealand, and occurs from Whangaroa North to Martin's Bay, but is decidedly rare and local in the North Island. It has been collected at Whangaroa North, near Ngauruhoe and Ruapehu, and on the Great Barrier Island, but does not form any large portion of the forest in these localities.

In the South Island it appears to be restricted to the west coast, and occurs from Golden Bay to Martin's Bay, but is most plentiful in the Westland District proper. It is largely converted by the sawmillers in Hokitika.

It ascends from the sea-level to fully 2,500ft., and is most frequent in damp woods.

DESCRIPTION.

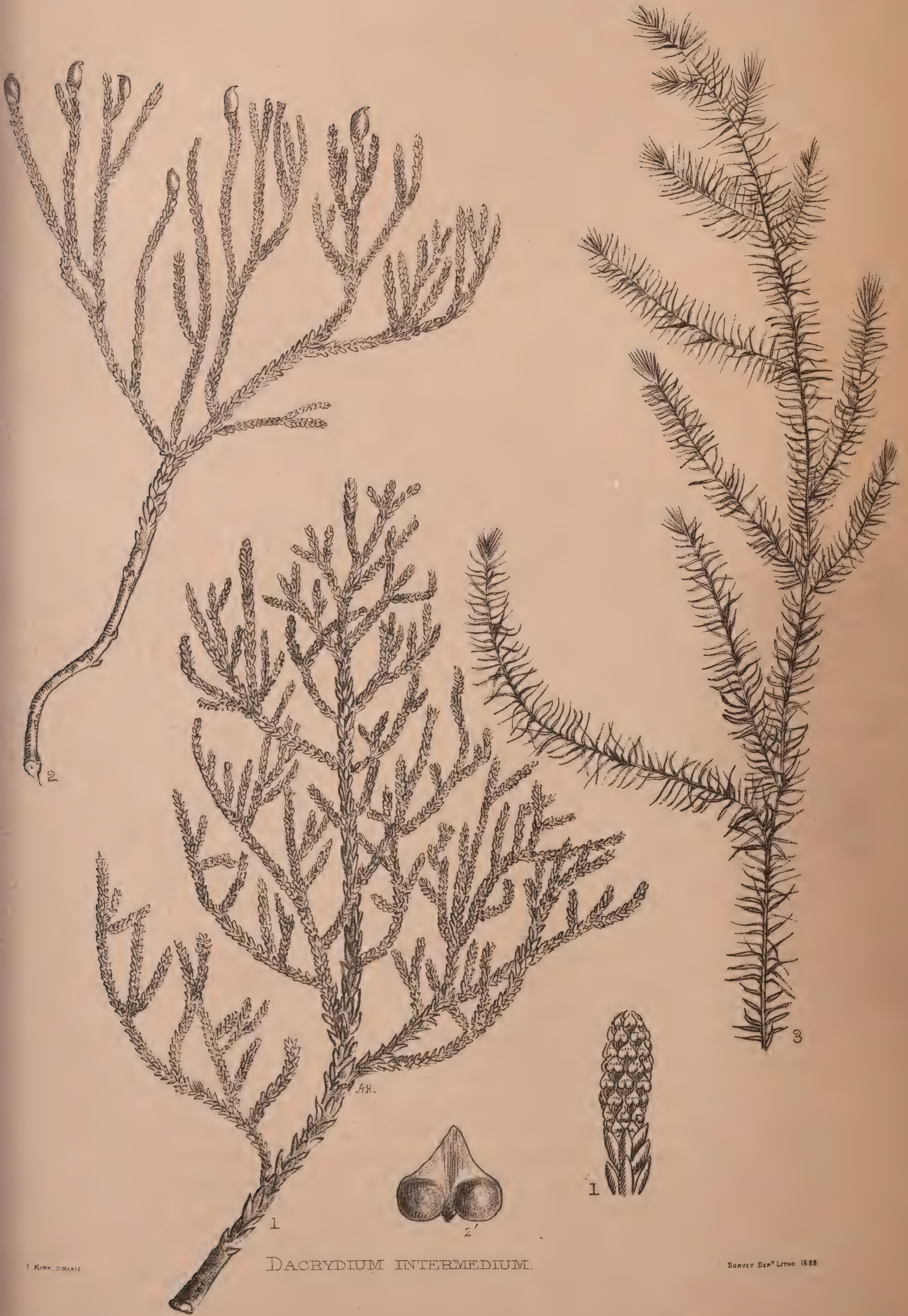
Dacrydium Westlandicum, T. Kirk.

Hook. f., "Icones Plantarum," t. 1, 218.

A conical diœcious tree, 30ft. to 50ft. high. Leaves various: in the young state scattered, terete or subterete, or trigonous or subulate, $\frac{1}{4}$ in. to $\frac{1}{3}$ in. long; or flat and triangular, spreading: in the mature state $\frac{1}{2}$ in. long, closely appressed, broadly triangular, obtuse, keeled, slightly imbricating. Ultimate branchlets $\frac{1}{20}$ in. to $\frac{1}{15}$ in. in diameter. Male catkins solitary, terminal, sessile, oblong, $\frac{1}{15}$ in. to $\frac{1}{10}$ in. long, connective broadly ovate, acute. Female flowers terminal, solitary or in pairs, each consisting of a single ovule; receptacle coriaceous, split on one side. Nut black, shining.

EXPLANATION OF PLATE LXXXV.

Dacrydium Westlandicum, T. Kirk. 1 and 2. Flowering specimens. 3. Branch of a young plant. Natural size. 4. A portion of the same, magnified. 5. Leaves of an intermediate stage, natural size. 6. Male catkin. 7 and 8. Upper and lower faces of an anther. 9. Female flower. 10. Ovule. All magnified. 11. Female flower immediately after fertilisation. 12, 13, and 14. Fruits in different stages of maturity. 15. Ripe fruit. 11 to 15 are drawn natural size and magnified.



J. KIRK, DUXIE.

DACRYDIUM INTERMEDIUM.

SURVEY DEP. LITHO 1888.

DACRYDIUM INTERMEDIUM, T. Kirk.

THE YELLOW SILVER-PINE.

ORDER—CONIFERÆ.

TRIBE—TAXEÆ.

(Plates LXXXVI. and LXXXVII. in part.)

THE yellow silver-pine or mountain-pine, as it is less frequently termed, was originally described by the writer in 1877. Usually it is a handsome conical tree, 40ft. high or more, with a trunk from 1ft. to 2ft. in diameter; but in mountain localities the trunk is often very short and of larger diameter, with spreading arms, forming a lax round-headed tree. In very old specimens the branchlets are pendulous, and the tree is of great beauty, especially when growing by the side of a river or creek. In the young state the leaves are awl-shaped, $\frac{1}{2}$ in. to $\frac{3}{8}$ in. long, somewhat crowded and spreading. They become gradually shorter and closely appressed to the branchlets until, in the mature state, they do not exceed $\frac{1}{10}$ in. in length, and are ridged or keeled on the outside, the base of each leaf being overlapped by the apex of the leaf below it.

The male and female flowers are developed on separate trees, and are carried at the tips of branchlets: the male catkins are about $\frac{1}{4}$ in. long, with numerous anther-scales, which are short and broad like those of all the New Zealand species except *D. cupressinum*. The female flowers are solitary, and consist of a single ovule. The fruit consists of a single cylindrical nut, which is partly embedded in a red pulpy receptacle, partially clothed with short green scales, as in *D. cupressinum*, but the receptacle only becomes pulpy in warm seasons. It frequently remains dry, or a few receptacles only may be pulpy, the majority remaining dry and leathery.

PROPERTIES AND USES.

The wood of the yellow silver-pine is of a reddish-yellow, resinous, straight in the grain, firm, compact, and even, of great strength and extreme durability. It is usually of smaller dimensions than the Westland pine, which somewhat detracts from its value, but it may be applied to the same purposes, and is reputed to be of even greater durability.

On Stewart Island it is highly valued for boat-building: a punt largely constructed of this timber has lasted over seventeen years, and seems likely to maintain its good condition for many years to come.

This and the Westland pine are dangerous when used for firewood, as sparks are projected from the burning logs in all directions.

DISTRIBUTION.

Dacrydium intermedium attains its northern limit on the higher parts of the Hirakimata Range, Great Barrier Island, and is common on the Thames Gold-field, where it is plentiful at about 2,000ft. It is found in many places in the central parts of the North Island, but has not been observed in the vicinity of Cook Strait.

In the South Island it is of frequent occurrence on the West Coast from Cape Farewell to Otago, but is most plentiful in the interior of Nelson and in Westland. It is common on Stewart Island, especially at low levels.

It ascends from the sea-level to fully 4,000ft.

DESCRIPTION.

Dacrydium intermedium, T. Kirk, Trans. N.Z. Inst., Vol. x., p. 386, t. xx.

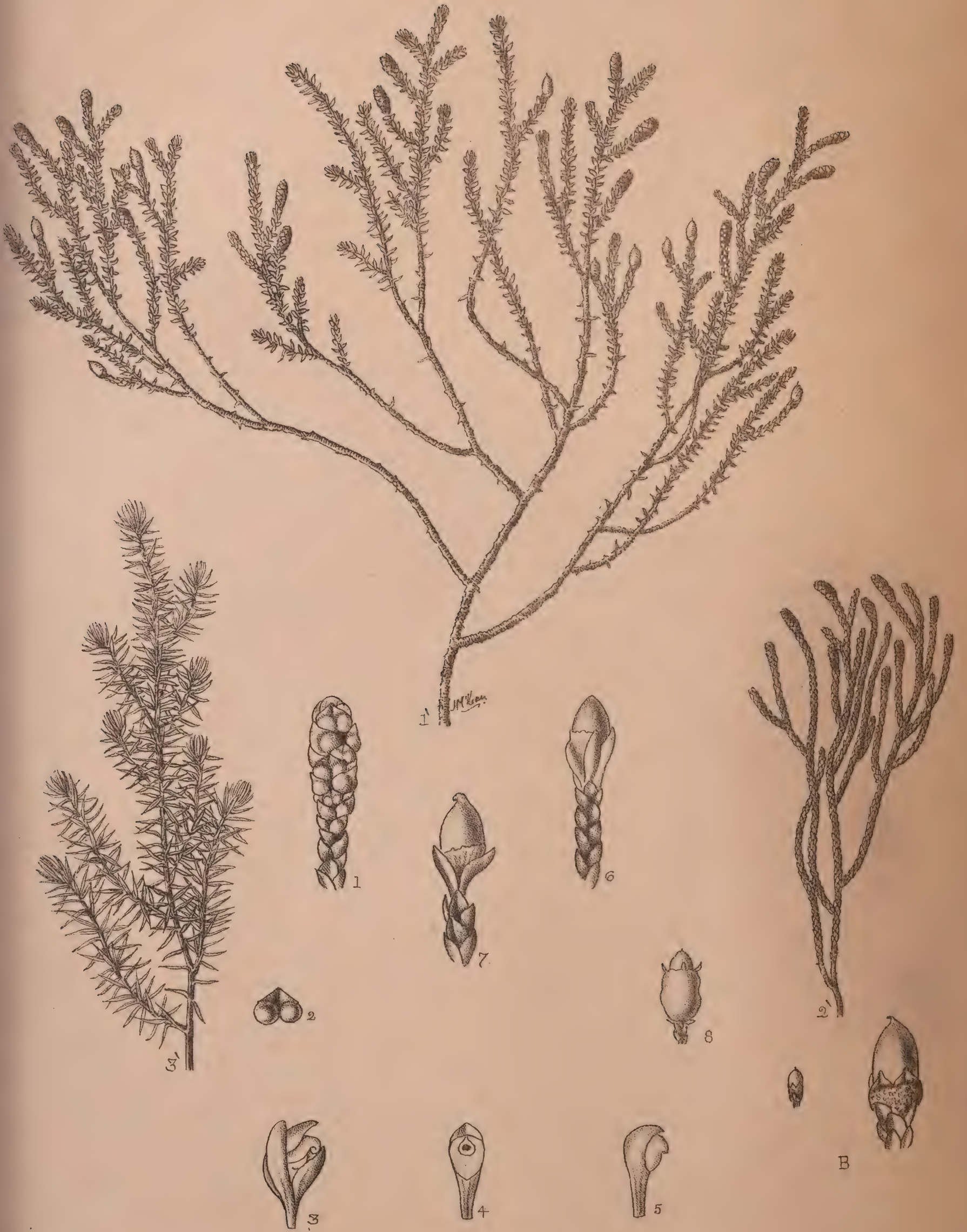
An erect usually conical diœcious tree, 40ft. to 50ft. high. Leaves on young plants laxly crowded, $\frac{1}{2}$ in. to $\frac{2}{3}$ in. long, subulate, patent or erecto-patent; on older plants $\frac{3}{8}$ in. to $\frac{1}{4}$ in. long, spreading; on mature trees, spirally arranged in four rows, closely imbricating, $\frac{1}{20}$ in. long, triangular-ovate, obtuse, strongly keeled. Male catkins terminal, $\frac{1}{4}$ in. long, connective broadly ovate, acuminate. Female flowers terminal; ovule solitary. Fruit, a black cylindrical nut, $\frac{1}{5}$ in. long, seated on a dry or fleshy receptacle.

Monœcious specimens were observed on Stewart Island.

EXPLANATION OF PLATES LXXXVI. AND LXXXVII. (IN PART).

LXXXVI. *Dacrydium intermedium*, T. Kirk. 1. Branch with male catkins. 2. Branch with dry fruits. 3. Branch of a young plant. Natural size. 1'. Male catkin. 2'. Connective. Magnified.

LXXXVII. *Dacrydium intermedium*, T. Kirk. B. Fruit with fleshy receptacle, natural size and magnified.



DACRYDIUM LAXIFOLIUM

DACRYDIUM LAXIFOLIUM, Hook. f.

THE MOUNTAIN RIMU.

ORDER—CONIFERÆ.

TRIBE—TAXEÆ.

(Plate LXXXVII.)

THIS small species is interesting as being the least of all the conifers: fruiting specimens may sometimes be found less than 2in. in height; usually, however, it is from 6in. to 12in. high: very rarely it may be found growing amongst other shrubs, and supporting its weak stems amongst their branches to the height of 2ft. or 3ft., but left to itself the stems are weak and prostrate.

In several respects it approaches the preceding species, *Dacrydium intermedium*—in the shape of the young leaves, in the closely-appressed mature leaves, and in the fruit being sometimes dry and sometimes pulpy. It is a much-branched shrub, with prostrate or, rarely, sub-erect stems. In the young state the leaves are subulate, acute, $\frac{1}{3}$ in. to $\frac{1}{2}$ in. long, which gradually give place to shorter spreading leaves, $\frac{1}{12}$ in. long: in another form the leaves are minute, overlapping, obtuse, $\frac{1}{25}$ in. long and nearly as broad. Both forms bear flowers and fruit: the male and female flowers may be produced on the same or on different plants. The male catkins are from $\frac{1}{3}$ in. to $\frac{1}{2}$ in. long, and are solitary on the branchlets. The female flowers are solitary; they consist of about three curved whitish leaves, one of which bears a single ovule. The fruit is a cylindrical nut seated on a fleshy or dry receptacle: when fleshy, three or four green scales are sometimes developed on the upper margin of the receptacle.

PROPERTIES AND USES.

This species has no known economic value, except that its roots serve to bind the surface of loose mountain-slopes, thus preventing landslips.

DISTRIBUTION.

Dacrydium laxifolium is common in mountain districts throughout the colony. The most northern habitat known to me is near the base of Tongariro, but in all probability it will yet be discovered on the higher parts of the East Cape district. It is common on the Southern Alps, and is found on Stewart Island, where it descends nearly to the sea-level. It ascends to upwards of 4,000ft.

DESCRIPTION.

Dacrydium laxifolium, Hook. f., "Icones Plantarum," t. 825.

A weak straggling shrub with prostrate stems, 3in. to 12in. long, or, rarely, sub-erect and longer when growing amongst adjacent shrubs. Monœcious or diœcious. Leaves in the young state subulate, acute, $\frac{1}{4}$ in. to $\frac{1}{2}$ in. long, shortly spreading and obtuse; in the mature state $\frac{1}{12}$ in. long; or closely appressed and imbricating, broadly ovate or rhomboid, keeled, $\frac{1}{25}$ in. long. Male catkins solitary, terminal; connective broadly triangular, acute. Female flowers solitary,

consisting of three leaves, one of which carries a single ovule. Fruit, a cylindrical nut, with a membranous cup at its base, seated on a coriaceous or pulpy crimson receptacle.

EXPLANATION OF PLATE LXXXVII.

Dacrydium laxifolium, Hook. f. Branch of a monoëcious plant, with spreading leaves. 2'. Branch of a male plant, with imbricating leaves. Natural size. 1. Male catkin. 2. Anther. 3. Female flower. 4 and 5. Front and side views of ovule. 6 and 7. Fruits with dry receptacle. 8. Fruit with pulpy receptacle. All magnified.

B. *Dacrydium intermedium*. Fruit with pulpy receptacle, natural size and magnified.



Karaka.
CORYNOCARPUS LAEVIGATA.

CORYNOCARPUS LÆVIGATA, Forster.

THE KARAKA.

ORDER—ANACARDIACEÆ.

(Plate LXXXVIII.)

The bold glossy foliage of the karaka renders it a striking object at all times, when its large fruits are fully ripe the contrast between the dark deep green leaves and the bright-orange colour of the fruits renders it one of the most attractive trees of the New Zealand flora. It is interesting, moreover, being one of the few trees cultivated by the Maoris for food, and none the less on account of its affording a deadly poison.

Corynocarpus laevigata is an evergreen tree, from 25ft. to 50ft. high, with a trunk from 1½ft. to 2½ft. in diameter, but larger specimens are not infrequent. The leaves are alternate, from 3in. to 7in. long and from 2in. to 3in. broad; they are carried on short leaf-stalks, and are very glossy. The flowers are ½in. in diameter, of a greenish-white tint, and are developed in erect terminal panicles, from 3in. to 5in. high. The flowers are shortly stalked, and may be solitary or crowded: the calyx is five-lobed, the lobes slightly overlapping, and the corolla consists of five narrow free whitish petals inserted at the base of the calyx-lobes; the stamens equal the petals, and are inserted between the lobes of the disc, each lobe being tipped with a narrow, jagged, petal-like process, thus presenting the appearance of an inner series of petals. The ovary is with a short straight style and rounded stigma. The fruit is of a dark red colour, 1in. long or more, and varying in shape: it has an outer woody layer and in general structure resembles a small plum; but the hard stony layer which envelops the seed of the plum is wanting, and is represented by a thin network, which adheres closely to the solitary seed.

PROPERTIES AND USES.

The wood is white and easily split, but is very perishable, and of little value for ship-wood. The leaves are greedily eaten by horses and cattle: their use for this purpose has led to the tree being almost extirpated in districts where it was once plentiful. The pulpy layer of the fruit was formerly eaten by the natives, especially in seasons of scarcity; and the seeds, after prolonged steaming, formed one of their most valued articles of food, although in the unsteamed state they are highly poisonous, causing spasmodic contraction and paralysis of the muscles.

Mr. Skey, the Colonial Analyst, finds the poisonous principle to reside in an essential oil, which is intensely bitter, and which, under treatment, crystallizes out in beautifully-radiating acicular forms. He has appropriately named this bitter principle of the karaka "karakine."*

Mr. Colenso's account of the collection and preparation of the nuts and the action of the poison is so interesting that I venture to transcribe it at length,

* Trans. N.Z. Inst., iv., p. 319.



Karakara.
CORYNOCARPUS LAEVIGATA.

CORYNOCARPUS LÆVIGATA, Forster.

THE KARAKA.

ORDER—ANACARDIACEÆ.

(Plate LXXXVIII.)

THE bold glossy foliage of the karaka renders it a striking object at all times, but when its large fruits are fully ripe the contrast between the dark deep green of the leaves and the bright-orange colour of the fruits renders it one of the most attractive trees of the New Zealand flora. It is interesting, moreover, as being one of the few trees cultivated by the Maoris for food, and none the less on account of its affording a deadly poison.

Corynocarpus laevigata is an evergreen tree, from 25ft. to 50ft. high, with a trunk from 1½ft. to 2½ft. in diameter, but larger specimens are not infrequent. The leaves are alternate, from 3in. to 7in. long and from 2in. to 3in. broad; they are carried on short leaf-stalks, and are very glossy. The flowers are ⅙in. in diameter, of a greenish-white tint, and are developed in erect terminal panicles, from 3in. to 5in. high. The flowers are shortly stalked, and may be solitary or crowded: the calyx is five-lobed, the lobes slightly overlapping, and the corolla consists of five narrow free whitish petals inserted at the base of the calyx-lobes; the stamens equal the petals, and are inserted between the lobes of a fleshy disc, each lobe being tipped with a narrow, jagged, petal-like process, at first sight presenting the appearance of an inner series of petals. The ovary is ovoid, with a short straight style and rounded stigma. The fruit is of a bright-orange colour, 1in. long or more, and varying in shape: it has an outer pulpy layer, and in general structure resembles a small plum; but the hard stony layer which envelops the seed of the plum is wanting, and is represented by a tough fibrous network, which adheres closely to the solitary seed.

PROPERTIES AND USES.

The wood is white and easily split, but is very perishable, and of little value except for firewood. The leaves are greedily eaten by horses and cattle: their value for this purpose has led to the tree being almost extirpated in districts where it was once plentiful. The pulpy layer of the fruit was formerly eaten by the Maoris, especially in seasons of scarcity; and the seeds, after prolonged soaking or steaming, formed one of their most valued articles of food, although in the crude state they are highly poisonous, causing spasmodic contraction and rigidity of the muscles.

Mr. Skey, the Colonial Analyst, finds the poisonous principle to reside in an essential oil, which is intensely bitter, and which, under treatment, crystallizes out in beautifully-radiating acicular forms. He has appropriately named this bitter principle of the karaka "karakine."*

Mr. Colenso's account of the collection and preparation of the nuts and the action of the poison is so interesting that I venture to transcribe it at length,

* Trans. N.Z. Inst., iv., p. 319.

merely stating that on one occasion, when travelling with Natives in the Tarawera district, they collected a large quantity of the ripe fruits, but refused to eat the pulpy layer: on camping for the night the baskets containing the fruits were placed in a boiling spring, and remained there till noon the next day, when the kernels were carefully rinsed and eaten with the greatest relish.

*“ 1. *Preparation as food.*—The kernels were prepared for food thus: In the autumn a large party would go to the karaka woods on the sea-coast, which were most rigidly preserved (tabooed), to gather the fruit. This was generally done by beating them down with a long pole (hence the term, ‘ka haere ki te ta karaka’; the verb *ta*, to hit or strike sharp, short, sudden blows with a stick; the same verb is used in speaking of the operation of tattooing), after which they gathered them up into baskets. In or near the adjoining beach large pits were dug for earth-ovens, into which when ready the karakas were poured, and the earth banked up in the usual way. These ovens were left several hours before they were opened, generally till the next day, or even longer, when the karakas were taken out, put into baskets, laced up, and placed under water, often at the mouth of some neighbouring stream or quasi-lagoon, where also they remained some time (I believe a day or two at least), for the double purpose of destroying all remains of the poisonous quality, and for the loosening and getting rid of the skin and flesh of the fruit; when they were washed clean by knocking them about pretty roughly to rid them of the outer skin, &c., taken out, spread in the sun on mats and stages, and carefully dried, and, when quite dry, again put up in new baskets for winter use, for feasts, for distinguished visitors, and for gifts to friendly chiefs and tribes residing inland.

“ As the same karaka woods did not bear alike plentifully every year, the seasons of barrenness were to the tribe seasons of calamity and want, the karaka being one of their staple vegetable articles of food.

“ 2. The symptoms attending cases of poisoning through eating the raw kernel were violent spasms and convulsions of the whole body, in which paroxysms the arms and legs were stretched violently and rigidly out, accompanied by great flushings of heat, protrusion of the eyes and tongue, and gnashing of the jaws, but unattended by vomiting (very different in appearance and result from the bite of the poisonous spider *katipo*, of which I have also seen and attended several cases, which are of a much more mild type and never fatal). I mention this as both were likely to be caused in the same locality (the uninhabited sea-shore) and season, and, at first, by a tyro might be mistaken. Unless speedily attended to, the poisoning of the karaka quickly proved fatal; and, even in those few cases in which I have known Natives to recover, very likely it was more owing to the small quantity of the poison received into the system than to the means used as internal remedies. As the sufferers were invariably little children they were more easily dealt with, and, to prevent the limbs becoming distorted or stretched and rigid, a pit was quickly dug, into which the child was placed in a standing posture, with its arms and legs bound in their natural position, and the mouth gagged with a bit of wood to prevent the sufferer biting its own tongue; and there the child was left, buried up to its chin, until the crisis had passed by: sometimes it was also plunged repeatedly into the sea before being pitted. Fortunately the cases of karaka-poisoning were but few, owing, no doubt, to the hard texture and disagreeable taste of the karaka kernel in its raw state—very much fewer than those arising from the eating of the sweet fruits of the *tutu* (*Coriaria*), which latter, however, were more easily managed by the Natives.

* Trans. N.Z. Inst., iv., p. 317: Extracts from a letter by W. Colenso, F.R.S., to Mr. Skey.

“The writer well recollects having seen at Whangarei (Bream Bay) in the years 1836–39, a fine healthy youth of about twelve years of age who had been recovered from poisoning by karaka kernels. He, however, had not been properly attended to as to the tying of his limbs in their right position while under the influence of the poison, and he was therefore now a curious spectacle, reminding one of the instrument called a caltrops more than anything else. One leg was curved up behind to his loins, and the other bent up in front with the foot outwards; one arm inclined behind his shoulder, and the other slightly bent and extended forwards; and all, as to muscles, inflexibly rigid. He could do nothing, not even turn himself as he lay, nor drive off the sandflies (which were there in legions) from feasting on his naked body, nor scratch himself when itching, nor put any food into his mouth.”

The karaka is readily propagated by seeds and easily cultivated, but is of slow growth. Cultivated specimens in poor soil produce flowers when less than 5ft. high.

DISTRIBUTION.

Corynocarpus consists of a single species, *C. laevigata*, which is endemic in New Zealand.

It is found on the Kermadec Islands and at the North Cape, whence it extends southwards to Cook Strait. It exhibits a decided preference for littoral situations, and is found on nearly all the outlying islands both on the east and west coasts of the North Island, as well as in many inland localities.

It is very rare in the South Island, being restricted to a few localities in the Nelson, Marlborough, and Canterbury Districts. In Nelson solitary trees are found near Collingwood and West Wanganui, but it occurs in some quantity on D'Urville Island. It is found sparingly in the lower parts of Queen Charlotte Sound and the Pelorus, in Marlborough; but in Canterbury it is confined to two or three localities on Banks Peninsula. It is plentiful on the Chatham Islands.

It is most plentiful at or near sea-level, but ascends to 1,200ft.

The karaka was formerly cultivated by the Maoris: small groves planted by them may still be found in many places on the coast.

It is said to have been introduced by the original Maori immigrants from Hawaiki—a belief which is still held by the Morioris on the Chatham Islands. But this tradition is inconsistent with the fact that the karaka is not found in any of the countries which are supposed to have been the cradle of the stock from which the Maori sprang, and is not found in any country except New Zealand. The late Major Heaphy used to meet this difficulty by suggesting that in all probability Hawaiki was one of the Pacific islands which became submerged after the departure of the ancestors of the present Maoris.

DESCRIPTION.

Corynocarpus laevigata, Forst., “Botanical Magazine,” t. 4, 379.

A glabrous evergreen tree, 20ft. to 40ft. high or more. Leaves exstipulate, alternate, 3in. to 7in. long, oblong or broadly lanceolate, obtuse, narrowed into short stout petioles, shining. Flowers perfect, $\frac{3}{8}$ in. in diameter, in erect rigid terminal panicles, globose; pedicels stout. Calyx inferior; sepals five, with membranous margins; petals five, free, perigynous. Disk fleshy, with five lobes, each carrying a jagged petaloid process. Stamens five. Ovary one-celled, with a solitary pendulous ovule; stigma capitate. Fruit, an ovoid or obovoid drupe; sarcocarp fleshy; endocarp reticulated, coriaceous, and fibrous. Seed with a thin, veined testa. Endosperm none. Cotyledons plano-convex, fleshy. Radicle minute, superior.

EXPLANATION OF PLATE LXXXVIII.

Corynocarpus lævigata, Forster. Specimen with immature fruit, and branch of a flowering panicle, natural size. 1. Flower. 2. Flower with sepals and petals removed to show the petaloid processes springing from the lobes of the disk. 3. Pistil. All magnified. 4. Ripe fruit. 5. Seed with endocarp. 6. A portion of the endocarp removed. 7. Seed showing the veined testa. 8. Seed with cotyledons diverging. 9. Transverse section of seed. All natural size.



T. KIRK, DREXIT.

Silver beech. (*Fagus Menziesii*).

SURVEY DEP. LITHO. 1885.

FAGUS MENZIESII, Hook. f.

THE SILVER-BEECH.

ORDER—CUPULIFERÆ.

(Plate LXXXIX.)

THE silver-beech, in common with all the New Zealand species of *Fagus*, is known as "tawhai" or "tawai" by the Natives. To settlers and bushmen it is known under various names, as "brown-birch," "red-birch," "white-birch," and "silver-birch." "Brown-birch" is the name most generally used. I have proposed the name of "silver-beech" for general use, on account of the pale-grey silvery bark.

Fagus Menziesii is a grand tree, sometimes exceeding 100ft. in height, with a trunk from 2ft. to 4ft. in diameter, although specimens exceeding 8ft. in diameter are occasionally met with. Old specimens are frequently found with large radiating buttresses, resembling those of the pukatea, but much thicker.

The bark is thin, whitish, and silvery, with narrow horizontal markings, more numerous than those of the English birch (*Betula alba*, Linn.), which it greatly resembles: on old specimens the bark becomes rugose, and more or less furrowed on the lower part of the trunk.

The twigs and leaf-stalks are clothed with fine brown hairs; the leaves are alternate, perfectly smooth, of hard texture and a pale colour when dry. In the early spring each leaf is furnished with a pair of narrow brown stipules at the base of the leaf-stalk, which however quickly fall away; the leaves vary considerably in shape, but are usually more or less rhomboid in outline, and seldom exceed $\frac{1}{2}$ in. in length by $\frac{1}{3}$ in. in breadth. The margins are toothed, but the teeth are always blunt, although varying much in depth.

The flowers are developed in the axils of the leaves: the males are solitary, and consist of a shallow membranous cup carried on a short pubescent stalk, and containing about twelve stamens on short slender filaments. The female flower is an involucre cleft to the base into four narrow leaves, and containing from two to four carpels.

The leaves of the involucre carry from five to seven narrow horizontal bands or transverse plates, cut to the base into narrow stalk-like processes, each carrying a round gland at its apex: these processes vary in width, and in some specimens are extremely fine, in others broad and flat. The fruit consists of two or three nuts enclosed in the woody glandular involucre.

Fagus Menziesii is the only New Zealand species having glandular involucres, so that it is readily distinguished in the colony, although it closely resembles the Tasmanian beech (*Fagus Cunninghamii*, Hook. f.), and approaches *F. Moorei*, Mueller, of New South Wales, and *F. betuloides*, Mirbel, of Cape Horn and Chili.

Its symmetrical habit of growth, smooth neat foliage, and silvery bark render it one of the most picturesque and attractive trees in the New Zealand forests. This species often exhibits a singular transformation of the leaves, which are developed into crowded panicles of scaly fulvous bracts at the tips of the

branchlets. Most frequently four scales form a flask-shaped cup, which is sessile in the axil of a larger bract-like scale, and covers a number of minute scales. These panicles present a close resemblance to the early stages of a true inflorescence.

PROPERTIES AND USES.

The wood of the silver-beech is usually of a deep-red colour, and remarkably straight in the grain, even, compact, hard and dense, but with very little figure. It is of great strength, very tough and elastic, but is not durable when exposed to the weather: experience shows that it is not suitable for house-blocks, fence-posts, sleepers, and similar purposes. Although rather heavy, it is suitable for the framing of houses, except ground-plates, and may be used for weather-boarding, &c. As it is easily split, it is often used for shingles, which last from five to seven years.

Its deep-red colour and even grain render it excellent for the manufacture of ordinary furniture, French bedsteads, sideboards, &c.: when French-polished it bears considerable resemblance to plain mahogany.

It is well adapted to the manufacture of tubs, buckets, and other coopers' ware, more especially wine-casks. If a shipment could be placed on the French market I am fully satisfied that it would speedily be in demand for this purpose and afford a profitable export. It is much the strongest of the beeches, and would prove of great value for beams required to carry heavy weights under cover.

At present it has only been used in the mountain districts where other timbers are not available.

Its weight per cubic foot in the green state is 52·621lb., when seasoned 38·99lb.; and its breaking weight, 175·50lb.*

DISTRIBUTION OF THE GENUS.

See under *Fagus Solandri*, p. 91, *ante*.

DISTRIBUTION OF THE SPECIES.

Fagus Menziesii is most plentiful in mountain districts, where it often forms extensive forests. It attains its northern limit on Table Mountain, near the head of the Hauraki Gulf, and is found on the Ruahine, Tararua, and Rimutaka Ranges, and the Wainuiomata hills, in the North Island. In the South Island it occurs on the Kaikoura Mountains, Mount Arthur Range, Spencer Mountains, and more or less throughout the Southern Alps, especially on their western slopes: it is abundant at the head of Lake Wanaka and Haast's Pass; the wood in this locality is almost of a bright cherry-red. In some lowland forests it occurs sparingly, being often restricted to single specimens. It is plentiful in Dusky Bay, Preservation Inlet, and attains its southern limit at Colac Bay and Lake George. It is not found on Stewart Island.

It ascends from sea-level to a little over 3,000ft.

DESCRIPTION.

Fagus Menziesii, Hook. f., "Icones Plantarum," t. 652.

An evergreen monoecious tree, 60ft. to 100ft. high; bark whitish, silvery, rugose, and furrowed when old; branches spreading; branchlets and petioles pubescent. Leaves alternate, glabrous, rigid, $\frac{1}{2}$ in. to $\frac{1}{2}$ in. long, shortly petioled,

* Blair: Building Materials of Otago, p. 226.

ovate or rhomboid-ovate or orbicular, with an obvious marginal nerve; margins serrate with short obtuse teeth, or doubly crenate. Male flowers solitary, axillary, on very short peduncles; perianth shallow, four- to five-toothed, membranous; stamens, about twelve. Female, involucre pubescent, four-lobed; lobes narrow, with from five to seven transverse lamellæ cut to the base into linear processes, each carrying a gland at its apex. Fruiting involucre woody, pubescent, with transverse rows of glands. Nuts, two or three, downy, two trigonous with winged margins, one flat; margins produced into points.

EXPLANATION OF PLATE LXXXIX.

Fagus Menziesii, Hook. f. Fruiting specimen, natural size. 1. Male flower. 2. Fruit. 3. Involucral cup. 4. A trigonous fruit. 5. A flat fruit. All magnified.



Tooth-leaved Beech.
FAGUS FUSCA.



FAGUS FUSCA.
Var. DUBIA.

FAGUS FUSCA, Hook. f.

THE TOOTH-LEAVED BEECH.

ORDER—CUPULIFERÆ.

(Plates XC. and XCI.)

THIS fine tree is termed "black-birch" in Auckland and the greater part of Otago and Southland, "bull-birch" in the southern lake district, and "red-birch" in Wellington, Nelson, and part of Otago. In common with the other species of *Fagus*, it is usually termed "tawhai" or "tawai" by the Maoris, but, as Mr. Colenso informs me, is specially distinguished as the "tawhai-rau-nui." It is the most important of all the New Zealand species, and has the widest distribution.

It was originally discovered in the North Island by Banks and Solander in 1749, when it received the MS. name of *Betuloides fusca*, but was not published until 1844, when it was figured in "Icones Plantarum" by Sir William Hooker under its present name. In the "Flora Novæ-Zelandiæ" Sir Joseph Hooker distinguished the form with obtuse teeth as variety *Colensoi*: in the "Handbook of the New Zealand Flora" the variety is mentioned without any distinctive name.

Fagus fusca is a noble tree, sometimes upwards of 100ft. high, with a trunk from 2ft. to 10ft. or more in diameter. In the early state the bark is white, smooth, and even, but on old trees it is deeply furrowed longitudinally, and in some localities has a rich-brown tint, which is easily distinguished at a distance, but is scarcely distinguishable at close sight; in other localities it is black or blackish-brown. Detached specimens form round-headed trees with spreading branches; but when growing in forests the trunks are straight and lofty, with few short branches. The branchlets and leaf-stalks are pubescent or almost hispid, and the leaves when young are clothed with soft hairs on the upper surface, and short glands beneath, which usually disappear with the growth of the leaf: each leaf has a pair of narrow brown stipules at its base, which fall away before the leaf is fully developed. The leaves, including the petiole, are from $\frac{3}{4}$ in. to $1\frac{1}{2}$ in. in length, and from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. in width; they vary greatly in shape, but are always wedge-shaped at the base, and may be acute or obtuse, or the mid-rib may be prolonged beyond the apex, forming a small point or apiculus: their texture is thin but firm, and the veins are usually prominent—a character by which it may easily be distinguished from the other New Zealand species. The upper portions of the margin are cut into sharp, rather large teeth: rarely the teeth may be obtuse, or reduced to slight marginal indentations.

The male flowers are arranged in fascicles, consisting of from two to four flowers, carried on a common flower-stalk springing from the axils of the leaves; the cup is membranous and hairy, funnel-shaped, with five obtuse teeth on its margin, and from eight to ten stamens. The female flowers are solitary; the involucrel cup is broader than in the other species, and contains four minute flowers, each with a three-celled ovary, and one ovule in each cell. In fruit the involucrel cup becomes woody, each of its four leaves carrying three or four

transverse plates, the upper margins of which may be entire or more or less toothed: the cup usually contains four nuts, one being often distorted and abortive; the others are three-sided, with a flat membranous wing produced from each angle.

In a strongly-marked variety, which I have named *dubia*, the veins are not prominent, the texture is rather thicker, and the leaf is narrow, with serratures restricted to the upper portion: at first sight it makes a closer approach to *F. Solandri* than to *F. fusca*.

PROPERTIES AND USES.

The wood of the tooth-leaved beech is red, straight, even, and compact in the grain, of great strength and toughness, and of great durability. It is of the highest value for railway-sleepers and piles, for wharves and bridges, as well as for house-blocks, fence-posts and rails, mine-props, caps and struts, &c. It is well suited for the framing, flooring-joists, and weather-boarding of houses, &c.: as it is easily worked it might be used for joiners' work. Mr. Blair mentions fences constructed of red-birch that have lasted from thirteen to fifteen years: I have, however, seen fences erected from twenty to twenty-four years which are still in good condition, and am satisfied that fences constructed of this timber would last forty years, if only good timber be used, and the posts proportioned to the weight of the rails—a point often neglected.

Well-grown trees split with the greatest ease, and with very little waste. I have seen trunks from 60ft. to 70ft. long split without a foot of waste, and am convinced that if required they could be split for their entire length without cross-cutting.

There can be no question as to the durability of this timber, but there appears some reason to think that its strength has been over-estimated.

In seven experiments to test the strength of this timber, as recorded by Balfour, the mean breaking weight was 202.5lb.: the maximum 250lb., and the minimum 122.5lb.

Mr. Blair records, as the results of ninety-nine tests, a mean breaking weight of 156.86lb., the maximum being 262.5lb., and the minimum 105lb. Forty of Mr. Blair's specimens were obtained from the west coast of the South Island, the others from the interior of Otago. The mean of both was almost identical, 156.91lb. and 156.83lb., but the maximum of the west-coast specimens was only 186lb., while that of the Otago specimens was 262.5lb. On the other hand the extreme minimum, 105lb., was shown by Otago specimens.*

The experiments by Mr. Blair confirm those by Balfour in showing the greater strength of specimens obtained from mountain localities. Balfour gives the mean of Wakatipu specimens as 232lb.; Blair, 192.79lb. There can be no doubt that specimens grown at elevations between 1,000ft. and 2,500ft. will be stronger and more durable than timber grown at low levels or in exceptionally moist districts. Although Mr. Blair's experiments show that the strength of tooth-leaved beech has been over-estimated by Balfour, they cannot at present be accepted as conclusive with regard to the extent of the error, which as stated is over 23 per cent. Mr. Blair's experiments were made with specimens obtained exclusively from the South Island, and nearly one-half from low levels. There is good reason for believing that if a series of specimens could be tested from mountain localities in Nelson, Wellington, and Hawke's Bay the discrepancy would be reduced nearly one-half: even if this should not be the case *Fagus fusca* must still be considered a timber of the highest value.

* Blair: Building Materials of Otago, p. 214.

According to Mr. Blair, the weight per cubic foot in the green state ranges from 39·620lb. to 68·909lb.; when seasoned, from 34·124lb. to 40·648lb. Boards 12in. wide and $\frac{1}{2}$ in. thick shrank from 0·92in. to 1·17in. in seasoning.*

It is worthy of remark that specimens of even the lowest specific gravity exhibit great durability. The planking of the old wharf at Picton is tooth-leaved beech, and scarcely heavier than totara, but has resisted wear and tear for twenty-one years, and is still in good condition.

DISTRIBUTION OF THE SPECIES.

Fagus fusca is endemic in New Zealand, and attains its extreme northern limit at Ahipara, from whence it extends to Southland, but is somewhat unevenly distributed. North of the Auckland Isthmus it is found in clumps or patches rarely containing more than a few hundred trees, and is sometimes solitary. It has not been observed on the Great Barrier Island or other outlying islands, except the Kawau, where a few trees are found. It has been destroyed on the Thames Goldfield, but is found at Te Aroha, and sparingly on the west coast between the Waikato River and the sea. In Hawke's Bay it forms forests often mixed with *F. Solandri* and *F. Menziesii*: these extend in a more or less interrupted state along the slopes of the Tararua and Rimutaka Mountains to Cook Strait. It is plentiful in all districts of the South Island, except Canterbury, where it is rare; a few trees are found on Banks Peninsula, and a remarkable belt exists at an elevation of between 2,000ft. and 3,000ft. between Bealey and the Poulter River, where it is mixed with *F. cliffortioides*.

The forests of this species in mountain districts of Otago and Southland are of great extent and value: the trunks are of great length and perfectly straight, although small, rarely exceeding 3ft. in diameter. The quality is excellent, and much superior to the same species growing at Catlin's River and the Blue Mountains. If properly conserved they will yield an enormous revenue to the colony a few years hence.

Mr. Colenso, F.R.S., is of opinion that the northern trees at Whangarei, Ahipara, &c., belonging to a species at present undescribed. An examination of fruiting specimens collected at Whangarei does not enable me to confirm this opinion.

DESCRIPTION.

Fagus fusca, Hook. f.

Hook., "Icones Plantarum," t. 630, 631.

An evergreen monoecious tree, 80ft. to 100ft. high. Branchlets and petioles pubescent. Leaves alternate; in the young state pubescent on the upper surface, glandular beneath, glabrous when old, stiff or sub-coriaceous, $\frac{3}{4}$ in. to 1 $\frac{1}{2}$ in. long, oblong-ovate or broadly ovate, cuneate at the base, acute or obtuse or apiculate, deeply serrate, teeth acute or obtuse or almost obsolete; stipules linear, deciduous. Male flowers axillary, solitary or in three- or four-flowered fascicles on a common peduncle; perianth membranous, downy, five-toothed; stamens, eight to twelve, exserted. Female flowers axillary; involucral cup four-lobed, each cup with three or four transverse lamellæ, margins entire or toothed; flowers, three or four, each with three stigmas. Fruit broadly ovate; nuts, three or four, trigonous, glabrous; margins winged.

Var. β , *Colensoi*. Leaves almost coriaceous; teeth obtuse.

Var. γ , *obsoleta*. Leaves sub-membranous or coriaceous; margins slightly indented or sinuate.

* Blair: Building Materials of Otago, p. 224.

Var. δ , *dubia*. Leaves almost coriaceous, oblong, cuneate at the base; teeth very shallow, obtuse, confined to the upper portion of the leaf. Fruit rather narrow.

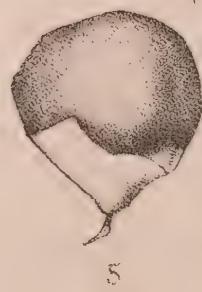
EXPLANATION OF PLATES XC. AND XCI.

XC. *Fagus fusca*, Hook. f. 1. Flowering specimen drawn from a specimen collected in the Rimutaka Mountains. 2. β , *Colensoi*. Fruiting specimen, drawn from a specimen collected at Mungaroa. Both natural size. 3. A male flower. 4. Involucral cup. 5. Carpels. 6. An abortive fruit. All magnified. 7. A seedling plant, natural size.

XCI. *Fagus fusca*, Hook. f. Var. δ , *dubia*. Fruiting specimen, natural size. 1. A male flower. 2. A fruit. 3. Carpels. All magnified. 4. Var. γ , *obsoleta*, natural size.



Titoki.
(ALECTRYON EXCELSUM.)



Titoki
ALECTRYON EXCELSUM

T. Kirk. DIXKIT

SURVEY DEPT. 1887

ALECTRYON EXCELSUM, De Candolle.

THE TITOKI.

ORDER—SAPINDACEÆ.

(Plates XCII. and XCIII.)

MR. COLENZO informs me that the titoki is often called "titongi" by the Maoris, the former being a northern, the latter a southern name; and I learn from the Ven. Archdeacon W. L. Williams that it is also known as the "tokitoki." It is sometimes termed "the New Zealand ash," doubtless on account of its resembling that tree in the shape of its foliage and the toughness of its wood, but it is most generally known as "the titoki."

It was one of the earliest trees discovered by Europeans, and received the MS. name of *Euonymoides excelsa* from Banks and Solander. It was described under its present name by De Candolle in the first volume of his "Prodromus."

The titoki is a handsome evergreen tree, from 40ft. to 60ft. high, with a trunk sometimes 3ft. in diameter, but usually smaller. Its branchlets, leaves, inflorescence, and fruit are clothed with a fine dense coat of minute brown hairs, which gives it a rusty appearance when the leaves are young; but as the leaves approach maturity the hairs gradually disappear from the upper surface.

The leaves are alternate, from 5in. to 10in. long, and consist of from nine to thirteen stalked leaflets from 2in. to 4in. long, and from $\frac{3}{4}$ in. to $1\frac{1}{2}$ in. wide: they are gradually narrowed towards the apex: the margins may be entire or obscurely toothed, or with a few distant acute teeth. In the young state the leaflets are irregularly lobed, or sometimes sharply serrate.

The flowers are arranged in slender panicles, which are from 4in. to 12in. long, and are irregularly branched. Perfect and unisexual flowers may be produced on the same tree, or even on the same panicle: each flower is carried on a short pedicel, and occasionally two or more spring from the same point. The calyx is a shallow cup with short teeth; the corolla is not developed: the stamens are usually six, seven, or eight in number, and, from their blackish-red colour, render the flowers somewhat conspicuous: the filaments are scarcely developed at first, so that the anthers appear to be sessile, but they increase in length during the expansion of the flower. The ovary is small and inconspicuous, being almost hidden by a dense coat of brown hairs: it is one-celled and contains a single ovule. The fruit is both singular and handsome: when ripe it is $\frac{1}{3}$ in. long, and almost woody, with a flattened crest on the upper portion, terminating in a spur-like prominence on one side: when the seed is ripe the fruit-vessel becomes ruptured transversely, but not along any definite line. It is one-celled, and contains a single pear-shaped black seed, which is surrounded by a bright-scarlet fleshy cup, termed an "aril," and has a granulated surface: the fiery scarlet of the aril and the glossy jet-black seed form a pleasing contrast, which is harmonized by the deep-russet pubescence of the fruit-vessel.

The flowers are produced during the months of November and December: the fruit requires a year to arrive at maturity, so that flowers and ripe fruit may be found on the tree at the same time.

PROPERTIES AND USES.

Although the titoki does not afford a durable timber under exposure, it is justly valued on account of its great strength, toughness, and elasticity, while it is straight in the grain, even, compact, and easily worked: it is of a light-reddish colour, and destitute of figure.

Its specific gravity varies from .904 to .929, its weight per cubic foot from 56.31lb. to 57.94lb., and its breaking weight from 246lb. to 250lb.; but as only three specimens were tested it is hardly probable that maximum results were obtained.*

It is suitable for purposes which demand great strength and elasticity, but do not involve any great amount of exposure to the weather. It is highly valued for bullock-yokes: with the exception of mangiao it is perhaps the best of all New Zealand timbers for that purpose: it is excellent for axe-handles and for the handles of carpenters' tools, for swingle-trees, for light framing for machinery, and for some purposes of the cabinetmaker; but it is most highly esteemed by the wheelwright and coachbuilder, being used for light spokes, felloes, hubs, panels, and bent ware. It is also suitable for the manufacture of the woodwork of many kinds of agricultural implements.

DISTRIBUTION.

Alectryon comprises only a single species, which is endemic in New Zealand. It is common in lowland woods or on their margins throughout the North Island, and, crossing Cook Strait, finds its southern limit on Banks Peninsula on the east coast, and between Hokitika and Ross on the west coast.

Although essentially a lowland plant it ascends from the sea-level to upwards of 2,000ft.

DESCRIPTION.

Alectryon excelsum, DC.

Hook., "Icones Plantarum," t. 570.

An erect tree, from 40ft. to 60ft. high, with black bark. Branchlets, leaves, inflorescence, and fruit clothed with russet pubescence. Leaves alternate, exstipulate, unequally pinnate, 4in. to 12in. long; leaflets shortly petioled, 2in. to 4in. long, entire, oblique at the base, ovate-lanceolate, acute or acuminate, entire or obscurely crenate, or with distant obscure teeth, or serrate. Flowers in axillary panicles, 4in. to 10in. long, branches slender; flowers pedicelled; calyx inferior, five-lobed; petals none; stamens six to eight, inserted between the lobes of the disk; ovary hirsute, one-celled, with a short style. Fruit, $\frac{1}{3}$ in. long, globose, gibbous, with a flattened ridge on one side, terminating in a spur at the back; indehiscent. Seed solitary, broadly pyriform, black, shining, surrounded at its base by a fleshy scarlet granulated arillus. The cotyledons are spirally folded.

EXPLANATION OF PLATES XCII. AND XCIII.

XCII. *Alectryon excelsum*, DC. Leaf and flowering panicle, natural size. 1. Flower showing stamens before dehiscence. 2. The same after dehiscence. 3. Ovary. All magnified.

XCIII. *Alectryon excelsum*, DC. Fruiting specimen, natural size. 1. Ripe fruit. 2. Fruit undergoing dehiscence. 3. Lower portion of the pericarp after the removal of the seed. 4. Seed with arillus at its base. 5. Seed. 6 and 7. Longitudinal sections of a seed. 8. Embryo.

* Balfour: Experiments on the Strength of New Zealand Timbers.



MYRTUS RALPHII.

MYRTUS RALPHII, Hook. f.

THE SMALL-LEAVED RAMARAMA.

ORDER—MYRTACEÆ.

(Plate XCIV.)

THIS charming plant was discovered by Dr. Ralph, formerly of Wellington, and originally described in the supplementary portion of the "Flora Novæ-Zelandiæ," published in 1853. It usually forms an evergreen shrub, but occasionally becomes a small tree, rarely exceeding 20ft. in height, with a trunk 6in. in diameter. It is closely related to *Myrtus bullata*,* Banks and Solander, but is smaller in all its parts.

Its branchlets are slightly hairy, and the leaves are opposite, about $\frac{3}{4}$ in. long and $\frac{1}{2}$ in. wide, narrowed into short leaf-stalks; the surface is usually plane, although sometimes slightly tumid, but never to so great an extent as those of *M. bullata*. The flowers are $\frac{1}{2}$ in. across, solitary, and carried on peduncles from $\frac{1}{2}$ in. to 1in. long or more: their structure is the same as that of the flowers of *Myrtus obcordata*,† already described. The red fruit is rounded, crowned with the remains of the calyx, and contains from two to four bony seeds. The leaves, flowers, and fruit in the young state are more or less dotted with pellucid glands.

It is the rarest of the New Zealand myrtles, and produces its charming flowers in great profusion during the months of December and January.

PROPERTIES AND USES.

The wood of *Myrtus Ralphii* is of small dimensions, but very strong, tough, and elastic; it is of a red colour, prettily streaked and mottled, and is suitable for ornamental turnery, inlaying, &c.; it is valued for the handles of axes, carpenters' tools, and similar purposes. It is easily cultivated, and deserves a place in every collection of flowering and ornamental shrubs.

DISTRIBUTION OF THE GENUS.

See under *Myrtus obcordata*, Hook. f., p. 127, *ante*.

DISTRIBUTION OF THE SPECIES.

Myrtus Ralphii has the most restricted distribution of all the New Zealand myrtles, and is at the same time the most local in its area. Its northern limit so far as known is at the south head of the Manukau Harbour: it occurs in Hawke's Bay, and is most plentiful in the southern portion of the Wellington District. In the South Island it is not infrequent in the Pelorus and in Queen Charlotte Sound, Marlborough, but is restricted to the Matai Valley in the Nelson District.

It ascends from the sea-level to about 1,200ft.

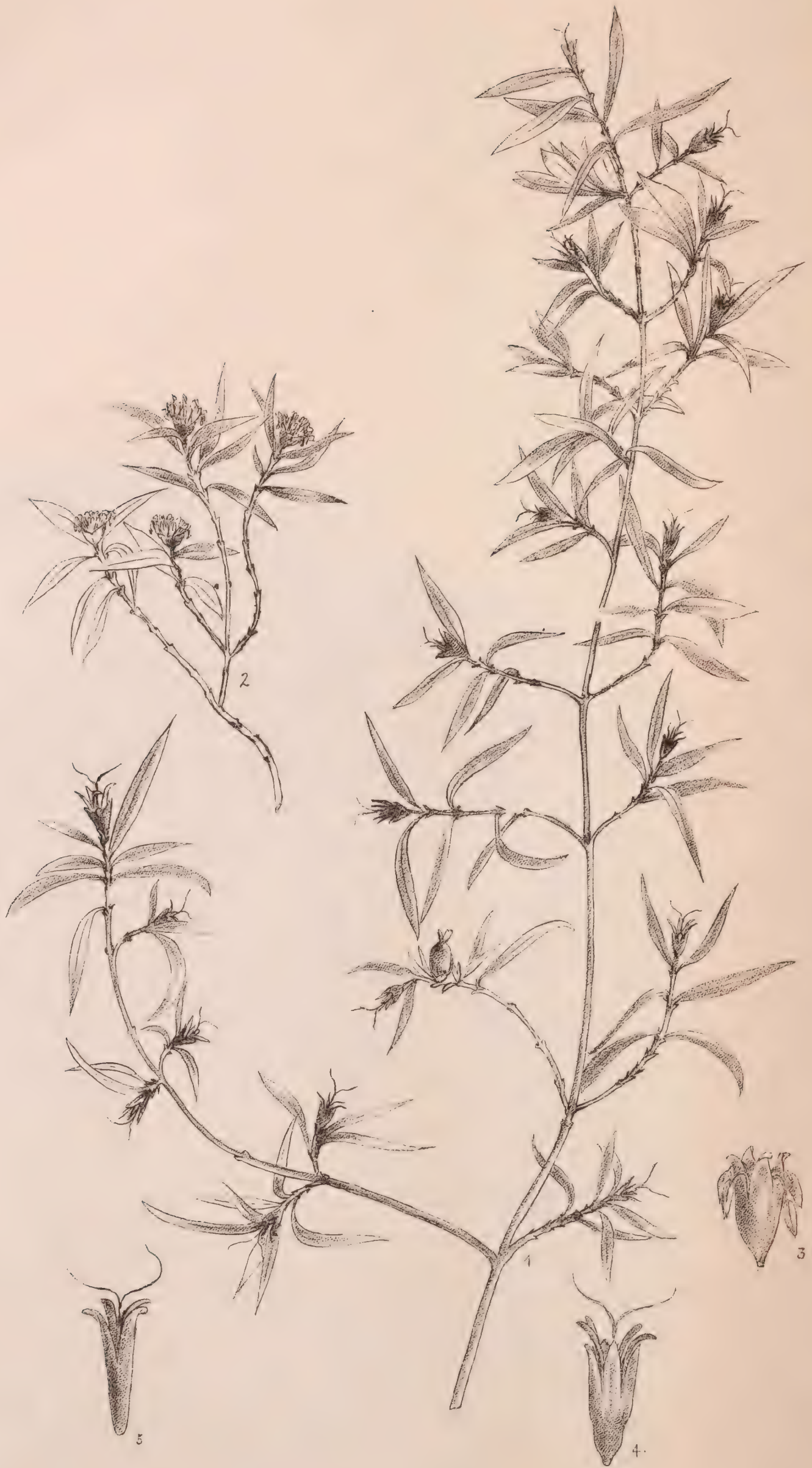
DESCRIPTION.

Myrtus Ralphii, Hook. f.

A much-branched shrub, or rarely a small tree, 25ft. high. Branchlets pubescent. Leaves opposite, shortly petioled, broadly ovate or orbicular-ovate, acute or obtuse, surface plane or rarely slightly tumid between the veins. Flowers axillary, solitary; peduncles $\frac{3}{4}$ in. to $1\frac{1}{2}$ in. long. Calyx superior, turbinate; sepals four; petals four; style slender; ovary two-celled. Fruit urceolate, with two or four bony seeds.

EXPLANATION OF PLATE XCIV.

Myrtus Ralphii, Hook. f. Flowering specimen, natural size. 1. Flowers. 2. Fruit. 3. Transverse section of fruit. All magnified.



COPROSMA LINARIIFOLIA

COPROSMA LINARIIFOLIA, Hook. f.

THE YELLOW-WOOD.

ORDER—RUBIACEÆ.

(Plate XCV.)

ALTHOUGH the yellow-wood is widely distributed, its Native name is unknown to settlers, even to those versed in Maori lore. In Otago it is known as "miki-miki," but this name is applied to *C. fœtidissima* on Stewart Island: by woodmen it is frequently termed "mingi," which is, Mr. Colenso informs me, the Native name of *Cyathodes acerosa*: the same name is applied to *Coprosma Colensoi*, but I am unable to say whether correctly or not. In Otago, where this species attains its largest dimensions, it is known as "yellow-wood" or "yellow karamu" on account of the colour of the wood.

Coprosma linariifolia varies from a low-growing shrub branched from the base to a small tree 25ft. high, with a trunk sometimes 9in. in diameter, but usually smaller. The leaves are opposite, rarely exceeding 1½in. in length, very narrow, smooth, and entire, carried on very short leaf-stalks: the stipules are united, very long, and sheathing, giving the branchlets a peculiar jointed appearance. The male and female flowers are produced at the tips of branchlets on different plants: the former are collected into small heads or fascicles, usually containing three or four flowers, but are sometimes two- or five- or even six-flowered: each fascicle has a kind of involucrel cup at its base, but the flowers are destitute of a calyx: the corolla is bell-shaped, four- or five-lobed, with the tips of the lobes slightly curved outwards: the stamens are four or five in number, with slender filaments. The female flowers are solitary and seated in an involucrel cup resembling that of the male fascicle, with two or, rarely, four lobes, which are narrow and obtuse: the calyx is unusually developed, having four narrow obtuse lobes longer than the cup. The ovary is two-celled, tipped with two stigmas. The fruit is a two-seeded berry, at first whitish and translucent, becoming black when fully ripe, and crowned with the remains of the calyx.

It resembles some states of *C. propinqua*, A. Cunn., but is easily recognised by its sheathing stipules, the large calyx of the female flower, and the fruit, which always bears the remains of the calyx.

PROPERTIES AND USES.

The wood is smooth, even, and compact: it is of a deep-yellow colour, which renders it useful to the cabinetmaker for inlaying and other purposes.

DISTRIBUTION OF THE GENUS.

See under *Coprosma Baueriana*, p. 109, *ante*.

DISTRIBUTION OF THE SPECIES.

Coprosma linariifolia is plentiful in mountainous districts from the upper part of the Thames Valley to Southland, but is somewhat local in the North Island.

It occurs in all the districts of the South Island, and ascends from the sea-level to nearly 3,000ft.

DESCRIPTION.

Coprosma linariifolia, Hook. f., "Handbook of the New Zealand Flora," p. 118.

C. propinqua, A. Cunn. Var. γ , *linariifolia*, Hook. f., "Flora Novæ-Zelandiæ," i., p. 109.

A shrub or small tree, rarely 25ft. high; branches slender, puberulous, when young. Leaves opposite, shortly petioled, glabrous, linear or linear-lanceolate, acute, $\frac{3}{4}$ in. to $1\frac{1}{2}$ in. long, rarely exceeding $\frac{1}{4}$ in. wide, slightly coriaceous. Stipules puberulous, ciliate, connate, more or less sheathing the branchlet. Flowers terminating branchlets. Male, in two- to five-flowered fascicles, seated in an involucre formed of two or, rarely, four linear foliaceous bracts, connate by their expanded bases, which are sometimes lobulate, with a pair of sheathing stipules beneath; calyx none; corolla campanulate, four- or five-lobed, lobes reflexed; stamens, four or five, exserted. Female, solitary, involucre as in the male; calyx equalling the corolla, deeply cleft into four linear-oblong lobes; corolla $\frac{1}{10}$ in. to $\frac{1}{8}$ in. long, tubular; lobes narrow. Drupe ovoid, two-seeded, at first translucent, ultimately black, crowned with the remains of the calyx.

EXPLANATION OF PLATE XCV.

- Coprosma linariifolia*, Hook. f. 1. Flowering specimen of the male plant. 2. Flowering specimen of the female plant. Both natural size. 3. Male flower. 4. Female flower. 5. The same with the involucre removed. Magnified.



Manoao.

(DACRYDIUM COLENSOI).

A. Leaves of young plant.

B. Mature state.

C. D^o with male flowers.

DACRYDIUM COLENZOI, Hooker.

THE MANOAO.

ORDER—CONIFERÆ.

TRIBE—TAXEÆ.

(Plates XCVI. and LXXXIIA. in part.)

THIS remarkable mountain-pine was originally discovered in Dusky Bay by Dr. Menzies in 1791, who collected young plants without fruit, one of which was figured by Sir William Hooker in "Icones Plantarum" under the name of *Podocarpus ? biformis*; but it was at least fifty years later before fruiting specimens were collected in the Ruahine Mountains and in the Tongariro district by Mr. Colenso, when the plant was figured in "Icones Plantarum" under the name of *Dacrydium Colensoi*. Unfortunately the specimens were confused at Kew with the plant now known as *D. Kirkii*, collected by Mr. Colenso on "high hills near the eastern coast of the North Island," and no mention was made of the remarkable dimorphism of the foliage, although the possibility of its being identical with the plant previously figured as *Podocarpus ? biformis* had evidently presented itself to the mind of the writer. The drawing of *D. Colensoi* in "Icones Plantarum" represents a specimen with solitary fruits: in *D. Kirkii* the fruits are aggregated in threes, fours, or fives near the tips of the branchlets: the present species is termed "yellow-pine" and "tar-wood" by the Otago bushmen.

Dacrydium Colensoi is a small tree, from 20ft. to 40ft. high; the trunk is usually short, and from 1ft. to 2ft. or rarely 3ft. in diameter, clothed with a thin dark-grey or blackish bark, nearly smooth, and about $\frac{1}{4}$ in. in thickness, falling away in thin flakes. The trunk is very short, usually from 6ft. to 10ft. high, crowned with spreading branches: frequently it is branched from the base. In exposed situations at great elevations the plant is sometimes reduced to a mere bush, 3ft. high, and bears a strange resemblance to *Veronica tetragona*. The branches are robust, and marked with the scars of old leaves; they are usually spreading, forming a rounded head, but occasionally they are short and ascending, when the tree assumes a conical appearance. This species is remarkable for its dimorphic foliage: in the young state and on the lower branches of many old trees the leaves are scattered, $\frac{1}{3}$ in. to $\frac{1}{2}$ in. long, $\frac{1}{15}$ in. wide, and carried on very short leaf-stalks, flat and spreading, with a distinct mid-rib. On the upper branches of old trees they are short, $\frac{1}{20}$ in. to $\frac{1}{12}$ in. long, nearly triangular, closely appressed to the branches and overlapping each other, and with a very stout outer rib or keel. These leaves are persistent for many years, and increase in width with the growth of the branch, at length becoming woody in texture and distorted in shape. The young leaves pass almost abruptly into those of the mature state, as may be seen by a reference to the lowest figure in Plate XCVI.; and the branchlets with mature leaves are four-angled in outline. The male and female flowers are produced on separate trees: the male catkins being solitary on the tips of branchlets, very short, oblong, each consisting of about six anthers. The female flowers have only been seen in an immature state; they are solitary, or

rarely in twos, at the tips of branchlets. The fruit has only been met with in an immature condition, and consists of a small nut seated on a coriaceous receptacle, apparently without a membranous inner cup. The branchlets vary considerably in thickness, and in exposed situations the leaves of the mature state are more strongly keeled than those of plants growing in sheltered places. Speaking generally, the branchlets and leaves of plants growing on the West Coast are more slender than those of eastern specimens. All parts of the plant are resinous, and the leaves of the mature state are dotted with resin-glands.

PROPERTIES AND USES.

The wood of *Dacrydium Colensoi* is straight in the grain, even, and compact, of a yellowish-brown colour, destitute of figure, but silky and easily worked. It is of great strength and extreme durability, especially when used for posts and sleepers. Mr. Buchanan, F.L.S., informed me that it formerly grew in considerable quantity near Dunedin, and was converted for general building purposes and furniture under the name of yellow-pine. It is rarely placed on the market, but in out-districts is employed for house-blocks, sleepers, fencing, and more rarely for building purposes and the manufacture of furniture: shepherds occasionally extract tar from its branches. Its dimorphic foliage and remarkable appearance render it valuable for ornamental planting, but its growth is very slow.

DISTRIBUTION OF THE GENUS.

See under *Dacrydium cupressinum*, p. 29, *ante*.

DISTRIBUTION OF THE SPECIES.

This species is endemic in New Zealand, and appears to find its northern limit on the Ruahine Ranges: it occurs chiefly at altitudes above 3,000ft. on Tongariro, Ngaurahoe, Ruapehu, and the Tararua Ranges, in the North Island: it is, however, somewhat local. It is more plentiful on the mountains of the South Island, especially those of Canterbury and Otago. Travellers by the West Coast Road from Christchurch to Hokitika can scarcely fail to observe it on Arthur's Pass at an altitude of 3,000ft. It is plentiful in several localities on Stewart Island, and I was informed by Mr. Walker that a small grove existed on the west coast of that island, some of the trunks being fully 3ft. in diameter.

It ascends from the sea-level to 4,000ft., and upwards.

DESCRIPTION.

Dacrydium Colensoi, Hook., "Icones Plantarum," t. 548.

Podocarpus ? biformis, Hook., "Icones Plantarum," t. 544.

A diœcious tree, 20ft. to 40ft. high, resinous in all its parts. Branches stout, marked with the scars of old leaves. Leaves dimorphic: on young plants scattered, linear, spreading, flat, acute, costate, $\frac{1}{3}$ in. to $\frac{1}{2}$ in. long, $\frac{1}{15}$ in. broad, narrowed into a short broad petiole; on mature branches quadrifariously imbricated, triangular or ovate-oblong, stoutly keeled, obtuse, $\frac{1}{20}$ in. to $\frac{1}{10}$ in. long, sometimes becoming woody and persistent. Ultimate branchlets tetragonous. Male catkins terminal, oblong, about $\frac{1}{3}$ in. long; anthers few, broad; connective obtuse. Female flowers only seen in an immature state, solitary or in twos. Fruit (immature), one or two near the tips of the branchlets. Nut small, seated on a coriaceous cup-shaped receptacle.

EXPLANATION OF PLATES XCVI. AND LXXXII. (IN PART).

XCVI. *Dacrydium Colensoi*, Hook. Branches from a young plant, and from a mature plant with male catkins. All natural size.

LXXXA. 1. *Dacrydium Colensoi*, Hook. 1. Male catkin. 2. Anther, side view. 3. Anther, front view. 4. Leaves. All magnified.



Manoao — Barrier Pine.
(DACRYDIUM KIRKII).

- 1. Mature state with fruit, etc.
- 2. Leaves from young plant.

J. H. B. BOGART.

DACRYDIUM KIRKII, F. Mueller.

THE MANOAO.

ORDER—CONIFERÆ.

TRIBE—TAXEÆ.

(Plates XCVII. and LXXXIIA. in part.)

THIS species was originally discovered by Mr. Colenso in 1841, but, as already stated, was for many years confused with *Dacrydium Colensoi* until published by Professor Parlatore in his revision of the *Coniferae* for De Candolle's "Prodrromus:" the specific name having been given by Sir Ferdinand Baron von Mueller, to whom specimens were sent in 1868.

It is a handsome pyramidal or conical tree, attaining the extreme height of 100ft., with a trunk sometimes 4ft. in diameter, but usually much smaller: it is clothed with light-brown bark. As in the preceding species, the foliage is of two kinds, but the difference is of a still more striking character. The lower branches are spreading, the upper ascending or erect, the ultimate branchlets forming fan-shaped masses. The lower branches are clothed with long narrow flat leaves, sometimes to the height of 4ft.; the upper branches are clothed with closely-appressed leaves; so that the lower part of the tree resembles a silver-fir, while the upper part puts on the appearance of a cypress. The large leaves change into those of the fully-mature state with great abruptness, both forms being often found on the same branch or even on the same branchlet. The leaves on sterile branches are from 1in. to 1½in. long, rather less crowded than in *D. Colensoi*, but wider and spreading, flat, acute, and shining, with midrib and veins distinct, and the margins slightly thickened: the short leaf-stalks have a curious half-twist. The fertile branches with the appressed leaves are almost cylindrical, and the leaves are broadly rhomboidal, $\frac{1}{15}$ in. long, slightly keeled, and with a membranous margin. The branches are faintly marked with old leaf-scars; the leaves being persistent for a short time only, and never becoming woody.

The male catkins are solitary, smaller than in *D. Colensoi*, and sessile at the tips of branchlets; the connective is longer and narrower than in the preceding species. The female flowers have not been seen in good condition, but are arranged near the tips of the branchlets, each being seated on a coriaceous receptacle formed of a modified leaf, which, as the ovule matures, becomes thick in texture, broad, and abruptly narrowed to a short point. In many cases the base of the nut is invested by a fleshy orange-coloured envelope, which is often entirely wanting. The nuts are obtuse, much larger than those of *D. Colensoi*.

The plant is resinous in all its parts.

The following table shows the chief points of difference between *Dacrydium Kirkii* and *D. Colensoi*:—

	<i>D. Kirkii.</i>	<i>D. Colensoi.</i>
Stature	... 40ft. to 100ft.	20ft. to 40ft.
Habit	... Trunk straight. Branches short.	Trunk short or almost absent. Branches long, spreading.
Linear leaves	... Abundant even on large trees.	Few, chiefly confined to young trees, or, rarely, given off from the base of the trunk of old trees.
Branches	... Faintly marked with scars of old appressed leaves. Leaves never woody.	Strongly marked with the scars of old leaves, or the leaves persistent and of woody texture.
Branchlets	... Nearly cylindrical.	Tetragonous.
Imbricating leaves	Faintly keeled.	With a prominent keel.
Male catkins	... Small, broad, black.	Larger, oblong, brown.
Female flowers	... Aggregated.	Solitary or, rarely, in twos.
Nuts	... Large, compressed, furrowed.	Small.

Sir Ferdinand von Mueller suggests that *Dacrydium Kirkii* should be referred to *Pherosphaera* on account of the frequent non-development of the disc; but the fruit and scales of the male catkin agree with those of *Dacrydium* too closely to allow the adoption of this course.

PROPERTIES AND USES.

The wood of the manaoa is of a light-brown colour, with a minute figure, very compact, even, dense, strong, elastic, and of extreme durability: it takes a high polish. It is of the highest value, but unfortunately, from its great rarity, it is scarcely known in commerce. Some years ago it was occasionally converted on the Great Barrier Island, and placed on the Auckland market as "Barrier pine." It was also converted at Whangaroa to a small extent only, and it has now become a matter of some difficulty to obtain specimens owing to the tree having been destroyed in accessible situations by the progress of settlement.

Mr. H. S. Wilson informs me that a post of this timber, which is known to have been erected a century ago, is still standing in good condition in the fence of an old Maori pa at Whatitiri, Poroti.

It is a highly valuable tree for the ornamental planter and landscape gardener.

DISTRIBUTION OF THE SPECIES.

This appears to be the rarest and most local species of the genus, being restricted to the extreme northern portion of the North Island, and is most frequent in the forest country between the Bay of Islands and Hokianga. It has been observed in several localities in the Hokianga district and the Upper Wairoa, Whangaroa (North), Bay of Islands, Cape Brett, Whangarei, Great Barrier Island, and Titirangi, but in some of these localities only a few solitary trees are found: in the Titirangi, where it reaches its southern limit, I believe only a single tree is known. It is usually thinly scattered amongst other trees, but is said to be the chief tree in a large forest in the Purua district.

It is endemic in New Zealand.

DESCRIPTION.

Dacrydium Kirkii, F. Mueller.

Parlatore, in De Candolle's "Prodromus," Vol. xvi., part ii., p. 495.

Hook. f., "Icones Plantarum," t. 1, 219.

A pyramidal or conical diœcious tree, 40ft. to 100ft. high; trunk, 2ft. to 4ft. in diameter. Leaves dimorphic: on sterile branches, 1in. to 1½in. long, ¼in.

wide, erecto-patent, flat, acute or subacute, coriaceous, costa and veins distinct, margins slightly cartilaginous. Fertile branches subcylindrical; leaves closely imbricated, $\frac{1}{15}$ in. long, broadly rhomboid, with a membranous margin, obtuse. Male catkin solitary, terminal, sessile, $\frac{3}{8}$ in. long, connective triangular, narrow, subacute. Female flowers, three to five, aggregated near the tips of branchlets. Receptacular scale broadly ovate, apiculate, coriaceous, with or without a thick almost fleshy inner coat in fruit. Nut oval, compressed, keeled on the upper margin, obtuse, deeply furrowed, truncate at the base.

EXPLANATION OF PLATES XCVII. AND LXXXIIA. (IN PART).

XCVII. *Dacrydium Kirkii*, F. Mueller. 1. Fruiting specimen. 2. Branch with linear leaves. Both natural size. 3. Portion of branchlet. 4. Tip of a branchlet with nearly ripe fruit. 5. Outline of nut, side view. 6. The same, front view. All magnified.

LXXXIIA. 5. *Dacrydium Kirkii*, F. Mueller. 1. Male catkin. 2. Side view of an anther. 3. Outer face of the same. All magnified.





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PHYLLOCLADUS GLAUCA, Carrière.

THE TOATOA.

ORDER—CONIFERÆ.

TRIBE—TAXEÆ.

(Plates XCVIII. and XCIX.)

WHEN speaking of this fine tree Sir Joseph Hooker enthusiastically designated it "the most charming of all the New Zealand pines"—a tribute of admiration well merited by its beauty and attractiveness. Although extremely local in its distribution and restricted to a narrow area, it is singular that it should have escaped the notice of botanists until a very recent period. It was described as *Phyllocladus glauca* about 1865 by Carrière, but so little was known about it that it was supposed to have come from Tasmania.* Fruiting specimens were first collected by the writer during 1865, but its diœcious character was not detected until 1867. Specimens collected on the Great Barrier Island at that date were forwarded to Professor Parlatore, who considered it to be a variety of *P. trichomanoides*, and described it as var. β , *glauca*, of that species, in his review of the *Coniferæ* for De Candolle's "Prodromus." A more detailed description was given by the writer in 1877.

The old Maoris in the North distinguished it as "toatoa," a name also applied to the next species, *P. alpinus*; but the younger Maoris term it "tane-kaha," confusing it with *P. trichomanoides*.

The toatoa is a handsome tree, 20ft. to 40ft. high, with a trunk 12in. to 18in. in diameter, and remarkably stout branches, which are frequently whorled. As stated under *P. trichomanoides*,† in this genus true leaves are only produced in the young state: they are from $\frac{1}{2}$ in. to $\frac{3}{8}$ in. long, and about $\frac{1}{8}$ in. broad, flat and rounded at the tip, or, rarely, terminating in a sharp point: they usually fall away before the third year. Leaves of a similar character, but rather broader, are produced at the base of new terminal shoots in the early spring, but disappear very quickly. The large foliaceous expansions which resemble ordinary pinnate leaves are termed "cladodes," and are in reality strangely-modified branchlets; which is proved by the female plants producing flowers and fruit in their place, or, rarely, on their margins. The cladodia are arranged on each side of a rhachis, which is a modified branchlet from 5in. to 1ft. in length: these modified branchlets are developed in whorls, and are mostly abortive; but usually the rhachis of one or more cladodes of a whorl becomes elongated, forming a new branch with a new whorl at its apex, and the following spring the process is repeated from the new whorl. From five to ten form a whorl, each cladode presenting the appearance of a pinnate leaf, with from five to eight pairs of cladodes, with or without a solitary terminal cladode: they vary in size from $\frac{3}{4}$ in. to 2in. long, and from $\frac{1}{2}$ in. to 1 $\frac{1}{2}$ in. broad: they are of a pale bluish-green when young, rhomboid in shape, lobed or toothed, and narrowed into a short stalk at the base, excessively thick and leathery in texture, with veins arranged

* Trans. N.Z. Inst., x., p. 380.

† See page 9, *ante*.

in a fan-shaped manner. The male and female flowers are produced on different trees. The male catkins are crowded at the tips of the branches, and carried on straight stout foot-stalks, each springing from the axil of a membranous leaf; including the pedicels, they are from 1in. to 2in. long. The female cones are produced on the terminal cladodes, usually three to six on each side, occupying the place of the lower lateral cladodes, and carrying from ten to twenty ovules, each embedded in a coriaceous or fleshy cup, and arranged in a spiral manner. In fruit the cone becomes woody, and attains the size of a small hazel-nut, the nuts projecting beyond the outer surface for one-half their length.

PROPERTIES AND USES.

The wood of the toatoa is white, remarkably straight in the grain, and, like that of the tanekaha, of great strength, toughness, and elasticity. As it is only found in situations difficult of access, it has not been utilised except for temporary purposes, and nothing is known as to its durability. In all probability the bark and phyllodes would prove of equal value with those of the tanekaha for tanning purposes.

Phyllocladus glauca is easily cultivated. The fan-shaped arrangement of the veins of the cladodes is similar to that of *Salisburia adiantoides*, and its habit is at once striking and beautiful.

DISTRIBUTION OF THE GENUS.

See under *Phyllocladus trichomanoides*, p. 9, *ante*.

DISTRIBUTION OF THE SPECIES.

Phyllocladus glauca is endemic in New Zealand, and appears to be confined to the Auckland District. It attains its northern limit between Mongonui and Ahipara, and occurs freely in many parts of the Whangape and Hokianga districts; in the Kauaeoruruwahine, Omahuta, and Waikorapupu forests; more sparingly at Maungatawhiri and other places in the Whangarei district; at Great Omaha, Titirangi, Wairoa East, the Great Barrier Island, Cape Colville Peninsula, and the Thames Goldfield to Te Aroha; and appears to find its southern limit on the Patetere plateau.

It ascends from the sea-level to nearly 3,000ft.

DESCRIPTION.

Phyllocladus glauca, Carrière.

Carrière, "Conifères," p. 502.

P. trichomanoides, Don. Var. β , *glauca*.

Parlatore, in De Candolle's "Prodromus," Vol. xvi., part ii., p. 498.

A diœcious tree, 20ft. to 40ft. high; trunk, 12in. to 18in. in diameter; branches stout; true leaves on young plant linear, membranous, scattered, obtuse or acute; scale-leaves similar but broader, recurved. Cladodia distichous on a rhachis 5in. to 12in. long; one or two rhachites at the end of a branch becoming produced into new branches, each developing a whorl of rhachites; cladodia glaucous when young, very coriaceous, $\frac{3}{4}$ in. to 2in. long, rhomboid or obliquely ovate, cuneate, narrowed into a short stalk, lobed or toothed; teeth obtuse. Male catkins, ten to twenty, on rather stout peduncles, crowded at the tips of the branchlets, peduncles equalling the catkins or longer, with one or two minute bracts; connective broadly oblong. Female cones distichous, shortly peduncled, four to six on each side of the lower part of the

rhachis, ovoid, $\frac{1}{2}$ in. long; ovules ten to twenty, sunk in a coriaceous or fleshy cup. Cone excessively coriaceous in fruit; nuts, ten to twenty, arranged spirally, the base of each invested with a membranous envelope.

EXPLANATION OF PLATES XCVIII. AND XCIX.

XCVIII. *Phyllocladus glauca*, Carr. 1. Specimen with male flowers, natural size. 2. An anther viewed from above. 3. Side-view of the same. 4 and 5. Outer and inner face of the same. All magnified.

XCIX. *Phyllocladus glauca*, Carr. 1. Fruiting specimen. 2. Female flower. Natural size. 3. The same. 4. Transverse section of the same. Both magnified. 5. Female cone, natural size. 6. The same, magnified. 7. Transverse section of the same, natural size. 8. Transverse section, magnified. 9. Nut, magnified.





Mountain toa-toa. (*Phyllocladus alpinus*).

1. Young plant shewing true leaves.

2. Mature state with fruit.

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PHYLLOCLADUS ALPINUS, Hook. f.

THE MOUNTAIN TOATOA.

ORDER—CONIFERÆ.

TRIBE—TAXEÆ.

(Plate C.)

THIS species is most plentiful in mountain districts, and is most generally known in the South Island as "toatoa," but is frequently termed "tanekaha:" by settlers and bushmen it is called "celery-pine" or "celery-topped pine," and in Southland "New Zealand hickory." It was originally discovered by Mr. Bidwill on Tongariro, and soon afterwards by Mr. Colenso on the Ruahine Mountains. It forms a bush or small tree, from 5ft. to 25ft. high, with numerous short stout branches: the trunk rarely exceeds 1ft. in diameter. True leaves are produced on young plants only, and are narrow-linear, acute, about $\frac{1}{3}$ in. long: these are succeeded by narrow rhomboid cladodes $1\frac{1}{2}$ in. long and from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. wide, of thick texture, narrowed into a short foot-stalk, and with the margins finely toothed, the teeth acute or obtuse: on older specimens the cladodes become shorter, narrower, with thickened margins and in many cases deeply cut into very narrow lobes.

Male and female flowers are produced on the same trees: the male catkins in clusters of from three to seven at the tips of branches, sessile or on short pedicels, connective obtuse, red: the female flower forms small cones, each consisting of two or three naked ovules in a fleshy cup. In the ripe fruit the cones are a bright crimson, with two or three nuts, each invested with a membranous cup at its base.

This species is closely related to the Tasmanian *P. rhomboidalis*, with which it should perhaps be united.

PROPERTIES AND USES.

The wood is white, straight-grained, and, although of small dimensions, equals if it does not surpass that of *P. trichomanoides* in strength, toughness, and elasticity; but as it is not durable it can only be used for temporary purposes. The thick bark and the cladodia are doubtless available for tanning, but, so far as I am aware, their value has not been ascertained.

DISTRIBUTION OF THE SPECIES.

Phyllocladus alpinus is endemic in New Zealand, and attains its northern limit on the summit of Cape Colville: it is not infrequent in mountain districts in the central parts of the North Island, but rarely occurs at altitudes below 2,000ft. In the South Island it is plentiful, from Marlborough and Nelson to Southland: on the eastern side of the Island it is restricted to high elevations, but on the western side it often forms a considerable portion of the forest at low levels, and in such situations the trunk is long and slender, with few branches.

It descends to the sea-level at Colac Bay, where it attains its southern limit. It has not been observed on Stewart Island.

It ranges from sea-level to 5,000ft.

DESCRIPTION.

Phyllocladus alpinus, Hook. f., "Flora Novæ-Zelandiæ," i., p. 235, t. 53.

A monœcious shrub or small tree, 5ft. to 25ft. high, with numerous short stout branches. True leaves produced on young plants only, linear-acute, $\frac{1}{3}$ in. long. Cladodia crowded, glaucous, $\frac{1}{2}$ in. to $1\frac{1}{2}$ in. long, very coriaceous, cuneate or narrow-rhomboid or linear-oblong, deeply lobed, margins erose, toothed, teeth apiculate. Male catkins short, in terminal fascicles of two to six, sessile or shortly peduncled; connective obtuse. Female cones on the margins of reduced cladodes or at the base of others. Ovules two or three. Cones crimson in fruit. Nuts, two or three, each with a membranous envelope investing its base.

EXPLANATION OF PLATE C.

Phyllocladus alpinus, Hook. f. Young plant with true leaves, and mature specimen in fruit. 1 and 2. Male catkins, natural size. 3. Male catkin. 4. Front and back views of anther. 5. Cone. 6. Nut. All magnified.





Mountain Beech.
FAGUS CLIFFORTIODES.

T. KING DELINQ.

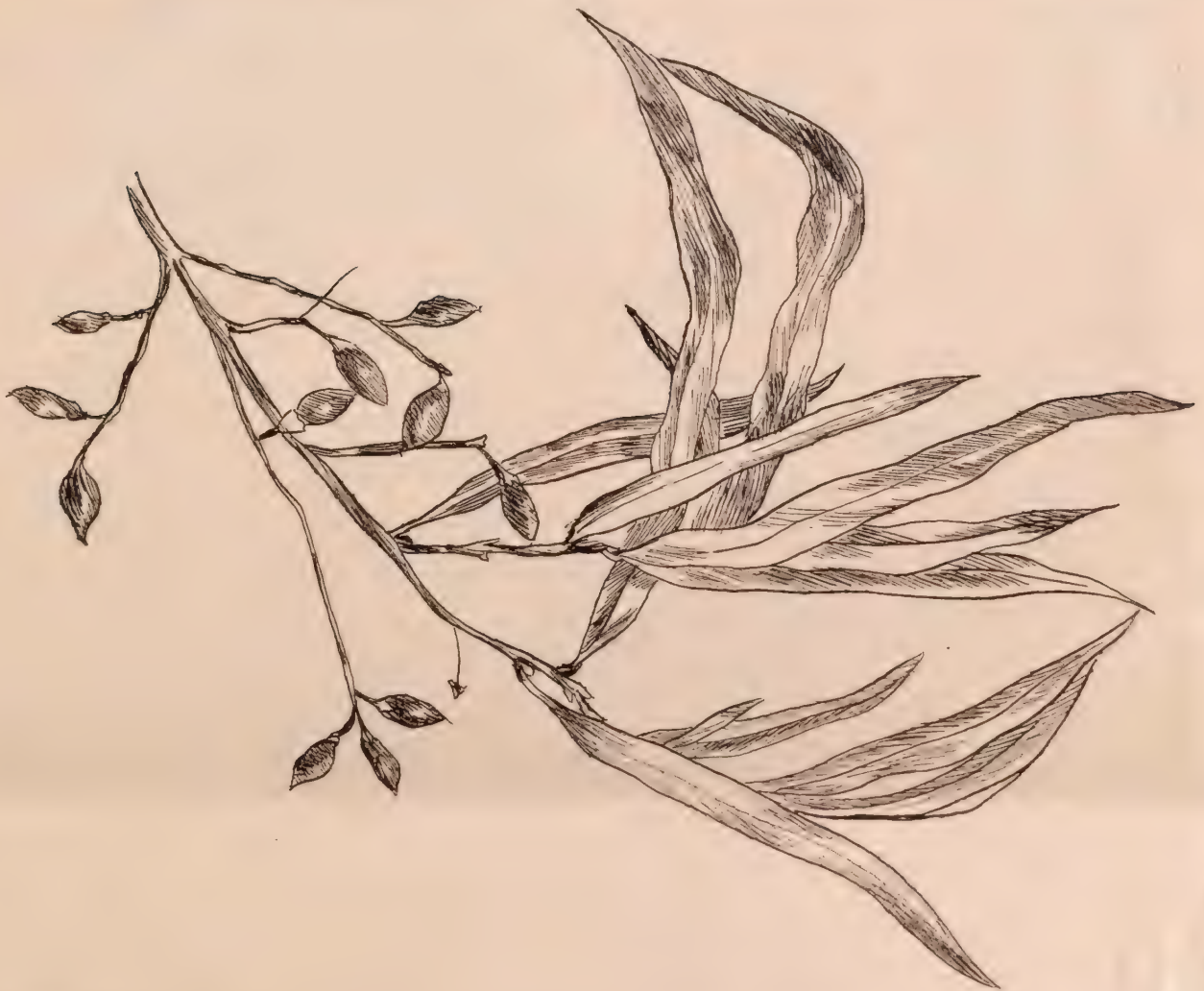
SURVEY DEP. 1887





FAGUS CLIFFORTIODES, Hook. f.

THE MOUNTAIN-BEECH.



Narrow leaved maire
 (Olea montana)
 (With immature fruit)



Laurelia novae-Zelandiae
 (Pukatea)



FAGUS CLIFFORTIODES, Hook. f.

THE MOUNTAIN-BEECH.

ORDER—CUPULIFERÆ.

(Plates CI. and CIA.)

FAGUS CLIFFORTIODES, in common with the other New Zealand species of *Fagus*, is perversely termed "birch" by the bushman, who prefixes the adjective "black" if he looks at the dark bark of an old tree, or "white" if he has before him the pale bark of a young tree; but, as a general rule, he makes no attempt to distinguish it from *F. Solandri*, which it resembles in general appearance. I propose the name of mountain-beech as a substitute for the unmeaning "white-birch," "black-birch," &c. Mr. Colenso informed me that it bears the same Maori name as *F. Solandri*—"tawai-rau-riki."

It was discovered in 1791 by Dr. Menzies, surgeon to Vancouver's expedition, in Dusky Bay, but was not described until 1844, when it was figured by Sir William Hooker in "Icones Plantarum:" drawings and description of the fruit were not given until a much later date.

Except in very favourable situations it rarely exceeds 40ft. or 50ft. in height: in narrow mountain-valleys at an altitude of 3,000ft. it is often not more than 6ft. or 8ft. high, and in exposed positions it is dwarfed into a flat-topped bush. Except in the extreme south-western corner of the South Island it is confined to the mountains, rarely descending below 2,000ft., but forming the chief portion of the forest up to 4,000ft.

Isolated specimens when growing in the open at elevations between 2,000ft. and 3,000ft. are often branched from the base, and form symmetrical trees of great beauty, giving a peculiar park-like character to the scenery.

The branchlets and leaves are arranged in two rows, the branchlets being clothed with short hairs. On young plants the leaves are rounded, membranous, and green on both surfaces: on old trees they are of thick texture, closely dotted above, and white with appressed hairs beneath, from $\frac{1}{10}$ in. to $\frac{2}{3}$ in. long, rounded unequally at the base and narrowed to a point at the apex: they are carried on very short petioles. The male flowers are solitary, and resemble those of *F. Solandri*, but are smaller. The female flowers are very small, the involucrel cup consisting of three lobes, each with two or three narrow transverse bands: the wings of the nuts are less prominent than those of the entire-leaved beech.

The contrast between the small-leaved alpine forms and luxuriant states from lower levels is very striking; but their identity is readily determined by an examination of the fruit or flower. This species is closely allied to *F. Solandri*, from which it is best distinguished by the oblong-ovate, acute, or sub-acute leaves, which are rounded at the base.

PROPERTIES AND USES.

The wood of the mountain-beech bears a close resemblance to that of the entire-leaved beech, *Fagus Solandri*, but is of smaller dimensions: it equals that

species in strength, but is not generally durable. Young trees used for the first telegraph-poles erected in the Waimakariri country showed a great difference in this respect: if in dry soil they perished in five or six years, but in swamps they remained sound for a much longer period; and similar results are exhibited when it is used for wire-fence posts. A large sleeper at the margin of a spring where it was constantly moist remained sound and good after being down sixteen years. It is often used for wharf-piles with satisfactory results. Old trees of this species are frequently swept into mountain-streams in situations where they become fixed amongst rocks and boulders, often remaining for years subject to alternations of wet and dry: under this severe test the sapwood quickly decays, and the outer cylinder of heartwood becomes furrowed; but the lapse of time only serves to harden it, and after years of exposure it rings like metal: logs hardened in this manner would probably endure for centuries when worked up, but would be difficult of conversion. It is almost superfluous to remark that immature trees decay in two or three years at most, but the timbers capable of enduring under such trying conditions for any lengthened period are few indeed.

Although of small dimensions, the mountain-beech is of considerable importance from an economic point of view: in some parts of the South Island it is the only timber to be found at altitudes above 2,500ft., while its beneficent effects on climate and in the prevention of landslips cannot be overrated. The destruction of the forests of mountain-beech on the western slopes of the Southern Alps would quickly be followed by the destruction of extensive tracts of lowland country, and the entire district would be rendered practically uninhabitable. The mountain-beech is easily cultivated, and would prove of great value to the landscape gardener.

DISTRIBUTION OF THE GENUS.

See under *Fagus Solandri*, p. 91, *ante*.

DISTRIBUTION OF THE SPECIES.

In all probability *Fagus cliffortioides* attains its northern limit near Lake Waikare, in the East Cape district: it is plentiful on the upper portions of the Kaimanawa and Ruahine Mountains, and is found on Tongariro, Ngaurahoe, Ruapehu, and other mountains in the centre of the North Island, also along the crest of Tararua and Rimutaka Ranges nearly to Cook Strait; but is much more abundant on the mountains of the South Island, from Nelson to Southland, attaining the extreme limit of arboreal vegetation at about 4,000ft., its upper limit often forming a straight line at that elevation along entire ranges: a few isolated trees may occasionally be found in sheltered places up to 4,800ft. It descends to the sea-level in several localities on the west coast of the South Island, as at Preservation Inlet, Dusky Bay, &c.

It has not been observed on Stewart Island.

DESCRIPTION.

Fagus cliffortioides, Hook. f., "Icones Plantarum," tt. 673 and 816B.

A small tree, 20ft. to 50ft. high, with a trunk 1ft. to 2ft. in diameter or less. Leaves coriaceous, shortly petioled, unequally rounded at the base, ovate or oblong-ovate, acute or sub-acute, $\frac{1}{10}$ in. to $\frac{3}{8}$ in. long, minutely punctate above, clothed with white appressed hairs beneath. Flowers: Male, solitary, axillary, perianth shortly peduncled, membranous; stamens, eight to twelve, exserted. Female, solitary, cupule three-lobed, each lobe with two membranous transverse

lamellæ. Fruit the smallest of the genus, $\frac{1}{8}$ in. to $\frac{1}{4}$ in. long; nuts, one to three, one or two triquetrous, the other flat with winged margins; ovate, puberulous.

In Hooker's drawing in "Icones Plantarum," t. 816B, the transverse lamellæ are represented with a sharp tooth in the middle, and the nut is rather longer and narrower than in any of my specimens.

EXPLANATION OF PLATES CI. AND CIA.

CI. *Fagus cliffortioides*, Hook. f. 1. Fruiting specimen. 2. Specimen with male flowers. 3. Alpine specimen. 4. Seedling. All natural size. 5. Male flower. 6. Female flower. 7. Fruit. 8. Involucral cup. 9. Nut. All magnified.

CIA. *Fagus cliffortioides*, Hook. f. Fruiting specimen from Lake Wakatipu.





Tupare
(OLEARIA COLENZOI)

OLEARIA COLENSOI, Hook. f.

THE TUPARI.

ORDER—COMPOSITÆ.

(Plate CII.)

THIS fine plant was originally discovered by Mr. Colenso on Hikurangi at an altitude of 5,000ft., and was subsequently found to be of frequent occurrence in mountain districts. Mr. Traill informs me that it is the tupari of the Stewart Island Natives: it is, however, generally termed "mutton-bird wood," or "mutton-wood" by settlers, on account of its growing on outlying islands frequented by mutton-birds. Owing to the great strength and toughness of its branches, combined with a dense habit of growth, it forms "scrub," through which a passage can only be forced by a great amount of labour. No other New Zealand plant forms undergrowth so extremely difficult to penetrate.

Olearia Colensoi is perhaps the largest species of the genus, but varies from a handsome bushy shrub, not more than 3ft. or 4ft. high, to a tree 40ft. high with a trunk 2ft. in diameter: it attains its largest dimensions on Stewart Island and the outlying islets. The branches are stout, and in the young state are clothed with a thick coat of whitish or yellowish-brown hairs, which are more or less appressed, especially on the under-surfaces of the leaves. The leaves are alternate, and are usually carried on stout leaf-stalks, sometimes $\frac{3}{4}$ in. long, at others so short that the leaf appears sessile: the leaves are excessively coriaceous, and of variable form, but are always pointed at the apex: they range from 2in. to 8in. in length, and from 1in. to 3in. in breadth; the mid-rib is very stout, and the veins are prominent on both surfaces. The upper surface is finely reticulated, the lower surface is clothed with appressed white hairs, and the margins are irregularly cut into sharp or obtuse teeth.

The flowers are arranged in from two to four axillary racemes developed at the tips of the branches, but usually become overtopped by the new shoot; the racemes are from 3in. to 8in. long, and carry from three to eight heads, from $\frac{3}{8}$ in. to 1in. in diameter; each head is borne on a stout stalk $\frac{3}{4}$ in. to 2in. long; at the base of each stalk is a small sheathing leaf or bract; the axes of the raceme, pedicels, and bracts are thickly clothed with loose white hairs. The involucreal scales are numerous, and form a broad cup, the upper portion of each scale being protected by short brown woolly hairs. The florets are very numerous, tubular, with a bell-shaped mouth, the great majority being perfect; a few of the outer series are female, but are invariably destitute of rays. This species is the only large-headed *Olearia* with rayless flowers.

The fruits are one-seeded and silky, crowned with a pappus consisting of several rows of brown hairs.

Sir Joseph Hooker recognised two forms of this plant: α , in which the leaves are without obvious petioles, and shorter than the racemes; β , leaves with distinct petioles, and longer than the racemes. Further observation has shown that there is no co-relationship between the length of the petioles and

the racemes, and that the same tree may exhibit racemes both longer and shorter than the leaves.

PROPERTIES AND USES.

The wood is firm, hard, and compact, with a satiny lustre usually with small silver grain, and often streaked or clouded: it is of a light-brown colour, becoming much darker towards the heart. It is suitable for many kinds of ornamental work.

Olearia Colensoi is of high value as an ornamental shrub: the bold foliage, of a deep glossy green above, contrasting with the white under-surface, renders this species very attractive.

DISTRIBUTION OF THE GENUS.

See under *Olearia Traversii*, p. 47, *ante*.

DISTRIBUTION OF THE SPECIES.

Olearia Colensoi is endemic in New Zealand, and attains its northern limit on Mount Hikurangi near the East Cape, and extends southwards along the crests of the Ruahine and Tararua Mountains. It is plentiful immediately above the gorge of the Pohangina, Ruahine; but, speaking generally, it is local in the North Island, and does not descend below 3,000ft.

In the South Island it is found on the summit of Mount Stokes, but no other locality is known to me in the Marlborough District, and it appears to be very local in the Nelson and Canterbury Districts, although it occurs freely in Westland. It is plentiful in Otago, and forms almost impenetrable scrub on the mountain-slopes of the West Coast. It is abundant from sea-level to the highest peaks on Stewart Island, and attains its southern limit on the Snares.

Its altitudinal range is from sea-level to upwards of 5,000ft.

DESCRIPTION.

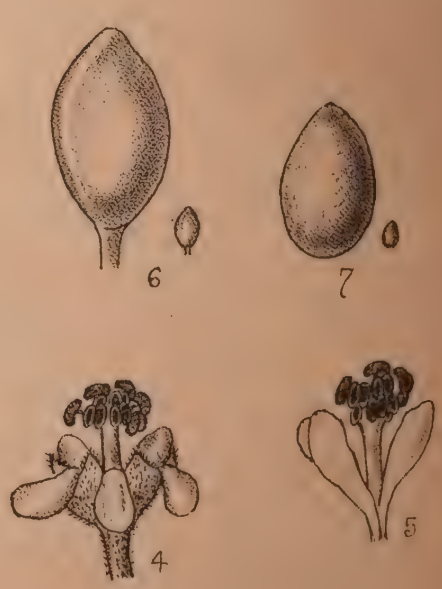
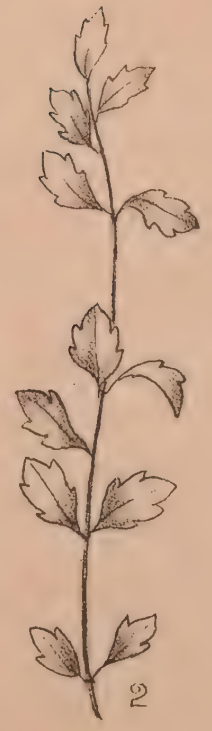
Olearia Colensoi, Hook. f., "Flora Novæ-Zelandiæ," i., p. 115, t. 29.

A much-branched shrub or, rarely, a small tree 40ft. high, with trunk 2ft. in diameter. Branches stout. Leaves alternate, shortly petioled, under-surface white or brown with appressed tomentum, coriaceous, rigid, ovate-acuminate or broadly oblong or narrow-obovate, acute margins distinctly or closely serrate or doubly serrate, or crenate. Flower-heads in terminal bracteate racemes at the tips of the branches, shorter or longer than the leaves. Rhachis, bracts, and peduncles white, with appressed hairs. Heads $\frac{3}{4}$ in. to 1in. broad, destitute of rays; involucral scales in one or two series, tomentose at the tips. Florets very numerous, all perfect or with a few female florets in the outer series. Corolla tubular, campanulate, very silky. Achene silky; pappus-hairs brown, in two or three series.

EXPLANATION OF PLATE CII.

Olearia Colensoi, Hook. f. Flowering specimen, natural size. 1. Perfect floret. 2. Female floret. Magnified.





PLAGIANTHUS BETULINUS.



PLAGIANTHUS BETULINUS.

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PLAGIANTHUS BETULINUS, A. Cunningham.

THE HOUI.

ORDER—MALVACEÆ.

(Plates CIII. and CIV.)

PLAGIANTHUS BETULINUS is an attractive tree, from 20ft. to 60ft. high, and is widely distributed through the colony, although entirely absent from certain districts and extremely local in others. Its habit is remarkably graceful, and in general appearance it bears considerable resemblance to the European birch, *Betula alba*, but the leaves are larger. Mr. Traill informs me that it is termed "houi" by the Stewart Island Natives, and by those on the Chatham Islands. I believe the same name is applied in other parts of the colony, but learn from the Ven. Archdeacon W. L. Williams that it should be termed "manatu:" it is the "ribbon-wood" of the South Island settlers. The trunk is from 1ft. to, rarely, 3ft. in diameter, and is usually clothed with smooth dark-brown bark, and crowned with a spreading head, the ultimate branchlets being very slender and often pendulous. In the young state it forms a bush with slender tortuous or interlaced branchlets, and distant ovate or rounded leaves variously lobed or toothed. In the mature state the leaves are alternate, from 1in. to 3in. long, and carried on slender leaf-stalks; usually they are broadest just below the middle and taper into a long point, the base being wedge-shaped or rounded, and the margins are more or less lobed, or cut into teeth, which may be acute or obtuse: when first developed they are clothed with short hairs, and furnished with a pair of stipules at the base of each leaf-stalk, which, however, quickly fall away.

The flowers are arranged in terminal panicles, sometimes 6in. long and repeatedly branched: all the flowers may be perfect, or male flowers and perfect flowers may be found on the same tree, or even on the same panicle: the branches of the panicle are dotted with starry hairs. The flowers are about $\frac{1}{4}$ in. in diameter; the calyx is cut into five lobes, alternating with which are five small white petals, rounded at the tips; the stamens are about twelve in number, and the filaments are coherent below, forming a tube adherent with the petals: the free portion of the filament is short, and the anther is kidney-shaped. The pistil consists of a single carpel with a one-celled ovary having the style included in the staminal tube. The fruit is a small dry one-seeded capsule, splitting down one side. Owing to the profusion of the anthers the flowers appear to be red, although the petals are white or nearly white. It is usually evergreen, but in some localities in the South Island the leaves fall away on the approach of winter.

After Cunningham's description was published it was made the type of a new genus, and figured in the "Annales des Sciences Naturelles," ser. ii., 8, t. 3, under the name of *Philippodendron regium*, Poit.

A. Cunningham described one of the forms as a distinct species under the name of *P. urticinus*; but it cannot be separated even as a variety.

PROPERTIES AND USES.

The wood of *Plagianthus betulinus* is white, straight in the grain, tough, and even: it is sometimes prettily marked, and would prove of value for "white-wood" furniture. It is easily split, and was formerly employed for rails, shingles, palings, &c., but owing to its perishable character it is now but seldom used. The twigs have been manufactured into paper in England, and the wood of the trunk is suitable for that purpose. The bark is very tough, and is often used for tying: like that of the houhere it is easily split into a number of layers.

DISTRIBUTION OF THE GENUS.

Plagianthus is a small genus, comprising about twelve species, four of which are endemic in New Zealand, the others being restricted to Australia.

DISTRIBUTION OF THE SPECIES.

Plagianthus betulinus is endemic in New Zealand, and occurs from Mongonui to Stewart Island: it is also found in the Chatham Islands, but is sometimes absent from large districts, as from Great Omaha, the Great Barrier Island, the Titirangi district, the vicinity of Auckland, the Thames Goldfield, &c.

It exhibits a marked preference for lowland habitats, but ascends to at least 1,500ft.

DESCRIPTION.

Plagianthus betulinus, A. Cunn.

P. urticinus, A. Cunn.

Philippodendron regium, Poit.

A tree, 30ft. to 60ft. high, but usually smaller; trunk 1ft. to 2ft. in diameter. Leaves on young plants distant, from $\frac{1}{2}$ in. to 1in. long, variously lobed and toothed; on mature plants, twigs, leaves in young state, and stipules pubescent: leaves alternate, membranous, 1in. to 3in. long, on slender petioles, ovate or ovate-lanceolate, acuminate, entire or variously lobed, or coarsely serrate or crenate or doubly serrate. Panicles, terminal; branches numerous, slender, clothed with stellate tomentum. Flowers very numerous; calyx five-cleft, inferior; petals, five, free, white, varying in size, rounded at the tip. Staminal tube adherent with the petals; free portion of the filaments very short; anthers reniform; carpel one. Fruit an ovoid capsule; pericarp thin; seed one.

EXPLANATION OF PLATES CIII. AND CIV.

CIII. *Plagianthus betulinus*, A. Cunn. Flowering specimen after the petals have fallen. 1 and 2. Portions of a young plant. 3. Portion of a panicle. All natural size. 4. Male flower. 5. The same with calyx removed. Both magnified. 6. Fruit. 7. Seed. Both natural size and enlarged.

CIV. *Plagianthus betulinus*, A. Cunn. Specimen with immature fruit, natural size.





Puriri.
(VITEX LITTORALIS).

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VITEX LITTORALIS, A. Cunningham.

THE PURIRI.

ORDER—VERBENACEÆ.

(*Plate CV.*)

THE puriri is sometimes termed “kauere;” the former is however the name most generally in use. On account of the strength of its timber it is sometimes termed by settlers “New Zealand oak,” but it would be far more correct to name it “New Zealand teak.”

It forms a noble tree, from 40ft. to 60ft. high, with a trunk from 2ft. to 5ft. in diameter, clothed with thin, smooth, whitish- or yellowish-brown bark. The trunk may be long and straight, with but few small branches, or short when the branches are spreading, and usually of large diameter. The plant is usually smooth in all its parts, although a few weak hairs may be occasionally found on the young leaves: the leaves are opposite, composed of from three to five stalked leaflets springing from the tip of a stout stalk 3in. or 4in. long, and arranged like the digits of the hand; they are from 2in. to 5in. long, and from 1in. to nearly 3in. wide, narrowed to a point, with the margins quite entire, and turned upwards from the mid-rib: the leaves are of a deep green, smooth, and almost shining: the two lateral leaflets are often diminutive. The flowers are produced in great abundance, and arranged in panicles springing from the axils of the leaves: each flower is carried on a pedicel 3in. to 1in. long, the flower being about 1in. long, and irregular in shape. The calyx is cup-shaped, with five minute teeth; and the dull-red corolla is two-lipped, the upper lip being entire and rounded, while the lower lip is bent downwards and deeply divided into three spreading lobes. The stamens are in two pairs, springing from the base of the corolla, and are curved downwards; the ovary is very small, and the style is divided into two short arms: the fruit is a red drupe, containing a club-shaped nut, rounded on the top and of bony hardness: it is four-celled, each cell containing a single seed, but as a rule not more than one or two are perfect.

The growing tree is attacked by the larvæ of the puriri-moth, which bore longitudinal galleries sometimes 3in. in diameter, but the durability of the timber is not affected, and the timber is not attacked when worked up.

PROPERTIES AND USES.

The wood of the puriri is of a dark-brown colour, excessively hard, dense, and heavy, of great strength and durability, but as a rule difficult to work on account of the interlaced and crossed arrangement of the fibres. It is the strongest and most durable of all the New Zealand timbers: it is to be regretted that its strength has not been properly determined.

It is extensively used for house-blocks, piles, railway-sleepers, culverts, bridges, and constructive works generally whenever it can be obtained; also for ships' blocks, machine-beds and bearings, and for purposes requiring great strength and durability. It is the best timber in the colony for fence-posts, &c.

Aged trees are difficult of conversion ; younger trees split more readily, but it is usually necessary to employ blasting-powder or dynamite : the large arms are of equal value with the trunk, as they can be converted into house-blocks or fence-posts, &c. The puriri is of great value for ornamental planting, and should be extensively planted on account of the value of its timber : it may be propagated by seeds or cuttings, and is of the easiest cultivation.

Its flowers are usually produced in September and October.

DISTRIBUTION OF THE GENUS.

The genus *Vitex* comprises about sixty species, which are chiefly distributed through the tropics, a few only being found in the temperate regions of Asia, Europe, and Australia. Four species are found in Australia, and one in New Zealand.

DISTRIBUTION OF THE SPECIES.

Vitex littoralis is endemic in New Zealand, and is restricted to the northern part of the North Island. It is very common from the North Cape to the Lower Waikato and Te Aroha. Farther south it becomes rare and local, being most plentiful in the vicinity of the coast. On the east coast it attains its southern limit at Poverty Bay, and on the west coast at Stony River, in the Taranaki District.

It is plentiful in sheltered places near the sea, and attains large dimensions in alluvial lands at sea-level, but exhibits equal luxuriance in hilly districts, and ascends to 2,800ft. It has, however, been cut out in many districts where it was formerly plentiful, and will soon become rare and difficult to obtain in quantity.

DESCRIPTION.

Vitex littoralis, A. Cunn.

Hook., "Icones Plantarum," tt. 419, 420.

A fine tree, 40ft. to 60ft. high, with a massive trunk from 2ft. to 5ft. in diameter, and spreading branches. Branches and leaves glabrous, except when very young. Leaves opposite, three- or five-foliolate ; petioles, 2in. to 4in. long ; leaflets, 2in. to 5in. long, 1in. to 2½in. wide, oblong or obovate, acute or sub-acuminate, keeled, shortly petioled. Flowers in axillary dichotomous panicles, spreading, three- to ten-flowered ; pedicels slender. Calyx basin-shaped, obscurely five-toothed. Corolla 1in. long, irregularly two-lipped ; upper lip notched at the base, rounded at the tip or with a minute notch ; lower lip deflexed, deeply trifid, lobes spreading. Stamens, four ; filaments long, curved, hairy at the base ; ovary four-celled, stigma bifid. Fruit, a red ovoid or almost globose drupe ; nut clavate, bony, rounded at the broad top, four-celled ; seeds, one to four.

EXPLANATION OF PLATE CV.

Vitex littoralis, A. Cunn. Flowering specimen, natural size. 1. Flower, magnified. 2. Fruit, natural size. 3. Nut. 4. Transverse section of fruit.



PANAX SIMPLEX.





PANAX SIMPLEX.

PANAX SIMPLEX, Forster.

THE HAUMAKOROA.

ORDER—ARALIACEÆ.

(Plates CVI. and CVII.)

PANAX SIMPLEX, like some other species of this genus, develops very different forms of foliage at different stages of growth and in different situations, so that it is frequently a source of perplexity to the collector who has not become familiar with its varying forms. It varies from a shrub 5ft. or 6ft. high to a small tree fully 25ft. high, with a well-defined trunk, and in its mature state is easily recognised: although some forms of *P. Edgerleyi* closely resemble large forms of *P. simplex*, the two plants may be readily distinguished by the number of styles, *P. Edgerleyi* having three and *P. simplex* two only. In some mountain districts small forms of *P. simplex* make a close approach to *P. anomalum*, which has two styles also, but the branches are clothed with bristly hairs while those of *P. simplex* are smooth.

In the young state it exhibits two forms so widely different from each other that it is difficult to believe that they can belong to the same plant. In the first, which appears to be the usual form in the South Island, the plant is singularly graceful; the leaves are compound (Pl. CVI., Fig. 1), and are composed of five leaflets, of thin texture, and usually of a bronzed hue, which spring from the apex of a long slender leaf-stalk, and are deeply and irregularly lobed or toothed. The second form (Pl. CVI., Fig. 2) has broad entire green leaves with toothed margins, which approach those of the mature state in general appearance; or, rarely, the leaves may consist of three entire leaflets springing from a short petiole: this is stated by Sir Joseph Hooker to be the only form of the young plant found on the Auckland Islands; it is also the prevalent form on Stewart Island, but the lobulate form occurs there also.

The form with lobulate leaflets may develop leaves with three flat entire leaflets (Pl. CVII., Fig. 3), which are succeeded by the leaves of the ordinary mature state accompanying flowers and fruit (Pl. CVII., Figs. 1 and 2); or the five lobulate leaflets may be reduced to three and diminished in length, with broader lobes, finally assuming the form of simple linear leaves deeply lobed or toothed, but never entire,—in this state producing small umbels of flowers and fruit (Pl. CVI., Fig. 2). Fruiting specimens are, however, somewhat rare in this state.

The leaves of the ordinary mature state are alternate, from 1in. to 5in. long, acute, jointed to slender petioles, and the margins are sharply toothed. The flowers are arranged in much-branched umbels, which spring from the axils of the leaves or from the tips of the branches, and are usually shorter than the leaves: the terminal portion of the umbel consists of female, the lateral portion of male, flowers: the secondary umbels consist of from eight to twelve flowers, carried on pedicels less than ½in. long. The male flowers have five free petals and five stamens: the female are destitute of petals and stamens: the ovary is

two-celled, and the fruit is small, slightly compressed, and two-seeded, with two recurved styles.

I am indebted to Mr. Charles Traill, of Stewart Island, for the Native name "haumakoroa."

PROPERTIES AND USES.

The wood of *Panax simplex* is white, even, compact, and tough, but is not durable when exposed. It is applied to various rustic uses, but is of little value. The plant is a welcome addition to the list of ornamental shrubs suitable for cultivation.

DISTRIBUTION OF THE GENUS.

See under *Panax Edgerleyi*, p. 73, *ante*.

DISTRIBUTION OF THE SPECIES.

Panax simplex is endemic in New Zealand, and is essentially a southern species, although its northern limit will probably be found between Te Aroha Mountains and the Thames Goldfield: it is frequent in mountain districts in the central part of the North Island, but is more local on the Ruahine and Tararua Ranges: on the latter it descends to within 1,300ft. of the sea-level. It is more plentiful in the South Island, especially on the west coast, but attains its largest dimensions on Stewart Island: it is plentiful on the Snares and on the Auckland Islands, where it attains its southern limit.

It ranges from the sea-level to nearly 4,000ft.

Panax discolor, T. Kirk, takes the place of *P. simplex* north of the Thames Goldfield.

DESCRIPTION.

Panax simplex, Forster.

M. A. Richard, "Flora de la Nouvelle-Zélande," t. 31.

Hook. f., "Flora Antarctica," i. 18, t. 12.

A dwarf shrub or small tree, 25ft. high. Leaves exstipulate, polymorphic; in the young state broadly ovate, on slender petioles, serrate, quite entire: or quinquefoliolate, the leaflets deeply lobed or pinnatifid, passing into unifoliolate leaves deeply lobed or toothed, in which state flowers are sometimes produced. The young plants with entire leaves develop trifoliolate leaves, and ultimately mature unifoliolate leaves, which are jointed to the petiole: these are 1in. to 5in. long, oblong-lanceolate or broadly lanceolate, sub-acute or acute or acuminate. Flowers in compound axillary or terminal umbels, shorter than the leaves; terminal umbellule female, lateral male. Male flowers, petals five; stamens five. Female, petals none; ovary two-celled. Fruit slightly compressed, with two recurved styles.

EXPLANATION OF PLATES CVI. AND CVII.

CVI. *Panax simplex*, Forster. 1. Portion of a young plant with quinquefoliolate leaves. 2. Fruiting specimens with lobulate leaves. 3. Young plant with entire leaves. All natural size.

CVII. *Panax simplex*, Forster. 1 and 2. Flowering specimen. 3. Specimen with small trifoliolate leaves, natural size. 4. Male flower. 5. Fruit. 6. Seed. All magnified.



CYATHODES ACEROSA.

CYATHODES ACEROSA, Brown.

THE MINGI.

ORDER—EPACRIDEÆ.

(Plate CVIII.)

CYATHODES ACEROSA is a shrub or, rarely, a small tree, 18ft. high, with pungent leaves and minute white flowers, which are succeeded by spherical red or white fruits, which give the plant an attractive appearance.

The leaves are rigid, spreading, and sharp at the apex, from $\frac{1}{4}$ in. to $\frac{3}{8}$ in. long, and from $\frac{1}{30}$ in. to $\frac{1}{25}$ in. wide. The flowers are minute, $\frac{1}{10}$ in. long, and are carried on short pedicels in the axils of the terminal leaves. The pedicels are clothed with minute scale-like bracts; the corolla is flask-shaped, with five spreading lobes, and slightly exceeds the calyx in length; stamens, five, inserted on the corolla. The fruit is a white or red drupe, $\frac{1}{3}$ in. in diameter.

Two forms are often recognised, but they are not of great importance: *a*, with the lateral nerves of the leaves branching outwards (Pl. CVIII., Fig. 2); *β*, with the nerves of the leaves simple, points longer and more pungent (Pl. CVIII., Fig. 4). Both forms of leaf may however be found on the same branch.

PROPERTIES AND USES.

The wood of the mingi is of a light-brown colour, hard, compact, even, and elastic, but of great durability. It is sometimes prettily marked, and is occasionally used for ornamental work. Although of small dimensions, it is one of the timbers used for survey-pegs on account of its durability. It is easily cultivated.

DISTRIBUTION OF THE GENUS.

Cyathodes comprises fourteen species, of which eight are found in Australia, two in the Sandwich Islands, &c., and five in New Zealand. One of the New Zealand species is also found in Australia; one is peculiar to the Chatham Islands, and another is only found in the Nelson District.

DISTRIBUTION OF THE SPECIES.

Cyathodes acerosa is distributed through the colony from the North Cape to Stewart Island, and attains its largest dimensions in open forest, especially if growing on gentle slopes.

It ascends from the sea-level to nearly 2,000ft.

C. acerosa is also found in Australia.

DESCRIPTION.

Cyathodes acerosa, R. Brown.

A shrub or, rarely, a small tree, 12ft. to 18ft. high; bark black. Leaves scattered, $\frac{1}{30}$ in. to $\frac{1}{25}$ in. wide, acerose, rigid, spreading, with pungent points, sometimes slightly wider above the middle. Flowers minute, solitary, axillary, on short peduncles near the tips of branchlets; peduncles clothed with obtuse

bracts. Calyx minutely five-lobed. Corolla urceolate, five-lobed, glabrous. Stamens five; ovary five-celled. Fruit, a drupe, containing a bony nut, five-celled, five-seeded.

EXPLANATION OF PLATE CVIII.

Cyathodes acerosa, Brown. Var. α , fruiting specimen. Var. β , flowering specimen. Both natural size. 2. Leaf with lateral veins branching outwards. 4. Leaf with simple veins. 5. Flower. 6. Longitudinal section of fruit. All magnified.



Inaka.
(DRACOPHYLLUM LONGIFOLIUM)

DRACOPHYLLUM LONGIFOLIUM, R. Brown.

THE INAKA.

ORDER—EPACRIDEÆ.

(Plate CIX.)

To see this singular plant in its most characteristic form it is necessary to visit Stewart Island or the Auckland Islands, for, although it is not uncommon in the mountains of the South Island, it is rarely more than a few feet high, with short erect leaves, but on Stewart Island it often forms a tree 35ft. high, with grass-like leaves nearly a foot in length. Mr. Charles Traill informs me that it is termed "inaka" by the Maoris on Stewart Island: it is one of several trees termed "grass-tree" by the settlers in the South Island.

This species was discovered in Dusky Bay by Forster during Cook's second voyage, and was described under the name of *Epacris longifolia*. It was referred to *Dracophyllum* by Robert Brown, and appears under that name in the "Flora Antarctica." A form with short leaves, triquetrous in the upper part, was described by Sir Joseph Hooker in "Flora Novæ-Zelandiæ" under the name of *D. Lyallii*, but referred to this species in the "Handbook of the New Zealand Flora."

It forms an erect shrub or small tree, from 3ft. to 30ft. high, with a trunk rarely exceeding 1ft. in diameter, clothed with black fibrous bark. The branches are slender, erect, and naked below, the leaves being restricted to the upper portion, so that the plant often presents a curious tufted appearance. The leaves are from 3in. to 10in. long, and of singular form: for about $\frac{1}{3}$ in. from the base they are expanded into a membranous sheath, which is nearly as broad as it is long, and abruptly narrowed into the long narrow blade, which is from $\frac{1}{3}$ in. to $\frac{1}{6}$ in. broad where it joins the sheath, and gradually tapers to a point, so that leaf and blade resemble a spade with a long tapering stock. The blade is concave on the upper surface, convex or faintly grooved on the lower. The upper surface of young leaves is usually pubescent, and the margins are fringed or ciliated, but this character is evanescent: the leaves are close-set near the tips of the branches, the sheathing bases overlapping each other: on young plants the leaves are often soft and curved downwards. The flowers are small, and crowded in racemes, which spring from the tips of very short branchlets. The racemes are from 1in. to 2in. long, and are composed of from eight to fourteen flowers: each flower has a large brown bract at its base, and its pedicel is clothed with green, overlapping, fringed bracts, which nearly hide the corolla. The calyx is deeply cleft into five broad lobes, which equal or slightly exceed the corolla in length. The corolla is entire, with five short lobes, which are slightly turned inwards at the points, and five stamens with extremely short filaments are inserted considerably below its mouth. The ovary is usually five-celled, with a short straight style, and the fruit is a five-celled capsule, with numerous minute seeds.

The flowers are developed from October to December.

PROPERTIES AND USES.

The wood is of a light-brown colour, with fine even grain and satiny lustre: the silver grain is very minute; its chief beauty consists in the oblique wavy markings and streaks, which occasionally exhibit a feathery appearance. It takes a high finish, and is suitable for all kinds of ornamental work. Although of slow growth the remarkable habit of this plant renders it of great value as an ornamental shrub.

DISTRIBUTION OF THE GENUS.

Dracophyllum is an Australasian genus, consisting of about thirty species, of which fourteen are found in New Zealand, ten in Australia, and seven in New Caledonia. One or possibly two of the New Zealand species extend to Australia.

DISTRIBUTION OF THE SPECIES.

Dracophyllum longifolium is endemic in New Zealand. In the North Island it appears to be rare and local, having been observed only in one or two localities in the Tararua Mountains. It is plentiful in many places on the mountains of the South Island from Nelson to Southland; it descends to the sea-level in the deep sounds of the south-west portion of the Island, and is abundant on Stewart Island, the Snares, the Auckland Islands, and forms the chief portion of the ligneous vegetation on Campbell Island.

It ranges from the sea-level to upwards of 4,000ft.

DESCRIPTION.

Dracophyllum longifolium, R. Brown, "Flora Antarctica," i., p. 45, tt. 31, 32.

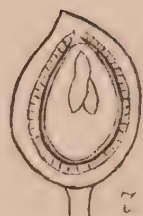
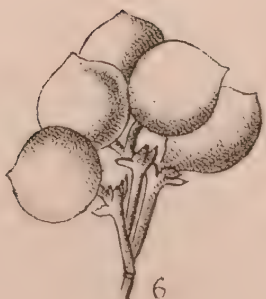
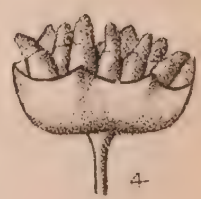
D. Lyallii, Hook. f., "Flora Novæ-Zelandiæ," i., p. 169.

Epacris longifolia, Forster.

A shrub or small tree, 20ft. to 35ft. high, with strict erect branches, usually naked below. Leaves often recurved in young plants, erect in mature plants, 3in. to 10in. long; with sheathing bases $\frac{1}{3}$ in. to $\frac{1}{2}$ in. long, abruptly narrowed into the blade, which is rigid, concave above, grooved beneath, minutely pubescent or ciliated at the tips and margins, or glabrous, acute. Flowers in racemes, 1 $\frac{1}{2}$ in. to 2 $\frac{1}{2}$ in. long, terminal on very short lateral branchlets: each flower is developed in the axil of a broadly-ovate chaffy bract, which speedily falls, and the pedicel is clothed with short green bracts. Calyx deeply cleft into five acute segments, ciliated. Corolla tubular; segments, five, recurved, and slightly hooded at the tips. Stamens, five, inserted at the mouth of the corolla; filaments very short; ovary five-celled, with five scales at the base; style short, straight. Fruit, a five-celled capsule; seeds numerous, attached to a pendulous placenta, springing from the axis of each cell.

EXPLANATION OF PLATE CIX.

Dracophyllum longifolium, R. Brown. 1 and 2. Leaves. 3. Raceme. All natural size. 4. Flower. 5. Corolla, laid open. 6. Ovary, showing the scales at its base. 7. Fruit. 8. Transverse section of a fruit. All magnified.



T. K. PH. DIREXIT

Porokaiwhiri.
HEIDYCARYA DENTATA.

HEDYCARYA DENTATA, Forster.

THE POROKAIWHIRI.

ORDER—MONIMIACEÆ.

(Plate CX.)

THE porokaiwhiri forms a tall shrub or small tree, sometimes from 40ft. to 50ft. high, with a trunk from 1ft. to 2ft. in diameter, clothed with dark or black bark. In tall specimens the branches are ascending, forming a close narrow head, but in small specimens they are often straggling. The leaves are of a dull green, and the plant can scarcely be deemed attractive except when studded with the light-red fruits, which are as large as cherries.

Mr. Colenso informs me that it is the "porokaiwhiri" of the Maoris, and I learn from the Ven. Archdeacon W. L. Williams that in the East Cape district it is termed "poporokaiwhiri." It does not appear to have received any distinctive appellation from the woodman or settler.

The branches are erect, and when young are clothed with short hairs. The leaves are opposite, from 2in. to 4in. long including the leaf-stalks, and from $\frac{1}{2}$ in. to 1in. broad: they are of rather thick texture, and may be acute or obtuse, the margins being cut into rather distant teeth or, rarely, entire. The male and female flowers are destitute of petals, and are produced on different trees: they are arranged in panicles or in simple racemes, which are from 1in. to 2in. long, and spring from the axils of the leaves. In the male the perianth is saucer-shaped, the margin being cut into from five to ten triangular lobes, which enclose numerous erect nearly sessile anthers with hairy tips. The perianth of the female flowers resembles that of the male, but is rather smaller, and contains numerous ovaries, each tipped with a conical sessile stigma, and containing a single ovule. The fruit is fully $\frac{1}{2}$ in. broad, slightly beaked, and contains a single seed: the outer envelope is red, and somewhat leathery in texture. The flowers are produced in October and November.

PROPERTIES AND USES.

The wood is white, very straight in the grain, but soft, and apparently not durable. Its economic value is unknown.

DISTRIBUTION OF THE GENUS.

Hedycarya comprises three species, one found in New Caledonia and other islands of the Pacific, one in Australia, and one in New Zealand.

DISTRIBUTION OF THE SPECIES.

Hedycarya dentata is endemic in New Zealand, where it is widely distributed in lowland situations, but does not extend to the Chatham Islands or to Stewart Island.

It attains its northern limit on the Three Kings Island and in the North Cape district, whence it extends southwards to Otago, attaining its southern limit

(so far as known) near Jackson's Head on the west coast, and near Port Chalmers on the east coast.

It ascends from the sea-level to 2,600ft.

DESCRIPTION.

Hedycarya dentata, Forster.

Raoul, "Choix de Plantes de la Nouvelle-Zélande," t. 30.

Zanthoxylon Novæ-Zelandiæ, A. Richard.

A tall diœcious shrub or small tree, sometimes exceeding 40ft. in height. Branchlets ascending, pubescent. Leaves opposite, petioled, oblong or linear-oblong or obovate, 2in. to 4in. long, obtuse or acute, with distant serratures or rarely entire, usually glabrous. Panicles axillary, 1in. to 2in. long, pubescent. Male, perianth saucer-shaped, five- to ten-lobed, pubescent, $\frac{1}{3}$ in. in diameter: anthers numerous, nearly sessile, opening by slits, hairy at the tips. Female, with numerous ovaries and sessile stigmas, one-celled; ovule solitary. Fruit, red, $\frac{1}{2}$ in. in diameter; endocarp coriaceous; seed solitary, with copious oily endosperm.

EXPLANATION OF PLATE CX.

Hedycarya dentata, Forster. Male flowering specimen, natural size. 1. Male flower. 2. Anther. 3. Portion of female panicle. 4. Female flower. 5. Longitudinal section of an ovary. 6. Fruits. 7. Longitudinal section of a fruit. All magnified except Figs. 3 and 6.





OLEARIA AVICENNIÆFOLIA.

OLEARIA AVICENNIÆFOLIA, Hook. f.

THE AKEAKE.

ORDER—COMPOSITÆ.

(Plate CXI.)

OLEARIA AVICENNIÆFOLIA is one of several small trees termed "ake" or "akeake" by the Maoris: it is an ornamental shrub, from 6ft. to 20ft. high or upwards. Its flowers are produced in great profusion, and, as they stand clear of the foliage, are displayed to great advantage. The branches are angular, grooved, hoary with fine white pubescence: the leaves are alternate, from 1½in. to 3in. long and from 1in. to 2in. in width, flat, and clothed with closely-appressed white hairs beneath. The flower-heads are very small, but produced in great profusion, forming large panicles, usually exceeding the leaves, and carried on long slender stalks: they are arranged in fascicles of from two to five on pedicels ¼in. to ½in. long. The involucre is narrow and cylindrical, consisting of but few leaves, and containing from two to four florets, of which two are perfect, with tubular corollas; the others being female and furnished with a ray, but the ray-florets are sometimes absent. The flowers are produced from November to January.

PROPERTIES AND USES.

The wood of this species is compact, dense, and even, with a yellowish satiny lustre, and is often marked with dark streaks: it is frequently waved and prettily figured. There is no certain evidence as to its durability, but it is of decided value for those purposes of the cabinetmaker which do not require wood of large dimensions, and for ornamental work generally, inlaying, &c. It is easily cultivated, and may be kept in a dwarf condition by pruning.

DISTRIBUTION OF THE GENUS.

See under *Olearia Traversii*, p. 47, ante.

DISTRIBUTION OF THE SPECIES.

Olearia avicenniæfolia is endemic in New Zealand, and is restricted to the South Island, being found in all the districts, although rather local in some localities. It occurs on Stewart Island. It is most plentiful in river-valleys, where it sometimes covers considerable areas, almost to the entire exclusion of other trees: when growing in rocky places, or solitary, it usually assumes a spreading habit.

It ranges from the sea-level to about 3,000ft., but is most plentiful below 1,600ft.

DESCRIPTION.

Olearia avicenniæfolia, Hook. f., "Handbook of the New Zealand Flora," p. 120.

Eurybia avicenniæfolia, Hook. f., "Flora Novæ-Zelandiæ," i., p. 127.

Shawia avicenniæfolia, Raoul.

A shrub or small tree, sometimes fully 20ft. high. Branches grooved, hoary. Leaves alternate, quite entire, lanceolate-oblong or ovate-oblong, sub-

acute or acute, narrowed into the slender petiole, flat, minutely reticulated, white, with appressed tomentum beneath. Panicles dense, solitary, axillary near the tips of the branches, equalling or exceeding the leaves in length; peduncles long, slender, hoary. Heads small, solitary, or in three- or four-flowered fascicles on short pedicels. Involucre of few scales, narrow, glabrous; ray-florets one or, rarely, two. Achene silky; hairs of the pappus in one series, not thickened at the tips.

DESCRIPTION OF PLATE CXI.

Olearia avicenniaefolia, Hook. f., natural size. 1 and 2. Flower-heads. 3. Ray-floret. 4. Perfect florets. 5. Achene.

NOTE.—In Fig. 5 the hairs of the pappus are erroneously drawn with thickened tips.



Rohutu.
(MYRTUS PEDUNCULATA).

MYRTUS PEDUNCULATA, Hook. f.

THE ROHUTU.

ORDER—MYRTACEÆ.

(Plate CXII.)

THIS species bears the same Native name as *Myrtus obcordata* (Pl. LXX.), although easily distinguished from that species. It has the widest distribution of all the New Zealand myrtles, and is generally known: a well-grown specimen forms an attractive object when thickly studded with its white flowers.

It varies considerably in its mode of growth, sometimes forming a compact bush or shrub, at others a straggling shrub irregularly branched, or a small tree 20ft. high. The branches are quite smooth; and usually angular or four-sided, with small opposite leaves marked with pellucid dots and round at the tip or, rarely, acute, but never notched as in *M. obcordata*: they are from $\frac{1}{3}$ in. to $\frac{1}{2}$ in. long, and carried on very slender leaf-stalks. The flowers are solitary, carried on long stalks springing from the axils of the leaves, and differ from those of other New Zealand species in the calyx being five-lobed instead of four-, and in the corolla being composed of five petals: in other respects the flowers resemble those of *M. obcordata*. The fruit is red or, rarely, orange-coloured, and contains two or more bony seeds.

PROPERTIES AND USES.

The wood is dense, firm, and compact, prettily marked, and very similar to that of *M. obcordata*. It is occasionally employed for axe-handles and similar purposes; transverse sections of the trunk are sometimes used for inlaying.

DISTRIBUTION OF THE GENUS.

See under *Myrtus obcordata*, p. 127, *ante*.

DISTRIBUTION OF THE SPECIES.

Myrtus pedunculata is endemic in New Zealand, and, although it cannot be considered a common plant, it is found in numerous localities from Mongonui to Stewart Island. It is sometimes extremely local, or is even absent from large districts.

It ascends from the sea-level to fully 2,000ft.

DESCRIPTION.

Myrtus pedunculata, Hook. f., "Icones Plantarum," t. 629.

A shrub of compact or straggling habit, or, rarely, a small tree, 20ft. high. Branchlets tetragonous, glabrous. Leaves opposite, obovate or oblong-ovate, rounded at the tips, $\frac{1}{3}$ in. to $\frac{1}{2}$ in. long, acute, pellucid-dotted; petioles slender. Flowers axillary, solitary on slender peduncles. Calyx superior, glabrous; limb five-lobed; petals five; stamens numerous; ovary two-celled. Fruit a berry with two or, rarely, four bony seeds. Peduncles 1in. long in fruit.

EXPLANATION OF PLATE CXII.

Myrtus pedunculata, Hook. f., natural size. 1. Leaf. 2. Flower. 3. Fruit.
4. Transverse section of fruit. 5. Seed. All magnified.



Makomako.
(ARISTOTELIA RACEMOSA).

ARISTOTELIA RACEMOSA, Hook. f.

THE MAKOMAKO.

ORDER—TILIACEÆ.

(Plate CXIII.)

THE makomako or "wine-berry" of the settlers was discovered by Banks and Solander, who gave it the MS. name of *Triphalia rubicunda*, but it was described by A. Cunningham under the name of *Friesia racemosa*: in the "Flora Novæ-Zelandiæ" it was placed by Sir Joseph Hooker in *Aristotelia*. It is one of the commonest plants in the colony, and is of interest from being the first plant to make its appearance after the forest has been cleared, especially in the southern districts: in many parts of the colony its straight stems may be found growing by roadsides or in abandoned clearings in a way that at once calls to mind the hazel-copses of Europe.

It forms a shrub or small tree, from 6ft. to 30ft. high, with a trunk 18in. in diameter, and when covered with its various-tinted flowers presents a handsome appearance. The branches are distant and spreading; they are slender, and clothed with fine hairs: the bark of the young wood is red, which changes into black. The leaves are opposite, from 2in. to 5in. long, and carried on long slender footstalks; they are of thin texture, and often red or purple below, broadly heart-shaped, tapering to a long point, and the margins are irregularly cut into large sharp teeth. The flowers are rosy-red of varying shades, about $\frac{1}{2}$ in. in diameter, and carried on slender pedicels; they are arranged in much-branched slender panicles, which spring from the axils of the leaves, and are clothed with downy hairs. The male and female flowers are produced on different trees, the latter being easily recognised by their smaller size. In the male flower the calyx consists of four sepals, and the corolla of four free petals, which are deeply lobed or toothed at the tips: the stamens are numerous, and clothed with long hairs. In the female flower the sepals and petals are similar to those of the male but smaller, and the ovary is conical, with three or four short styles. The fruit is a small red berry, changing into black, four- or, rarely, three-celled. The seeds are remarkable from having a thin fleshy outer coat casing the hard bony envelope.

The flowers are produced during the months of October and November.

PROPERTIES AND USES.

The wood is white, straight in the grain, often streaked and figured. Although of light specific gravity, it is suitable for many purposes of the cabinet-maker and for general turned work: it is occasionally used for inlaying. Although not durable when exposed, it is frequently used for fence-rails and similar purposes.

It is extensively converted into charcoal for the manufacture of certain kinds of gunpowder. For this purpose long straight rods, 10ft. to 15ft. long, and not exceeding 5in. or 6in. in diameter at the base, are preferred; these are felled, peeled, and cut into 4ft. lengths, for which £1 10s. per cord is paid on delivery

at the landing at the Owake mills. It was stated that a man and two boys could prepare two cords per day when felled, but the sticks have to be conveyed several miles by boat or punt, and contrary winds may cause the trip to extend over three or four days. A royalty of £1 per acre is paid to the owner of the forest.

Its attractive flowers render it of great value for the shrubbery, but wherever possible it should be allowed sufficient space to assume the arboreal habit.

DISTRIBUTION OF THE GENUS.

Aristotelia is a small genus comprising six species, one endemic in Chili, two in Australia, and three in New Zealand.

DISTRIBUTION OF THE SPECIES.

Aristotelia racemosa is endemic in New Zealand, and is plentiful in lowland districts from Mongonui to Stewart Island, being most frequent on the margins of woods. On the west coast it ascends to considerably above 2,000ft. as an occasional straggler, but is rarely found in any quantity at that altitude.

DESCRIPTION.

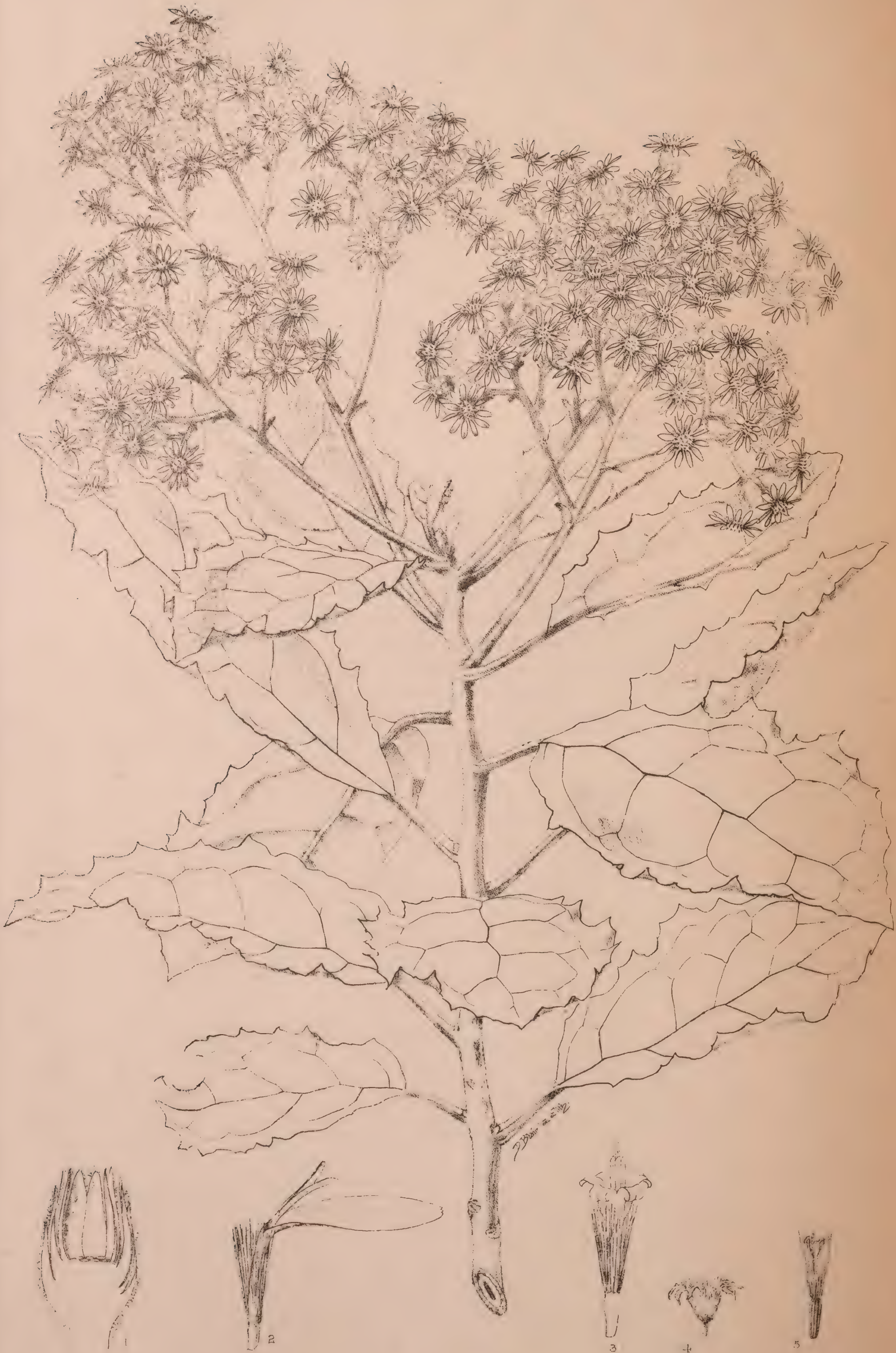
Aristotelia racemosa, Hook. f., "Flora Novæ-Zelandiæ," i., p. 33.

Friesia racemosa, A. Cunn. Hook., "Icones Plantarum," t. 601.

A diœcious shrub or small tree, 6ft. to 30ft. high; bark of young branches red, ultimately black. Branchlets, petioles, young leaves, and panicles pubescent. Leaves opposite or sub-opposite, 2in. to 5in. long, on long slender petioles, ovate-cordate or ovate-acuminate, irregularly serrate; teeth acute. Flowers in much-branched slender axillary panicles. Calyx of four free sepals, inferior; petals four-lobed at the tips. Male flower, stamens numerous, inserted on a glandular disc; anthers equalling or exceeding the filaments, hairy. Female, stamens abortive; ovary three- or four-celled; style short, straight. Fruit, a red berry, four-celled. Seeds with an outer fleshy coat. The flowers are sometimes perfect.

EXPLANATION OF PLATE CXIII.

Aristotelia racemosa, Hook. f. Male flowering specimen, natural size. 1. Female flower. 2. Male flower. 3. Fruits. 4. Transverse section of a fruit. 5. Seeds. All magnified except Fig. 3.



OLEARIA CUNNINGHAMII.

OLEARIA CUNNINGHAMII, Hook. f.

THE HEKETARA.

ORDER—COMPOSITÆ.

(Plate CXIV.)

OLEARIA CUNNINGHAMII was discovered by Banks and Solander in 1769, and received the MS. name of *Solidago canescens*, but was first published by Cunningham under the name of *Brachyglottis Rani*. It was described by Sir Joseph Hooker in the "Flora Novæ-Zelandiæ" as *Eurybia Cunninghamii*, but in the "Handbook of the New Zealand Flora" all the New Zealand species of *Eurybia* were merged in *Olearia*.

Olearia Cunninghamii varies greatly in habit and stature, and is evidently affected by the conditions under which it grows: when in the open, it forms a much-branched bush, sometimes with leaves little more than 1 in. in length; if in cool partially-shaded situations, it forms a tall shrub, branched from the base, and usually exhibiting great luxuriance; if growing in woods, it becomes a small tree, sometimes 25 ft. high, with a trunk 1 ft. or more in diameter and large leaves. In all situations its large panicles of white flowers are developed in the greatest profusion, so that during the month of October it forms a marked feature in the northern woodlands.

I am indebted to the Ven. Archdeacon W. L. Williams for the Native name, "hekctara."

The branchlets, leaf-stalks, and panicles are clothed with soft brown hairs. The leaves are alternate, from 2 in. to 5 in. long, and from 1 in. to 2½ in. wide; they vary considerably in shape, but are usually acute at the apex, the margins being cut into close or rather distant teeth, and the under-surface white with partially-appressed hairs. The panicles are from 3 in. to 7 in. long, and spring from the axils of the leaves near the tips of the branches. The flower-heads are ¾ in. in diameter, with spreading rays. Each head contains from fourteen to twenty-four florets, of which the outer series is female, with strap-shaped corollas, forming the ray: the inner florets are perfect, tubular, bell-shaped at the mouth; they are only about half the number of the ray-florets. The flowers are produced from the latter part of September to the middle of November.

PROPERTIES AND USES.

The wood of *Olearia Cunninghamii* is light-coloured, compact, and satiny, with very fine silver grain and small figure. It is occasionally used by the cabinetmaker.

It is a valuable plant for the shrubbery and for deep borders, as it readily adapts itself to a great variety of soils and situations, producing its large panicles in great profusion alike on light volcanic soils and stiff clays.

DISTRIBUTION OF THE GENUS.

See under *Olearia Traversii*, p. 47, ante.

DISTRIBUTION OF THE SPECIES.

Olearia Cunninghamii occurs alike in dry broken places, in open situations, and in woods. It is frequent from the North Cape to Cook Strait. In the South Island it is found in the Districts of Marlborough and Nelson, and, on the authority of Mr. Buchanan, on the west coast of Otago also, but appears to be absent from Canterbury and Westland. It ascends from sea-level to upwards of 2,000ft.

DESCRIPTION.

Olearia Cunninghamii, Hook. f., "Handbook of the New Zealand Flora," p. 126.

Eurybia Cunninghamii, "Flora Novæ-Zelandiæ," i., p. 117, t. 30.

A shrub or small tree, 6ft. to 25ft. high; trunk sometimes 1ft. in diameter or more. Branchlets, panicles, and involucre clothed with soft brown tomentum: branchlets finely grooved. Leaves alternate, petioled, 2in. to 5in. long, ovate or broadly oblong or narrow-oblong or lanceolate, acute; margins with few acute teeth; under-surface white. Panicles 3in. to 7in. long, with spreading branches, axillary. Heads very numerous, $\frac{3}{4}$ in. in diameter, pedicelled; involucre scales in several series, obtuse or sub-acute. Florets, eighteen to twenty-four; ray-florets spreading, twice as numerous as the disk-florets; disk-florets perfect, tubular mouth, campanulate, with recurved segments. Achene glabrous; pappus-hairs few, whitish or reddish-brown, slightly thickened at the tips.

EXPLANATION OF PLATE CXIV.

Olearia Cunninghamii, Hook. f. Flowering specimen, natural size. 1. Longitudinal section of involucre. 2. A ray-floret. 3. Perfect floret. 4. A flower-head. 5. An achene. All magnified.





The Totara.
(PODOCARPUS TOTARA).

PODOCARPUS TOTARA, A. Cunningham.

THE TOTARA.

ORDER—CONIFERÆ.

TRIBE—PODOCARPEÆ.

(Plate CXV.)

WITH the exception of the kauri the totara affords the most valuable timber in New Zealand, but, unlike the kauri, it is found almost throughout the colony. It sometimes forms large groves or even forests, but is usually mixed with other trees. The foliage is of an unattractive dull-brown tint, but it forms a noble tree, sometimes exceeding 100ft. in height, with a trunk from 2ft. to 6ft. or even 8ft. in diameter, clothed with fibrous brown bark, which is deeply furrowed, and sometimes fully 3in. thick at the base of the trunk: it is often ringed horizontally near the base of the trunk, and hangs in thin papery ribbons. Massive symmetrical trunks, from 60ft. to 80ft. long without a branch, are found in many localities: usually, however, it is of less dimensions; not unfrequently ripe trees may be found with trunks from 20ft. to 30ft. long and less than 2ft. in diameter. The leaves are usually spreading, and, except in size, there is but little difference between those of seedlings and mature trees; they may be scattered or arranged in two rows, and are of very thick texture, stiff and rigid, about 1in. long and scarcely $\frac{3}{8}$ in. wide, narrowed at both ends, sharply pointed, straight or curved, erect or spreading. The young shoots and leaves are of a pale bluish-green; at the base of the shoots a few recurved membranous leaves are developed, but speedily fall away.

The male and female flowers are produced on separate trees, and closely approach those of *P. Hallii* in structure. The male catkins are developed in the axils of the leaves on shoots of the previous year; they may be solitary or in clusters of two or three, and sessile or very shortly stalked; they are about $\frac{3}{8}$ in. to $\frac{1}{2}$ in. long, obtuse, and have a small involucre consisting of four minute flat leaves at the base: the connective is slightly produced upwards, obtuse and toothed. The female flowers are developed in the axils of the leaves at the base of new shoots, and appear before the leaves are fully formed, which probably accounts for their having remained so long unknown; they are solitary or, rarely, in twos, and are shortly stalked; each flower consists of two united carpellary leaves, one of which carries an ovule: after fertilisation the ovule increases rapidly in size, while the carpels remain stationary. When the nut is fully formed, which may be in the autumn or not until the following spring, the carpellary leaves usually become swollen and pulpy, assuming a bright-red or crimson colour, often hiding the peduncle; but in many instances the carpellary leaves do not swell, becoming dry and shrivelled: the nut is rounded at the apex.

The flowers are produced in October and November, and ripe fruits may usually be found on the tree at the same time, but the bulk of the fruit falls in March or April. *P. Hallii* produces its flowers in December and January.

The chief points of difference between this species and *P. Hallii** were briefly referred to under that species, but may be stated at greater length: it will be seen that they are to a great extent comparative:—

	<i>P. Hallii.</i>	<i>P. Totara.</i>
Branchlets of young state .	Often pendulous.	Stiff and rigid.
Leaves of young state ...	Larger than in the mature state.	Similar to those of mature state.
Leaves of mature state ...	$\frac{1}{2}$ in. to $\frac{3}{4}$ in. long.	1in. to $1\frac{1}{2}$ in. long.
Male catkins ...	Solitary. Distinctly stalked.	Rarely solitary. Sessile, or very shortly stalked.
Nut ...	Pointed at the apex. Often in twos.	Rounded at the apex. Usually solitary.

The subject is of considerable importance on account of the great difference in the durability of the timber afforded by each species.

PROPERTIES AND USES.

The wood of the totara is of a deep-red colour, varying considerably in depth of tint: many specimens present a close approach to Honduras mahogany in general appearance. It is clean, straight in the grain, compact, and of great durability: it does not warp or twist, and is easily worked: in the latter respect it is not equal to Californian red-wood, but it is superior to that timber in strength, and probably in durability also. It is an excellent timber for general building purposes—framing, joists, rafters, weather-boards, &c. It is of great value for bridges, wharves, and other constructive works where large spans are not required, but is not suitable for long beams. It is valued for railway-sleepers, and is largely employed for this purpose on account of the ease with which it can be converted: it is one of the best timbers for telegraph-posts. It is easily split, and has come into general use for fence-posts, rails, palings, shingles, &c.; sawn shingles are also manufactured to a large extent. For marine piles it is unrivalled on account of its great power of resisting the attacks of the teredo: except the pohutukawa and puriri, which are only available in comparatively short lengths, no other native timber exhibits equal power of resistance to this destructive mollusc: it surpasses the West Australian jarrah, from which great results were anticipated, and is only excelled by the costly greenheart of Demerara. It has proved of great value for the wood pavements formed at street-crossings, also for kerbing for sidewalks instead of stone, &c., and is highly valued for fencing-posts and rails; but whenever sunk in the ground it should be perfectly free from sapwood, as this decays in a comparatively short time and affects the heartwood, which lasts longer when the sapwood is removed before the post is fixed. The chief defect of totara is its somewhat brittle character: specimens loaded up to their full strength break suddenly and without warning; ordinary fence-posts after standing a few years often become extremely brittle, although remaining perfectly sound; a horse tied to a totara fence and suddenly startled would break three or four standing posts in his efforts to get free; railway-sleepers when carelessly packed break across the middle: but even with this drawback it is a timber of high value. When used for marine piles it is said to retain its power of resisting boring crustaceans and molluscs for a much longer period if driven while in the green state: the sapwood of totara is sometimes attacked before the pile has been driven from two to four years, but the heartwood remains untouched for a much longer period. Clean piles from which all sapwood has been removed would resist the attacks of marine borers for a protracted period: I have seen piles in which,

* See *Podocarpus Hallii*, p. 13, ante.

after perforating the sapwood in all directions, the teredines had abandoned the attack and deserted the pile on coming in contact with the heartwood.

The specific gravity, as stated by Balfour, is .559, the weight per cubic foot 35.17lb., and the breaking weight 133.6lb., the mean average obtained from seventeen specimens. The maximum breaking weight was 170lb., the minimum 118.7lb.* Mr. Blair states the weight per cubic foot in the green state to vary from 49.783lb. to 56.715lb.; when seasoned, 36.210lb. to 42.228lb.; and the breaking weight 142.50lb., the last results being obtained from tests of ten specimens.† As it is uncertain whether the specimens tested in either case were those of *P. Hallii* or *P. Totara*, the results cannot be applied with certainty. It is of considerable importance that an extended series of experiments should be undertaken to determine the relative value of the timber of the two species.

Occasionally specimens with figured and mottled wood are found, and are highly valued. Mottling is produced in the same manner as in the kauri, chiefly by the trees being "bark-bound," so that portions of the bark become imbedded in the wood, but the effect is less attractive than in the kauri on account of the absence of the satiny lustre so characteristic of the latter. The trunks of old trees often develop large wens or excrescences, which are finely mottled and are usually converted into veneers.

Kauri and totara are extensively used for general building purposes, the former enormously in excess of the latter; both exhibit the same amount of durability, but kauri is more easily worked, and takes a higher finish. For fencing purposes they are of nearly equal value, kauri having a slight advantage arising from its greater strength. The same may be said for their use as railway-sleepers and telegraph-posts. In constructive works kauri has the advantage of greater strength, and endures a larger amount of wear and tear. For marine piles totara is vastly superior to kauri. For masts, deck-planking, and other purposes of the shipbuilder, kauri is decidedly preferred. Both timbers are used in the manufacture of furniture, with equally good results except as to colour, in which respect kauri has a marked advantage.

The totara is easily cultivated, and, although flourishing most luxuriantly in cool alluvial soils, exhibits a great amount of indifference to the nature of its habitat. It may be found on sandy soils, light basaltic scoria, and stiff clays. It is occasionally used for ornamental planting, and for hedges for breakwinds, for which it is very suitable, as it bears clipping as well as the English yew. Specimens planted in the Auckland Domain twenty-two years ago are now 28ft. high, and 2ft. in circumference at 2ft. from the ground.‡ Sometimes the vertical growth of this tree is at the rate of 2ft. per annum.

ON THE CONVERSION OF TOTARA.

Owing to the mixed character of the forests in which totara is usually found, few mills are devoted exclusively to its conversion, but it forms an important item in the output of many of the mills working in the Wairarapa, Manawatu, and Hawke's Bay: at one sawmill in the Upper Waikato, Auckland, totara is the only timber converted; so also at the sawmills of Messrs. Nannestead, Richter, and Company at the Tamaki, Tahoraite, and that formerly held by Messrs. Wilding and Company, Waipukurau. Large quantities are also converted at sawmills in Napier. The amount of totara converted in the South Island is but small; in many districts it is completely cut out. The machinery

* Balfour: Experiments on the Strength of New Zealand Timbers.

† Blair: Building Materials of Otago, pp. 224, 213.

‡ J. Eaber: "On the Growth of Transplanted Trees," Trans. N.Z. Inst., Vol. XIX., p. 187.

of these mills does not call for special notice, and there is nothing remarkable in the working of the forests, which in most cases are penetrated by tramways, with rails of wood or, rarely, of iron, in one instance worked by steam motor. In old totara trees the waste is very large, owing to the decay commencing in the upper branches and descending to the heart: in some cases it exceeds 50 per cent., and is rarely under 40 per cent. Not unfrequently irregular swellings and outgrowths on the trunks of old trees render them unsymmetrical, which increases the percentage of waste. I have seen excessive waste caused by a small amount of heart-decay at the base, where it formed a cone from 2ft. to 4ft. high, and from 2in. to 4in. in diameter. Defects of this nature are chiefly due to the timber having been allowed to stand too long after it has attained ripe maturity. In trees cut at the proper stage the waste is comparatively small except in unsymmetrical trunks.

Many of the sawmillers obtain their logs from freehold land, and not unfrequently they are sent long distances by rail: the Napier mills are supplied in this way from forest adjoining the Napier and Woodville Railway. Others obtain it from settlers or Natives on payment of a royalty varying from 1s. to 2s. per 100 superficial feet. Two shillings is not more than a fair royalty for good totara. In some cases blocks of land are leased from the Maoris at a fixed annual rental: I was informed of an instance in which a large area, originally leased from the Maoris for a yearly payment of £300, was sublet for £1,500, which would be equivalent to a royalty of 2s. per 100 superficial feet on a million and a half superficial feet of converted timber, or very nearly three million feet, log measurement.

First-class totara forest often yields very high returns per acre: in one instance in which the returns were carefully worked out the average for twenty-six acres was 43,092 superficial feet; but from 80,000ft. to 100,000ft. has been obtained. A grove of totara which certainly did not exceed thirty acres in extent, situated near the mouth of the Pohangina River, was leased to Messrs. Warne and Beard, of Ashurst, at a royalty of 1s. 3d. per 100 superficial feet. These gentlemen obtained 3,104,000 superficial feet of converted timber from the area, and paid £1,940 in royalty, which gives an average yield of 103,466 superficial feet, equivalent to £64 13s. 4d. per acre: but forest of this kind has now become extremely rare, except in the central portion of the North Island. It may be fairly assumed that the districts in which totara is chiefly produced at this date will be exhausted within ten years.

Totara is exported from Napier to the Australian Colonies to a small extent only, and, although strenuous efforts have been made to force an export trade, they have failed to command success. Notwithstanding the high intrinsic value of totara, it has no advantage over kauri except for certain special purposes, while it is less easy to work, and, owing to the enormous waste in the conversion of old trees, is slightly more expensive to manufacture. This, however, is of small importance, as the home demand is increasing with great rapidity. For some years past Auckland has obtained the chief portion of totara consumed in that district from Hawke's Bay, and Otago is now being supplied from the same source. Year by year it is becoming increasingly difficult to obtain piles of large dimensions, and there can be no doubt that before any great length of time has elapsed prices will advance rapidly.

At present first-class totara for ordinary building purposes sells at from 12s. to 13s. 6d., all heart at from 14s. 6d. to 16s., per 100 superficial feet; bridge and wharf timbers at somewhat higher rates, according to the dimensions required; railway-sleepers, from 2s. 10d. to 3s. 3d. each; telegraph-posts, 20ft.

long, 8in. \times 8in. at base, tapering to 6in. \times 6in., 15s. each; 25ft. long, 18s. to 20s. each; 35ft. long, 16in. \times 16in. at base, tapering to 10in. \times 10in., £6 10s. to £7 each. For marine piles the price varies considerably, according to the dimensions required, and partly according to the state of the labour-market. Squared piles up to 45ft. long, of a mean square not exceeding 14in. \times 14in., may be obtained at 4s. per lineal foot, equivalent to 24s. per 100 superficial feet. Piles 50ft. long would fetch at least 30s. per 100 superficial feet; longer lengths could only be obtained at much higher rates.

Two contracts for piles for wharf-extension in Wellington were taken as under, on different dates:—

Squared piles, practically all heart, 27ft. to 33ft. long, 14in. \times 14in. at butt, tapering to 12in. \times 12in., 4s. 8d. per lineal foot.

Squared piles, 33ft. to 46ft. long, 16in. \times 16in. at butt, tapering to 13in. \times 13in., 4s. per lineal foot. This rate must be too low to allow a fair remuneration to the contractor.

Heart-of-totara shingles cost about 18s. per 1,000. When totara is used for wood pavement it is sawn into blocks 3in. thick, 6in. deep, and 9in. long: the present contract price is 14s. 4d. per 100 superficial feet. Mr. Loughrey, City Engineer, Wellington, informs me that if laid with the grain vertical it exhibits great power of resisting wear and tear. He is of opinion that it ought to last at least twenty years if laid on a good foundation.

DISTRIBUTION OF THE GENUS.

See under *Podocarpus spicata*, p. 5, *ante*.

DISTRIBUTION OF THE SPECIES.

Podocarpus Totara is endemic in New Zealand, and is generally distributed from Mongonui to Otago. I have not seen specimens growing in Southland or on Stewart Island, as it is replaced by *P. Hallii* in the extreme South. *P. Totara* is however found in the Catlin's River district. It is most extensively converted in the Hawke's Bay and Wairarapa districts, but occurs in great abundance in the centre of the North Island, some of the grandest trees in the colony being found in the Pungapunga Valley. It was formerly plentiful in several districts on the east coast of the South Island, but has been cut out in nearly every locality. In the Westland District it occurs in narrow strips or belts—a peculiarity which may occasionally be seen elsewhere.

The totara evinces a decided preference for growing at low levels, and attains its greatest dimensions at elevations below 1,200ft.; it rarely ascends to 2,000ft., and at higher elevations is completely replaced by *P. Hallii*.

DESCRIPTION.

Podocarpus Totara, A. Cunn.

Hook., "London Journal of Botany," i., 572, t. 19.

A diœcious tree, 40ft. to 80ft. or even 100ft. high; bark brown, fibrous, furrowed. Leaves distichous or scattered, $\frac{1}{2}$ in. to $\frac{3}{4}$ in. long, acute, pungent, narrowed at the base, coriaceous, usually spreading, brown when dry. Male catkins axillary, equalling the leaves, obtuse, solitary or in twos or threes, sessile or on very short peduncles, with four bracts at the base, connective with a rounded appendage at the apex, finely toothed. Female, shortly peduncled, solitary or two together in the axils of the leaves of new shoots; ovule solitary or, rarely, geminate. Fruit usually pulpy, with the nut rounded or slightly narrowed at the apex, never acuminate.

EXPLANATION OF PLATE CXV.

Podocarpus Totara, A. Cunn. 1. Male flowering specimen, natural size. 2. Male catkin. 3. Bracts at base of a male catkin. 4 and 5. Upper and lower views of an anther. 6. Pollen-grains. All magnified. 7. Shoot with female flowers, natural size. 8. Portion of the same. 9. Female flower. Both magnified. 10. Immature fruits, natural size. 11. An immature fruit, magnified. 12. Ripe fruit, natural size.





SENECIO ROTUNDIFOLIUS.

SENECIO ROTUNDIFOLIUS, Hook. f.

THE PUHERITAIKO.

ORDER—COMPOSITÆ.

(Plate CXVI.)

THE puheritaiko was originally discovered by Forster in Dusky Sound, and was described by him under the name of *Cineraria rotundifolius*, but was removed to *Senecio* by Sir Joseph Hooker on the publication of the "Flora Novæ-Zelandiæ." I am indebted to Mr. Charles Traill, of Stewart Island, for the Native name, "puheritaiko."

It forms a very handsome and striking plant; its stiff, coriaceous, bright-green leaves, with white under-surfaces, are most attractive, although, from the absence of rays, the inflorescence is not showy. It usually grows in the most exposed situations, and frequently in places where it is washed by the sea-spray: when growing in woods it develops fewer branches.

Senecio rotundifolius is a shrub or small tree, sometimes 30ft. high, with a trunk 2ft. in diameter, clothed with extremely thin smooth bark. The branches are very stout, and, with the leaf-stalks, under-surfaces of the leaves, and panicles, are clothed with a coating of rather loose white or buff hairs. The leaves are alternate, and are carried on leaf-stalks from 1in. to 3in. long, the blades being more or less rounded and from 2in. to 4in. broad, of very thick leathery texture, bright glossy green above, white beneath, and furnished with a stout marginal nerve.

The flowers are produced in much-branched panicles at the tips of the branches; the heads are numerous, about $\frac{1}{2}$ in. in diameter, with stout involucreal scales clothed with white hairs. The florets are tubular and bell-shaped at the mouth; they may be all perfect, or a few of the outer series may be female but destitute of rays. The flowers are produced during the months of November and December.

PROPERTIES AND USES.

The wood of the puheritaiko is of a pale-brown colour, with a bright satiny lustre and pretty silver grain: it is rarely figured, but is suitable for many kinds of ornamental work, for inlaying, and for general turnery purposes. The power of sustaining the force of the fiercest gales and the dashing of the spray exhibited by this tree is marvellous; I have never seen a leaf torn or injured by the action of either: this is partly due to the thick texture of the leaf, but more especially to the stout marginal nerve with which it is furnished. It is of great value for planting as shelter in exposed situations. On such places as Dog Island it would enable the lighthouse-keepers to form a garden with but little trouble: thousands of seedlings could be readily obtained from Stewart Island or the sounds of the south-west coast.

DISTRIBUTION OF THE GENUS.

Senecio is a large genus, comprising fully nine hundred species, found in nearly all parts of the world, from the arctic to the antarctic regions.

About thirty-five species are found in New Zealand, most of which are endemic. Several species are of great beauty; others are remarkable for the large size of their foliage or for their peculiar habit.

DISTRIBUTION OF THE SPECIES.

Senecio rotundifolius is found over a very limited area, and usually in the near vicinity of the sea. It attains its northern limit in Martin's Bay, and occurs in all the sounds as far as Puysegur Point, but has not been observed farther eastward on the mainland. It is plentiful on Centre Island, Ruapuke, &c., Stewart Island, and, I believe, on the Snares also.

It is most plentiful at or near the sea-level, but ascends to 1,600ft.

DESCRIPTION.

Senecio rotundifolius, Hook. f.

A shrub or small tree, 6ft. to 30ft. high, with thin smooth bark and robust tomentose branches. Leaves alternate, very thick, entire, and coriaceous when fresh, with a stout marginal nerve, orbicular or broadly ovate, 3in. to 5in. broad, unequal or slightly cordate at the base; petioles stout, 1in. to 3in. long, and, with the under-surface of the leaves, clothed with whitish tomentum. Panicles terminal; branches stout, erect; branches of the panicle and involucre tomentose and woody. Heads numerous, pedicelled, $\frac{1}{3}$ in. to $\frac{1}{2}$ in. in diameter, destitute of rays, broadly campanulate; involucreal scales thick. Florets all tubular and campanulate; a few of the outer series female, or all perfect. Pappus-hairs white, scabrid. Achene furrowed, glabrous or, rarely, with a few silky hairs.

EXPLANATION OF PLATE CXVI.

Senecio rotundifolius, Hook. f., natural size. 1. Perfect floret. 2. Involucre.





Манука.
LEPTOSPERMUM SCOPARIUM

LEPTOSPERMUM SCOPARIUM, Forster.

THE MANUKA.

ORDER—MYRTACEÆ.

(Plate CXVII.)

THE manuka, or, as it is less frequently termed, the "kahikatoa," is the most common plant in the colony, being found in great abundance in every district, and occupying the place of the furze (*Ulex europæus*) in the British Islands. In some localities hundreds of acres are covered with a dense growth of small manuka, from 6in. to as many feet in height; in other places large areas are covered with a close coppice-like growth of straight stems, 10ft. to 15ft. high and the thickness of a man's wrist; more rarely this plant assumes an arborescent form, and attains the height of 30ft., with a trunk rarely 2ft. in diameter, the reddish-brown bark often hanging in long ribbons. When its seed falls on ground which is flooded during the winter and spring months, the young plants appear in vast numbers, but myriads die off as the ground gradually becomes hard during the summer months; but a dense crowd survives until the following spring, when the majority develop a single flower at the apex of the stem, numbers varying from $\frac{1}{2}$ in. to 2in. or 3in. in height; but the production of flowers in this early stage of growth is too exhausting, and but few survive. Flowers are, however, produced freely on dwarf plants from 1ft. to 2ft. high: small specimens when growing luxuriantly make long slender shoots, and, as the white flowers are produced in profusion, they present a very graceful appearance during the flowering season, which commences during the early part of November, and is protracted until the close of January, or longer in the Auckland District, where it is not difficult to find a few flowers nearly all the year round.

This species varies to a great extent in habit as well as in the form of the leaves and the dimensions of the flowers. The branches may be spreading, or strict and ascending: on the mountains the plant is often prostrate and spreading, not exceeding 1in. or 2in. in height: the leaves may be erect or spreading, or curved backwards, narrow or broad or almost rounded, and the flowers may vary from less than $\frac{1}{4}$ in. to upwards of $\frac{1}{2}$ in. in diameter. The branches are very slender, and, with the young leaves, are clothed with silky hairs: the leaves may vary from $\frac{3}{8}$ in. to nearly $\frac{1}{2}$ in. in length, and are of stiff texture, quite entire, with acute or pungent tips: they are dotted with minute oil-glands, and vary much in width, some being almost needle-shaped, others being half as broad as long, and erect or spreading. The flowers are fragrant, solitary, and may be produced in the axils of the leaves or at the extremities of short branchlets. The calyx is entire, and forms a cup with five white lobes, which resemble small petals, and quickly fall away; five free petals, rounded at the tips, spring from its margin. The stamens are numerous, with very short filaments, and form a ring within the petals: the ovary is deeply sunk within the calyx-tube, with which it is closely adherent: it is four- or five-celled, with a short straight style and a rounded or lobed stigma. As the ovary ripens into fruit it rises above the calyx-tube and becomes woody, forming a woody capsule containing numerous minute seeds. The vast majority of flowers are perfect, but, as in many plants which

produce their flowers in great profusion, the stamens are occasionally abortive, or, more rarely, the pistil is imperfect.

It is commonly termed "tea-tree" by the settlers, but must not be confused with the "ti" or "toi" of the Maoris, which is a handsome palm-lily, *Cordyline australis*, often termed "cabbage-tree" by the bushmen.

A handsome variety with red flowers is not infrequent in the North Cape district and other localities, and, contrary to expectation, comes true from seed: a plant raised from seed collected near Spirits Bay by Mr. Justice Gillies, in April, 1868, is now 26ft. high, with a trunk 2ft. 2in. in circumference.

PROPERTIES AND USES.

The wood is of a deep-red colour, very straight in the grain, even, compact, strong, and elastic, but is inferior to the wood of *L. ericoides*, while usually of much smaller dimensions; trunks 1ft. or upwards in diameter are not frequent.

On account of its deep colour it is occasionally used by the cabinetmaker for inlaying: figured specimens are sometimes met with.

An infusion of the leaves is often used by bushmen as a substitute for tea: in all probability it owes its common name "tea-tree" to its having been used for this purpose by the early voyagers.

The fragrant oil which is so plentifully secreted by its leaves may prove to possess medicinal qualities, when its extraction would doubtless prove remunerative, as the raw material can be obtained for the mere cost of cutting.

The twigs are used for rustic brooms and in the construction of bush-whares, &c., and the long straight stems are valued for hop-poles, &c., on account of their durability. *Leptospermum scoparium* is a valuable honey-yielding plant.

DISTRIBUTION OF THE GENUS.

See under *Leptospermum ericoides*, p. 123, *ante*.

DISTRIBUTION OF THE SPECIES.

Leptospermum scoparium is plentiful in all the districts from the Three Kings Islands and the North Cape to Stewart Island and the Snares. I have been assured that it is found on Campbell Island, but hesitate to accept the statement in the absence of specimens, as it has not been recorded by Sir Joseph Hooker and other botanists who have visited the island. On Mount Anglem, Stewart Island, it forms short round-headed trees, 9ft. to 18ft. high, with stout trunks 1ft. in diameter, at an altitude of from 1,200ft. to 1,800ft. It has not been recorded from the Chatham Islands. This species extends to Australia.

DESCRIPTION.

Leptospermum scoparium, Forst.

Varying from a slender dwarf shrub to a small tree 30ft. high. Branchlets and young leaves silky. Leaves alternate or scattered, from $\frac{1}{8}$ in. to $\frac{1}{2}$ in. long; variable in shape—linear, linear-lanceolate, lanceolate-ovate, or nearly orbicular; spreading or recurved, sessile, rigid, pungent, erect or spreading, concave, dotted. Flowers solitary, sessile, axillary or terminal. Calyx-tube turbinate, with five deciduous lobes, superior; petals five, broadly rounded; ovary five-celled; style short, straight. Fruit a woody capsule girt with the remains of the calyx-limb; the upper portion five-valved.

EXPLANATION OF PLATE CXVII.

Leptospermum scoparium, Forst. Flowering and fruiting specimens, natural size. 1. Flower. 2. Transverse section of flower. Both magnified.





Pohutukawa.
 METROSIDEROS TOMENTOSA.

T. KIRK, DIREXIT.

SURVEY DEP. LYONS.

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METROSIDEROS TOMENTOSA, A. Cunningham.

THE POHUTUKAWA.

ORDER—MYRTACEÆ.

(Plate CXVIII.)

THE pohutukawa is, perhaps, the most magnificent plant in the New Zealand flora: it attains upwards of 70ft. in height, often with a comparatively short trunk and numerous large tortuous arms clothed with bold foliage, green above but white and silvery beneath: from the beginning of December to the middle of January its branches are crowned from base to summit with large panicles of glittering blood-red flowers, affording a pleasing contrast with the white under-surface of the leaves as the branches are from time to time uplifted by the breeze.

Very rarely it forms a straight symmetrical trunk with a compact round head. On Rangitoto, an extinct volcano at the entrance to the Waitemata, diminutive specimens, 1ft. to 3ft. high, may be seen growing from the face of the basaltic rock, and, notwithstanding the unfavourable nature of the habitat, exhibiting the utmost luxuriance of foliage and extremely brilliant flowers.

It was originally discovered by Banks and Solander during Cook's first voyage, and received the MS. name of *Metrosideros excelsa*, but was first described by Allan Cunningham. It is the "Christmas-tree" of the settlers, who use its flowers freely for Christmas decorations.

It is often of irregular growth, with a trunk from 2ft. to 4ft. in diameter, clothed with brown bark, which is much furrowed and wrinkled. The primary branches are often massive and wide-spreading: the branchlets are stout, and clothed with a dense coat of white or dark hairs; the under-surfaces of the leaves are coated with snow-white hairs. The leaves are carried on short leaf-stalks, and are arranged in four rows; they are from 1in. to nearly 4in. long, including the leaf-stalk, and from $\frac{3}{4}$ in. to $1\frac{1}{4}$ in. broad, sharply narrowed towards the apex, and rounded at the base: they are of very stout texture, with the upper surface finely reticulated.

The flowers are developed in dense panicles, about 3in. or more in diameter, terminating the branchlets: they are arranged in threes, each flower being carried on a short stout pedicel, which, with the branches of the panicle, is clothed with a dense coat of snow-white woolly hairs; the pedicels are jointed to the branches of the panicle. The calyx is protected in the same manner, and is funnel-shaped, with five triangular teeth at its margin, which carries five small free scarlet petals, hairy at the back, and a dense ring of stamens with long scarlet filaments. The ovary is adherent with the lower part of the calyx-tube, and is three-celled, with a style longer than the filaments. In fruit it forms a woody capsule exceeding the calyx-tube, and containing numerous minute seeds.

The leaves of the young plant are perfectly smooth, and closely resemble those of *M. robusta*.

Although most frequent on maritime cliffs, it is occasionally found in woods near the sea, when the leaves and flowers are usually smaller.

What appears to be a hybrid between this species and *M. robusta* is occasionally found in situations where both species occur. The branchlets are stout, and the leaves smaller and perfectly smooth on both surfaces. The flowers are of small size, in few-flowered panicles, the branches and pedicels being nearly smooth.

PROPERTIES AND USES.

The wood is of a deep-red colour, excessively dense, heavy and compact, and of great strength and durability. Its spreading tortuous habit of growth renders it of the greatest value for ship-timbers, and it has been extensively used for that purpose since the earliest period of settlement; it is also used for planks for various special purposes, for trenails, for machine-beds and bearings, &c. It is very suitable for the framing and sills of dock-gates, &c.

The pohutukawa exhibits great power of resistance to the attacks of the teredo: I have never seen logs seriously injured by the perforations of this destructive mollusc. It affords excellent firewood, although difficult to split.

Although the trunk does not rival that of the English oak in dimensions its massive arms are equally valuable, and will probably be found superior in durability.

A decoction of the inner layers of the bark is highly valued by bushmen as a remedy for dysentery.

It is to be regretted that it has been wantonly destroyed in many localities, and is now very scarce in districts where it was formerly plentiful. It is generally planted for ornamental purposes: under cultivation it commences to flower when about 5ft. or 6ft. high. Cultivated specimens withstand the winter frost as far south as Banks Peninsula.

DISTRIBUTION OF THE GENUS.

See under *Metrosideros lucida*, p. 99, *ante*.

DISTRIBUTION OF THE SPECIES.

Metrosideros tomentosa is endemic in New Zealand, and is restricted to the northern portion of the colony. It is chiefly found on sea-cliffs, and in woods by the margin of the sea, from the Three Kings Islands and the North Cape to Poverty Bay on the east coast and the mouth of the Mimi River on the west. It is also found inland at Waikaremoana, in the East Cape district, along the course of the Tarawera River to the Tarawera Lake, where it was plentiful and of large dimensions prior to the volcanic eruption of June, 1886. Associated with it were *Astelia Banksii* and other maritime plants of a northern type, forming a scene which could only be elsewhere witnessed on the rocky coast to the north of Auckland. It is not found at Rotokakahi, which is 300ft. higher than Lake Tarawera, into which it discharges, but it occurs sparingly on islands in Taupo Lake, in the centre of the North Island.

It ascends from the sea-level to about 2,000ft. on headlands in the vicinity of the sea, and at Waikaremoana, where it was discovered by Mr. Colenso. It attained a somewhat greater altitude on Tarawera Mountain previous to the eruption.

I have been assured that this species is plentiful between Riwaka and Waitapu, on the southern side of Cook Strait, and that it was used for the framework of a small vessel constructed there a few years ago. I have also been assured

by a surveyor and by a Native that one or two trees are to be found on a point between Takaka mud-flats and Collingwood, but unhappily I have not been able to obtain confirmation of either statement. Wood sections sent from the first-named locality certainly belong to *Metrosideros robusta*. As the statements were made on apparently good authority, I am unable to consider them disproved by the small amount of negative evidence obtained, although they cannot be accepted in the absence of direct evidence in their favour.

DESCRIPTION.

Metrosideros tomentosa, A. Cunn.

A. Richard, "Flora de la Nouvelle-Zélande," t. 37.

A tree, 30ft. to 70ft. high, with a short trunk and massive spreading arms. Branchlets stout, tomentose. Leaves decussate, 1in. to nearly 4in. long, shortly petioled, narrow-lanceolate, oblong or broadly oblong, usually narrowed to the apex, rounded at the base, margins often recurved, clothed with white appressed tomentum beneath, or, rarely, glabrous. Flowers arranged in threes, forming broad terminal cymes; pedicels stout, and, with the calyx, clothed with dense white tomentum. Calyx superior, funnel-shaped, with five short triangular lobes; petals, five, pubescent on the outer surface. Stamens numerous, filaments fully 1in. long; ovary three-celled, adnate with the lower part of the calyx-tube; style stout, longer than the stamens. Fruit, a woody capsule, girt about the middle by the calyx-tube.

EXPLANATION OF PLATE CXVIII.

Metrosideros tomentosa, A. Cunn. Flowering specimen, natural size.
 1. Flower. 2. Longitudinal section of a flower, slightly reduced. 3. Petal, magnified. 4. Capsule. 5. Capsule dehiscing. Both slightly reduced.
 6. Transverse section of capsule, natural size. 7. Seed, magnified.





METROSIDEROS POLYMORPHA, Forster.

THE SMALL-LEAVED POHUTUKAWA.

ORDER—MYRTACEÆ.

(Plate CXIX.)

THIS handsome tree bears considerable resemblance to the pohutukawa, but the branchlets are less robust, and the leaves and flowers are much smaller, the leaves being more rounded. It is the only species of *Metrosideros* in the New Zealand flora which is not endemic. It forms a tree of similar dimensions to the pohutukawa, and varies to a great extent in the form of the leaves and the extent to which the leaves and branches are clothed with hairs: the branchlets are more or less pubescent, and the leaves are arranged in four rows; they are borne on short leaf-stalks, and are from 1 in. to 1½ in. in length, of thick texture, and are usually rounded at the tips; as a rule they are clothed with white appressed hairs beneath. The flowers are arranged in small panicles or cymes, which are borne in the axils of the leaves or on the tips of the branchlets, and vary from 1 in. to 1½ in. in breadth: the flowers may be few or many, arranged in pairs or threes on short stout pedicels, which are clothed with dense snow-white hairs. The calyx is also covered with white woolly hairs, except the minute teeth, which are green. The general structure of the flowers and fruit is similar to that of the pohutukawa, but the stamens are only from ½ in. to ¾ in. in length and very slender, and the upper portion of the ovary is silky.

PROPERTIES AND USES.

The wood of *Metrosideros polymorpha* resembles that of the pohutukawa, and may be applied to the same uses. Owing to its being restricted to the outlying northern islands of the colony it has not been utilised.

In view of the increasing scarcity of pohutukawa in the North Island it would be far wiser to conserve the small-leaved pohutukawa of the Kermadec Islands than to allow it to be destroyed merely to facilitate settlement, which must of necessity be extremely restricted. Nearly two hundred persons are now engaged in ship- and boat-building, of whom fully three-fourths are employed in the Auckland District, where alone pohutukawa is to be procured.

During the year 1885, 403 boats and 53 vessels of from 50 tons to 200 tons burden were built in the colony; the total value of material and labour alone being estimated at £47,116, the cost of the labour being £25,645. By far the greater portion of this work was performed in the Auckland District, the number constructed there being 316 boats and 31 vessels, the total value of which is estimated at £30,613 for labour and material, as against 87 boats and 22 vessels constructed in all other parts of the colony, and valued at £16,503.

DISTRIBUTION OF THE SPECIES.

Metrosideros polymorpha is found in New Zealand, New Caledonia, Fiji, and other Polynesian islands to the Sandwich Islands. It is found on Lord Howe's

Island, but is absent from Norfolk Island and from Australia. In this colony it is confined to Sunday Island, one of the Kermadec group, where it occurs from the sea-level to 1,700ft.

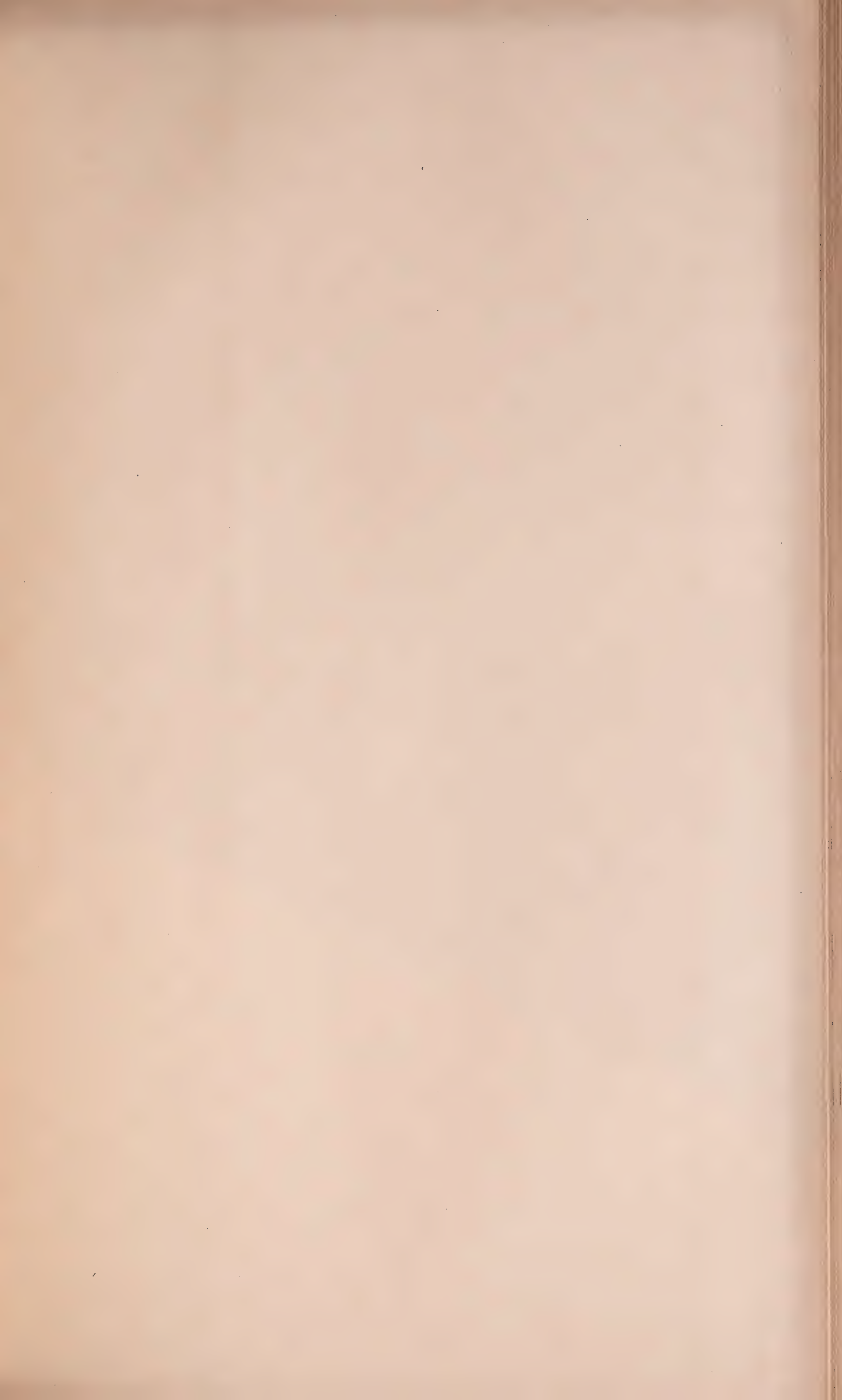
DESCRIPTION.

Metrosideros polymorpha, Forst.

A tree, 40ft. to 60ft. high, varying in the shape of its foliage and the size of its flowers in different localities. In Kermadec Island specimens the leaves are of a light-green above, and the branchlets rather slender, densely clothed with white tomentum, as are the petioles, the under-surfaces of the leaves, the pedicels, and calyxes. Leaves decussate, $\frac{3}{4}$ in. to $1\frac{1}{2}$ in. long, including the petioles, broadly ovate or obovate, rounded at the apex, coriaceous, margins slightly recurved. Flowers in small axillary or terminal cymes, few- or many-flowered, flowers in twos or threes; pedicels stout; calyx woolly, superior; lobes five, small, green at the tips; petals, five, pubescent on the outer surface. Stamens on slender filaments, $\frac{1}{2}$ in. to $\frac{3}{4}$ in. long; ovary adnate with the lower part of the calyx-tube, upper portion silky, style longer than stamens. Fruit, a woody capsule, girt round with the rim of the calyx, three-celled; seeds numerous.

DESCRIPTION OF PLATE CXIX.

Metrosideros polymorpha, Forst. Flowering specimen, natural size. 1. Flower, natural size. 2. Petal. 3. Longitudinal section of calyx-tube. Both magnified.





W. H. R. 1872



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Koromiko.
(VERONICA SALICIFOLIA)
Var gracilis.

VERONICA SALICIFOLIA, Forster.

THE KOROMIKO.

ORDER—SCROPHULARINEÆ.

(Plate CXX.)

ARBORESCENT veronicas are to be met with only in New Zealand, with the single exception of *V. elliptica*, which is found in New Zealand, Fuegia, the Falkland Islands, and South Chili: in the Northern Hemisphere the veronicas are almost exclusively herbs, sometimes less than 1in. in height: in New Zealand they vary from minute herbs to trees 30ft. high, with well-developed trunks; it is, however, remarkable that the arborescent habit is attained only by a comparatively few individuals of a species. The present species, for instance, is most frequent as a much-branched shrub, 3ft. to 6ft. high, but in certain localities it becomes a small tree 20ft. high, with a trunk 1ft. in diameter. The same remark applies to *V. parviflora*, which, in lowland situations, is invariably a shrub, rarely 6ft. high; but on the crests of hills, at an altitude of about 2,000ft., it is frequently a tree 25ft. high, sometimes with a straight trunk 1ft. or more in diameter and a well-developed head, at others with the trunk inclined or prostrate from the effects of the wind: and *V. elliptica* displays the same peculiarity.

V. salicifolia is a variable plant, especially with regard to the breadth of the leaves, the length of the racemes, and the size of the flowers. In its most common form the branches are slender, clothed with thin dark-grey bark: the leaves are from 2in. to 6in. long, and about $\frac{3}{4}$ in. wide, arranged in four rows, perfectly smooth, narrowed at both ends, acute, and destitute of leaf-stalks. The flowers are white or bluish-purple, and are arranged in racemes springing from the axils of the leaves, from 3in. to nearly 1ft. in length; the flowers are close-set and carried on short pedicels: the calyx is deeply cleft into four obtuse or, rarely, acute lobes, and the corolla is entire, the lower part being tubular, and the upper divided into four unequal spreading lobes: the stamens are two in number, inserted at the throat of the corolla, and the ovary is two-celled, compressed, with a slender style. The fruit is a dry two-celled capsule, splitting down the middle, when each cell opens along a median line to liberate the minute seeds.

The variety *gracilis*, selected for illustration on Plate CXX., differs from the type in the shorter and broader leaves, in the very slender racemes, the long pedicels, large flowers, and acute calyx-lobes. The flowers are as large as those of *V. macrocarpa*, and the entire plant is remarkable for its singular grace and beauty. It appears to be very local, and is not to be found in cultivation at present.

PROPERTIES AND USES.

The wood of *Veronica salicifolia* is white, or sometimes brown at the heart, very straight in the grain, and remarkable for its toughness and elasticity. The branches give off a large amount of heat when burned.

The koromiko has long been valued for its beneficial effects in cases of diarrhœa and dysentery, and will probably take its place in the pharmacopœia as a recognised remedy for diseases of this class. Bushmen troubled with English cholera frequently cure the disease by chewing fresh leaves of the plant and swallowing the juice; but usually the drug is taken in the form of an infusion. It is kept in stock by the leading druggists in the colony.

All the forms of this species are easily cultivated, and add largely to the charms of the flower-border and shrubbery.

The leaves of the young plant are sometimes sharply toothed.

DISTRIBUTION OF THE GENUS.

The genus *Veronica* comprises upwards of two hundred species, of which about fifty species are found in New Zealand: the others are most plentiful in Europe and temperate Asia, being comparatively rare in other countries. About fourteen species are found in Australia, two or three of which are naturalised.

DISTRIBUTION OF THE SPECIES.

Veronica salicifolia is endemic in New Zealand: it occurs on the Kermadec Islands, and from the North Cape to Stewart Island, being found in every district. It usually grows in open places or on the margins of woods and gullies, and is most plentiful in lowland situations. It ascends from the sea-level to about 2,300ft.

On southern specimens the leaves and racemes are usually narrower and longer than on northern specimens, but there are many exceptions.

The var. *gracilis* has only been observed on the Bluff Hill, Southland, where it forms a tree 20ft. high.

DESCRIPTION.

Veronica salicifolia, Forst.

A much-branched glabrous shrub or small tree, 5ft. to 20ft. high. Branches and leaves glabrous. Leaves opposite, 2in. to 6in. long, sessile, linear-lanceolate or oblong-lanceolate, acute or acuminate, entire or, rarely, with a few distant serratures. Racemes 3in. to 10in. long, axillary, glabrous or puberulous. Flowers very numerous; pedicels stout; sepals, four, oblong, obtuse; corolla-tube short, limb with four spreading lobes; stamens two; ovary two-celled, compressed; style exceeding the filaments. Fruit, a two-celled capsule, much longer than the sepals, ovate, acute, compressed. Seeds numerous, minute.

Var. *gracilis*. Leaves broadly lanceolate, shortly petioled. Racemes very slender, $\frac{1}{4}$ in. to $\frac{3}{8}$ in. long. Sepals acute, ciliated; corolla very large; stamens shortly exerted; capsule less compressed.

EXPLANATION OF PLATE CXX.

Veronica salicifolia, Forst., var. *gracilis*. Flowering specimen, natural size. 1. Flower. 2. Corolla, laid open. Both magnified. 3. Dehiscing capsule, natural size. 4. The same, magnified.



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MERYTA SINCLAIRII

MERYTA SINCLAIRII, Seemann.

THE PUKA.

ORDER—ARALIACEÆ.

(Plate CXXI.)

THIS noble species is one of the rarest plants in the world, being restricted to a few individuals growing on one or two small islands near the northern extremity of the colony: its leaves are larger than those of any other plant with entire leaves in the New Zealand flora.

It does not occur on any part of the mainland: a tree said to have been brought from the Poor Knights Islands, and planted by Maoris at the head of Whangaruru Bay, was observed by Mr. Colenso and Dr. Sinclair, who obtained leaves which were forwarded to Sir Joseph Hooker, and the plant was described by him in the "Flora Novæ-Zelandiæ"* under the name of *Botryodendrum Sinclairii*. Dr. Sinclair and, I believe, Mr. Colenso also again visited the tree, in the hope of procuring flowers and fruit, but without success. Mr. William Mair, however, was more fortunate, and, after considerable perseverance, obtained fruiting specimens, which he gave to Dr. Sinclair, who sent them to Kew, where they formed the basis for the improved but still imperfect description which appeared in the "Handbook of the New Zealand Flora,"† under the name which it now bears, Seemann having transferred it to the genus *Meryta*. In 1869 Professor Hutton and myself visited the Taranga Islands, where we had the good fortune to find a few trees which had long been known to the Maoris, when a description was published in the "Transactions of the New Zealand Institute."‡ The plants found at that visit were confined to old Palæozoic rocks on one of the small islands of the group. Mr. Robert Mair has recently discovered a few plants on another island; and Mr. T. F. Cheeseman has found a single plant on the largest island, which is entirely volcanic.

The plant forms a small tree from 12ft. to 25ft. high, with stout branches; it is charged with a peculiar resin in all its parts, and the bark is easily wounded, producing large callosities as it heals. The leaves are alternate, crowded near the extremities of the branches, and carried on long leaf-stalks, which vary from 4in. to 14in. in length, the blades being from 9in. to 20in. long: many of the leaves were 30in. long including the leaf-stalk, and from 4in. to 10in. broad, equally rounded at both ends, or slightly contracted below the middle, with the margins slightly waved and strengthened by a remarkably stout marginal nerve. They are of a thick texture and bright-green colour.

The male and female flowers are developed on separate trees, and are arranged in panicles from 8in. to 16in. long at the extremities of the branches, with a few large deciduous scales at the base of each, the branches of the panicle being jointed to the axis. The branches of the male panicle are slender, and the flowers are arranged in fours, with an ovate bract at the base of each

* Flora Novæ-Zelandiæ, i., p. 97.

† Handbook of the N.Z. Flora, p. 104.

‡ Trans. N.Z. Inst., Vol. II., p. 101.

cluster, and two minute bractlets below each flower. The calyx consists of four free sepals, alternating with four stamens, the corolla being absent. In the female flowers the calyx-tube is adherent with the ovary, the upper portion being usually divided into five or six sepals, shorter than those of the male; the ovary is five-celled, and crowned with as many short styles, usually surrounded by four abortive stamens with weak filaments. The fruit is an ovoid berry, nearly $\frac{1}{2}$ in. long, containing five or, rarely, six compressed bony seeds.

The branches of the female panicle are shorter and stouter than those of the male.

The tree stated to have been planted by the Maoris at Whangaruru was tabooed, and destroyed by them on their discovering that Mr. Mair had taken fruits from it. The Ohora Natives planted a specimen on one of the Fanal Islands, which grew very slowly for a few years, but I am not aware if it is still in existence.

Mr. Colenso kindly informed me that it is termed "puka" by the Maoris: it will be remembered that the same name is applied to *Griselinia lucida*.*

Meryta Sinclairii flowers from January to April.

PROPERTIES AND USES.

The wood of *Meryta Sinclairii* is white and brittle, but of no special value so far as known. The resin which exudes whenever any part of the plant is wounded or bruised in all probability possesses medicinal properties, but it has not been subjected to analysis.

Meryta Sinclairii is of great value as an ornamental tree, and is easily cultivated in Auckland, Taranaki, and Hawke's Bay, but is unable to resist the light frosts experienced at Wellington. It is easily propagated from seeds, and, under cultivation, makes a handsome symmetrical tree, very different in habit from the somewhat naked irregularly-branched trees on the Taranga Islands.

The finest cultivated specimen is one raised by Mr. Justice Gillies from a cutting brought from the Taranga Islands in 1869. Its present height is 25ft., the trunk is 4ft. 8in. in circumference, and the spread of its branches 28ft.

DISTRIBUTION OF THE GENUS.

Meryta comprises six species found on various islands in the South Pacific; one in Norfolk Island, and one in New Zealand.

DISTRIBUTION OF THE SPECIES.

Meryta Sinclairii is only known with certainty to be found on two or three islands of the Taranga group, opposite the entrance of Whangarei Harbour, in the Auckland District. It is reported to grow on the Poor Knights, farther to the north, and may possibly occur on one of the Three Kings Islands, about thirty miles from the North Cape.

DESCRIPTION.

Meryta Sinclairii, Seemann.

Botryodendrum Sinclairii, Hook. f.

A small dioecious tree, 12ft. to 20ft. high, branches robust, naked below. Leaves on very long stout petioles, crowded near the ends of the branches, from 9in. to 30in. long (including the petioles), and from 4in. to 10in. broad, very coriaceous, ovate or obovate-oblong or rarely oblong; mid-rib stout, with stout

* Plate XLI.

lateral veins; margin slightly waved, sometimes with a few large crenatures, and surrounded with a stout marginal nerve. Flowers in terminal panicles; branches jointed to the rhachis. Male flowers sessile, in tetramerous clusters; sepals, four, valvate, ligulate, ultimately flexuous; stamens, four, inserted beneath a corrugated glandular disc. Female flowers solitary or crowded; calyx-tube adnate with the ovary; sepals, five or six; ovary three- to six-celled; styles, three to six, short, united below, tips recurved; four staminodia are usually present. Fruit oblong, three- to six-celled, black, shining, each cell containing one hard bony compressed seed.

EXPLANATION OF PLATE CXXI.

Meryta Sinclairii, Seemann. Male flowering specimen, natural size.
2. Female flower, with petals removed. 3. Female flower. 4. Portion of a fruiting panicle. 5. Transverse section of a fruit.



Maire tawhake.
(EUGENIA MAIRE)

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EUGENIA MAIRE, A. Cunningham.

THE MAIRE-TAWHAKE.

ORDER—MYRTACEÆ.

(Plate CXXII.)

THE maire-tawhake forms a handsome conical tree with slender twigs, which carry a profusion of large white myrtle-like flowers, succeeded by large red fruits, presenting a bright attractive appearance in either state: it is most frequently found in boggy woods or on the margins of swamps.

It is from 20ft. to upwards of 50ft. in height, with a trunk from 1ft. to 2ft. in diameter, clothed with smooth white bark: the branches are somewhat angular, and, with the leaves, are perfectly smooth. The leaves are opposite, from 1in. to 2in. long, and carried on slender leaf-stalks; they are of thin texture; the margins are entire or with distant obscure teeth: the blades are narrowed at the base and pointed at the apex.

The flowers are white, and are usually arranged in flat-topped panicles at the tips of the branches; the panicles are many-flowered, and vary from $\frac{3}{4}$ in. to 1 $\frac{1}{2}$ in. in width: the flower closely resembles that of a myrtle in structure, and is carried on a slender pedicel, which is jointed at its base. They may be perfect, or the pistil may be abortive, or, more rarely, the stamens. During expansion the petals frequently adhere to the stamens, and are torn out of their places as the stamens become erect: this is especially the case in damp weather.

The calyx is broadly cup-shaped, with five minute lobes, but is very shallow, and adherent with the ovary: the petals are small, rounded at the tips: the stamens are very numerous, and the ovary is two-celled, with several ovules in each cell; but as it ripens into fruit one cell becomes obliterated, and only a single ovule matures into a seed. The fruit is red, somewhat uneven and irregular in shape, with a pulpy outer layer, and is crowned with the remains of the calyx: it contains a single seed.

The flowers, as already stated, are very similar to those of the myrtle in structure; but the flowers of New Zealand myrtles are always solitary, and the fruit contains several seeds: the flowers of the *Eugenia* are arranged in panicles, and the fruit is one-seeded.

PROPERTIES AND USES.

The maire-tawhake affords a valuable timber, very straight and even in the grain, hard, dense, heavy, and of great strength and durability. It is of a whitish or light-brown colour, and, although rarely figured, it is suitable for many purposes of the cabinetmaker, and is highly valued for mooring-posts, jetty-piles, jetties, breastworks, fence-posts, and other purposes which require combined strength and durability. Its specific gravity varies from .618 to .943, and its weight per cubic foot from 38.54lb. to 60lb. The breaking weight of three sound Wellington specimens ranged from 223lb. to 225lb., and of six specimens

from Hawke's Bay from 135lb. to 212lb.* : in order of strength it must be placed next to matai.

DISTRIBUTION OF THE GENUS.

Eugenia comprises about six hundred species, distributed throughout tropical and sub-tropical America, tropical Asia, and Africa. Sixteen species are found in Australia, and thirty in New Caledonia, but only one in New Zealand.

DISTRIBUTION OF THE SPECIES.

Eugenia Maire is endemic in New Zealand, and is the only species found in the colony: it is found in swampy situations in many localities in the North Island, from Mongonui to Cook Strait: it is most plentiful and attains its largest dimensions from the Waikato northwards, but is also found in the Districts of Hawke's Bay, Taranaki, and Wellington. In the South Island it appears to be confined to the Marlborough and Nelson Districts, but is very rare, being only known to occur in Queen Charlotte Sound and the Pelorus, where it was discovered by Mr. J. Rutland. It is essentially a lowland plant, and ranges from the sea-level to 1,300ft.

DESCRIPTION.

Eugenia Maire, A. Cunn.

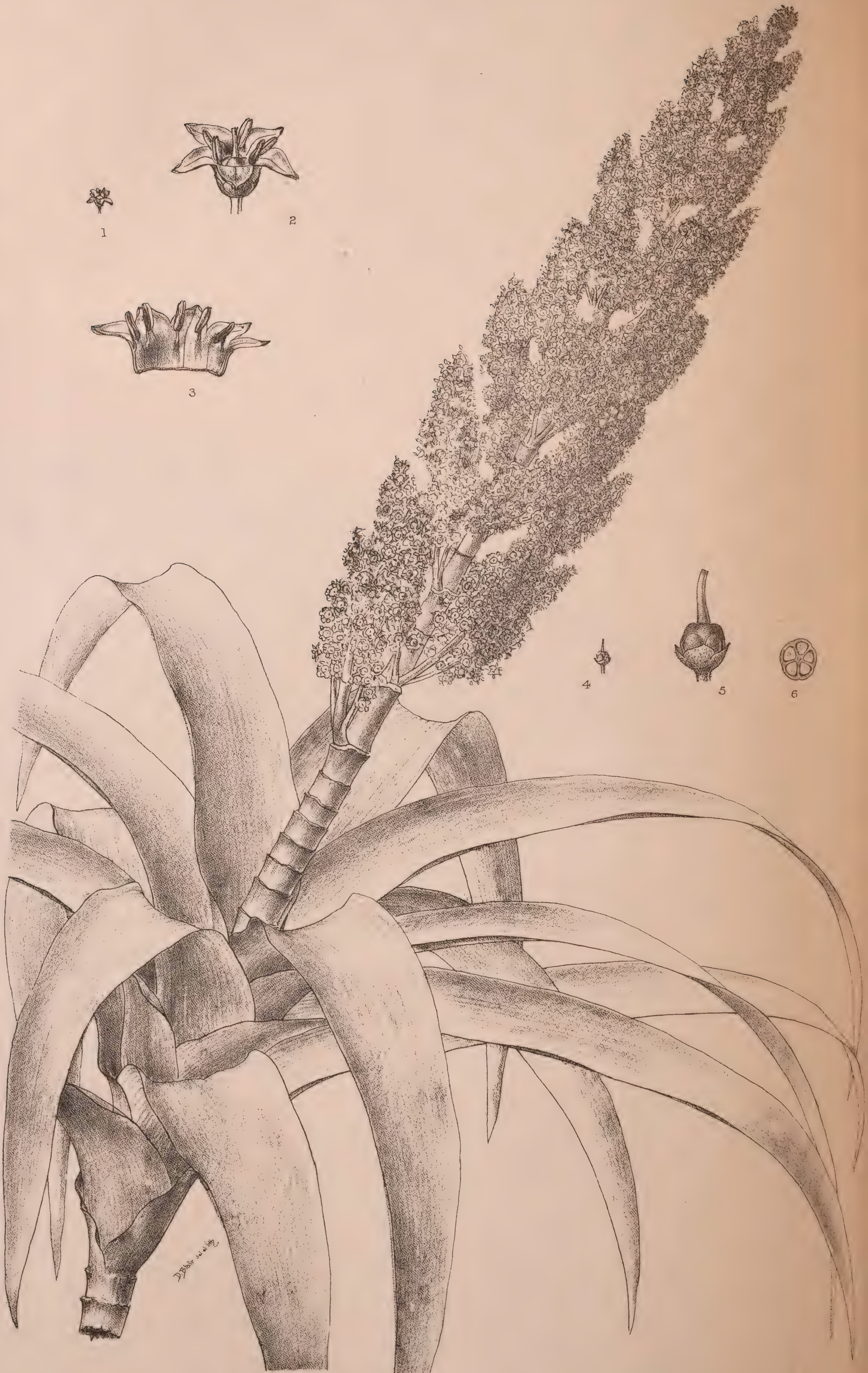
A small, conical tree, 20ft. to 50ft. high, with white bark, glabrous in all its parts. Branchlets slender, four-angled. Leaves opposite, 1in. to 2in. long, membranous, oblong-lanceolate or lanceolate, acuminate, narrowed into the slender petiole. Flowers in terminal many-flowered corymbs; pedicels slender, jointed to the rhachis. Calyx superior, with five minute deciduous lobes; petals, five, perigynous, orbicular; stamens numerous, slender; ovary two-celled, with numerous ovules in each cell; style slender, exceeding the stamens. Fruit, a red drupe, ovoid, uneven, fully $\frac{1}{3}$ in. long, crowned with the remains of the calyx; seed large, solitary.

EXPLANATION OF PLATE CXXII.

Eugenia Maire, A. Cunn. Flowering specimen. 1. Fruiting specimen, natural size. 2. Flower. 3. Longitudinal section of a fruit. 4. Transverse section of the same. All magnified.

* Balfour: Experiments on the Strength of New Zealand Timbers.





Neinei.
(DRACOPHYLLUM LATIFOLIUM)

DRACOPHYLLUM LATIFOLIUM, Hook. f.

THE NEINEL.

ORDER—EPACRIDÆ.

(Plate CXXIII.)

THE neinei is a plant remarkable alike for the singularity of its habit, the beauty of its leaves and flowers, the ornamental character of its wood, and its peculiar distribution. It forms an erect shrub or small tree from 10ft. to 25ft. high, clothed with brown fibrous bark; the trunk rarely exceeds 1ft. in diameter: the branches are usually given off in whorls, spreading and ascending, naked below, but carrying a large cluster of spreading recurved leaves 10in. to 2ft. long and from 1in. to 2in. broad at the base, tapering into very long drooping points, concave on the upper surface, with the margins very minutely toothed. From the centre of the leaves rises a many-flowered almost cylindrical panicle of red flowers, the panicle being from 6in. to 18in. long, and nearly 2in. in diameter; the axis is very stout, and the short erect branches are jointed at their base. The minute flowers, $\frac{1}{3}$ in. long, are excessively crowded. The calyx consists of five broad obtuse sepals, one-fourth the length of the red bell-shaped corolla, which has five small spreading lobes and five extremely short stamens inserted at its mouth. The fruit is a dry capsule with numerous seeds.

An allied species, *Dracophyllum Traversii*, is apparently confined to the South Island, where it chiefly occurs at altitudes between 2,800ft. and 5,000ft. It is more sparingly branched than *D. latifolium*, but the trunk is sometimes 2ft. in diameter; the leaves are more rigid, of a pale bluish-white, and the wood is less ornamental.

PROPERTIES AND USES.

The wood is smooth, even, and firm, of a light reddish-brown colour, very prettily figured, and often waved or clouded in small patches; it takes a high finish, and is of great durability. It is suitable for all kinds of ornamental work.

Dracophyllum latifolium is easily cultivated in cool situations.

DISTRIBUTION OF THE GENUS.

See under *Dracophyllum longifolium*, p. 215, ante.

DISTRIBUTION OF THE SPECIES.

Dracophyllum latifolium occurs chiefly in woods, especially in hilly country, and is most frequent in the Auckland District. It is found sparingly in the Taranaki and Hawke's Bay Districts, but has never been observed in the Wellington District. In the South Island it appears to be confined to the Nelson and Westland Districts, attaining its southern limit near Charleston.

It ascends from the sea-level to 3,000ft.

DESCRIPTION.

Dracophyllum latifolium, Hook. f.

A small tree, 10ft. to 25ft. high. Branches often whorled, naked below, with a crown of spreading squarrose rather coriaceous leaves, with sheathing

bases, gradually tapering into long points which are often drooping, concave margins, serrulate or crenulate. Flowers very small, $\frac{1}{3}$ in. long, arranged in densely crowded, rigid, erect, conical panicles, 6in. to 18in. long; primary branches branched from the base, rigid, jointed to the stout base, 1in. to $1\frac{1}{2}$ in. long. Calyx: Sepals, five, ovate, obtuse; corolla shortly campanulate, with five reflexed lobes; stamens, five, inserted at the mouth of the corolla, filaments very short; ovary five-celled, with five erect ovate scales at the base. Fruit, a five-celled capsule; seeds numerous.

EXPLANATION OF PLATE CXXIII.

Dracophyllum latifolium, Hook. f. Flowering specimen, natural size. 1 and 2. Flower, natural size and magnified. 3. Corolla, laid open. 4 and 5. Capsule, natural size and magnified. 6. Transverse section of capsule, magnified.





T. KIRK DREXEL

Ngaio.
MYOPORUM LAETUM.

SURVEY DEPT 1887

MYOPORUM LÆTUM, Banks and Solander.

THE NGAIO.

ORDER—MYOPORINEÆ.

(Plate CXXIV.)

THE ngaio forms a shrub or small tree, from 10ft. to 30ft. high, with a trunk 1ft. or more in diameter, clothed with brown bark, which is deeply furrowed in old specimens. It varies considerably in habit, sometimes exhibiting a much-branched spreading head; at others the branches are short from base to apex, and the head comparatively narrow. Although not restricted to the coast it exhibits a marked partiality for littoral situations, or for old sea-basins, as in the valley of the Rangitikei, where it sometimes occurs in abundance and of large dimensions, often presenting a picturesque appearance, and imparting a park-like character to the scenery.

The branches are rather stout, slightly viscid at the tips, and, with the leaves, are destitute of hairs: the leaves are alternate, from 1in. to 4in. in length and from $\frac{1}{2}$ in. to $1\frac{1}{2}$ in. broad; they are acute at the apex, and narrowed at the base into a short stout leaf-stalk; they are thickly studded with translucent oil-glands, and the margins of the upper part of the leaf are cut into small sharp teeth.

The flowers are produced in clusters of from two to six, springing from the axils of the leaves, and carried on flower-stalks from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. in length; the calyx is small, and divided at the margin into five sharp teeth: the corolla is bell-shaped, about $\frac{1}{2}$ in. broad, the upper portion being divided into five rounded spreading lobes, the two uppermost being rather shorter than the others: four short stamens are inserted in the throat of the corolla: the ovary is four-celled. Fruit $\frac{1}{4}$ in. to $\frac{1}{3}$ in. long, reddish-purple, with a pulpy outer layer; nut hard and bony, four-celled, usually with a single seed in each cell.

The corolla is white, with purple dots and markings on the lobes; both the tube and lobes are clothed with short stiff shaggy hairs.

The translucent glands are not confined to the cellular tissue of the leaf, but occur also in the mid-rib and secondary nerves, in the epidermis of the branches, and even in the pith.

PROPERTIES AND USES.

The wood of the ngaio is of a dark-brown colour with black streaks and veins, which are often broad and form an irregular figure: it is dense, heavy, hard, and durable.

Some specimens are very attractive, and are valued for cabinet-work, ornamental turnery, and similar purposes. It is also valued for fence-posts, rails, &c., on account of its great durability. Unfortunately in many localities it does not attain large dimensions.

The Maoris wash their faces and the exposed portions of their bodies with an infusion of the leaves to prevent the bites of mosquitoes and sandflies. The

leaves afford a volatile oil in considerable quantities, but its properties have not been ascertained.

The ngaio is valued for ornamental planting, especially in the vicinity of the sea, and is easily propagated by seeds or cuttings.

DISTRIBUTION OF THE GENUS.

The genus *Myoporum* contains about twenty species, chiefly found in Australia, New Caledonia, New Zealand, Norfolk Island and other islands in the Pacific, the Mascarene Islands, the Malay Archipelago, China, Japan, and one in tropical Africa.

DISTRIBUTION OF THE SPECIES.

Myoporum lætum is chiefly found in lowland situations near the sea, and attains its northern limit on the Kermadec Islands, extending southwards to Otago, but is not found on Stewart Island. It is rare and local in many districts, especially in the South Island, although it occurs on both the east and west coasts.

It is the only New Zealand species, and is endemic, although closely allied to a Norfolk Island species.

DESCRIPTION.

Myoporum lætum, Banks and Sol.

A shrub or small tree, 10ft. to 30ft. high, with rather stout branchlets, which are slightly viscid at the tips. Leaves alternate or sub-opposite, glabrous; lanceolate, broadly lanceolate, or obovate-lanceolate; 1in. to 4in. long, narrowed into short petioles; thickly dotted with translucent glands; margins serrate near the apex. Flowers in axillary two- to six-flowered fascicles, peduncles $\frac{1}{2}$ in. to $\frac{3}{4}$ in. long; calyx inferior; corolla five-lobed, $\frac{1}{2}$ in. to $\frac{2}{3}$ in. broad, tube and lobes villous, the two upper lobes approximate. Fruit, a reddish-purple drupe, $\frac{1}{4}$ in. to $\frac{1}{2}$ in. long. Nut, four-celled, of bony hardness; cells one-seeded.

EXPLANATION OF PLATE CXXIV.

Myoporum lætum, Banks and Sol. Natural size. 1. Corolla laid open, magnified. 2. Cluster of fruits. 3. Stone. Both natural size. 4. Transverse section of fruit. 5. Portion of leaf. Both magnified.





QUINTINIA SERRATA, A. Cunningham.

THE KUMARAHOU.

ORDER—SAXIFRAGÆÆ.

(Plate CXXV.)

FOR the Native name "kumarahou" I am indebted to the Ven. Archdeacon W. L. Williams, who informs me that it is applied to this plant in the East Cape district: it is also commonly applied to *Pomaderris elliptica* by the Maoris living to the north of the Auckland Isthmus. The settlers frequently term this plant the "New Zealand lilac," and on the west coast of the South Island it is known as "white-birch"—perhaps the most unmeaning application of the comprehensive word "birch" that has yet been recorded.

Quintinia serrata is a handsome flowering shrub or small tree, which attains its extreme dimensions on the west coast of the South Island, where it is upwards of 40ft. in height, with a trunk from 1ft. to 2ft. in diameter, clothed with black even bark. The young shoots, leaves, and racemes are clothed with scurfy scales, consisting of matted radiating hairs. Leaves alternate, 2in. to 6in. long and from $\frac{3}{4}$ in. to 2in. wide, carried on slender leaf-stalks, acute or rarely obtuse, texture submembranous or very coriaceous; margins waved or with a few distant serratures. The young shoots and leaves are excessively viscid and adhesive. Flowers in erect racemes, 1in. to 4in. long, springing from the axils of the leaves, carried on slender pedicels. The calyx is five-toothed at the margin, and bears five free petals and five free stamens with short filaments. The ovary is adherent with the calyx-tube, and is three-celled, with a conical three-furrowed style. The fruit is a capsule, which opens by the splitting of the style, and contains numerous seeds.

The leaves of the Auckland plant are longer, narrower, and more coriaceous than those of the South Island form: the latter are sometimes membranous. The racemes of the northern plant are very much longer than those of the southern plant, and the flowers are of a deep-lilac colour: in the southern plant they are very pale, almost white. The southern plant may be considered a distinct variety.

The stamens vary considerably in length; those of the northern plant are usually longer than those of the South, but not invariably so. In some cases the short stamens are abortive, but the pistils of flowers with long stamens are usually perfect. This point deserves further investigation.

PROPERTIES AND USES.

The wood of *Quintinia serrata* is of a light-red colour, often prettily marked and figured; it is strong, tough, and elastic, but is not durable when in contact with the ground. It has been used for tramway sleepers, rails, house-blocks, and fence-posts, but the results are not satisfactory. It answers better for fence-rails, and, in the absence of superior timbers, might be used for general building purposes so long as it is not in contact with the ground. On account of its strength, toughness, and elasticity it might be used for some wheelwrights' work,

but, so far as I am aware, it has not been tried. It is occasionally used by the cabinetmaker for various purposes, and affords excellent firewood. In the North it is usually of smaller dimensions than in the South, and the wood is more prettily figured.

Quintinia serrata is of easy cultivation, and deserves a place in all shrubberies.

DISTRIBUTION OF THE GENUS.

Quintinia is a small genus, containing only four species, two of which are endemic in New South Wales, and two in New Zealand. One of the New Zealand species is probably only a variety of *Q. serrata*.

DISTRIBUTION OF THE SPECIES.

Quintinia serrata attains its northern limit near Mongonui, and appears to be confined to the Districts of Auckland, Hawke's Bay, and Taranaki in the North Island. The var. β is found on the western coast of the South Island, from Golden Bay to Jackson's Bay.

It ascends from the sea-level to 3,000ft.

DESCRIPTION.

Quintinia serrata, A. Cunn.

A large exstipulate shrub or erect evergreen tree, 40ft. high or more. Young shoots and leaves viscid. Branchlets, leaves, and racemes clothed with lepidote scales. Leaves alternate, 2in. to 6in. long, $\frac{3}{4}$ in. to 2in. broad, petioled, submembranous or very coriaceous, narrow-lanceolate or lanceolate or oblong or obovate, obtuse or acuminate, margins waved, distantly irregularly obtusely serrate; yellow-brown when dry. Racemes axillary, many-flowered, 1in. to 4in. long. Calyx superior, five-toothed; petals, five; stamens, five; ovary three-celled, sunk in the calyx-tube; styles three, conical, furrowed; stigma three-lobed. Capsule, $\frac{1}{2}$ in. to $\frac{1}{4}$ in. long, three-celled, three- to five-ribbed; seeds numerous, minute.

Var. β . Leaves broader, more membranous; racemes shorter; stamens shorter.

EXPLANATION OF PLATE CXXV.

Quintinia serrata, A. Cunn. Flowering specimen from Great Omaha, natural size. 1. Flower of the same. 2. Flower, with petals and stamens removed. 3. Capsule. 4. Transverse section of capsule. 5. Seed. All magnified. 6. Leaf of var. β , from Greymouth, natural size. 7. Flower, magnified.



Tawa.
(BEILSCHMIEDIA TAWA).

BEILSCHMIEDIA TAWA, Bentham and Hook. f.

THE TAWA.

ORDER—LAURINEÆ.

(Plate CXXVI.)

THE tawa was discovered by Banks and Solander, who gave it the MS. name of *Laurus salicifolia*: it was, however, first described by Allan Cunningham, who named it *L. Tawa*, but it is to be regretted that the original specific name was not maintained. In the "Flora Novæ-Zelandiæ" Sir Joseph Hooker removed it to *Nesodaphne*, which has been merged in *Beilschmiedia* by Bentham and Hooker in their "Genera Plantarum."

The tawa is a handsome evergreen tree, with slender branches and graceful willow-like foliage, occurring in such abundance as to constitute the greater portion of the forests in many northern districts. It is from 50ft. to 80ft. high, with a trunk from 1ft. to 4ft. in diameter, clothed with thin smooth black bark: in the margins of forests the trunk is often short, or divided from the base into spreading arms: usually it is of considerable length, although often unsymmetrical and irregular in growth. The branches are usually short, slender and silky when young, clothed with alternate leaves 2in. to 4in. long and from ½in. to ¾in. broad, carried on slender leaf-stalks: specimens with much broader leaves are occasionally met with: usually they are very narrow, tapering to a sharp point, smooth on both surfaces, and sometimes of a pale bluish-green beneath. The flowers are green, minute, about 1/10in. in diameter, and arranged in panicles, which spring from the axils of the leaves near the tips of the branches: the panicles are from 2in. to 3in. long, with very slender spreading branches and comparatively few flowers, which are carried on very slender pedicels, and resemble those of *B. Tarairi* in structure, but are perfectly smooth. The fruit resembles a damson, and is less than 1in. in length, one-seeded.

PROPERTIES AND USES.

The wood of the tawa is white, very straight in the grain, and is easily split: when thoroughly seasoned it is very hard and somewhat brittle.

Until recently it was supposed to be of but little value; but during the last six years it has been largely utilised for dairy-ware, buckets, tubs, casks, and more especially for butter-kegs, for which it appears to be superior to any other New Zealand timber.

It was formerly used by the Maoris for their bird-spears, which Mr. Colenso states were from 30ft. to 36ft. long; he adds that only two spears were obtained from a tree, and as these had to be chopped out with stone implements it is no wonder that two years were required for the completion of a single spear: the long straight rods were also used for battens for the roofs and sides of their houses. The outer layer of the fruit was formerly used for food: the leaves are aromatic, but do not appear to have been utilised.



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BEILSCHMIEDIA TAWA, Bentham and Hook. f.

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THE CONVERSION OF TAWA.

For some years past large quantities of tawa have been worked up into dairy-ware, butter-kegs, &c., in Christchurch, the supply being chiefly obtained from the Pelorus and Queen Charlotte Sounds: Christchurch must be looked upon as the original seat of the industry. It has been utilised to a very limited extent in Wellington and Auckland, but the chief centre of the industry at the present time is the Taranaki District, from whence several thousands of butter-kegs are shipped to Auckland and other parts of the colony every year.

The logs are usually sent to the mill in from 6ft. to 15ft. lengths, and, preferably, from 16in. to 24in. or 30in. in diameter: as they are often unsymmetrical the proportion of waste in conversion is large, varying from 35 to 50 per cent. on the log measurement. Most of the logs are cut into $\frac{1}{2}$ in. or $\frac{5}{8}$ in. boards: the boards for heads are edged down to 12in. or 14in. in width, and those for staves are ripped into 3in. battens, which are passed through a moulding-machine or through a small planing-machine with special knives, which turns them out concave on the lower surface and convex on the upper. They are next cross-cut into the required lengths, 18in. for a 60lb. cask, 20in. for a 90lb. cask: they are next tapered by a finely-toothed circular saw, which removes a narrow triangular piece extending from each corner to near the middle of the stave, so that when finished the stave is 3in. wide in the middle and $2\frac{1}{2}$ in. at each end. The heads are usually formed of a single piece, 11 $\frac{1}{2}$ in. to 13 $\frac{1}{2}$ in. in diameter, according to the size of the cask: if formed with two or three pieces dowelled together the cask would be improved, but at an additional cost for extra labour. The staves and ends are now ready for the cooper, who can put from twelve to fourteen casks together per day, and earns about 10s. per dozen. Tawa prepared for the cooper sells at about 14s. per 100 superficial feet. Two knives fixed in a small planing-machine will enable one man and a boy to shape 4,000 superficial feet of stave-battens per day. Sometimes staves and headings are sold in sets, at 1s. 6d. for a 60lb. keg and 1s. 10d. for a 90lb. keg. Tawa is not considered suitable for the heads of wine-casks, but tawa bodies with kauri heads are deemed excellent.

The manufacture in Christchurch is languishing partly on account of the growing scarcity of tawa in the Cook Strait sounds, and partly on account of the saving in first cost by manufacturing in the place where the timber is grown, thus saving sea- and railway-freight. It is, however, remarkable that the manufacture has not become established in various parts of the Auckland and Wellington Districts where tawa is abundant: large orders for butter-kegs are sent from Auckland to New Plymouth every year.

DISTRIBUTION OF THE GENUS.

See under *Beilschmiedia Tarairi*, p. 71, *ante*.

DISTRIBUTION OF THE SPECIES.

Beilschmiedia Tawa occurs from Spirits Bay throughout the North Island, sometimes forming the chief portion of the forest in hilly districts. In the South Island it is restricted to the Marlborough and Nelson Districts, but is only found in the near vicinity of Cook Strait.

It ascends from the sea-level to 3,000ft.

DESCRIPTION.

Beilschmiedia Tawa, Benth. and Hook. f.

Nesodaphne Tawa, Hook. f.

Laurus Tawa, A. Cunn.

A lofty evergreen tree, 50ft. to 80ft. high, with thin black bark and slender branches. Young shoots silky. Leaves alternate, 2in. to 4in. long, lanceolate, or narrow-oblong or broadly lanceolate, membranous, entire, acute, often glaucous beneath, finely reticulated on both surfaces. Panicles axillary, 2in. to 3in. long; branches and pedicels very slender, glabrous. Flowers minute; perianth with six lobes; stamens, twelve, in two series; anthers opening by valves; ovary one-celled, with a short straight style. Fruit, a deep-purple berry, 1in. long or less, one-seeded; seed without endosperm.

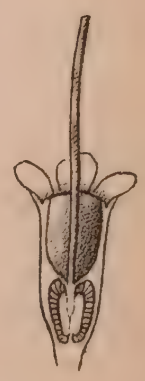
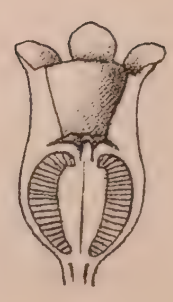
EXPLANATION OF PLATE CXXVI.

Beilschmiedia Tawa, Benth. and Hook. f. Flowering specimen, natural size.

1. Flower. 2. Stamen. 3. Pistil. All magnified.

(*Beilschmiedia Tarairi*, Benth. and Hook. f. 5. Flower. 6. Stamen, with perianth-lobe. 7. Stamen. 8. Pistil. All magnified.)





Aka.
(METROSIDEROS FLORIDA.)

METROSIDEROS FLORIDA, Smith.

THE AKA.

ORDER—MYRTACEÆ.

(Plate CXXVII.)

THE Ven. Archdeacon W. L. Williams informs me that this fine climber is termed the "aka" or "aka-tawhiwhi" or "pua-tawhiwhi:" a white-flowered species, *Metrosideros scandens*, is also termed "aka." Many settlers confuse this species with the next, *M. robusta*, which never climbs, but forms a large erect tree.

M. florida is a climber during all stages of its existence, except in the absence of a tree to which it can cling, when its stems are at first prostrate, but give off erect branches, which sometimes form dense thickets or low scrub 3ft. or 4ft. high: it never forms an erect trunk. Its orange-scarlet flowers are produced in great profusion, and, whether exhibiting its natural scandent habit on the trunk of a lofty tree or growing as a dense bush, it is equally attractive. In old specimens the stems are from 3in. to 6in. in diameter, and frequently hang from the branches of lofty trees like immense cables: they are clothed with deep chestnut-coloured bark, which gives off large flakes, often presenting a ragged appearance. The young stems are very slender, and become firmly attached to the stems of the supporting tree by small claspers or aërial rootlets, resembling those of the ivy. The branchlets are usually clothed with short downy hairs, and the leaves are opposite, quite entire, from 1in. to nearly 3in. long, and from ½in. to ¾in. wide; they are carried on short petioles, and are obtuse at the apex. The flowers are arranged in panicles at the extremities of the branchlets, and are from three- to twelve-flowered, the flowers being about 1in. in length, and carried on slender pedicels singly or, rarely, in twos or threes. The calyx is narrow and deeply funnel-shaped, five-lobed at the margin, carrying five small red petals and numerous crowded erect stamens with scarlet filaments; the ovary is adherent with the base of the calyx-tube, and the long slender style slightly exceeds the stamens in length. The fruit is a three-celled woody capsule, is wholly embedded within the woody calyx-tube, and is not more than half its length—a character which distinguishes it from all other New Zealand species, especially from *M. robusta*, with which it is often confused. A solitary specimen, with golden-yellow flowers, has long been known on the Mokau River, and is highly prized by the Natives of the district.

PROPERTIES AND USES.

The long scandent stems of this species are used for rustic-work, garden-seats and decorations, &c., but its commercial value is very small. It bears cutting freely, and is easily cultivated, forming compact bushy specimens suitable either for the border or lawn.

DISTRIBUTION OF THE GENUS.

See under *Metrosideros lucida*, p. 99, ante.

DISTRIBUTION OF THE SPECIES.

Metrosideros florida is common in forests throughout the North Island, from the North Cape to Cook Strait. It is less plentiful in the South Island, but is found in Marlborough, Nelson, Westland, and on the west coast of Otago. It appears to be absent from the eastern side of the South Island, and has not been observed in Southland or on Stewart Island.

It ascends from the sea-level to nearly 3,000ft.

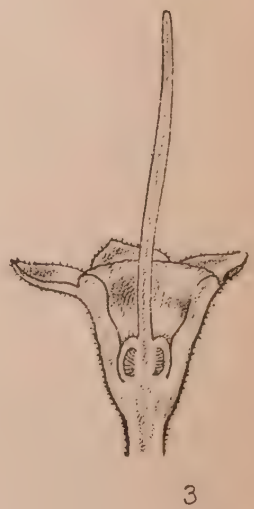
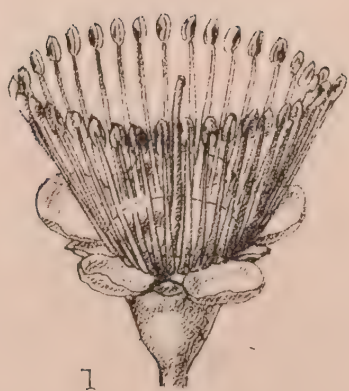
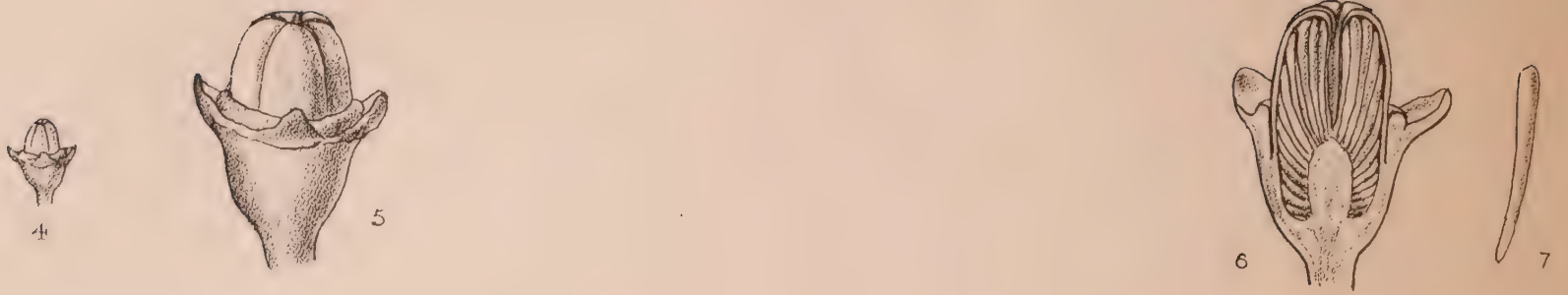
DESCRIPTION.

Metrosideros florida, Smith.

A lofty climber; stems from 4in. to 6in. in diameter, with deep chestnut-coloured bark. Leaves opposite, petioled, 1in. to 3in. long, elliptic-oblong or lanceolate-oblong, entire, obtuse. Flowers in terminal cymes, simple or branched, few- or many-flowered. Calyx obconic, superior, glabrous; petals, five, perigynous; stamens very numerous, slender, 1in. long; ovary adnate with the base of the calyx-tube, three-celled; style exceeding the stamens. Fruit, a three-celled inferior woody capsule, adherent with and half the length of the ribbed woody calyx-tube; seeds numerous.

EXPLANATION OF PLATE CXXVII.

Metrosideros florida, Smith. Flowering and fruiting specimens, natural size. 1. Longitudinal section of a flower with the stamens removed. 2. Longitudinal section of a fruit. 3. Transverse section of the same. 4. Seed. All magnified.



Northern Rata.
(METROSIDEROS ROBUSTA)

METROSIDEROS ROBUSTA, A. Cunningham.

THE NORTHERN RATA.

ORDER—MYRTACEÆ.

(Plate CXXVIII.)

THE northern rata is one of the largest trees in the New Zealand flora, being commonly from 60ft. to 100ft. in height, and from 3ft. to 12ft. in diameter, while much larger specimens are occasionally found, the largest recorded being 68ft. in circumference and upwards of 22ft. in diameter. It is invariably erect, never climbing, although bushmen and settlers frequently state that it climbs the loftiest trees, and sooner or later squeezes them to death in its iron clasp. In proof of this they assert that, when felling huge ratas, they often find a dead tree in the centre of the rata: this is a common occurrence, but it by no means follows that this species is a climber. The error is simply due to imperfect observation, which has led careless observers to confuse the preceding species, *M. florida*, which is a true climber, with *M. robusta*: at the same time the remarkable habit of the latter species often causes the death of trees on which it may be growing, although not by climbing.

This error is not confined to bushmen and settlers, but has been adopted by many writers on New Zealand, and widely circulated. I extract the following from Wakefield's "Handbook for New Zealand": "Rata (*Metrosideros robusta*). There are several varieties of this tree: one grows at first as a parasite, creeping in numerous stem-like ropes up the trunks of the other forest-trees, gradually enclosing them till they perish, and then uniting to form a noble tree taller than that which it has destroyed, with an enormous trunk, but hollow within." This appears a very circumstantial statement, but it will be shown presently that the mode of growth is the reverse of climbing.

The seeds of this species are very minute and dustlike, and, as they are produced in large quantities, it is not surprising that they are often carried by the wind into the forks of lofty trees, and readily germinate in the vegetable mould formed by the decaying leaves of orchids and other epiphytes which are so abundant on the arms of large trees in the northern forests. The seedling rata commences life as a born aristocrat "high up in the world," and grows as freely in its elevated station as the more humble tawa or rimu below, until the limited supply of nutriment at its high level is exhausted, when it boldly stretches one or more aerial roots down the trunk of the supporting tree, until they reach the earth in quest of an increased food-supply: as increased nourishment is thus drawn directly from the soil, the aerial roots gradually assume the appearance of stems, and present one or two features of great interest. If, during the progress of growth, a single root-stem becomes forced away from the supporting trunk for a portion of its length, a lateral root is given off at right angles, and grows horizontally around the supporting trunk until it returns to the opposite side of the main root-stem: sometimes several lateral arms are given off in this way: it is difficult to conceive of any phenomenon connected

with plant-life which is more directly suggestive of intelligence. When two or more root-stems are developed, they are frequently connected by laterals, and in many cases they give off oblique laterals, which usually become united by a process of natural grafting, and the supporting tree is sooner or later killed by their iron embrace.

When several roots are given off they ultimately become inosculated, and constitute an uneven gigantic cylinder, but never form a solid trunk as is commonly supposed. On felling a tree of this kind the form of the original aërial roots can be made out; the enormous pressure has forced the central column of pith much closer to the side in contact with the supporting tree, and distorted the stem itself. It is often found that a second series of root-stems is given off from giant specimens, and overlies the original series: this is only seen in very old specimens, and may arise from the original root-stems being unable to obtain sufficient nourishment for the increased bulk. This phenomenon is chiefly exhibited by gigantic specimens with large heads: a grand specimen on Mount Egmont has given off a secondary root-stem above 3ft. in diameter, which is nowhere in contact with the old trunk, although parallel with it for its entire length.

Large stems are only produced by single roots, and in some places they are so abundant that it is evident a remarkable form of replacement has been effected: in these localities the forest consists almost exclusively of ratas which commenced life high up on the stems of the kahikatea, tawa, pukatea, or other trees which formerly occupied the site, but have passed away, their places being taken by the slow-growing but more gigantic ratas, which germinated not on the ground, but on the trees which they have replaced. In localities where the rata is abundant it occasionally forms a natural arch, 12ft. to 20ft. high, and from 10ft. to 18ft. wide at the base, crowned with the erect stem and spreading head, and affording ample space for a buggy to be driven underneath. This peculiar growth has evidently been caused by the bifurcation of the descending root, and the subsequent divergence of the limbs.

There is one tree, and only one, on which the rata can make no impression—the puriri, *Vitex littoralis* (Pl. CV.): its iron grain sets the epiphyte at defiance; slowly but surely it forces the epiphytic root-stems apart, and sometimes dislodges the trespasser entirely. Instances may occasionally be seen in which a puriri is growing between three or four large root-stems of rata which it has gradually forced apart by its tremendous energy.

It has been asserted that the northern rata must invariably originate as an epiphyte; but there is no real foundation for the statement, as terrestrial specimens are often met with, but they never attain such large dimensions as those which begin life as epiphytes. Terrestrial specimens give off several ascending stems, and many years elapse before one of them takes a decided lead: numerous cultivated specimens from twelve to twenty years old may be seen, which are little more than bushy shrubs, having made less than 1ft. of growth for every year of their existence. A plant with this peculiar habit, and with such a slow rate of growth, could never attain large dimensions in an ordinary forest unless able to obtain some advantage over other trees in early life: this is gained by its epiphytic habit, which affords ample compensation.

It stands alone amongst Australasian forest-trees in developing stems of large bulk, affording durable timber, from aërial roots.

In very rare cases the same remarkable habit is exhibited by the pohutukawa (*Metrosideros tomentosa*) and by the southern rata (*M. lucida*) when growing on the margin of cliffs, but specimens of this kind are extremely rare.

M. robusta is remarkable for the splendour of its flowers as well as for its singular habit of growth: a fine specimen, 60ft. or 80ft. high, with almost every branchlet crowned with a cluster of brilliant scarlet flowers, forms a magnificent object, the remembrance of which seldom passes from the mind of those who have seen it: when this species forms the chief portion of the forest the glittering effect under a bright sun is almost insupportable.

The bark of the rata is brown or reddish-brown, with shallow longitudinal and transverse furrows, so that the outer layer falls away in small flakes. The branchlets are usually short, somewhat angular, and clothed with a thick coat of very short downy hairs. The leaves are arranged in four rows, and are about 1½in. in length including leaf-stalks, narrowed at both ends, quite entire, and obtuse: they are of thick texture, very uniform, and dotted with glands: a very firm intramarginal nerve runs round the leaf at about $\frac{1}{30}$ in. from the margin. The flowers are produced in short many-flowered clusters or panicles about 1½in. across, carried on the tips of the branches: the branches of the inflorescence and the pedicels are clothed with short downy hairs. The calyx and stamens are much shorter than those of *M. florida*, although very similar in structure, but the fruit differs widely, the capsule being twice the length of the calyx, and closely girt round at about half its length by the margin of the calyx: it is three-celled, and contains numerous seeds, which are thickened upwards.

M. florida and *M. robusta* are so frequently confused that it seems advisable to state the characters by which they are separated in a convenient form:—

	<i>M. florida.</i>	<i>M. robusta.</i>
Habit	... A climber, with stems not exceeding 6in. in diameter.	Erect, with a trunk from 3ft. to 12ft. or more in diameter.
Leaves	... 1in. to 3in. long.	Never exceeding 2in. in length.
Flowers	... Panicles with short branches and pedicels. Calyx long and narrow, smooth.	Panicles with long branches and pedicels. Calyx short and broad, hairy.
Fruit	... Capsule included in the woody calyx-tube.	Capsule twice the length of the calyx-tube, which is not woody.

This species commences to flower in the latter part of November, and the flowering season continues until about the middle or end of January.

PROPERTIES AND USES.

The wood of the northern rata is of a red colour, varying greatly in depth of tint, usually straight in the grain, hard, dense, heavy, of great strength and durability, but totally destitute of figure. The durability of this timber is proved by old specimens which have been lying in the bush for uncounted years until they have been overgrown by mosses, ferns, and small shrubs, or even by larger trees, still remaining sound and good.

Its large crooked limbs and root-stems are often used for ships' timbers, but, although of great value for this purpose, it is scarcely equal to the pohutukawa. It has been used for tramway-sleepers with good results, and is, I believe, the chief timber employed for the arms of telegraph-posts. It is excellent for the heavy framework of railway-waggons and carriages, also for machine-beds and bearings, &c. For bridges, wharves, and other constructive works its strength, toughness, and durability render it vastly superior to a great portion of the imported *Eucalyptus* timber. Trees felled in the Manawatu Gorge were utilised in the construction of the Manawatu Gorge Bridge, erected in 1873-74, and were employed for rail-beams, cross-beams, and radial posts in the main truss. In April of the present year (1888) two sections were cut from the rail-beams

to which the roadway planking was spiked—a specially trying position: section No. 1 was quite hard and sound; section No. 2 showed signs of partial decay and softening *where a crack gave access to water*, but still retained a good proportion of sound wood. It is not easy to understand the cause of its value in constructive works having been so long ignored. Logs from 20ft. to 50ft. long, and from 12in. × 12in. to 48in. × 48in., could be obtained in large quantities, and would afford remunerative employment to settlers in felling, hewing, and hauling to the nearest railway-station or shipping-place.

It is of great value for wheelwrights' stuff; spokes, felloes, and hubs could be obtained in any quantity, and of quality superior to much of the imported Australian wood. It is highly valued for firewood, and would be one of the best timbers for use on railway locomotives: if utilised for this purpose on the Taranaki railways it could probably be obtained for little more than the cost of cutting; its utilisation would prove of material assistance to the struggling settler.

Hundreds of acres of this timber are destroyed by fire every year in various parts of the North Island, and in the Aorere district, Nelson. On account of its great hardness and the small demand for the converted timber, it is rarely felled by the settlers; the undergrowth is felled and burnt, scorching the rata and killing it, but the trunks stand for years afterwards. If its value for wheelwrights' work and for bridge-building, &c., were better known, a large portion of the wasted timber would be utilised, and the position of many settlers with small means would be greatly improved.

The leaves are charged with an essential oil, which in all probability possesses medicinal value, but at present it has not been tested.

It is of great value for the shrubbery, as, under cultivation, it commences to flower when from 6ft. to 10ft. high: small specimens may be seen in flower in the Colonial Botanical Garden, Wellington, as well as in private gardens near Wellington and other places.

DISTRIBUTION OF THE SPECIES.

Metrosideros robusta is found in the North Cape district and generally throughout the North Island to Cook Strait. It is less plentiful in the South Island, being confined to the Districts of Marlborough, Nelson, and Westland: it is extremely rare in Marlborough, but plentiful in various localities in Nelson, and attains its extreme southern limit between Greymouth and Hokitika.

It ascends from the sea-level to nearly 3,000ft.

Its distribution is very unequal: it is plentiful in the Kaipara and many other districts of the North Island, but rarely forms any large portion of the forest, chiefly occurring as single specimens, frequently of very large dimensions: it is plentiful on the Great Barrier Island, but only a solitary specimen is found on the Kawau. In many parts of the Taranaki District it forms the chief portion of the forest, and occurs in equal abundance in a few localities in the Wellington District, also in some portions of the Aorere Valley in the South Island, where, however, it is of smaller dimensions.

DESCRIPTION.

Metrosideros robusta, A. Cunn.

M. florida, Hook., "Botanical Magazine," t. 4,471 (not of Smith).

An evergreen tree, epiphytic or terrestrial, but never scandent, 50ft. to 100ft. high; trunk often irregular, 2ft. to 12ft. or even 22ft. in diameter. Branchlets short, angular, puberulous. Leaves decussate, 1½in. long; petioles pubescent or

glabrate; lamina glabrous, coriaceous, elliptic-oblong or lanceolate, obtuse, entire, minutely reticulated. Flowers in terminal many-flowered short cymes; branches and pedicels short and stout, pubescent; calyx pubescent, broad, shortly obconic, with five shortly-triangular lobes; petals, five, orbicular. Stamens numerous, rather short. Ovary adnate with the lower part of the calyx-tube; shorter than the tube until the flower has withered. Fruit, a three-celled capsule, twice as long as the calyx-tube, with which it is girt around the middle; upper part free, obtuse, three-valved.

EXPLANATION OF PLATE CXXVIII.

Metrosideros robusta, A. Cunn. Flowering specimen, natural size. 1. Flower. 2. Petal. 3. Longitudinal section of a flower with the petals and stamens removed. All magnified. 4. Fruit, natural size. 5. Fruit. 6. Longitudinal section of a fruit. 7. Seed. All magnified.



ASCARINA LUCIDA.

ASCARINA LUCIDA, Hook. f.

THE HUTU.

ORDER—CHLORANTHACEÆ.

(Plate CXXIX.)

ASCARINA LUCIDA is the hutu of the Maoris, according to Mr. Buchanan, F.L.S.; but I believe the name is sometimes applied to the tooth-leaved beech (*Fagus fusca*). Although widely distributed through the colony, it is remarkably local, and has been collected by very few New Zealand botanists.

It forms an evergreen shrub or tree, 10ft. to 25ft. high, with a trunk 6in. to 8in. in diameter, and presents an attractive appearance from the contrast afforded by its dark or bronzed leaves with the grooved blackish-purple branchlets. The leaves are opposite, and, including the leaf-stalks, from 1in. to 3in. long, less than 3/4in. wide, narrowed at both ends, acute at the apex, smooth, and with the margins cut into rather coarse teeth: the leaf-stalks are connected on each side of the stem by curious stipules, which develop three short acute teeth, as shown in Fig. 6 (Pl. CXXIX.). The male and female flowers are produced on separate trees, and are without calyx or corolla: they are arranged in panicles springing from the axils of the leaves: each male flower consists of a single anther destitute of a filament, and opening by slits in the sides; it is seated in the axil of a small bract. The female flower consists of a single ovary inserted in the axil of a small bract, and with a short obtuse sessile stigma. The fruit has an outer pulpy layer, and contains a single seed. Each branch of the inflorescence, whether male or female, forms a small spike, from 3/4in. to 1 1/2in. long—the male being smaller and less branched than those of the female. Specimens from the Kermadec Islands have longer and larger leaves than those from other localities, and were formerly considered to belong to a distinct species, which was named *A. lanceolata*. Leaves from different localities vary much in shape, size, and especially in the teeth and apex, both of which may be acute or obtuse.

PROPERTIES AND USES.

The wood of *Ascarina lucida* is of a reddish-brown when seasoned, straight-grained, tough, and strong: figured specimens are occasionally met with: it appears to be of small economic value, but, from its ornamental appearance, the tree will doubtless prove useful to the cultivator.

DISTRIBUTION OF THE GENUS.

Ascarina is a small genus comprising three or, possibly, four species, distributed through various Pacific Islands, New Caledonia, and New Zealand.

DISTRIBUTION OF THE SPECIES.

Ascarina lucida extends to New Caledonia, the Fiji Islands, and Samoa.

In the colony it is chiefly confined to littoral situations, and is most plentiful on the western side of the North and South Islands. It is plentiful on the Kermadec Islands, and has been recorded from Ahipara, Hokianga, Whangaroa,

the Bay of Islands and Whangarei, and the head of the Wairarapa Valley, in the North Island. In the South Island it has been found in the Districts of Nelson, Westland, and Otago, as far south as Puysegur Point.

The only inland habitat in which it has been found is the head of the Wairarapa Valley, where three or four small trees were discovered by Mr. Colenso many years ago. One or two specimens have been found in the Titirangi district, but not far from the sea.

DESCRIPTION.

Ascarina lucida, Hook. f.

A. lanceolata, Hook. f.

A much-branched diœcious evergreen shrub or small tree, 10ft. to 25ft. high. Branchlets grooved, blackish-purple in colour. Stipules interpetiolar, with three subulate teeth. Leaves opposite, 1in. to 3in. long, glabrous, shining, oblong or oblong-lanceolate or lanceolate, sharply or obtusely serrate, usually acute or acuminate; petioles slender. Flowers spicate, in axillary or terminal panicles, with opposite branches 1in. to 1½in. long; perianth, none. Male anther solitary, sessile in the axil of a small bract. Female panicle large; ovary ovoid, sessile, one-celled; stigma sessile. Fruit, a small drupe, one-seeded.

EXPLANATION OF PLATE CXXIX.

Ascarina lucida, Hook. f. Female flowering specimen, natural size.
 1. Panicle of female flower. 2. Portion of a female spike; drawn from Westland specimens. 3. Panicle of male flowers. 4. Portion of a male spike.
 5. A male flower, detached; drawn from a Kermadec Island specimen.
 6. Portion of a branchlet, showing the stipules.





Mangrove.
AVICENNIA OFFICINALIS.

AVICENNIA OFFICINALIS, Linné.

THE MANAWA.

ORDER—VERBENACEÆ.

(Plate CXXX.)

THIS littoral tree is well known to settlers as the "mangrove" or "white mangrove," and is found in estuaries or muddy tidal rivers, where it presents a singular appearance, especially at high water, when large specimens rise above the water to the height of 40ft., so that boats may be easily rowed amongst them. At low water their naked trunks are exposed, and the mud is seen to be thickly studded with erect shoots from 1ft. to 3ft. high, given off from the tangled roots, and resembling very strong shoots of asparagus: the naked trunks of large specimens are frequently covered between tide-marks with the rock-oyster (*Ostrea glomerata*). Although the tree can only attain its greatest luxuriance in deep water, specimens may be seen, little more than 1ft. in height, growing on muddy beaches where they are all but submerged during high tides.

The white mangrove forms an evergreen shrub or small tree, usually from 6ft. to 40ft. high: the branchlets are opposite, and clothed with short brown downy hairs: the leaves are opposite, and are carried on rather broad leaf-stalks, smooth above, but clothed with grey or brown hairs below: they are from 2in. to 3in. long and from 1in. to 1½in. in breadth, narrowed at both extremities, and acute or obtuse at the apex. They turn black in drying.

The flowers are arranged in heads about ½in. or less in diameter, carried on foot-stalks springing from the axils of the leaves: each cluster of heads has a pair of small bract-like leaves at its base, and consists of three or five furrowed flower-stalks of unequal length, each carrying from five to eight sessile flowers, forming a compact head with three brown shaggy bracts at its base; each flower is seated between a pair of smaller bracts: all the bracts, with the calyx and upper part of the corolla, are thickly clothed with brown silky hairs. The calyx is deeply cleft into four or five sepals, and nearly equals the corolla, which is thick and leathery in texture, bell-shaped, with four or five spreading lobes, and carries four or five short stamens inserted in the upper part of its tube. The ovary is two- or, rarely, three-celled, clothed with long silky hairs on its upper surface, and with two ovules in each cell; it is crowned with two or, rarely, three short styles. The fruit is a large ovoid leathery capsule containing a single cell and a single seed: the process of germination is commenced by the protrusion of the rootlet while the fruit is still on the tree.

Forster erroneously supposed this species to produce a resin, which led him to describe it as *Avicennia resinifera*.

Its local distribution is nearly identical with that of the kauri and the rock-oyster.

PROPERTIES AND USES.

The wood of the mangrove is white, straight in the grain, tough, and elastic, but very perishable. From an analysis made at the Colonial Laboratory it is

found that the leaves and twigs contains 6.41 per cent. of potash, and the wood 3.92 per cent.

DISTRIBUTION OF THE GENUS.

Avicennia is a small genus comprising three or four species found in tropical and subtropical Asia, Africa, America, also in Australia and New Zealand.

DISTRIBUTION OF THE SPECIES.

Avicennia officinalis has a wide distribution in tropical or subtropical countries: Asia, Africa, South America, Australia, and New Zealand.

In New Zealand the plant is distributed from the North Cape to Kawhia Harbour on the west coast, and the northern part of Tauranga Harbour on the east coast.

DESCRIPTION.

Avicennia officinalis, Linné.

A. tomentosa, Jacq.

A. resinifera, Forst.

An evergreen shrub or tree, sometimes 40ft. high, growing on the mud-flats of tidal rivers or estuaries. Branchlets opposite, pubescent. Leaves opposite, entire, coriaceous, 2in. to 3in. long including the petiole, clothed with appressed tomentum beneath, ovate or oblong, acute or obtuse. Flowers on axillary peduncles clustered in threes or fives; peduncles pubescent, crowned with a compact head of from five to eight sessile flowers; calyx deeply four- or five-cleft, silky; corolla coriaceous, campanulate, with four or five silky lobes; stamens four or five, with short filaments inserted on the corolla; ovary silky above, two-celled, with two pendulous ovules in each cell; styles very short, erect. Fruit large, ovoid, compressed, one-celled and one-seeded; seed with very large cotyledons and scanty endosperm.

EXPLANATION OF PLATE CXXX.

Avicennia officinalis, Linné. Flowering specimen, natural size.



HUGH BOSCAWEN.

Rama rama.
(MYRTUS BULLATA).

MYRTUS BULLATA, Banks and Solander.

THE RAMARAMA.

ORDER—MYRTACEÆ.

(Plate CXXXI.)

THE ramarama is the largest and most attractive of the New Zealand myrtles: it varies from a dwarf shrub to a small tree 30ft. in height, but is easily distinguished from all other indigenous plants by its reddish-brown leaves, the spaces between the veins of which are tumid or inflated, presenting a singular appearance, as if blistered. Its white flowers are produced freely, and form an agreeable contrast with the brown leaves.

The branchlets are red and clothed with very short hairs, a character which is exhibited also by the leaves when young. The leaves are opposite, from 1in. to nearly 2in. in length, and from $\frac{1}{2}$ in. to nearly 1in. broad: they are carried on short leaf-stalks, and are quite entire, and acute at the tip. The flowers are borne on slender flower-stalks, which are as long as or shorter than the leaves: the calyx is divided into four lobes; four white or pink petals and numerous stamens are carried on its inner margin. The fruit is a bright-red berry, $\frac{3}{8}$ in. long, and contains several flat bony seeds arranged in two cells.

The flower-stalks and calyx are clothed with short silky hairs, and nearly all parts of the plant are dotted with pellucid glands. The flowers are produced in December and January.

PROPERTIES AND USES.

The wood of the ramarama is red, straight, and compact, strong, tough, and elastic: it is often prettily figured. It is used for the handles of axes and carpenters' tools, and is valued for ornamental work; transverse sections are used for inlaying.

This species is valuable for ornamental planting, but has been much neglected.

DISTRIBUTION OF THE GENUS.

See under *Myrtus obcordata*, p. 127, ante.

DISTRIBUTION OF THE SPECIES.

Myrtus bullata is frequent in lowland districts in the North Island, from Mongonui to Cook Strait. In the South Island it is confined to the Districts of Marlborough and Nelson, being plentiful in some parts of Marlborough, but rare and local in Nelson.

It ascends from the sea-level to 1,800ft.

DESCRIPTION.

Myrtus bullata, Banks and Solander.

An evergreen shrub or erect tree, 5ft. to 30ft. high. Branchlets and young leaves tomentose. Leaves reddish-brown, opposite, shortly petioled, $\frac{3}{4}$ in. to 2in. long, broadly ovate or orbicular-ovate, obtuse or acute, subcoriaceous, tumid

between the veins. Flowers axillary, solitary, peduncles equalling the leaves or shorter, pubescent. Calyx pubescent, superior, with two small bracts at the base, four-lobed; petals, four, orbicular, perigynous. Calyx and petals pellucid-dotted; stamens numerous; ovary two-celled; style exceeding the stamens. Berry, red, ultimately black, two-celled; seeds, four to eight in each cell, reniform, bony, without endosperm.

EXPLANATION OF PLATE CXXXI.

Myrtus bullata, Banks and Solander. Flowering specimen, natural size.
1. Flower. 2. Flower with petals and stamens removed. 3. Flower before expansion. 4. Calyx. 5. Transverse section of fruit. All magnified.





COPROSMA ARBOREA.

COPROSMA ARBOREA, T. Kirk.

THE TREE KARAMU.

ORDER—RUBIACEÆ.

(Plate CXXXII.)

THIS species was for many years confused with *C. spathulata*, although it differs widely from that small plant, and is the largest member of the genus, as well as one of the most distinct. "Karamu" is applied by the Maoris to several species of *Coprosma*, amongst which, I believe, this is included, but it is commonly termed "tree-karamu" by bushmen and settlers in the North. When growing in open places *Coprosma arborea* forms a round-headed tree, 20ft. to 30ft. high, with a trunk from 6in. to 16in. in diameter; sometimes, however, numerous trees grow close together, when the branches are very short, and the trees are little more than straight poles less than 1ft. in diameter. The leaves are opposite, from 1in. to 3in. long and from $\frac{2}{3}$ in. to 1 $\frac{1}{2}$ in. broad, of a brownish-green tint, but often purple or red beneath: they are obtuse at the apex, but gradually narrowed below into slender leaf-stalks. The male and female flowers are produced on separate trees, the former being crowded in many-flowered globular heads, terminating branchlets: the calyx is highly developed, and is deeply divided into four or five sepals: the bell-shaped corolla is deeply cut into four or five lobes, and the anthers are four or five in number, and carried on very long drooping filaments. The female flowers are crowded in smaller heads, and the corolla is smaller than in the male. The berries are developed in clusters, and are at first translucent, ultimately becoming black: they are two-seeded.

PROPERTIES AND USES.

The wood of *Coprosma arborea* is of a yellow colour, although not of so deep a tint as that of *C. linariifolia*: it is very straight in the grain, firm, compact, and even, very tough and elastic. Although not durable when in contact with the ground, it is frequently used for fence-rails, which last for many years. It is also used by cabinetmakers for inlaying and other ornamental work, where its peculiar colour can be employed to advantage.

DISTRIBUTION OF THE GENUS.

See under *Coprosma Baucriana*, p. 109, ante.

DISTRIBUTION OF THE SPECIES.

Coprosma arborea is endemic in the North Island, and has a very restricted distribution, being confined to the area between Mongonui and Tauranga on the east coast and Raglan on the west coast. It is rarely abundant, although it formerly occurred in profusion on Waiheke Island: it will probably become a rare plant with the progress of settlement.

It prefers low levels, and has not been observed at altitudes above 800ft.

DESCRIPTION.

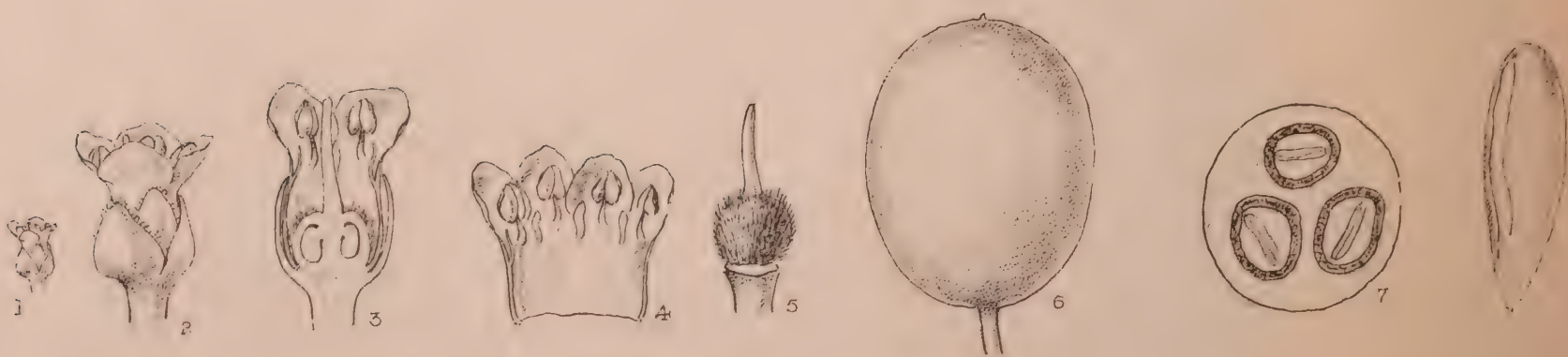
Coprosma arborea, T. Kirk, Trans. N.Z. Inst., Vol. x., p. 420.

An erect diœcious evergreen tree, 20ft. to 30ft. high. Branchlets puberulous or pubescent. Leaves opposite, brownish-green above, purple below, slightly coriaceous, 1in. to 3in. long; ovate, spathulate, or oblong-spathulate; obtuse, narrowed below into broad petioles; veins prominent. Flowers terminal, densely capitate. Male: Calyx narrow, deeply four- or five-cleft; lobes ciliate; corolla campanulate, four- or five-lobed; stamens, four or five on long filaments. Female in smaller heads; calyx with four or five shorter lobes; corolla smaller; styles slender. Fruit clustered, white, translucent, ultimately black; seeds two.

EXPLANATION OF PLATE CXXXII.

Coprosma arborea, T. Kirk. 1. Male flowering specimen. 2. Male flower. Both natural size. 3. Male flower, magnified. 4. Fascicle of male flowers, natural size. 5. The same, magnified. 6. Female flowering specimen. 7. Female flower. Both natural size. 8. Female flower, magnified. 9. Fascicle of female flowers, natural size. 10. The same, magnified. 11. Cluster of fruits, natural size. 12. Fruit, magnified. 13 and 14. Transverse section of a fruit, natural size and magnified. 15 and 16. Seed, natural size and magnified.





SAPOTA COSTATA.

SIDEROXYLON COSTATUM, F. Mueller.

(**SAPOTA COSTATA**, A. De Candolle.)

THE TAWAAPOU.

ORDER—SAPOTEÆ.

(Plate CXXXIII.)

THE tawaapou, or pou as it is termed by the Maoris of the Great Barrier Island, is a handsome evergreen tree, varying from 20ft. to 60ft. in height, with a trunk 1ft. to 3ft. or, very rarely, 5ft. in diameter. It attains its largest dimensions in littoral situations on the Great and Little Barrier Islands and on Kawau Island, at the entrance to the Hauraki Gulf: it has a very restricted distribution. The branches and leaf-stalks contain a milky juice, and are clothed with minute hairs. The leaves are alternate, from 2in. to 3in. long, including the leaf-stalks, and $\frac{3}{4}$ in. to 2in. broad, quite smooth and entire, broadest above the middle, and with numerous parallel veins diverging from the mid-rib. The flowers are solitary or, rarely, two together in the axils of the leaves, and are borne on rather stout flower-stalks, $\frac{1}{4}$ in. to $\frac{1}{3}$ in. long; flowers very small, $\frac{1}{8}$ in. to $\frac{1}{6}$ in. in diameter: the calyx is deeply divided into four lobes, which are fringed with hairs; the corolla is white, slightly longer than the calyx, and divided into four lobes; four very short stamens are inserted at the throat of the corolla. The ovary is clothed with long silky hairs, and is four-celled, with a short straight style. The fruit is handsome, about 1in. long, and resembles a small plum, but usually contains three hard crescent-shaped polished bony seeds nearly as long as the fruit, or, rarely, only one or two seeds are developed when the fruit is narrowed at the base: the inner side of the fruit is rough, with a small aperture at its apex. Some flowers are produced with imperfect stamens, others with an abortive pistil, but in the New Zealand plant most of the flowers are perfect.

The Norfolk Island plant, which is usually identified with this, has five sepals, five petals, and five stamens.

PROPERTIES AND USES.

The wood is white, with a fine close wavy grain; it is tough and elastic, but does not appear to be durable. It is easily worked and takes a high finish, but, so far as is known, no attempt has been made to utilise it, although it would be useful to the cabinetmaker and ornamental turner.

The hard seeds were formerly used as necklaces by the Native chiefs, and the fruits form a favourite food of the wood-pigeon.

DISTRIBUTION OF THE GENUS.

Sideroxylon comprises about sixty species, chiefly natives of tropical regions: a few species are found in southern Africa, temperate Australia, one in New Zealand, and one in Norfolk Island.

DISTRIBUTION OF THE SPECIES.

Sideroxylon costatum is found on Norfolk Island and in Australia and New Zealand, where it extends from the North Cape to the East Cape. It is most plentiful on the islands at the entrance to the Hauraki Gulf, and occurs freely on Waiheke and other islands in the Gulf. It is rare on the west coast, but one or two specimens occur on the shores of the Manukau Harbour, possibly planted by the Maoris.

It is usually confined to littoral situations, but a few small trees were observed on the Little Barrier Island at an elevation of 1,800ft. or upwards.

This species is better known to New Zealand botanists under the name of *Sapota costata*, under which it was described by A. De Candolle.

DESCRIPTION.

Sideroxylon costatum, F. Mueller.

Sapota costata, A. DC.

Achras costata, Endl.

A. Novz-Zelandica, F. Mueller.

An erect evergreen tree, 20ft. to 60ft. high, sometimes with a spreading head. Branchlets and petioles hoary with appressed down, lactescent. Leaves alternate, exstipulate, obovate or obovate-oblong, obtuse, entire, glabrous. Flowers axillary, solitary or, rarely, in pairs; peduncles rather stout, less than $\frac{1}{2}$ in. long, pubescent. Calyx inferior, deeply four-lobed; lobes ciliated; corolla slightly exceeding the calyx, four-lobed. Stamens, four, on short fleshy filaments, inserted on the corolla; ovary four-celled, silky, each cell containing a single suspended ovule. Fruit, 1in. long, one- to four-celled, one- to four-seeded. Seeds crescent-shaped, $\frac{3}{4}$ in. long, bony, polished, with copious endosperm.

EXPLANATION OF PLATE CXXXIII.

Sideroxylon costatum, F. Mueller. (*Sapota costata*, A. DC.) Specimens with perfect flowers, natural size. 1 and 2. Flower, natural size and magnified. 3. Transverse section of a flower. 4. Corolla, laid open. 5. Pistil. All magnified. 6. Ripe fruit. 7. Transverse section of a fruit. 8. Seed. All natural size.





T. KIRK DREWIT

PLAGIANTHUS LYALLII.

SURVEY DEP'T 1888.

PLAGIANTHUS LYALLII, Hook. f.

THE WHAU-WHI.

ORDER—MALVACEÆ.

(Plate CXXXIV.)

THE whau-whi, or "lace-bark" as it is usually termed by settlers, is one of the most graceful and beautiful flowering trees in the New Zealand flora: its large white flowers, nearly an inch in diameter, are produced in vast profusion, and harmonize beautifully with the foliage, which is at once soft in character and bold in outline: it has an additional attraction, for it is one of the few New Zealand trees which are truly deciduous, and exhibits vivid autumnal tints, mostly of soft-yellow shades, which afford a fine contrast with the deep green of the mountain-beech and other trees by which it is usually surrounded. This deciduous character is restricted to high levels, and is only seen at altitudes of 3,000ft. and upwards; at lower levels the plant is evergreen.

The bark is extremely tough, and the inner portion is capable of division into numerous thin layers which are beautifully perforated and bear some resemblance to lace: this has led the settlers to give this tree the name of "lace-bark."

Plagianthus Lyallii forms a sub-alpine or alpine shrub or small tree, sometimes 40ft. high, with rather distant branches; the branchlets, young leaves, flower-stalks, and calyces are clothed with very short, soft, starry hairs, which, however, gradually disappear from the upper surface of the leaves. The leaves of young plants are deeply lobed, and their margins are cut into smaller lobes or coarse teeth: on old plants the leaves are alternate and carried on slender leaf-stalks, 1in. to 2in. long; the blades are from 2in. to 5in. long, and from 1½in. to 2in. broad, narrowed into a long point at the apex, and with the margins cut into large obtuse teeth, many of which are again divided.

The flowers are carried on slender peduncles springing from the axils of the leaves, and may be solitary or arranged in clusters of from three to six: the calyx is broadly cup-shaped, with five spreading triangular teeth: the petals are five, inserted on the floral receptacle, narrowed at the base, and slightly notched on one side. The stamens are numerous; the filaments are united below, forming a short tube which surrounds the base of the style; and the ovary is globose, about ten- to fourteen-celled, with the same number of styles united below, the upper portion free; the stigmas are flattened, and stigmatiferous on the upper surface only. The fruit is globose, but flattened on the upper surface, and composed of from ten to twelve or more flattened carpels, each containing a flattened seed.

PROPERTIES AND USES.

The wood of *Plagianthus Lyallii* is white and rather soft, but is often prettily figured and suitable for ornamental cabinetwork, turnery, and inlaying. It makes excellent firewood. The inner bark is useful for tying plants, &c., and is occasionally used by ladies for trimming for hats, bonnets, and dresses. The wood is suitable for the manufacture of paper.

DISTRIBUTION OF THE GENUS.

See under *Plagianthus betulinus*, p. 207, *ante*.

DISTRIBUTION OF THE SPECIES.

Plagianthus Lyallii is endemic in New Zealand, where it is restricted to the South Island, and extends from Marlborough and Nelson to Otago: it attains its southern boundary at Dusky Bay, but does not occur on Stewart Island.

It is comparatively rare on the eastern side of the Island, but is plentiful on the western side. It descends nearly to sea-level, but is most abundant at elevations above 2,000ft., ascending to fully 4,000ft. It is common on the borders of streams in alpine and sub-alpine forests.

DESCRIPTION.

Plagianthus Lyallii, Hook. f.

Hoheria Lyallii, Hook. f., "Flora Novæ-Zelandiæ," i., t. 11.

A shrub or small tree, 10ft. to 40ft. high, often with distant branches. Branchlets and young leaves clothed with short stellate pubescence, which falls away from the upper surface of the leaves. Leaves alternate: on young plants deeply irregularly lobed and coarsely toothed; on old trees alternate, ovate-cordate or broadly ovate, acuminate, membranous, 2in. to 4in. long, doubly crenate or, rarely, serrate; petioles long, very slender, pubescent. Flowers axillary, solitary or in two- to six-flowered fascicles; peduncles long, slender, pubescent. Calyx pubescent, with five spreading triangular lobes; petals, five, oblique, with a slight notch near the apex; staminal tube short; stamens numerous, spreading; ovary ten- to fourteen-celled, style divided into as many filiform branches; stigmas expanded, flattened. Fruit, a depressed globular capsule, consisting of ten to fourteen separable reniform carpels, sharply keeled on the outer surface. Seeds solitary, much compressed.

NOTE.—In the "Flora Novæ-Zelandiæ" this species is figured with very long filiform styles and linear stigmas; but in all the specimens which I have been able to examine the free portion of the style is very short, with a decidedly flattened and expanded stigma, stigmatiferous on the upper surface and outer margin, sometimes almost capitate. It might fairly be placed in *Hoheria*.

EXPLANATION OF PLATE CXXXIV.

Plagianthus Lyallii, Hook. f. Flowering specimen. 1. Leaf of young plant. Both natural size. 2. Pistil with its short styles, magnified. 3. A ripe fruit, natural size. 4. A seed, magnified.



FAGUS APICULATA.

FAGUS APICULATA, Colenso.

THE POINTED-LEAVED BEECH.

ORDER—CUPULIFERÆ.

(Plate CXXXV.)

FAGUS APICULATA was described by Mr. Colenso in 1883, and does not appear to have been met with by other botanists: its discoverer states that it attains the height of 40ft., with a trunk 2ft. in diameter, clothed with rather smooth pale bark. The branchlets are clothed with short downy hairs. The leaves are alternate, about 1in. long, and of thin texture, quite entire or with a few minute indentations on their margins: they are carried on short leaf-stalks, and the mid-rib is produced beyond the margin into a short point, which is thickened at the base by the marginal nerve.

The male and female flowers are produced on the same tree; the former are usually solitary, although occasionally they are found in pairs: in general appearance they are similar to those of the tooth-leaved beech (*Fagus fusca*, Hook. f.), but the perianth is rather narrow. The female flowers are solitary: the cupules resemble those of *F. fusca*, but are usually three- or rarely four-leaved, and carry from two to four transverse membranous plates. The fruiting cupule is somewhat ovate, and contains two or three nuts, one of which is flat, the other three-angled, with narrow wings at each angle. This plant closely approaches entire-leaved forms of *Fagus fusca*, but the leaves are more membranous, and the fruit is narrow. It agrees with that species in having the branchlets and under-surfaces of the leaves clothed with fine downy hairs, and in the male flowers being occasionally clustered. In *Fagus fusca* some of the leaves are apiculate, especially in the toothless forms: in Mr. Colenso's plant all the leaves are apiculate; but it should, I think, be regarded as a strongly-marked variety of *F. fusca*, although, in deference to the opinion of its author, I have retained it as a distinct species. Botanists will do well to consult Mr. Colenso's detailed description in the "Transactions of the New Zealand Institute."*

PROPERTIES AND USES.

No information is given as to the quality of the timber, which will probably be found similar to that of the tooth-leaved beech.

DISTRIBUTION OF THE GENUS.

See under *Fagus Solandri*, p. 91, *ante*.

DISTRIBUTION OF THE SPECIES.

At present *Fagus apiculata* has only been observed in forests between Matama and Danevirke, in the Hawke's Bay District.

* Trans. N.Z. Inst., Vol. XVI., p. 335; Vol. XVII., p. 247.

DESCRIPTION.

Fagus apiculata, Colenso, Trans. N.Z. Inst., Vol. xvi., p. 335;
Vol. xvii., p. 247.

A tree, 40ft. high. Branchlets pubescent; petioles and leaves pubescent beneath. Leaves broadly oblong-lanceolate, 1in. long, minutely crenulate, strongly apiculate. Male flowers as in *F. fusca*; solitary or in twos. Female solitary: fruiting cupule with three or, rarely, four lobes, each with from two to four transverse lamellæ. Nuts, two or three, one flat, the others trigonous, winged at the margins.

EXPLANATION OF PLATE CXXXV.

Fagus apiculata, Colenso. 1. Female flowering specimen. 2. Male flowering specimen. Both natural size. 3 and 4. Male flowers. 5. Fruiting cupule. 6. Nut.

NOTE.—I have to express my indebtedness to Mr. Colenso for the specimens here figured.



D. Blair del et lith

DISCARIA TOUMATOU.

DISCARIA TOUMATOU, Raoul.

THE TUMATUKURU.

ORDER—RHAMNEÆ.

(Plate CXXXVI.)

THE tumatukuru merits a place in this work rather on account of its value in the past than of its present usefulness. In the early days of settlement in the South Island this afforded the only available timber in many mountain-valleys, and was frequently converted by hand sawyers for building purposes; being of great durability, it was found very serviceable, notwithstanding its small dimensions: the formation of roads has deprived it of value by facilitating the conveyance of ordinary building timber. This plant was formerly considered a variety of the Tasmanian *Discaria australis*, Hook., from which it differs chiefly in the constant absence of petals, but it is now considered by most botanists to be distinct. At the sea-level it forms a spinous bush, but in cool mountain-valleys it becomes a small tree, 20ft. high or more, with spreading branches and but few leaves: the branches are jointed beneath the leaves, and the ultimate branchlets are modified into stout woody spines, sometimes 2in. long, arranged in two or four rows. The leaves are developed in opposite clusters of from two to six just below the spines, or sometimes in their axils: they are from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. in length, narrowed at the base, and quite entire, obtuse or sometimes slightly notched at the tip. The flowers are $\frac{1}{2}$ in. in diameter, produced in the axils of the leaves, and arranged in small clusters or solitary: they are carried on short flower-stalks, the calyx being membranous, with four or five white downy lobes, which are three-nerved and are bent backwards: the corolla is absent: the stamens are four or five in number, on short filaments, and the ovary is three-lobed, adherent with the base of the calyx: the style is short, straight, three-lobed. The fruit is a coriaceous capsule formed of three coherent carpels, which are one-seeded, and separate from each other when ripe.

PROPERTIES AND USES.

The wood of the tumatukuru is strong, tough, elastic, and durable: it was formerly used for building purposes where larger timbers could not be obtained, but large trees have now become scarce. Straight stems are prized for the handles of stock-whips: the stout sharp spines were used by the Maoris for tattooing.

If properly treated it would form an almost impenetrable live fence.

DISTRIBUTION OF THE GENUS.

Discaria is a small genus, comprising about twelve species, all natives of temperate countries in South America except one which is found in Australia, and another in New Zealand.

DISTRIBUTION OF THE SPECIES.

Discaria Toumatou is endemic in New Zealand, and attains its northern limit between the south head of the Manukau Harbour and Port Waikato. It is

found in all districts as far as Southland, but has not been observed on Stewart Island.

It ascends from the sea-level to about 3,000ft.

DESCRIPTION.

Discaria Toumatou, Raoul, "Choix de Plantes de la Nouvelle-Zélande," t. 29.

D. australis, Hook. β , *apetala*, Hook.

Notophæna Toumatou, Miers.

A straggling bush or small tree, with distichous or decussate spines, 1in. to 2in. long, and a fascicle of leaves at the base of each spine; branches jointed below each pair of spines. Leaves in fascicles of two to six or, rarely, solitary, $\frac{1}{3}$ in. to $\frac{2}{3}$ in. long, shortly petioled, linear-obovate or oblong, entire, obtuse or retuse, rarely serrate, and sometimes pubescent. Flowers in two- to four-flowered fascicles amongst the leaves, $\frac{1}{8}$ in. in diameter; pedicels very short, pubescent. Calyx pubescent, with a short tube and four or five spreading white lobes; disc prominent, with a raised margin; stamens, four or five, on short filaments; ovary adnate with the base of the calyx, three-lobed; style short, three-lobed. Fruit, a capsule when ripe, consisting of three separable one-seeded carpels.

EXPLANATION OF PLATE CXXXVI.

Discaria Toumatou, Raoul. Flowering specimen, natural size. 1. A flower. 2. Longitudinal section of a flower. 3. A fruit. Natural size. 4. The same, magnified. 5, 6, and 7. Seeds. 8. Transverse section of a seed. All magnified.



OLEARIA FORSTERI.

OLEARIA FORSTERI, Hook. f.

THE AKIRAHŌ.

ORDER—COMPOSITÆ.

(Plate CXXXVII.)

THE flower-heads of this very distinct plant frequently contain a single floret only, which led Forster to take it as the type of a new genus, *Shawia*, and the species was originally described by him as *Shawia paniculata*; but in the "Flora Novæ-Zelandiæ" it was placed by Sir Joseph Hooker under *Eurybia* on account of the pappus-hairs being arranged in a single row, and in the "Handbook of the New Zealand Flora" it was referred to *Olearia*, in which both *Shawia* and *Eurybia* are rightly merged.

Olearia Forsteri is a much-branched shrub or small tree, 6ft. to 20ft. high, with stiff branches and alternate yellowish-green leaves, which vary from 1in. to 3in. in length, and are usually much waved at their margins; the upper surface is finely reticulated, and the lower surface is white, with closely-appressed hairs.

The flowers are produced in panicles, which are usually but not invariably shorter than the leaves; they spring from the axils of the leaves, and are much branched. The flowers are very numerous and are sessile, two or three being inserted on a common footstalk; they are about $\frac{1}{2}$ in. long: the involucral cup is tubular and narrow; it is formed of from six to eight scales, the uppermost being longer than those at the base, and nearly smooth. The heads are from one- to three-flowered, and most of the flowers are perfect; ray-florets are very rare: the perfect florets have a long silky tube, with a bell-shaped mouth, cut into five recurved segments. The fruit is pubescent, and the pappus-hairs are arranged in one series.

In many districts this species is liable to the attacks of a dipterous insect, which deposits its eggs in the buds and gives rise to leafy galls: in some districts scarcely a plant is to be found exempt from the attacks of the insect: sometimes the panicles are unusually large in infested plants, and the leaves reduced in size.

PROPERTIES AND USES.

The wood of *Olearia Forsteri* is of a light-brown colour, with a satiny lustre, and is sometimes prettily figured. It is suitable for many kinds of ornamental work. The plant is easily cultivated, and forms excellent shelter-hedges: it bears clipping freely.

DISTRIBUTION OF THE GENUS.

See under *Olearia Traversii*, p. 47, ante.

DISTRIBUTION OF THE SPECIES.

Olearia Forsteri is of somewhat restricted distribution; it attains its extreme northern limit at Poverty Bay, and extends southwards to Oamaru, on the east coast of the South Island; on the west coast it does not extend beyond the boundary of the Nelson District. It ascends from the sea-level to nearly 1,500ft., and is most plentiful in the vicinity of the sea.

DESCRIPTION.

Olearia Forsteri, Hook. f.

Shawia paniculata, Forster. Raoul, "Choix de Plantes de la Nouvelle-Zélande," t. 13.

Eurybia paniculata, Hook. f.

A shrub or small tree, with numerous stiff branches. Leaves alternate, 2in. to 3in. long, petioled, oblong, obtuse, margins waved, finely reticulated; lower surface white, with appressed hairs. Panicles axillary, usually shorter than the leaves, much-branched, heads numerous, sessile in few-flowered fascicles, $\frac{1}{3}$ in. long. Involucre narrow, scales six to eight, rather lax and coriaceous, nearly glabrous. Florets, one to three, usually perfect; corolla silky, campanulate, with five recurved segments. Achene pubescent; pappus brown.

EXPLANATION OF PLATE CXXXVII.

Olearia Forsteri, Hook. f. Specimen with panicles longer than the leaves. 1. Flowers. Both natural size. 2. Perfect flower. 3. An involucre. 4. A floret removed from the involucre. 5. A pappus. All magnified.



Survey Dec. 1886.

OTEFARIA ANGSTIFOLIA.

T. Munk. DREVET.

OLEARIA ANGUSTIFOLIA, Hook. f.

THE TETE-A-WEKA.

ORDER— COMPOSITE.

(Plate CXXXVIII.)

THIS rare and little-known species is one of the most beautiful flowering plants yet discovered, and is attractive alike from the remarkable character of the foliage, the beauty of the flowers, and the delicate perfume it exhales. Looking down from some sea-cliff on Stewart Island, the visitor may see below a compact dome-shaped head, 3ft. in diameter: the narrow rigid leaves, of the deepest green above, are seen to be white beneath as the branches are agitated by the breeze: carried on the tips of the branches are clusters of from four to ten large flower-heads, each about 2in. in diameter, with a rich deep-purple disc, surrounded by snow-white rays, the separate clusters resembling large bouquets set in deep green, and producing one of the richest effects imaginable. In a genus which contains many species of great beauty *Olearia angustifolia* stands unrivalled.

It was originally discovered by Dr. Lyall, Surgeon on board H.M.S. "Acheron," who collected specimens long past flowering in 1848: the flowers were first collected by the writer in 1884, and are now fully described for the first time. The plant is extremely rare and local, often growing in situations where it is washed by the sea-spray. For the Native name, tete-a-weka, I am indebted to Mr. Charles Traill, of Stewart Island.

Olearia angustifolia forms a shrub or small tree, 6ft. to 20ft. high, the trunk being clothed with light-brown fibrous bark, which is deeply furrowed: the branches are stout, and the branchlets are as thick as the little finger, clothed with snow-white wool, as are the under-surfaces of the leaves. The leaves are alternate, from 3in. to 5in. long and from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. broad, sessile, but narrowed towards the base, and tapering to a long point at the apex; they are excessively thick and rigid, and the margins are divided into small rounded teeth. Three parallel veins are obvious on both surfaces.

The flower-heads are produced in clusters of from three to ten at the tips of the branches, and are carried singly on stout leafy stalks, the bracts or leaves of which closely resemble the stem-leaves, but are only from $\frac{1}{2}$ in. to 1in. long. The flower-heads are from 1in. to 2in. in diameter; the involucral leaves are very numerous, narrow, arranged in a single series, and clothed with woolly hairs at their tips. The florets are very numerous, the outer series being female, with a long strap-shaped corolla: the disc-florets are of a deep purple, perfect, with a short tubular corolla, bell-shaped at the mouth, which is divided into five short lobes. The fruit is silky, crowned with a reddish-brown pappus.

The Chatham Islands plant, which Mr. Buchanan considers a variety of *O. angustifolia*, is, I think, a distinct species, more closely allied to *O. semidentata* than to *O. angustifolia*.

PROPERTIES AND USES.

The wood of *Olearia angustifolia* is of a whitish-brown colour, and of a satiny lustre, with dark streaks and small silver grain. It is suitable for many kinds of ornamental work. If felled during the growing season the bark shrinks longitudinally in a most remarkable manner, and the sapwood becomes discoloured. It affords good firewood, but I am assured that if water is thrown on the embers an explosion takes place, and the embers assume a remarkable slag-like appearance, the cause of which is unknown.

This species is easily cultivated in cool soils, but suffers if exposed to drying winds.

DISTRIBUTION OF THE SPECIES.

Olearia angustifolia is one of the most local plants in the New Zealand flora, being restricted to the southern portion of Stewart Island and some of the outlying islets. It attains its northern boundary on the southern side of Paterson's Inlet, and is only found on the verge of sea-cliffs, and in similar situations. It ascends from the sea-level to about 100ft.

DESCRIPTION.

Olearia angustifolia, Hook. f., "Flora Novæ-Zelandiæ," 1., p. 115.

A shrub or small round-headed tree, 6ft. to 20ft. high, with stout branchlets, white with appressed tomentum. Leaves alternate, rigid, 3in. to 5in. long, excessively coriaceous, linear-lanceolate, acuminate, white with appressed tomentum beneath, crenate or doubly crenate, the teeth small, rounded, and hard. Flower-heads with stout leafy peduncles rather shorter than the leaves, and clustered at the tips of the branches; leaves on the peduncles $\frac{1}{2}$ in. to 1in. long; heads $1\frac{1}{2}$ in. to 2in. in diameter; involucral leaves in one series, narrow-linear, with scarious margins. Disc-florets all perfect, with tubular campanulate corollas; ray-florets female, with ligulate corollas, each with a linear scale at its base; achene silky, grooved; pappus reddish-brown, short, unequal.

EXPLANATION OF PLATE CXXXVIII.

Olearia angustifolia, Hook. f. 1. Flowering specimen, natural size. 2 and 3. Disc-floret, natural size and magnified. 4. Transverse section of the same. 5. Stamen. Both magnified. 7 and 8. Ray-floret, natural size and magnified. 9. Fruiting specimen, natural size. 10 and 11. Achene, natural size and magnified.



CORIARIA RUSCIFOLIA

CORIARIA RUSCIFOLIA, Linné.

THE TUTU.

ORDER—CORIARIÆ.

(Plate CXXXIX.)

I LEARN from Mr. Colenso that this plant is the tupakihi of the northern Natives, and the tutu of those in the South: the latter is the name by which it is most generally known to settlers. When in fruit the aspect of the plant is singularly handsome and striking: the pendulous racemes, sometimes exceeding 1ft. in length, of shining purplish-black fruit, present a most attractive appearance. It possesses special interest on account of its poisonous properties, which are far more deadly than that of any other plant in the colony, and cause numerous fatalities amongst sheep and cattle every year. It varies in habit from a sub-herbaceous bush or much-branched evergreen shrub to a small tree 25ft. high, with a trunk sometimes 10in. in diameter, but is easily recognised in all its forms. The young shoots are angular, and frequently from 6ft. to 8ft. long; in the early state, before the leaves are fully developed, they resemble gigantic stems of asparagus. In the mature state the leaves are opposite, 1in. to 3in. long and 1in. or more broad, with leaf-stalks often undeveloped but never exceeding $\frac{1}{10}$ in. in length, deep-green, acute or, rarely, obtuse, with three or five primary nerves. The flowers are perfect, about $\frac{3}{8}$ in. in diameter, arranged in long pendulous racemes frequently more than 1ft. in length; each flower is carried on a slender pedicel. The calyx consists of five green sepals, which are minutely toothed, and five small free petals—both sepals and petals being persistent. The stamens are ten in number, on short filaments, which elongate considerably after fertilisation has taken place. The pistil consists of five one-celled carpels, forming a whorl around the fleshy receptacle to which they are attached; each carpel has a single cell containing a single ovule, and is crowned by a long red style, which is stigmatiferous for its entire length. In fruit the five petals become translucent, and are charged with purple juice, forming a sphere completely surrounding the ripe carpels: ultimately they are black and shining, and the pendulous racemes present a striking and handsome appearance amongst the green foliage.

It has been stated that specimens have been found with all the parts of the flower in sixes: I never met with an instance of this remarkable divergence from the type.*

The process of fertilisation is very interesting: as already stated, the flowers are perfect; on expansion the green anthers are erect, and form a close ring round the styles, but the filaments are undeveloped. In this state the stigmas are ready for the reception of the pollen, but the anthers of the same flower are not sufficiently mature to liberate the pollen which they contain, so that the fertilisation is effected by pollen brought by the wind from more advanced flowers. After fertilisation the styles quickly wither, and the minute petals

* Trans. N.Z. Inst., Vol. XIX., p. 317.

increase rapidly in size until they cover the fertilised carpels: by the time the stamens are fully developed no trace of the stigmas remains. The anthers now liberate their pollen to fertilise other flowers, and droop over the margin of the persistent calyx until they wither, while the petals become swollen with purple juice, and the seeds make rapid progress towards maturity.

It is evident from this statement that the pistil must be fertilised by pollen from other flowers, either from the same or from another tree, self-fertilisation being next to impossible: it also affords an explanation of the reason why the earliest flowers of the plant do not produce seeds; there is no pollen available for their fertilisation.

PROPERTIES AND USES.

No attempt has been made to utilise this plant, although there can be no reason to doubt that a valuable tanning extract could readily be obtained from it. An analysis of the bark has proved that it contains 16·8 per cent. of tannin: but tannin is not confined to the bark; it is plentiful in both the old and young wood, so that the entire plant could be utilised for the manufacture of the extract. If cultivated for the purpose, it would probably prove more profitable than the black wattle, as a much heavier return could be obtained per acre, and it would flourish in situations unsuited to the wattle. The name of the genus is derived from the powerful tanning properties of *Coriaria myrtifolia*, which is plentiful on the coasts of the Mediterranean, and is largely employed for this purpose. It cannot be too strongly insisted upon that the market for tanning extracts is widening every day, and, with the near exhaustion of the supply of hemlock extract from America, there is no probability of its being glutted. It is most desirable that the manufacture of tanning extracts from this and other native trees should be commenced without further delay, as for many years to come the New Zealand tanners would be able to take all that could be placed on the market, instead of importing barks and extracts from other countries.

The wood affords a useful dye for all tints, from a neutral grey to a pure black, when treated in the same manner as logwood. Mr. Skey considers its dyeing properties to be due to the abundance of tannin contained in the plant.*

A striking instance of the deadly nature of tutu poison was afforded a few years ago, when an elephant which had been landed in Otago was marched inland by its owner. On arriving at a spot where the grass was luxuriant the owner allowed the animal to feed; unfortunately, a quantity of young succulent tutu was growing amongst the grass. After feeding for four hours, the elephant drank at a neighbouring creek, and began to reel, fell on his side, and died after about three hours—so that only seven hours elapsed between the time the animal began feeding and his death.

The poisonous principle resides in all parts of the plant, but is most plentiful in the young shoots and in the seeds. Mr. H. G. Hughes, M.P.S., of Hokitika, is of opinion that young woody shoots yield a more virulent poison than that obtained from succulent shoots, and Mr. Colenso states that the seeds from fruits with less juicy petals are non-poisonous. Tutu poisoning results in partial paralysis of the brain, convulsions, delirium, and death: the affected animal reels or staggers and ultimately falls, exhibiting symptoms of the most intense distress.

In 1869 Mr. Skey, the Colonial Analyst, made a careful examination of the constituents of the plant, and, so far as his experiments went, the poisonous principle appears to exist in a peculiar oil, if, indeed, it be not the oil itself.

* Trans. N.Z. Inst., Vol. II., p. 243.

He characterizes the oil as "somewhat viscid at common temperature, but flowing freely at a little above this; colour, pale-green; reaction, acid; taste, bland; burns away rapidly with much flame; scarcely volatile without decomposition; soluble in ether, alcohol, and strong acetic acid; insoluble in hydrochloric or nitric acid, also insoluble in water; does not dry when long exposed to the air." Mr. Skey adds: "If further experiments should confirm the accuracy of the views here stated, this case will, I conceive, become invested with an interest beyond that immediately under our notice, since it will afford another instance in which a non-nitrogenous oily principle is proved to affect the system like a neurotic poison: this class of poisons being almost always alkaloids, or at least nitrogenous substances."

Mr. Skey recommends as antidotes to be used in cases of tutu poisoning, "in addition to emetics and purgatives, very dilute acids, as tending to prevent saponification of the oil and to keep it insoluble."*

An interesting paper on this subject by Mr. H. G. Hughes, with an account of experiments by Dr. Acheson, appeared in the "Transactions of the New Zealand Institute" for 1870:† the paper is much too long to be given *in extenso*, but one or two paragraphs may be quoted with advantage. Mr. Hughes obtained an extract from ground-shoots of tutu, which was found to possess very active properties: "he took less than one-twelfth of a grain, which in five minutes' time produced a most disagreeably irritating sensation in the throat, extending to the stomach, with pain across the region of the stomach, and accompanied by nausea. In a quarter of an hour's time vomiting came on, which continued more or less for two hours. Very unpleasant sensations continued more or less for two hours longer, when, after great flushing of the face, with all but intolerable heat, the effects passed away." When preparing the extract Mr. Hughes found that "handling the wet shoots rather frequently induced vomiting." About half a scruple of the extract was given to a cat, which was found dead twenty minutes afterwards. The poisonous properties of the extract were unimpaired on the second day, but diminished on the third, and completely disappeared on the fourth. Dr. Acheson found that a mixture of lime and water administered to a dog that had previously taken a drachm of the extract was a complete antidote to the effects of the poison, although at the time it was administered the dog was exhibiting pure tetanic convulsions. Dr. Acheson adds: "From what I have seen I am persuaded that lime is an antidote against the tutu poison."

Mr. Skey objected to some of the conclusions arrived at by Mr. Hughes, and prepared a paper in reply, which does not appear to have been printed.‡

A common practice, when cattle are poisoned by tutu, is to bleed at the ear, and administer vinegar or dilute acetic acid. When sheep are poisoned, the head is kept as erect as possible, and vinegar is administered.

During the late autumn and winter months sheep eat the tips of half-woody or woody shoots without apparent injury, the poisonous principle having lost much of its activity. Sheep and cattle living in tutu districts rarely suffer from poisoning except in spring, but, when brought from enclosed paddocks into wild country, they often suffer severely, especially if they have fasted during the journey.

Horses rarely eat tutu, even when suffering from hunger, and rabbits are unfortunately proof against its poison.

* Trans. N.Z. Inst., Vol. II., p. 154.

† *Ibid.*, Vol. III., p. 237.

‡ *Ibid.*, Vol. III., p. 243.

A pleasant wine is often made by settlers from the juicy petals, and, after standing some time, resembles a light claret. The Maoris formerly made a similar extract, which was thickened with certain sea-weeds.

DISTRIBUTION OF THE GENUS.

Coriaria is a small genus comprising about five species, of which one is found on the shores of the Mediterranean, &c., the others in the Himalayas, Japan, and on the western coast of South America: three species are found in New Zealand. The genus is not represented in Australia.

DISTRIBUTION OF THE SPECIES.

Coriaria ruscifolia occurs throughout the colony, from the Kermadec Islands to Stewart Island; it is most plentiful in lowland situations, especially by the sides of streams and on the margins of woods, open places in forests, &c.

It is plentiful in Chili.

DESCRIPTION.

Coriaria ruscifolia, Linné.

C. sarmentosa, Forster. Hook., "Botanical Magazine," t. 2,470.

A shrub or small tree, 5ft. to 25ft. high. Branches tetragonous, often very long. Leaves sessile or nearly so, oblong or obovate, acuminate, acute or rarely obtuse, with three or five primary nerves. Racemes axillary, 5in. to 12in. long or more, many-flowered, pendulous, pubescent; pedicels slender, $\frac{1}{4}$ in. to $\frac{1}{3}$ in. long, bracteolate. Flowers, $\frac{1}{8}$ in. in diameter, green; sepals, five, exceeding the petals; petals, five. Stamens, ten, elongating after fertilisation; carpels, five, inserted on a fleshy receptacle; styles long, flexuous, proterogynous. Fruit spherical, consisting of five crustaceous achenes, invested by five juicy petals. Endosperm scanty.

EXPLANATION OF PLATE CXXXIX.

Coriaria ruscifolia, Linné. Flowering specimen, natural size. 1. Flower before fertilisation. 2. The same after fertilisation. 3. A fruit. 4 and 5. Seeds. All magnified.





PISONIA BRUNONIANA

PISONIA BRUNONIANA, Endlicher.

THE PARAPARA.

ORDER—NYCTAGINEÆ.

(Plate CXL.)

MR. COLENSO informs me that this plant is the parapara of the northern Natives, and I learn from the Ven. Archdeacon W. L. Williams that it is the "puwha-ure-roa" of the East Cape Natives. It is sometimes termed the "bird-catching plant" by settlers and bushmen. Its large dark-green leaves render it a striking plant, but its flowers are by no means attractive. It will always be a plant of special interest, as small birds are often found captured by its viscid fruits, to which their feathers become attached as effectively as if they were glued.

Pisonia Brunoniana varies from a shrub to a medium-sized tree nearly 50ft. high, with a trunk from 2ft. to 3ft. in diameter. The leaves are from 4in. to 14in. long, and from 2in. to 6in. broad, usually opposite, rarely three together, or solitary, and are carried on leaf-stalks from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. in length: they are of thin texture, quite entire, and may be obtuse or acute. The flowers are produced in panicles at the tips of the stout branchlets, and are carried on slender pedicels; they are from 4in. to 8in. long: the branches of the panicle may be clothed with fine hairs or nearly smooth. There is no separate calyx or corolla; the perianth is tubular, from $\frac{1}{4}$ in. to $\frac{1}{3}$ in. long, somewhat bell-shaped at the mouth, with five angles: the stamens vary in number from six to ten, with the filaments expanded and united at the base: the ovary is one-celled, with an erect style, crowned by an expanded lateral stigma. The fruit consists of a single seed invested with a very thin coat, and enclosed in the persistent perianth, which is longitudinally ribbed, and is extremely viscid: it is narrowed immediately below the mouth. The flowers are usually bisexual, but flowers with abortive stamens may sometimes be met with.

PROPERTIES AND USES.

The wood of *Pisonia Brunoniana* is white, straight, and even, but brittle: its economic value is unknown.

The viscid fruits attract large numbers of insects and spiders, which become glued to the fruit, and in their turn attract numerous small birds, who meet with the same unhappy fate, and become so firmly attached to the fruits that unless released they perish miserably. Although the plant has long been known to the Maoris as a tree which captures birds, the notice of settlers was only drawn to this singular property five years ago, when Mr. R. H. Govett recorded the fact.* He stated that he had been informed by a letter from New Plymouth that two "white-eyes" and a sparrow had been found glued by their wings to the viscid seed-vessels: his correspondent added: "Thinking I was doing a merciful act, I collected all the branches with seed on them I could lay hands on, and threw

* Trans. N.Z. Inst., Vol. xvi., p. 364.

them into the ash-pit. To-day the servant comes in to say that about a dozen 'silver-eyes' are glued to these branches; and a pretty piece of work we had to get them clear, for four or five of the sticky pods, at the lowest average, were clinging to each bird. When you look at the tree you can see tufts of feathers and legs where the birds have died, and I really don't think they could possibly get away without help. The black cat just lives under the tree, so that a good many fall to her share; but, in revenge, many pods get into her fur, and she has to come and get them dragged out."

This plant is of easy cultivation, and may be readily propagated by seeds or cuttings, but requires a situation in which it is sheltered from high winds and frost: the former tear the thin leaves into strips, and the latter kills back the young shoots. It suffers severely from frost when planted in the vicinity of Wellington, but is not killed.

DISTRIBUTION OF THE GENUS.

Pisonia comprises about sixty species, chiefly natives of tropical regions, often littoral: a few species are found in Asia, the Pacific Islands, the Mascarene Islands, &c., three in Australia, and one in New Zealand.

DISTRIBUTION OF THE SPECIES.

Pisonia Brunoniana is found in littoral situations on the Kermadec Islands, the Three Kings, near Ngunguru (north of Whangarei), on the Taranga Islands, and on the south side of Whangape Harbour on the west coast. It is also found on Arid Island, the Little Barrier Island, Cape Colville Peninsula, and on the East Cape, where it attains its southern limit. It ascends to 800ft. on the largest of the Taranga Islands.

It extends to New South Wales, Queensland, and Norfolk Island.

DESCRIPTION.

Pisonia Brunoniana, Endl.

P. Sinclairii, Hook. f., "Flora Novæ-Zelandiæ," i., t. 50.

P. umbellifera, Seemann, "Journal of Botany," i., 244.

An evergreen shrub or tree, 6ft. to 40ft. high or more. Branches soft, stout. Leaves usually opposite, 4in. to 14in. long, on slender petioles, broadly oblong, obtuse or acute, entire, membranous. Flowers in much-branched terminal cymes or panicles, pubescent, 2in. to 4in. broad. Flowers $\frac{1}{4}$ in. to $\frac{1}{3}$ in. long, on slender pedicels, bracteolate. Perianth tubular, campanulate, five-lobed. Stamens, six to ten, hypogynous, the filaments united at the base. Ovary elongate, one-celled; style slender; stigma expanded laterally. Fruit, an elongated utricle, with the remains of the staminal tube at its base, enclosed in the enlarged ribbed viscid perianth, 1in. to 2in. long. Embryo with flattened wing-like cotyledons, longitudinally folded.

EXPLANATION OF PLATE CXL.

Pisonia Brunoniana, Endl. 1. Flowering specimen and large leaf, natural size. 2. Flower. 3. Flower with perianth partly removed. 4. Pistil. All magnified. 5 and 6. Fruits, natural size. 7. Utricle, with remains of filaments at its base. 8. Embryo. Magnified.





CORDYLINAE AUSTRALIS.

CORDYLINE AUSTRALIS, Hook. f.

THE TI-KOUKA.

ORDER—LILIACEÆ.

(Plate CXXI.)

THIS grand palm-lily is commonly termed "ti," or, as Mr. Colenso states, properly ti-kouka, "ti" being a kind of generic name applied to the different species of *Cordyline*: it is sometimes termed simply "kouka." The Ven. Archdeacon W. L. Williams informs me that it is termed "kauka" or "whanaka" by the East Cape Natives. Settlers and bushmen generally apply the unmeaning name of "cabbage-tree."

It is almost the only plant in the New Zealand flora that gives a distinctive character to the scenery: when growing on river-banks or on the margins of boggy woods, or on islands in large lakes, it gives a peculiar palmy feature to the landscape, which is unique and attractive, and affords different effects at different seasons of the year: it is most light and graceful when the huge many-branched panicles of fragrant whitish flowers are fully expanded, and is scarcely less attractive when the panicles have become compact and drooping from the weight of myriads of milk-white spherical berries. It is one of the most gigantic plants of the order to which it belongs: specimens from 30ft. to 40ft. high are common, but in the King-country I observed several specimens 60ft. high, with trunks upwards of 5ft. in diameter at the base. In an account of Mr. Colenso's early botanical journeys in the central portion of the North Island he mentions a large specimen in the trunk of which a Patea Maori had constructed a small room in which to keep his baskets and tools: it was fitted with a door, and sufficiently high to allow a man to stand upright within it: the tree was living, and was 20ft. 2in. in girth at the base. Young plants up to 10ft. high have a simple erect stem, with entire leaves 2ft. long or more, and from ½in. to 1in. in width: the stem remains simple until the first panicle of flowers is developed at the apex, when one or more branches are given off, which are ultimately terminated by panicles, and again give rise to new branches: this is repeated until a compact round-headed tree is formed, with a naked trunk; or long branches may be given off irregularly from a few feet above the ground. At first these branches carry a large head of spreading green leaves, each leaf being 1½ft. to 2ft. or more in length, and from 1½in. to 2in. broad, contracted just above the broad base by which it is attached: the leaf is flat, with numerous fine parallel veins but no distinct mid-rib, and is narrowed into a sharp point: ultimately the lower part of the stem is sheathed by the pendulous dead leaves, which in sheltered places are persistent for seven or eight years or more.

The flowers are produced in large terminal panicles, 1ft. to 2ft. in diameter, with densely-crowded branches bearing thousands of flowers: each branch springs from the axil of a green leaf-like bract, and the flowers, which are carried on short pedicels, are protected at the base by three small chaffy-looking leaves or bracteoles, which form a cup; they are usually one-nerved, but sometimes the largest is two-nerved. The perianth is bell-shaped, and about ⅓in. in diameter

when expanded : it consists of six narrow leaves, which are united for about one-fifth of their length above the base : each carries a single stamen : the ovary is three-celled, with a short straight style. The fruit is a spherical white berry containing several angular black seeds.

PROPERTIES AND USES.

The leaves of this plant afford a paper-making material of very high value. Samples sent to England about a quarter of a century ago were worked up at one of the largest mills and received high praise ; but at that time the excessive cost of land-carriage and the high rates of sea-freight prevented exportation. Probably they might be exported at a profit under the more favourable conditions now prevailing, but in any case they could be utilised in the local manufactories, as they could be readily procured in large quantity. The wood appears to be of value for the same purpose, but, so far as I am aware, its exact value has not been ascertained. The leaves afford a valuable fibre for the manufacture of string and cordage, &c.

The berries form a favourite food of the wood-pigeon and other birds. It is a valuable plant for the shrubbery and for ornamental plantations, as it forms a fine contrast with ordinary trees and gives a tropical aspect to the scene.

DISTRIBUTION OF THE GENUS.

Cordyline comprises about twelve species, distributed through the West India Islands, the Malay Archipelago, the Pacific Islands, and Brazil : four species are found in Australia, and six in New Zealand.

DISTRIBUTION OF THE SPECIES.

Cordyline australis extends from the North Cape district to Stewart Island, where, however, it is now extremely rare. Although most abundant in lowland situations, it ascends from the sea-level to 2,500ft.

DESCRIPTION.

Cordyline australis, Hook. f.

Dracæna australis, Forster.

A tree, 20ft. to 60ft. high, with a straight erect trunk and round head, or branched from the base ; lower part of the branches naked or clothed with the dead pendulous leaves. Leaves forming spreading heads at the tips of the branches, ensiform, 1ft. to 2½ft. long and 1in. to 2in. broad, with numerous fine parallel veins, contracted above the broad base, acute, firm ; mid-rib indistinct. Flowers in large terminal panicles, erect or drooping, 1ft. to 1½ft. in diameter, excessively branched, bracteate. Flowers shortly pedicelled, with three one-nerved scarious bracts at the base of the pedicel ; perianth superior, ½in. in diameter, of six linear spreading leaves united at the base ; stamens, six, inserted on the perianth ; ovary three-celled. Fruit a globose berry, white, three-celled ; seeds, several, black, angular.

EXPLANATION OF PLATE CXLI.

Cordyline australis, Hook. f. Leaf and branch of a flowering panicle, natural size.





OLEARIA TRAILLII.

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OLEARIA TRAILLII, T. Kirk.

TRAILL'S OLEARIA.

ORDER—COMPOSITÆ.

(Plate CXLII.)

THIS noble species is one of the most striking plants in the New Zealand flora as well as one of the rarest: it was discovered by the writer in December, 1883, and described in the "Transactions of the New Zealand Institute" for that year. Its large flower-heads, although not rivalling those of *Olearia angustifolia* in size, are very attractive with their violet-coloured centres surrounded with short broad rays; but, instead of being solitary, they are arranged in three- to eight-flowered erect racemes, which are thickly clustered at the extremities of the branches; so that the mode of inflorescence forms a marked contrast to that of the *tete-a-weka*.

Olearia Traillii is a shrub or small tree from 5ft. to 15ft. high or more, with stout branchlets, which are clothed with a coat of woolly hairs. The leaves are crowded near the tips of the branches, and are from $\frac{1}{2}$ in. to 6in. in length and from 1in. to $1\frac{1}{2}$ in. broad, narrowed below into a short broad leaf-stalk, and acute at the apex: they are of thick texture, and white beneath with appressed hairs; the margins are cut into small teeth, which are sharp in the young state, but ultimately become obtuse. The flower-heads are produced in racemes from 5in. to 10in. long, clothed with large leafy bracts closely resembling the leaves, and 2in. or more in length, broad, and almost sheathing at the base; the pedicels are from 1in. to 3in. long, and, with the axis and the lower surfaces of the bracts, white with appressed woolly hairs: the heads are about 1in. or more in diameter; the involucral leaves are narrow, acute, and woolly at the tips. The disc-florets are of a deep-purple colour, perfect, with a tubular corolla, having a bell-shaped mouth; the outer florets are female, with a short broad ray. The fruits are silky and faintly grooved, crowned with reddish-brown pappus-hairs, arranged in a single series.

As already pointed out, it differs from *Olearia angustifolia* in the mode of inflorescence as well as in the larger, broader leaves and more distant bracts. It is distinguished from *O. Colensoi* and *O. Lyallii* by the rayed flowers and narrower leaves.

The racemes are terminal when first developed, but often become overtopped by the young shoots, when the fruiting heads appear to be given off from the base of the young shoots.

PROPERTIES AND USES.

The wood appears similar to that of *O. angustifolia*, but has not been tested at present.

It is easily cultivated, and forms a grand addition to the shrubbery.

DISTRIBUTION OF THE GENUS.

See under *O. Traversii*, p. 47, *ante*.

DISTRIBUTION OF THE SPECIES.

Olearia Traillii is restricted to the neighbourhood of the sea, although it is not found within the reach of its spray. It occurs on Puysegur Point, in the South Island, and on the southern part of Stewart Island, but is rare and local in both habitats.

DESCRIPTION.

Olearia Traillii, T. Kirk, Trans. N.Z. Inst., Vol. xvi., p. 372.

A shrub or small tree, sometimes 15ft. high or more. Branches stout, tomentose. Leaves crowded near the tips of the branchlets, lanceolate or narrow obovate-lanceolate, 4in. to 6in. long, 1in. to 1½in. broad, narrowed into a short broad petiole, acute or acuminate, coriaceous, clothed with appressed white hairs beneath, margins doubly serrate or crenate. Flower-heads in erect terminal racemes with leafy bracts, three- to eight-flowered, 5in. to 10in. long, clustered at the tips of the branches, bracts almost sheathing at the base; rhachis, pedicels, and under-surface of bracts tomentose. Involucral leaves narrow-linear, in one or two series, and woolly at the tips. Florets of the disc perfect; outer florets female, with short broad white rays. Achene silky, grooved; pappus in one series.

EXPLANATION OF PLATE CXLII.

Olearia Traillii, T. Kirk, natural size. 1. Floret of the ray. 2. Floret of the disc. 3. Achene. All natural size and magnified. 4. Involucre, magnified.

A D D E N D A .

Page 1. *Drimys axillaris*, Forster.

I learn from Mr. Colenso that this is the puhikawa of the northern Natives; and Mr. C. Traill informs me that it is termed "ramarama" by the Maoris on Stewart Island.

Page 5. *Podocarpus spicata*, R. Brown.

Mr. Colenso informs me that this is also termed "mai" by the Natives.

By the courtesy of Mr. W. N. Blair, Assistant Engineer to the Public Works Department, I have been allowed to examine a series of reports on the durability of matai from officers of the Public Works and Railway Departments in the South Island, also from architects, surveyors, and inspectors of county bridges. They afford very little additional information, but show a vast difference of opinion as to the value and durability of this timber. In some cases the reports state the kind of situation in which the timber was grown, and are of great value; in others this information is not given.

Numerous opinions expressed in these reports amply confirm the statements in the text as to the actual value of matai, while others are directly antagonistic.

Mr. W. Hay states that the heartwood of the Port Molyneux jetty is perfectly sound above and below high-water mark, although the piles are only about 12in. in diameter. The jetty was erected in 1864, examined in 1884. The Puerua Bridge was erected in 1860, and examined in 1884, when it was still carrying traffic: the heart was fairly sound after twenty-four years. The timber used in both structures grew on dry rocky ground at an altitude of between 400ft. and 500ft.

Mr. W. Smaill states that matai obtained from Tapanui will last at least twenty years in beams, but that Southland matai will only last from twelve to fifteen years.

Mr. James Hunter, Inspector of Permanent-way, Otago, states that survey-pegs of 4in. x 2in. matai, driven in the Molyneux district, were sound and hard above and below ground, without any appearance of decay, after thirty-five years.

Mr. Rennie, Inspector of County Bridges, Southland, found all bridges where heart of matai alone was used very sound.

Mr. J. T. Thomson reports that matai sleepers on the Bluff railway-line are sound after seventeen years.

Mr. T. Kerr considers that heart of mature matai is as durable as any timber in Westland, silver-pine alone excepted.

Mr. Somerville, architect, Nelson, states that the bottom plates of the Nelson Institute, on stone foundation-walls, exhibit the heartwood sound throughout, sap decayed and much worm-eaten, after twenty-four or twenty-five years. Also gate-posts 5½in. x 5½in. with sap 1½in. thick, show the heart sound throughout after thirty-one years, and the sap remaining above ground.

Mr. William Akerston, Nelson, reports that sleepers under rails laid for ballasting ships are quite sound after twenty-two years, and the lower part of a clothes-post is quite sound after twenty-five years.

Mr. J. Burnett, Assistant Engineer, Christchurch, gives an interesting table showing the total percentage of matai sleepers removed from the railway-line during four years ending 31st March, 1884, to have been 15·6; of Oregon pine, 58·4; of totara, 4·6; of kauri, 2·4.

It would be easy to give numerous additional extracts proving the durability of matai, but it is desirable to extract a few adverse statements.

Mr. C. Maltby, Assistant Engineer, Dunedin, states that ordinary bridge-timbers of matai will last from six to sixteen years, but sills and cattle-stops decay in from five to fifteen years. If tarred or painted *when green*, matai has been known to decay right through within a year or two after being so treated.

Mr. R. Hay, Dunedin, states the principal cause of decay of matai is dry-rot: it is not a lasting timber, and should not be used in any work designed to be of a lasting nature. He instances the Mill Creek Bridge, erected in 1878 and examined in 1884, when it was found to be so much decayed that it would have to be removed in about two years.

Mr. James Hunter, Inspector of Permanent-way, Otago, who has given a striking instance of the durability of matai, also states that 10in. × 10in. matai piles used in the construction of the goods-shed, Dunedin, were completely rotten in eleven years.

Mr. W. Stone, District Manager, Nelson, states that railway-sleepers were badly decayed in nine years, and that bridge cap-sills and cattle-stop beams were badly decayed where in contact with the earth after the same period.

Mr. Gerald Fitzgerald, Assistant Engineer, Blenheim, states that crossing-baulks at Blenheim were badly decayed on the lower side and the grain shortened throughout after four years, and that railway-sleepers were too rotten to be of further service after the same period.

Mr. E. Rawlings states that matai piles were used in the Taipo Bridge, but lasted only five years, although the heartwood was still good.

Mr. A. Salmond states that matai was used in the construction of the foot-bridge over the Maitai River, Bridge Street, Nelson, and that the tenons, scarves, and mortices were partly rotten within five years.

Mr. John Robinson, Nelson, considers matai a most useless timber, which has in no instance been found to stand for any length of time.

The following extracts are remarkably suggestive: Mr. C. Banks, Engineer, Waitaki County, states that a square-pile bridge of twenty spans, each 28ft. 4in., was erected near the mouth of the Kakanui River in 1871, and examined in August, 1884, when all bearing-beams were found decayed on the top to a depth of about 2in., and several beams for as much as 4in. in the centre. In all other positions the timber is perfectly sound. The worst pile examined was decayed to the depth of 1in. at the surface of the ground. The timbers used "were matai and totara, some of each being placed in all positions. *There is no apparent difference in the condition of the two timbers.*" Mr. M. Paterson, Engineer to the Clutha County Council, states that a bridge erected over the Wawera Stream in 1860 or 1861 was examined in July, 1884, when both totara and matai were so badly decayed that a new bridge had to be erected during the following summer. He adds, "*The totara beams and piles in this bridge show as much decay as the matai.*"

In numerous instances the reports state the matai employed was not mature, or that it was too young, or that the proportion of sapwood was large, &c. Unfortunately, no information is afforded as to the season in which the timber was felled.

A careful study of the entire series of reports leads to the following conclusions:—

1. That matai should be felled during the dormant season, and thoroughly seasoned before being worked up.
2. That only fully-matured timber should be used.
3. That matai growing in elevated dry situations is more durable than when grown in lowland swamps.
4. That the sapwood of matai speedily perishes, and communicates the decay to the heartwood.
5. That decay is often caused by water being allowed to gain access to joints.
6. That miro is often fraudulently substituted by contractors for matai, causing an unfair prejudice against the latter.
7. That when used for ground-plates, machine-beds, &c., ventilation should be given beneath, to prevent the growth of dry-rot.
8. That matai should never be painted or tarred until it is properly seasoned.

Most of the conclusions stated above apply with equal force to nearly all kinds of timber. I see no cause whatever to modify the good opinion of the value of matai expressed in the body of the work. The majority of cases of premature decay mentioned in the reports have obviously been caused by the timber being immature when felled, or having been felled during the growing season, and, generally, having been used in an unseasoned condition.

Page 13. *Podocarpus Hallii*, T. Kirk.

Mr. R. Helms, late of Greymouth, has kindly forwarded specimens of this species in which the peduncles of the male catkins are very short indeed, but the catkins are never sessile.

This species ascends to upwards of 3,000ft. In an account of visits to the Ruahine mountain-range by W. Colenso, F.R.S., published in 1884, but which has only recently come into my hands, Mr. Colenso writes, "On my way down the mountain I discovered a plant of what I believed to be a new species of *Podocarpus*, and therefore named it *P. Cunninghamii* (after my dear old friend and early botanist in New Zealand Allan Cunningham, who first described *P. Totara*). Its leaves and male amentæ, with the squamulæ at their base, were very much larger than those of *P. Totara*, and the amentæ were also on long peduncles. Its bark, too, was semi-papery, more like that of some large specimens of *Fuchsia excorticata*, and not at all resembling that of *P. Totara*. I subsequently found a small tree of it again in the same forest, but, as before, having only male flowers. I have little doubt of its being a distinct species. The Natives call it totara-kiri-kotukutuku (fuchsia-barked totara)." The bark of *P. Hallii* resembles that of the true totara much more closely than that of *Fuchsia*, but differs from that of totara in being very thin; and the peduncles could scarcely be described as "long:" yet it is extremely probable that *P. Hallii* and *P. Cunninghamii* are identical. Should the fruit of Mr. Colenso's plant agree with that of *P. Hallii* the name of *P. Cunninghamii* must take precedence. I regret not having seen Mr. Colenso's short description until fully a year after my diagnosis was printed.

In a letter recently received from Mr. C. Traill he states that "the totara of Stewart Island, *P. Hallii*, is sometimes referred to by the Natives as kirkotukutuku (resembling bark of native fuchsia), to distinguish it from the common totara to the north of Foveaux Strait, which has thicker bark, called 'amoka.'"

Page 19. *Elæocarpus Hookerianus*, Raoul.

I learn from Mr. Colenso that this is termed mahimahi by the northern Natives, pokaka by those in the South.

Page 27. *Dodonæa viscosa*, Linné.

This is also called ake-rautangi by the Maoris, according to Archdeacon W. L. Williams.

Page 29. *Dacrydium cupressinum*, Solander.

The male catkins of the rimu differ widely from those of any other species of *Dacrydium*: they are terminal, solitary or, rarely, in twos or threes, erect, green, and inconspicuous, consisting of many series of imbricating anther-scales, triangular-ovate at the base. Those below have the connective gradually narrowed into very long linear points thrice as long as the base; but the upper connectives are abruptly narrowed into very short points scarcely exceeding the base, or shorter.

Page 39. *Olea montana*, Hook. f.

I learn from Archdeacon W. L. Williams that this species is termed rororo by the Natives.

Page 41. *Podocarpus dacrydioides*, A. Rich.

I learn from Mr. Colenso that this is also termed kahika by southern Natives.

Page 57. *Dacrydium Bidwillii*, Hook. f.

This species, with other alpine plants, has been recently discovered by Mr. J. Adams, B.A., on the summit of Te Moehau, Cape Colville, a most unexpected extension of its northern range.

Page 65. *Podocarpus nivalis*, Hook. f.

This species was also found by Mr. Adams on the summit of Te Moehau.

Page 77. *Carpodetus serratus*, Forster.

I learn from Mr. C. Traill that this is the puna-weta of the Maoris of Stewart Island.

Page 83. *Sophora tetraptera*, Aiton.

The inner bark of this plant is often used by bushmen as a poultice for sprains, &c.

It has long been known that the tui in some districts, and probably the bell-bird in others, assist in the fertilisation of the kowhai, although it does not absolutely require the aid of either birds or insects; but few are aware, however, that a large parrot (*Nestor meridionalis*) occasionally takes the place of the honey-birds in aiding the process. The following account of a scene witnessed by Mr. Colenso, F.R.S., at Matuku, a village "picturesquely situated on the ridge or summit of a very high hill in the Old Patea district, and surrounded by

forests on every side," will be read by all with interest. It is extracted from "Mr. Colenso's account of visits to the Ruahine mountain-range, &c."*

"It was early summer (October), and snow had fallen pretty heavily but quietly during the night, and in the morning the whole village was a few inches deep in snow, while the great mountain-range before me was looking sublime. Close to the village and even within its fence were several very large kowhai trees (*Sophora tetraptera*); these were covered with their golden flowers, and mostly without leaves. The sun was shining brightly, and the parrots flocked screaming from the forests around to the *Sophora* blossoms. It was a strange sight to see them; how deftly they managed to go out to the end of a long lithe branch—preferring to walk parrot-fashion—and there swinging, back downwards, lick out the honey with their big tongues *without injuring the young fruit!* . . . For, seeing but very few petals falling (and those only *vexillæ*), I sent some of the boys to climb the trees and bring me several marked flowering branches which had been visited by the parrots. I found that all of the fully-expanded flowers had had the upper part of their calyces torn open, and the uppermost petal (*vexillum*) torn out; this the parrots had done to get at the honey. As the flowers are produced in large thick bunches some are necessarily twisted or turned upside down; still, it was always that peculiar petal and that part of the calyx (though often in such cases undermost) which had been torn away. Through this no injury was done to the young enclosed fruit, which would in all probability have been the case if any of the other petals had been bitten off. It cannot be said that it is owing to the *vexillum* being the largest petal (as it is in many papilionaceous flowers) that it is then laid hold of and torn away by the parrot, such *not* being the case in this genus, for the long fruit runs down through the two carinated lowermost petals that are often quite 2in. long, and is further protected by the two side ones (*alae*), which four, from their being closely imbricated together, form a much larger and firmer hold for the bird's beak. Further, as the New Zealand parrot (*Nestor meridionalis*) is a large bird with a huge bill, and as the flowers are always produced on the tips of the small branches, which bend and play about under the weight of its body—not to mention the high winds which generally prevail in those elevated and open regions—one cannot but suppose it to be no easy matter for the bird to get a bite at them at all so as to make a proper opening whereby to insert its thick tongue and lick out the sweet contents without injuring the young immature fruit, especially when we further consider that the common practice of the parrot is to take up in its claws whatever it wishes to discuss. Of all the flowers I examined (and I scrutinised a great many during the two or three days of snow) only the upper part of the calyx and corolla had been torn, and in none was the young fruit wanting; nor did I notice any bunches which had had their flowers wholly torn off. What with the glistening snow, the sun shining, and the golden blossoms of those trees, the numerous parrots diligently and fearlessly at work so close to the village, yet often screaming, the other birds, tuis (*Prothemadera Novæ-Zelandiæ*), and korimakos (*Anthornis melanura*), singing melodiously, snugly ensconced in their leafy bowers, having earlier had their morning meal, with now and then the large feathery flakes of snow falling thickly and silently around, it was altogether a peculiar and interesting sight; and, natural though it was, it seemed unnatural and by no means pleasing."

* Page 47.

Page 85. *Sophora tetraptera*, Aiton. Var. α , *grandiflora*.

In Pl. L. the draughtsman has erroneously represented the leaves with only ten or twelve pairs of leaflets: specimens with so small a number of leaflets are very rare, as there are usually not less than eighteen and sometimes as many as thirty pairs. The specimens selected were mostly furnished with from sixteen to twenty-two pairs.

Page 109. *Coprosma Baueriana*, Endlicher.

Archdeacon W. L. Williams informs me that this species is also termed *angiangi* by the Maoris.

Page 123. *Leptospermum ericoides*, A. Rich.

The flowers of this species are sometimes truly fasciculate.

Page 143. *Agathis australis*, Salisbury.

The flowers of the kauri are usually developed in October; the fruit requires a year and a half to arrive at maturity.

I learn from the Hon. Colonel Haultain that a kauri planted at St. John's College in 1852 or 1853 is now 30ft. high, the trunk being 32in. in circumference.

Page 180. *Fagus fusca*, Hook. f.

The bark is used for tanning, and affords a valuable extract, which might be manufactured and exported on a large scale. Mr. Goodhue, of the Pelorus, has prepared an extract of which a sample was analysed at the Colonial Museum and found to contain 22.51 per cent. of tannin.

Page 213. *Cyathodes acerosa*, Brown.

Archdeacon W. L. Williams states that this plant is called *taumingi* by Natives in the Bay of Plenty, and is also known as *manga-ponio*.

Page 227. *Podocarpus Totara*, A. Cunn.

From a letter recently received from Mr. C. Traill I learn that the southern Natives distinguish two forms of the true totara: red totara or *taikuru*, in which the wood is red right through and extremely durable, but more brittle than the white; and white totara or *taitea*, in which the wood is white or pale-coloured. It is the best kind for firewood, as it does not throw off so many sparks.

Page 263. *Metrosideros robusta*, A. Cunn.

It should have been stated that the bark of this species contains 18.56 per cent. of tannin.

Page 286. *Olearia Forsteri*, Hook. f.

I am indebted to Archdeacon W. L. Williams for the Native name of this species.

APPENDIX.

APPENDIX.

A CATALOGUE OF THE MOST IMPORTANT NEW ZEALAND WOODS, CLASSIFIED ACCORDING TO THEIR PROPERTIES AND USES.

IN the following catalogue an attempt has been made to arrange the different woods in the order of their respective values for the purposes indicated at the head of each section: the results, however, can only be regarded as approximately correct, on account of the conflicting evidence with regard to the properties of certain kinds, and the absence of detailed knowledge concerning others. It is therefore desirable that in every case reference should be made to the detailed statements of Properties and Uses given in the body of the work:—

STRENGTH.

- | | |
|--|---------------------------------|
| Puriri. | Toatoa. |
| Maire-rau-nui. | Kauri. |
| Titoki. | Kamaha. |
| Tawhiwhi. | Papauma. |
| Manuka-rauriki. | Towai. |
| Tarata. | Rewarewa. |
| Kowhai. | Mangeao. |
| Karo. | Rimu. |
| Tawa. | Toro (<i>Persoonia Toro</i>). |
| Silver-beech. | Westland Pine. |
| Entire-leaved Beech. | Ngaio. |
| Tooth-leaved Beech. | Yellow Silver-pine. |
| Pohutukawa. | Kahikatea. |
| Northern Rata. | Totara. |
| Southern Rata. | Hall's Totara. |
| Mapou. | Hinau. |
| Toro (<i>Myrsine salicina</i>). | Pokaka. |
| Matai. | Makomako. |
| Maire-tawhake. | Kawaka. |
| Fuchsia. | Pahautea. |
| Maire (<i>Fusanus Cunninghamii</i>). | Kohekohe. |
| Tanekaha. | Taraire. |

DURABILITY.

- | | |
|---------------------------------------|---------------------|
| Puriri. | Matai. |
| Maire-rau-nui. | Maire-tawhake. |
| Manoao (<i>Dacrydium Colensoi</i>). | Tooth-leaved Beech. |
| Manoao (<i>Dacrydium Kirkii</i>). | Kauri. |
| Pahautea. | Totara. |
| Kawaka. | Hall's Totara. |
| Westland Pine. | Pohutukawa. |
| Yellow Silver-pine. | Northern Rata. |
| Kowhai. | Southern Rata. |
| Papauma. | Hinau. |
| Fuchsia. | |

CONSTRUCTIVE WORKS.

Puriri.	Tooth-leaved Beech.
Maire-rau-nui.	Entire-leaved Beech.
Northern Rata.	Mountain Beech.
Southern Rata.	Westland Pine.
Kauri.	Totara.
Matai.	Kamahia.

PILES.

Puriri.	Manuka-rauriki.
Totara.	Tooth-leaved Beech.
Hall's Totara.	Entire-leaved Beech.
Matai.	Northern Rata.
Miro.	Southern Rata.
Westland Pine.	Horoeka.
Kowhai.	Pahautea.

SLEEPERS.

Puriri.	Totara.
Maire-rau-nui.	Tooth-leaved Beech.
Kauri.	Entire-leaved Beech.
Westland Pine.	Hall's Totara.
Manoao.	

HOUSE-BLOCKS, FENCE-POSTS, ETC.

Puriri.	Kowhai.
Maire-rau-nui.	Pahautea.
Fuchsia.	Entire-leaved Beech.
Papauma.	Tooth-leaved Beech.
Maire-tawhake.	Westland Pine.
Kauri.	Yellow Silver-pine.
Totara.	Hall's Totara.

FRAMING.

Kauri.	Pahautea.
Totara.	Miro.
Hall's Totara.	Rimu.
Matai.	Kahikatea.
Westland Pine.	Silver-beech.
Yellow Silver-pine.	Tooth-leaved Beech.

INSIDE JOINERY.

Kauri.	Matai.
Tanekaha.	Rimu.
Totara.	Pukatea.
Hall's Totara.	Kahikatea.
Pahautea.	Silver-beech.
Miro.	Pokaka.

FLOORING AND WEATHERBOARDS.

Matai.	Rimu.
Kauri.	Kahikatea.
Westland Pine.	Silver-beech.
Totara.	Tooth-leaved Beech.
Hall's Totara.	

MACHINE-BEDS AND FRAMING.

Puriri.	Northern Rata.
Maire-rau-nui.	Southern Rata.
Matai.	Maire-tawhake.
Kowhai.	Tooth-leaved Beech.
Manuka-rauriki.	Entire-leaved Beech.

TEETH AND BEARINGS.

Puriri.	Kowhai.
Maire-rau-nui.	White Maire.
Manuka-rauriki.	Maire-tawhake.
Northern Rata.	Maire (<i>Fusanus Cunninghamii</i>).
Southern Rata.	Rororo.

WHEELWRIGHTS' WORK.

Northern Rata.	Titoki.
Southern Rata.	Pukatea.
Tangeao.	Tooth-leaved Beech.
Manuka-rauriki.	Taraire.

SHIP-TIMBERS, ETC.

Pohutukawa.	Northern Rata.
Small-leaved Pohutukawa.	Southern Rata.
Puriri.	Papauma.

SHIP-PLANKING, ETC.

Kauri.	Northern Rata.
Matai.	Southern Rata.
Tooth-leaved Beech.	

FURNITURE.

Kauri.	Manoao.
Rimu.	Maire-rau-nui.
Kohekohe.	Toro, or Toru (<i>Persoonia Toro</i>).
Rewarewa.	Toro (<i>Myrsine salicina</i>).
Kawaka.	Mapou.
Pukatea.	Ngaio.
Totara.	Ake (<i>Dodonæa viscosa</i>).
Silver-beech.	Akeake (<i>Olearia Traversii</i>).
Fuchsia.	Tree Karamu.
Tawaapou.	

ORNAMENTAL WOODS OF SMALL DIMENSIONS SUITABLE FOR INLAYING, ETC.

Wharangi.	Puheretaiko.
Rohutu.	Yellow-wood.
Kaikomako.	Tupari.
Makomako.	Tete-a-weka.
Neinei.	Traill's Olearia.
Akeake (<i>Olearia avicenniæfolia</i>).	Ramarama.
Heketara.	Akiraho.

TANNING-BARKS.

Tanekaha.	Tooth-leaved Beech.
Toatoa.	Entire-leaved Beech.
Mountain Toatoa.	Northern Rata.
Hinau.	Pokaka.
Towai.	Tutu.
Kamahi.	Rimu.

WOODS OR LEAVES SUITABLE FOR PAPER-MANUFACTURE.

Houhere.	Kahikatea.
Houi.	Ti Kouka.
Lacebark.	

WOODS AFFORDING CHARCOAL FOR THE MANUFACTURE OF GUNPOWDER.

Makomako.	Totara.
Mahoe.	

FIREWOOD.

Maire-rau-nui.	Matai.
White Maire.	Northern Rata.
Manuka-rauriki.	Southern Rata.
Manuka.	Tooth-leaved Beech.
Puriri.	Inaka.
Rororo.	Maire-tawhake.
Maire.	Mapou.
Pohutukawa.	Toro (<i>Myrsine salicina</i>).
Kowhai.	

A SYNOPSIS OF THE CHARACTERS OF THE ORDERS AND
 GENERA OF PLANTS DESCRIBED IN THIS WORK.

CLASS I. DICOTYLEDONS.

SUBCLASS I. ANGIOSPERMS.

§ 1. THALAMIFLORÆ.

CALYX and corolla usually present; petals free; stamens immediately beneath the pistil.

ORDER 1. MAGNOLIACEÆ.

Trees or shrubs, with exstipulate alternate leaves. Flowers perfect: sepals, two to six; petals in one or several series, hypogynous; stamens indefinite, hypogynous, often with dilated filaments; carpels few; seeds few, with copious endosperm; embryo minute.

The type of this order is the fine genus *Magnolia*. The order includes the tulip-tree of North America (*Liriodendron tulipifera*) and the Winter's bark of antarctic America (*Drimys Winteri*).

GENUS I. DRIMYS, *Forster*.

Sepals, two to four, more or less coherent; petals, about six, in two series; filaments clavate; anthers diverging. Fruit, a berry.

ORDER 2. VIOLARIEÆ.

Herbs, shrubs, or trees, with alternate stipulate leaves. Flowers perfect or diœcious, irregular, or rarely regular: sepals five, petals five, both imbricate, hypogynous; stamens, five, hypogynous; anther-cells adnate by the back to the inner surface of the connective, with the connective prolonged above the apex, or with an appendage developed at the back; ovary free, one-celled, with two or, rarely, three parietal placentas. Fruit, a capsule or an indehiscent berry; seeds with fleshy endosperm.

The violet is the type of this order.

GENUS I. MELICYTUS, *Forster*.

Shrubs or trees, with toothed leaves; stipules minute. Flowers diœcious or polygamous, very small, regular, fascicled; sepals, five; petals, five; stamens, five, free, sessile, connective usually expanded, membranous, with a scale at the back; stigma discoid. Fruit, a berry, with several black angled seeds.

ORDER 3. PITTOSPOREÆ.

Shrubs or trees, with alternate or verticillate leaves, exstipulate. Flowers regular: sepals, five; petals, five, with long erect claws and spreading limbs, imbricate; stamens, five, alternating with the petals, hypogynous; ovary free, two-celled or incompletely two- to five-celled; stigma obtuse; ovules numerous. Fruit, a woody capsule with two to five valves, or an indehiscent berry.

GENUS I. PITTOSPORUM, *Linné*.

Shrubs or trees, with alternate or whorled leaves. Flowers often unisexual: sepals free; petals, five, hypogynous, recurved; stamens, five; ovary two- to five-celled, cells sometimes imperfect, placentas parietal. Fruit, a coriaceous or woody capsule; seeds imbedded in black gluten.

ORDER 4. MALVACEÆ.

Herbs, shrubs, or trees usually with light soft wood and tough fibrous inner bark. Leaves alternate, stipulate, often with stellate hairs. Flowers usually perfect: sepals, five, valvate; petals, five, hypogynous, often adnate to the staminal tube; stamens very numerous, their filaments united to form a tube which sheathes the style and is often divided at the top into segments, separating into numerous filaments, each carrying a reniform anther; ovary of one or more free or coherent carpels, sometimes whorled around a central axis; ovules, one or more; styles equalling the carpels in number, cohering below, filiform above. Fruit of one or several usually indehiscent cocci, or capsular; seeds reniform, often hairy, endosperm scanty.

This order contains the various mallows, *Malva*, *Althæa*, *Lavatera*; also the cotton, *Gossypium herbaceum*; and the baobab, *Adansonia digitata*, the trunk of which is sometimes 100ft. in circumference.

GENUS I. PLAGIANTHUS, *Forster*.

Flowers perfect or unisexual: calyx usually persistent, five-toothed or lobed; staminal tube much divided at the top; anthers numerous; ovary of one free carpel or of three, five, or more coherent carpels; styles filiform, united below, tips stigmatiferous on the inner face. Fruit of one indehiscent carpel, or of ten or more compressed carpels whorled round an axis.

GENUS 2. HOHERIA, *A. Cunn.*

Leaves uniform or polymorphous, pellucid, dotted, alternate or fascicled. Flowers perfect: peduncles jointed in the middle; calyx broad, tubular; staminal tube divided at the top into five sets; ovary five-celled; styles, five, filiform; stigmas capitate. Fruit of three, five, or six flat indehiscent carpels arranged round an axis winged at the back; seed solitary.

ORDER 5. TILIACEÆ.

Shrubs or trees, rarely herbs. Leaves stipulate or exstipulate. Flowers perfect or unisexual: sepals, four or five; petals, four or five, hypogynous; stamens twice as many as the petals, or numerous, free; ovary two- to ten-celled; style simple; stigma lobed; ovules few or numerous. Fruit a one- or many-celled capsule, or a drupe or berry; seeds with fleshy or oily endosperm.

This order includes the genus *Tilia*, which contains the lime-tree of Europe.

GENUS I. ENTELEA, *Brown*.

A small tree, with light wood. Leaves alternate; stipules persistent. Sepals, four or five; petals, four or five; stamens very numerous; ovary four- to six-celled. Fruit a four- to six-celled capsule clothed with long spines; seeds numerous, with oily endosperm. Monotypic.

GENUS 2. ARISTOTELIA, *L'Héritier*.

Shrubs or trees. Leaves opposite, exstipulate. Flowers unisexual: sepals, four or five, valvate; petals, four or five, lobed at the tips; stamens, four or five or more; ovary, two- to four-celled, with two ovules in each cell. Fruit, a two- to four-celled berry; seeds sometimes with a fleshy coat investing the hard testa.

GENUS 3. ELÆOCARPUS, *Linne*.

Large shrubs or trees. Leaves alternate, exstipulate. Flowers perfect, usually pendulous: sepals, four or five, valvate; petals, four or five, laciniate; receptacle glandular; stamens numerous; anthers pubescent, curved at the tip; ovary, two- to five-celled; ovules, two or more in each cell. Fruit, a drupe; nut, bony, wrinkled or tuberculated, one or more celled; one-seeded.

§ II. DISCIFLORÆ.

Calyx and corolla usually present; petals free; stamens usually inserted on the surface of a thickened disc, which sometimes forms a ring or cushion, or is broken up into glands; ovary usually superior.

ORDER 6. RUTACEÆ.

Herbs, shrubs, or small trees. Leaves opposite or alternate, simple or compound. Flowers perfect or unisexual: sepals, four or five; petals, four or five, free; stamens, eight or ten, inserted at the base of a swollen disc; anthers versatile; ovary of three to five carpels, more or less united; styles, four or five, coherent; stigma sessile, four- or five-lobed. Fruit, a capsule or berry, one or many seeded, the inner coat separating from the outer.

This order includes the rue (*Ruta graveolens*), the well-known *Diosmas* of the Cape, and *Boronias* of Australia, also the orange, lemon, lime, shaddock, &c.

GENUS 1. MELICOPE, *Forster*.

Shrubs or small trees, with opposite or alternate leaves, pellucid-dotted. Flowers perfect or unisexual, in axillary cymes: sepals, four; petals, four, with inflexed tips; stamens, eight; ovary, three- to four-lobed, three- to four-celled; styles, one to four, coherent; stigma capitate or three- to four-lobed. Fruit capsular, of three to four cocci, inner coat papery; seeds jet black, shining, with copious endosperm.

ORDER 7. MELIACEÆ.

Usually large trees. Leaves alternate, exstipulate, pinnate, or, rarely, simple. Flowers perfect or, rarely, unisexual: calyx small, four- to five-lobed, imbricate; petals, four to five, contorted or imbricate, sometimes adherent to the staminal tube; stamens, five to twenty, inserted with the petals outside the base of an hypogynous disc, the filaments usually united by their margins into a tube, toothed or laciniate at the apex; anthers sessile or subsessile on the staminal tube; ovary, three- to five-celled; style single; stigma capitate; cells two or more; ovules, two in each cell. Fruit, a drupe or berry or capsule, &c.; seeds usually destitute of endosperm.

This order includes the Australian cedar (*Cedrela australis*), the Pride of India (*Melia Azedarach*), the satinwood (*Chloroxylon Swietenia*), and the mahogany (*Swietenia Mahogoni*).

GENUS 1. DYSOXYLUM, *Blume*.

Large trees. Leaves alternate, pinnate. Flowers perfect, in pendulous panicles, axillary, or springing from naked branches or even from the trunk:

petals, four or five, linear, flexuous, valvate, coherent at the base, and united with the cylindrical staminal tube; anthers, eight or ten, shortly exerted; disc tubular, sheathing the ovary; ovary three- to five-celled. Fruit, a coriaceous pyriform capsule, one- to five-celled, two- to five-valved; seeds large, arillate, with a broad hilum and large cotyledons.

ORDER 8. OLACINEÆ.

Shrubs or trees. Leaves usually alternate, exstipulate. Flowers perfect or unisexual, regular: calyx four- or five-toothed or lobed; petals, four or five, free or tubular at the base; stamens, four to twelve, hypogynous or at the base of a disc; ovary one- to three-celled or imperfectly three- to five-celled; stigma often lobed; ovules, one to five, anatropous, pendulous. Fruit, a drupe, one-celled, one-seeded; seed with copious endosperm.

GENUS I. PENNANTIA, *Forster*.

Shrubs or trees. Flowers dioecious: calyx minute, five-toothed; petals valvate; stamens, five, hypogynous; filaments flexuous in the male flower, with versatile anthers—in the female, erect with abortive basifixed anthers; ovary oblong, faintly trigonous; stigma sessile, three-lobed; ovule, one, pendulous below the top of the cell. Fruit, a small fleshy drupe; stone trigonous, with a vertical groove on one face and an aperture at the apex, a flat cord fits into the groove and enters the cell by the aperture, the seed being suspended from the apex of the cord.

ORDER 9. RHAMNEÆ.

Shrubs or trees, sometimes with spinous branches. Leaves usually alternate, with small stipules. Flowers perfect or unisexual: calyx four- or five-toothed, or lobed, valvate; disc hypogynous or epigynous; petals absent, or four or five, minute, inserted at the edge of the disc; stamens, four or five, opposite to and inserted with the petals; ovary superior or inferior, three-, two-, or four-celled; cells one- or two-ovuled. Fruit, a capsule or drupe.

This order includes the buckthorn (*Rhamnus catharticus*) formerly used in medicine, and the bark of which affords a yellow dye. *Rhamnus Frangula* affords the best charcoal for the manufacture of gunpowder.

GENUS I. POMADERRIS, *Labill*.

Shrubs often clothed with stellate pubescence. Flowers small, in umbellate cymes: calyx tubular, five-lobed, adnate with the ovary; petals, five or none; stamens, five, filaments longer than the petals; disc epigynous; ovary inferior; capsule three-valved, enclosing three cocci.

GENUS 2. DISCARIA, *Hook*.

Spinous shrubs or small trees, glabrous, rigid, tortuous; branches articulate at the nodes. Flowers axillary: calyx membranous lobes, four or five, recurved; disc adnate with the base of the calyx; petals, none, or four or five; stamens, four or five; ovary free, or sunk in the tube of the calyx, three-lobed. Fruit, capsular, of three dehiscent cocci.

ORDER 10. SAPINDACEÆ.

Shrubs or trees erect or scandent. Leaves alternate, exstipulate. Flowers apetalous, unisexual or perfect: calyx of three to five sepals, imbricate or valvate; disc fleshy, sometimes wanting; stamens, five to twelve, filaments elongating, hypogynous or inserted with the disc; ovary superior, lobed, one- to

four-celled, with one or two ovules attached to the inner angle of each cell. Fruit, a membranous, coriaceous or woody capsule, one- to four-celled, sometimes winged or, rarely, a drupe or berry, usually indehiscent; seeds without endosperm, cotyledons spirally folded.

GENUS I. DODONÆA, *Linne'*.

Shrubs or trees, often with viscid twigs. Leaves usually simple, exstipulate. Flowers diœcious or polygamous, apetalous: sepals, three to five. Male flowers, stamens, five to eight, filaments short, anthers four-angled. Female flower, ovary superior, with two ovules in each cell. Fruit, a membranous or coriaceous capsule, three- to six-valved, each valve broadly winged at the back.

GENUS 2. ALECTRYON, *Gaertner*.

A tree with tomentose branchlets. Leaves alternate, unequally pinnate. Flowers in axillary or terminal many-flowered panicles, small bi- or uni-sexual: calyx four- or five-lobed, imbricate; disc eight-lobed, small; stamens, five to eight, inserted between the lobes of the disc, filaments elongating; anthers large; ovary compressed, one-celled, one-ovuled; stigma simple or bifid. Fruit, a woody indehiscent capsule, with a compressed ridge on one side terminating in a spur at the back; seed pyriform, black, arillate, cotyledons coiled in a spiral.

Monotypic.

ORDER II. ANACARDIACEÆ.

Trees with alternate exstipulate leaves and regular flowers, perfect or unisexual. Calyx three- to seven-lobed; petals, three to seven, inserted on an annular disc, sometimes absent; stamens equal or double the number of petals, alternating with staminodia; anthers versatile; ovary usually superior, one- to five-celled; ovule solitary, pendulous. Fruit, a drupe; seed with a membranous testa, cotyledons fleshy, endosperm absent.

This order comprises the Pistachio nut, *Pistacia vera*; *P. Terebinthus* yields the famous Cyprus turpentine; the genus *Rhus*, several species of which are valuable for tanning, also belongs to the order.

GENUS I. CORYNOCARPUS, *Forster*.

A glabrous tree with perfect flowers. Calyx five-lobed, imbricate; petals, five, perigynous, erect, imbricate, toothed or lacerate; disc fleshy, five-lobed; stamens, five, inserted between the lobes of the disc, and alternating with five petaloid jagged scales; ovary one-celled. Fruit, a fleshy drupe, with a coriaceous and fibrous endocarp; seed, one, pendulous.

ORDER 12. CORIARIEÆ.

Glabrous shrubs, with angular branches and opposite exstipulate leaves. Flowers perfect, axillary, solitary or racemed: sepals, five, imbricate, persistent; petals hypogynous, becoming fleshy and appressed to the carpels after flowering; stamens, ten, hypogynous, filaments elongating; carpels, five or ten, arranged round a fleshy receptacle, one-celled; styles, five or ten, free, stigmatiferous over the greater portion of their surface. Fruit of five to eight small crustaceous achenes invested by the fleshy petals; endosperm thin.

GENUS I. CORIARIA, *Linne'*.

The only genus.

§ III. CALYCIFLORÆ.

Calyx and corolla usually present; petals usually free, perigynous or epigynous; disc adnate to the base of the calyx or, rarely, tumid; stamens inserted with the petals; ovary inferior or superior.

ORDER 13. LEGUMINOSÆ.

SUB-ORDER—PAPILIONACEÆ.

Herbs, shrubs, or trees, usually with alternate compressed stipulate leaves. Flowers irregular, usually perfect: calyx five-cleft or toothed; petals, five, alternating with the sepals, the upper (standard) usually broader than and embracing the others, often reflexed, the two lateral (wings) pressing upon the two innermost, which are more or less united by their lower margins (forming the keel); stamens usually united, forming a single tube surrounding the ovary (monadelphous) or nine united and one free (diadelphous) or, rarely, all free; ovary superior, one-celled, containing one or several ovules. Fruit, a legume, one- or more-seeded, splitting into two valves, or indehiscent; seeds without endosperm.

GENUS I. SOPHORA, *Linné*.

Trees or shrubs with pinnate leaves, leaflets in many pairs. Flowers large, pendulous: calyx bell-shaped or hemispherical, inflated, obscurely toothed; standard very broad, shortly clawed, wings clawed, shorter than the straight keel; stamens, ten, free; ovary stipitate, linear; style exceeding the stamens; stigma minute. Fruit, a legume, four-angled or winged, almost indehiscent; seeds oblong.

ORDER 14. SAXIFRAGÆÆ.

Herbs, shrubs, or trees. Leaves opposite or alternate, stipulate or exstipulate. Flowers usually perfect, regular: calyx four- or five-lobed, valvate or imbricate; petals, four to six, free, valvate or imbricate, rarely absent, disc perigynous or epigynous; stamens, as many or twice as many as the petals; carpels, one to five; styles, one to five, free or united; ovules numerous, usually axile in placentation. Fruit, a capsule or, rarely, a berry, one- to five-celled; seeds minute, with copious endosperm.

GENUS I. QUINTINIA, *A. De Candolle*.

Shrubs or trees with alternate exstipulate leaves. Flowers small, in many-flowered racemes: calyx-tube with five persistent teeth, adnate with the ovary; stamens, five; filaments short; ovary inferior, three- to five-celled; style short, conical, furrowed; stigma three-lobed. Fruit, a capsule, with three to five ribs, one-celled; seeds numerous, minute, with a winged testa.

GENUS 2. IXERBA, *A. Cunningham*.

A shrub or tree. Leaves opposite or alternate or verticillate, exstipulate. Flowers large: calyx-tube adherent with the base of the ovary, five-lobed, imbricate; disc five-lobed; petals, five, inserted beneath the disc, imbricate; stamens, five; ovary superior, five-celled, narrowed into a twisted beak-like furrowed style. Fruit, a coriaceous capsule, five-celled, valves united at the base, two partite above; seeds oblong, shining, endosperm scanty.

GENUS 3. CARPODETUS, *Forster*.

A shrub or small tree, with alternate exstipulate leaves. Calyx superior, five- or six-lobed; petals, five or six, inserted beneath an epigynous disc, valvate; stamens, five or six, on short filaments; ovary inferior, three- to five-

celled, with numerous ovules in each cell. Fruit, a berry, globose, inferior, invested at the middle by the calyx-limb, three- to five-celled, many seeded; seeds pendulous, embryo minute, endosperm fleshy.

GENUS 4. ACKAMA, *A. Cunningham.*

A shrub or tree, with opposite pinnate, stipulate leaves. Flowers in spreading panicles, small, perfect, or unisexual: calyx five-lobed; disc ten-lobed; petals, five, linear, inserted beneath the disc; stamens, ten; anthers didymous; ovary superior, hirsute, two-celled; ovules many, on parietal placentas; styles, two, filiform. Fruit, a capsule, two-celled; seeds turgid, with scanty endosperm.

GENUS 5. WEINMANNIA, *Linné.*

Shrubs or trees. Leaves opposite, stipulate, unifoliolate, or pinnate. Flowers small, racemed or racemose-paniculate: calyx inferior, four- or five-lobed, imbricate; disc lobed; petals, four or five, inserted beneath the disc; stamens, eight to ten; ovary superior, conical, two-celled; styles filiform; ovules few or many; placentas axile, restricted to the upper part of the ovary. Fruit, a coriaceous capsule, two-celled; seeds minute, oblong-curved, pilose, endosperm fleshy.

ORDER 15. MYRTACEÆ.

Erect or scandent shrubs or large trees. Leaves opposite or alternate, simple, exstipulate, glandular-dotted. Flowers perfect: calyx-tube adherent with the ovary, sometimes exceeding it, three- to five-lobed or cleft, imbricate, sometimes closed in bud and falling away like an operculum; petals as many as the calyx-lobe, imbricate rarely wanting, inserted on a disc at the throat of the calyx, and ultimately covering the top of the ovary; stamens numerous, inserted with the petals; filaments filiform or more or less united at the base; anthers small; ovary inferior, three- to five-celled; style simple, slender. Fruit, a capsule or drupe or berry, one- to five-celled, one- or many-seeded; seeds without endosperm.

This order comprises the genera *Myrtus*, *Metrosideros*, *Eugenia*, and *Eucalyptus*, all of which afford timber of high value. The Brazil nut of commerce, *Bertholletia excelsa*, is also included.

GENUS 1. LEPTOSPERMUM, *Forster.*

Shrubs or trees. Leaves small, alternate, coriaceous. Flowers white or pink: calyx-tube campanulate or turbinate, five-lobed, valvate; petals, five, rounded, perigynous; stamens numerous, with short filaments, perigynous; ovary four- or five-celled; style short; ovules many. Fruit, a capsule, woody or coriaceous, opening by five valves within the calyx-margin; seeds numerous, linear, minute.

GENUS 2. METROSIDEROS, *Brown.*

Erect or scandent shrubs or large trees. Leaves opposite, often distichous, more or less coriaceous. Calyx-tube globose, oblong, or turbinate; lobes, five, imbricate; petals, five, spreading; stamens very numerous, longer than the petals; filaments slender; ovary three-celled; style slender; ovules numerous. Fruit, a coriaceous capsule, deeply sunk within the calyx-tube, or the upper portion free, three-valved; seeds minute, numerous.

GENUS 3. MYRTUS, *Linné.*

Trees or shrubs. Leaves opposite. Flowers axillary, solitary or cymose: calyx-tube globose or ovoid, four- or five-lobed; petals, four or five, imbricate,

perigynous; stamens numerous, free, exceeding the petals; style filiform; stigma small; ovary completely or imperfectly two- or three-celled; ovules, several in each cell. Fruit, a berry crowned with the calyx limb; seeds reniform or rounded, with a bony testa, embryo small, curved terete, cotyledons small, radicle long.

GENUS 4. *EUGENIA*, *Linné*.

Trees or shrubs with opposite leaves. Flowers perfect or unisexual, closely resembling those of *Myrtus* in structure: ovary two- or three-celled; ovules two or more in each cell. Fruit, a drupe or berry; embryo thick, fleshy; radicle small; cotyledons more or less inseparable.

ORDER 16. ONAGRARIÆ.

Herbs, shrubs, or small trees. Leaves opposite or alternate, simple, exstipulate. Flowers usually perfect: calyx superior, tubular, often coloured, and frequently exceeding the ovary, the limb two- to five-lobed, valvate; petals as many as the sepals or, rarely, absent, free, inserted at the throat of the calyx on a flat or annular disc, contorted; stamens free, as many or twice as many as the petals; ovary inferior, two- to four-celled, many ovuled; style filiform; stigma capitate or two- to four-lobed. Fruit, a berry or capsule, one- to four-celled; seeds usually numerous, without endosperm.

GENUS 1. *FUCHSIA*, *Linné*.

Prostrate or erect shrubs or small trees, with opposite or alternate leaves. Flowers usually pendulous: calyx-tube coloured, with four large spreading lobes; petals, four or, rarely, absent, inserted at the throat of the corolla; stamens, eight, inserted with the petals; ovary inferior, crowned with the disc, four-celled; ovules numerous; style slender; stigma capitate. Fruit, a berry, four-celled, many seeded.

ORDER 17. ARALIACEÆ.

Herbs, shrubs, or trees. Leaves alternate or, rarely, opposite, usually exstipulate. Flowers perfect or unisexual, often polygamous: calyx-tube adnate with the ovary; limb undeveloped or three- to five-toothed; petals, five or absent, valvate or imbricate, epigynous; stamens, five, or, rarely, ten or more, inserted on the margin of an epigynous disc; ovary inferior, two- to fifteen-celled, crowned by the disc; styles short, subulate, recurved; ovules pendulous in each cell. Fruit fleshy or coriaceous, compressed, or terete, or angular, two- or many-celled; cells one-seeded; seed flat, with copious endosperm, embryo small.

GENUS 1. *PANAX*, *Linné*.

Trees or shrubs. Leaves alternate, digitate, or, rarely, simple, sometimes polymorphic, stipulate or exstipulate. Flowers monœcious or diœcious, or polygamous, articulated on the tips of the pedicels: calyx-margin prominent or with five small teeth; petals, five, epigynous or absent; disc broad; ovary inferior, two- to four-celled, sometimes compressed or ribbed, coriaceous or fleshy.

GENUS 2. *PSEUDOPANAX*, *C. Koch*.

Shrubs or trees. Leaves often polymorphic. Flowers and fruit with the general structure of *Panax*, but the ovary is usually five-celled, with five styles, connate into a cone with the tips reflexed. Fruit, five- or, rarely, four-seeded, spherical, fleshy.

GENUS 3. *MERYTA*, *Forster*.

Small diœcious trees, branches stout, crowned with a cluster of very large leaves. Flowers in terminal panicles. Male: Calyx three- to five-lobed or

partite, valvate; petals absent; stamens, four, inserted beneath a glandular disc. Female: Calyx, five- to nine-partite; petals absent; stamens abortive; ovary five- to nine-celled; stigmas united at their base, recurved above. Fruit, an ovoid or oblong berry, five- to nine-celled; seeds bony, compressed.

ORDER 18. CORNEÆ.

Herbs, shrubs, or trees with opposite or alternate exstipulate, entire leaves. Flowers perfect or dioecious: calyx-tube adnate with the ovary, limb four- or five-toothed; petals, four or five, valvate, rarely absent, perigynous; stamens, four or five, perigynous, or inserted at the base of an epigynous disc; ovary inferior, one- to three-celled; style very short; stigma solitary and capitate or three to four, filiform or recurved; ovules solitary in each cell, pendulous, anatropous. Fruit, usually a drupe; stone one- to three-celled; endosperm fleshy; embryo very small.

GENUS I. GRISELINIA, *Forster*.

Dioecious shrubs or small trees, sometimes epiphytic. Leaves coriaceous, glossy, oblique, petioled, jointed to the stem. Flowers in axillary panicles. Male: Calyx five-toothed; petals, five, valvate; stamens, five. Female: Calyx superior, five-toothed; petals, five, rarely absent; stamens, none; ovary inferior, one- or, rarely, two-celled; styles, three, subulate, very short. Fruit, a small fleshy drupe or berry.

DIVISION II. COROLLIFLORÆ.

Calyx and corolla usually present, the corolla consisting of coherent petals, forming a tube or cup.

ORDER 19. RUBIACEÆ.

Herbs, shrubs, or trees. Leaves opposite, with interpetiolar stipules or verticillate, simple. Flowers regular, dioecious or monœcious or perfect: calyx adherent with the ovary, four- or five-toothed or lobed or partite, or absent; corolla funnel-shaped or campanulate, limb of four to six segments, valvate or rarely imbricate or contorted; stamens, two to six, inserted on the corolla; ovary inferior, one- to three-celled; styles, one to three, filiform; stigmas filiform or capitate; ovules solitary in each cell. Fruit, a capsule, berry, or drupe, two- to six-celled, each cell one-seeded; endosperm fleshy or cartilaginous or horny; embryo small; cotyledons flat.

GENUS I. COPROSMA, *Forster*.

Shrubs or small trees, sometimes small and prostrate, often fœtid when bruised. Leaves opposite. Flowers dioecious, frequently small and inconspicuous, solitary or fascicled. Male: Calyx two- to five-toothed or lobed, often truncate or absent; corolla, four- to five-fid; stamens, four to five, pendulous, inserted on the corolla. Female smaller than the male; calyx adnate with the ovary, four- to five-toothed or truncate or, rarely, with linear lobes; ovary inferior, two- or, rarely, three- or four-celled, with a single ovule in each cell; styles, two to four, filiform. Fruit, a berry, two- to four-seeded.

ORDER 20. COMPOSITÆ.

Herbs, shrubs, or trees, with alternate, rarely opposite, exstipulate leaves. Flowers small, sessile, usually crowded in involucrate heads, rarely solitary, the involucre being composed of one or more series of erect imbricating bracts; receptacle pitted or paleaceous or naked. Flowers (florets) perfect, male or female or neuter; all the florets may be perfect or male or female when the

heads are diœcious, but usually two or more kinds are found in the same head. The calyx is adherent with the ovary; its limb may be membranous or scarious or paleaceous, or divided into fine hairs or bristles; corolla epigynous, of two forms, tubular, regular, four- to five-lobed or cleft, or irregular, tubular below, and with a strap-shaped limb usually minutely toothed at the extremity; most frequently both kinds occur on the same head, the tubular corollas forming the disc-florets, and the ligulate corollas forming a ray surrounding the disc-florets; the disc-florets are usually male or bi-sexual, those of the ray-florets female or bi-sexual: stamens, five, inserted on the corolla-tube; anthers syngenesious, forming a tube which surrounds the style; ovary inferior, one-celled; ovule solitary; style filiform, usually bifid, the branches being stigmatiferous. Fruit, an achene; seed without endosperm.

The Compositæ comprise nearly ten thousand species, and form the largest order of flowering plants, including about one-tenth of the entire number.

But few species afford useful timber, although many are used for food, medicine, and in the arts.

GENUS 1. OLEARIA, *Mærch.*

Shrubs or trees. Leaves alternate or, rarely, fasciculate, usually coriaceous with appressed tomentum beneath. Heads large or small usually rayed; involucre of one or more series of imbricating scales, receptacle convex; florets numerous or, rarely, one to four; ray-florets in one series, ligulate, white; the disc-florets tubular, perfect; pappus of one or more series of radiating scabrid hairs; achenes ribbed.

GENUS 2. SENECIO, *Linné.*

Herbs, shrubs, or trees. Flower-heads bracteate at the base: involucre of one or two rows of linear-erect scales; florets yellow or white, all similar and perfect, or the ray-florets female and ligulate, the disc-florets tubular and perfect; anthers with very short tails; pappus hairs in one or several series, sometimes thickened at the tips; achene linear-oblong with a thickened apex or grooved.

ORDER 21. EPACRIDEÆ.

Shrubs or small trees with alternate or, rarely, opposite exstipulate leaves. Flowers perfect, pedicels with two or more cylindrical bracts: calyx inferior, deeply five-lobed; corolla monopetalous, tubular or campanulate, or funnel-shaped, five-lobed, valvate or imbricate, the throat sometimes bearded; stamens, four or five, hypogynous or epipetalous, anthers one-celled; ovary superior, free, one- to ten-celled; style simple; stigma capitate; ovules, one or several in each cell, pendulous, or rarely erect, or on projecting placentas. Fruit, a berry or drupe or capsule, one- or many-celled; seeds minute, embryo small, straight, cylindrical, endosperm fleshy.

GENUS 1. CYATHODES, *Brown.*

Shrubs or, rarely, small trees. Leaves acerose, rigid, pungent, or oblong and obtuse. Flowers small, pedicels clothed with bracts which almost hide the calyx: corolla funnel-shaped, tube scarcely exceeding the calyx-lobes, sometimes bearded; stamens, five, epipetalous; ovary superior, three- to ten-celled, each cell containing a single ovule. Fruit, a small drupe; nut bony, three- to ten-celled.

GENUS 2. DRACOPHYLLUM, *Lab.*

Shrubs or trees, rarely prostrate. Leaves long, linear, rigid, or grassy, often crowded near the tips of the branches, rarely small and ovate. Flowers axillary

or terminal: calyx five-toothed or lobed, persistent, sometimes longer than the corolla, which is tubular or campanulate, shortly five-lobed; stamens, five, sessile or sub-sessile at the mouth of the corolla; disc hypogynous, of five erect scales; ovary five- or six-celled; style short, straight; ovules numerous in each cell, on a pendulous placenta. Fruit, a capsule, shorter than the calyx, five- or six-celled, five- or six-valved.

ORDER 22. MYRSINEÆ.

Shrubs or trees, sometimes prostrate. Leaves alternate, exstipulate, simple, glandular, dotted. Flowers small, usually perfect, often glandular: calyx inferior or superior, four- or five-lobed; corolla four- or five-lobed, or petals rarely free; stamens, four or five, filaments free or united, usually epipetalous; ovary free or inferior, one-celled; style simple; stigma entire or lobed. Fruit, a drupe or berry, indehiscent, one- or several-seeded, seeds sometimes with several embryos; endosperm fleshy; embryo transverse.

GENUS I. MYRSINE, *Linné*.

Trees or shrubs, sometimes prostrate, rarely with recurved rigid branches. Flowers perfect or polygamous: calyx inferior, four- or five-lobed, rarely bifid or absent; corolla four- or five-lobed nearly to the base or free, tips reflexed; stamens four or five, inserted at the base of the petals or free; ovary superior, one-celled; style short, or stigma sessile, concave, or fimbriated; ovules, one to five. Fruit, a berry or drupe; seeds, one or several.

ORDER 23. SAPOTEÆ.

Trees or shrubs, with milky juice. Leaves alternate, exstipulate, entire. Flowers perfect or unisexual or polygamous, solitary or fascicled, axillary: calyx inferior, four- to eight-toothed or lobed; corolla monopetalous, hypogynous, four- to eight-lobed, imbricate; stamens, four to sixteen, sometimes with alternating staminodia; ovary superior, two- to twelve-celled, with one ovule in each cell. Fruit, a drupe or berry, one- to four-seeded; seeds usually polished, with a long oblique hilum, endosperm fleshy, copious, scanty, or absent, cotyledons broad, sometimes fleshy, radicle inferior.

This order includes many species which furnish hard durable timber. *Bassia Parkii* produces the shea butter of Western Africa; *Isonandra gutta*, of the Malay Archipelago, yields the valuable resinous substance known as gutta percha; the star apple, *Chrysophyllum Cainita*, the West Indian medlar, *Mimusops Elengi*, and other species afford excellent fruit.

GENUS I. SIDEROXYLON, *Linné*.

Trees, with milky juice. Flowers bisexual or polygamous: calyx four- to six-lobed; corolla monopetalous, four- to six-lobed, hypogynous; stamens, four to six, inserted on the corolla; filaments short, often alternating with imperfect stamens; ovary superior, hirsute, two- to twelve-celled; ovules solitary in each cell; style simple; stigma simple or lobed. Fruit, a drupe or berry, one- to four-seeded; seeds elongate, shining, hilum long, linear or broad, endosperm copious, fleshy, cotyledons usually thin, radicle short.

ORDER 24. JASMINEÆ.

Shrubs or trees. Leaves opposite, exstipulate. Flowers perfect or unisexual, sometimes apetalous: calyx small, two- to four-toothed, inferior; corolla usually monopetalous, sometimes absent, valvate; stamens, two or, rarely, four, epipetalous or, rarely, hypogynous; ovary, two-celled, superior; ovules usually

one in each cell; stigma simple or bifid. Fruit, a drupe, with a bony one- or two-celled nut or a two-celled berry, or a capsule, or indehiscent samara.

This order includes the olive (*Olea Europea*), which affords the well-known olive oil of commerce; the ash (*Fraxinus excelsior*), highly valued for its timber; the privet (*Ligustrum vulgare*), and other valuable plants.

GENUS I. OLEA, *Linne*.

Shrubs or trees, with opposite entire coriaceous leaves. Flowers perfect or unisexual: calyx small, inferior, two- to four-toothed or lobed; corolla monopetalous, hypogynous, absent in the New Zealand species; stamens, two, rarely four, epipetalous or hypogynous; anthers large; ovary superior, oblong, two-celled; style short; stigma bifid; ovules one in each cell. Fruit, a drupe, ovoid, oblong, or trigonous, one- or two-celled, one-seeded.

ORDER 25. SCROPHULARINEÆ.

Herbs, shrubs, or small trees. Leaves opposite, alternate or verticillate, exstipulate. Flowers perfect, more or less irregular: calyx inferior, of four or five free or coherent sepals; corolla monopetalous, hypogynous, tubular, limb irregular or two-lipped, imbricate; stamens, two or four, often didynamous, epipetalous; ovary superior, usually two-celled; style simple; stigma two-lobed; ovules numerous, rarely solitary. Fruit, a two-celled capsule or, rarely, a berry; seeds horizontal, with fleshy endosperm, embryo straight or curved.

GENUS I. VERONICA, *Linne*.

Herbs, shrubs, or small trees. Leaves opposite, distichous or decussate, often united at the base or very small and densely-imbricating quadrifariously. Flowers perfect: calyx, sepals, four or, rarely, five; corolla monopetalous, with a spreading four- or five-lobed limb; stamens, two, inserted on the corolla, sometimes exserted; ovary superior, small, compressed, two-celled; style slender; ovules numerous. Fruit, a capsule, often didymous, compressed; seeds few or many.

ORDER 26. VERBENACEÆ.

Herbs, shrubs, or trees. Leaves opposite or alternate, exstipulate. Flowers perfect, irregular or regular: calyx inferior, persistent, tubular, four- or five-toothed or lobed; corolla monopetalous, hypogynous, tubular, four- or five-lobed or partite, or unequally two-lipped; stamens, two, four, or five, inserted on the corolla, didynamous; ovary superior, two- to four-lobed, two- four- or eight-celled; ovules, one or two in each cell; style slender, entire or bifid. Fruit, a drupe or berry, one- to four-celled, indehiscent; seeds solitary in each cell, endosperm absent or scanty, radicle inferior.

GENUS I. VITEX, *Linne*.

Trees or shrubs with digitate leaves. Flowers perfect: calyx five-toothed or lobed; corolla two-lipped, five-lobed; stamens, four, with long filaments, epipetalous; ovary superior, four-celled; ovules pendulous; style bifid. Fruit, a drupe, nut four-celled.

GENUS 2. AVICENNIA, *Linne*.

Shrubs or trees more or less hoary or downy, roots often branching above the mud. Leaves opposite. Flowers perfect: calyx inferior, regular, deeply four- or five-lobed; corolla monopetalous, hypogynous, coriaceous, four- or five-lobed; stamens, four or five, on short filaments, epipetalous; ovary ovoid or conical, silky, two-celled, with a short style; stigmas, two, short, erect or

diverging; ovules, two, pendulous, in each cell. Fruit ovoid, coriaceous, compressed, one-celled, one-seeded; embryo very large with scanty albumen; testa wanting; cotyledons very large; radicle long; endosperm scanty.

ORDER 27. MYOPORINEÆ.

Shrubs or small trees. Leaves usually alternate, exstipulate, gland-dotted. Flowers perfect, axillary: calyx inferior, five-lobed, persistent, scarious; corolla monopetalous, hypogynous, five-lobed, scabrid, regular; stamens, four, epipetalous; anthers confluent; ovary superior, two-celled; style simple; ovules solitary or in pairs in each cell. Fruit, a drupe, two- to four- or rarely five-celled; cells one- or, rarely, two-seeded; seeds anatropous, endosperm scanty, embryo cylindrical, radicle superior.

GENUS I. MYOPORUM, *Banks and Solander*.

Glabrous shrubs or small trees, branchlets often viscid. Leaves alternate. Calyx deeply five-lobed, inferior; corolla monopetalous, hypogynous, with a short tube, five-lobed; stamens, four, epipetalous; anthers two-celled, the cells ultimately confluent; ovary superior, two- to five-celled; style slender; stigma obtuse; ovules solitary or geminate in each cell. Fruit, a drupe, sometimes nearly dry, two- to five-celled; cells usually one-seeded, rarely two-seeded, pendulous.

DIVISION III. INCOMPLETÆ.

Perianth leaves in one series only or absent.

ORDER 28. NYCTAGINEÆ.

Herbs, shrubs, or trees. Leaves mostly opposite, entire, exstipulate. Flowers perfect or unisexual, with small or large bracts at the base, which in some species form a coloured involucre: perianth monophyllous, inferior, tubular or funnel-shaped, five-lobed, persistent, enveloping the fruit; stamens, one to thirty, hypogynous; ovary superior, one-celled; stigma simple, entire, or lobed, or plumose; ovule, one, erect. Fruit, a utricle enclosed in the persistent perianth-tube; seed, one, embryo with curved or folded or straight cotyledons, foliaceous, endosperm mealy or mucilaginous, radicle inferior.

GENUS I. PISONIA, *Linne*.

Trees or shrubs. Leaves opposite, alternate or verticillate. Flowers terminal, perfect or unisexual, with minute bracts at the base: perianth cylindrical; mouth campanulate, five-lobed; stamens, six to ten, hypogynous; ovary linear, one-celled; style lateral or terminal, slender; stigma entire or lobed or plumose; utricle closely invested by the persistent-ribbed perianth; embryo straight.

ORDER 29. CHLORANTHACEÆ.

Herbs, shrubs, or small trees. Leaves opposite, stipulate. Flowers minute, monœcious, diœcious or bisexual, spiked, bracts concave or absent: perianth absent; stamens, one to three, sessile, or on very short filaments, epigynous in bisexual flowers; ovary sessile, one-celled; stigma sessile; ovule solitary, pendulous. Fruit, a small drupe, fleshy, one-seeded; endosperm fleshy; embryo minute; radicle inferior.

GENUS I. ASCARINA, *Forster*.

Shrubs or trees, with diœcious spicate flowers; bracts small; stamen, one; anther linear-oblong, two-celled; ovary ovoid.

ORDER 30. MONIMIACEÆ.

Trees or shrubs, rarely scandent. Leaves opposite or verticillate, rarely alternate, exstipulate. Flowers unisexual or bisexual: perianth regular, four- or many-lobed, more or less united with the expanded receptacle or staminal disc. Male: Stamens, five to eight, or indefinite; filaments short, stout, opening by slits or valves. Female: Stamens reduced to scales or absent; ovaries numerous, sessile, one-celled; style lateral or terminal; ovule, one, erect or pendulous. Fruit, a nut or drupe or achenes, with persistent feathery styles, sometimes included in the elongated perianth-tube; endosperm copious, fleshy or oily; embryo straight.

GENUS 1. HEDYCARYA, *Forster*.

Diœcious shrubs or trees, with opposite leaves; perianth broad. Male: Hemispherical or flat, five- to ten-lobed, lobes small; anthers very numerous, nearly sessile, covering the entire disc, opening longitudinally. Female: Carpels numerous, one-celled, sessile, covering the disc; style short, thick, obtuse; ovary solitary, pendulous. Fruit, a drupe.

GENUS 2. LAURELIA, *Fuss*.

Lofty trees, with opposite leaves and unisexual or polygamous flowers, aromatic. Flowers in axillary cymes or racemes, shorter than the leaves. Male: Perianth tube short, limb with six to twelve spreading-lobes, arranged in one or two series; stamens, six to twelve, on short filaments, each with two glands at the base; anthers two-celled, opening by upturned valves. Female: Perianth ovoid, cylindrical or tubular, narrow; stamens reduced to scales; carpels, six to ten; styles linear, pilose; ovules erect. Fruit included in the elongated, urceolate perianth; achenes, six to ten, plumose; embryo small, in fleshy endosperm; radicle inferior.

ORDER 31. LAURINEÆ.

Shrubs or trees, often aromatic. Leaves usually alternate, exstipulate, rarely absent. Flowers perfect or diœcious; perianth monophyllous, four- to eight-lobed, imbricate; lobes in two series, often with a four- to six-leaved or scaly involucre at the base, rotate or funnel-shaped; tube usually persistent, becoming changed into a cup surrounding the base of the fruit; stamens, twelve to fifteen, arranged in three or four series, inserted on the perianth, often reduced to glands or staminodia in the female flower; filaments free or monadelphous, naked or glandular at the base; anther-cells, two to four, opening by upturned valves before or behind, or by pores at the apex; ovary superior, one-celled; style short; stigma simple; ovule, one, pendulous. Fruit, a drupe or berry or dry, one-seeded, seated on the thickened pedicel; seed without endosperm, cotyledons large, plano-convex, radicle very short, superior.

This order comprises many species, affording valuable ornamental timbers. The tree-laurel (*Lauris nobilis*) or sweet bay is the type of the order; it includes also the sassafras (*S. officinalis*), the alligator pear (*Persea gratissima*), the cinnamon (*Cinnamomum officinale*), and the camphor (*Camphora officinarum*).

GENUS 1. LITSEA, *Lambert*.

Shrubs or trees, with alternate or, rarely, opposite leaves. Flowers diœcious; axillary, fascicled or umbelled, with a four- or five-leaved involucre; perianth deeply divided, four to eight lobes or, rarely, absent. Male flower: Stamens, six to fifteen; filaments usually glandular at the base; anthers four-

celled; ovary abortive. Female flower: Stamens abortive; ovary oblong, with a dilated stigma. Fruit, a berry, one-seeded.

GENUS 2. *BEILSCHMIEDIA*, *Nees*.

Large trees, with alternate leaves. Flowers paniculate, perfect: perianth small, six-lobed; stamens, twelve, in two series, the outer series opposite the perianth-lobes, fertile with introrse anthers; the inner series comprises three fertile extrorse anthers, with glands opposite the base of the filaments, and three with abortive anthers; ovary one-celled; style short. Fruit, an oblong or ovoid drupe.

ORDER 32. *PROTEACEÆ*.

Shrubs or trees, rarely herbs. Leaves scattered, rarely opposite or verticillate, usually coriaceous and toothed. Flowers bisexual: perianth of four segments, usually coherent below, valvate; stamens, four or, rarely, three, epiphyllous or, rarely, hypogynous; hypogynous glands, one to four, sometimes absent; ovary superior, one-celled, sessile or stipitate; style filiform; stigma simple; ovules, one or more. Fruit, an indehiscent nut or drupe or samara, or a one- or two-valved follicle or capsule, one-celled or incompletely two-celled; seed solitary, ovoid or globose or compressed or winged, without endosperm, embryo straight, radicle inferior.

GENUS 1. *PERSOONIA*, *Smith*.

Shrubs or trees. Leaves alternate. Flowers in axillary racemes or spikes: perianth segments at first tubular, ultimately spreading; stamens inserted near the middle of the segments; hypogynous glands, four; style slender; ovules, one or two. Fruit, a drupe; nut one- or two-celled; cotyledons, two to eight.

GENUS 2. *KNIGHTIA*, *Brown*.

Lofty trees, with stout branches. Flowers in dense racemes: perianth segments at first coherent, tubular, ultimately separating and forming spiral coils; stamens, four, inserted near the tips of the segments; anthers linear; hypogynous glands, four; ovary sessile, narrowed into a long rigid style; stigma vertical, stigmatiferous at the apex; ovules, one to four. Fruit, a woody follicle; seeds winged at the tip.

ORDER 33. *SANTALACEÆ*.

Herbs, shrubs, or trees, sometimes parasitic on the roots or branches of other plants. Leaves usually alternate, entire, exstipulate. Flowers bisexual or unisexual, usually small: perianth exceeding the ovary, three- to six-lobed; stamens, three to six, inserted on the perianth-lobes, filaments very short; ovary inferior or superior, one-celled; style short; stigma lobed; ovules, two to five, pendulous from an erect central placenta. Fruit, a nut or drupe, indehiscent, one-seeded, with fleshy endosperm; embryo small; radicle superior.

GENUS 1. *FUSANUS*, *Linne*.

Shrubs or trees with opposite or alternate leaves, and axillary panicles or racemes shorter than the leaves. Perianth-tube superior, campanulate, longer than the ovary, four- or five-lobed; disc four- or five-lobed; stamens, four or five, inserted on the perianth-lobes, with a tuft of hairs behind each stamen, filaments short; ovary inferior, with an erect placenta; ovules, two or three; style conical, short; stigmas, two or three, minute, terminal. Fruit, a globular drupe, crowned by the remains of the perianth-lobes, succulent or fleshy, one-seeded.

ORDER 34. CUPULIFERÆ.

Monœcious trees, rarely shrubs. Leaves alternate, stipulate. Flowers solitary or in unisexual spikes or fascicles. Male: Perianth single, four- to six-lobed, lobes often unequal; stamens, one to twenty, with slender filaments and two-celled anthers. Female solitary or two, three, or five, sessile included in a common cupuliform involucre clothed on the outer surface with spines or scales or transverse plates; perianth superior, two- to six-lobed; ovary inferior, two- to six-celled; styles, two to six, short, stigmatiferous at the tips; ovules usually two in each cell, pendulous. Fruit of one or several nuts enclosed in an involucre; seed solitary, without endosperm, embryo straight, usually folded or sinuous, radicle small, superior.

This order comprises numerous fine timber trees: it includes the English oak (*Quercus Robur*) and many other species, also the sweet chestnut (*Castanea vesca*), the European beech (*Fagus sylvatica*), &c.

GENUS I. FAGUS.

Trees with scaly buds. Leaves persistent or deciduous, often unequal at the base: stipules deciduous, chaffy. Male: Flowers in a membranous campanulate perianth, five- or six-lobed, solitary or fascicled; stamens, eight to twelve, exserted; anthers apiculate. Female: Two to four minute, in a three- or four-lobed involucre, which is clothed externally with spines or adnate bracts; perianth urceolate, adnate with the ovary; ovary inferior, three-celled; styles, three, very short, filiform; ovules one in each cell. Fruit, two to four trigonous nuts contained in a woody three- or four-lobed involucre, clothed with spines or transverse lamellæ; nuts one-seeded; cotyledons plaited.

SUB-CLASS. GYMNOGENS.

ORDER 35. CONIFERÆ.

Lofty trees or shrubs, rarely prostrate, usually resinous; wood destitute of true vessels, and consisting of fibres, with one or more series of concave discs. Leaves needle-shaped or linear or ovate, often reduced to imbricating scales, sometimes dimorphic, exstipulate. Flowers, in catkins, monœcious or diœcious: perianth absent. Male: Catkins of several or numerous scale-like stamens, opposite or whorled or spirally imbricated round an elongated axis, each stamen consisting of a connective sessile or stipitate at the base, and usually expanded at the apex, sometimes peltate; anther-cells, two to twenty, parallel or radiating or pendulous, opening longitudinally. Female: Cones consisting of opposite or whorled or spirally-arranged imbricate scales, each carrying one or more naked ovules, or of a fleshy cup or receptacle, with one or two naked ovules, micropyle gaping. Fruit, a woody, coriaceous, or succulent cone or drupe, or a seed imbedded at the base in a dry or fleshy receptacle; seeds often winged, testa hard or membranous, endosperm horny or fleshy, embryo straight, with two or more cotyledons, radicle superior or inferior.

This order includes a large number of valuable timber-trees, and affords the chief commercial timbers used for general purposes in both hemispheres. Amongst those best known outside New Zealand may be mentioned the California red-wood (*Sequoia sempervirens*), the Scotch fir (*Pinus sylvestris*), the deodar (*Cedrus deodara*), the larch (*Larix Europæe*), the Norway fir (*Picea excelsa*), the Norfolk Island pine (*Araucaria excelsa*), and many others.

GENUS 1. *LIBOCEDRUS*, *Endlicher*.

Shrubs or lofty trees. Branchlets compressed when young, tetragonous when old. Leaves small and scale-like, opposite: on young plants the lateral leaves are larger than the upper and lower; on old trees all the leaves are equal or nearly so, quadrifariously imbricate. Flowers monœcious or diœcious: catkins solitary, terminal. Male: Cylindrical; stamens, six to ten, connective peltate; anther-cells pendulous. Female of four to six erect decussate scales, the two innermost with an erect fleshy scale or disc at the base of each, carrying two naked ovules. All the scales become woody in fruit, and carry a short curved spine or horn at the back; seeds, two or four, unequally winged.

GENUS 2. *PHYLLOCLADUS*, *L. C. Rich.*

Shrubs or trees, monœcious or diœcious, with whorled branches, leaves of two forms, linear, developed chiefly on young plants, or minute and scale-like. In old plants leaves are represented by flattened, flabellate, coriaceous branchlets termed cladodia, which are often lobed or toothed, and carry the female flowers on their margins. Male catkins terminal, usually fascicled, sessile or pedicellate: stamens imbricated; anther-cells, two. Female catkins very small, one- or many-flowered, each flower consisting of a single erect naked ovule, seated on a fleshy scale, ultimately coriaceous. Fruit amorphous or globular, coriaceous, often coloured; the seeds longer than the scales.

GENUS 3. *DACRYDIUM*, *Solander*.

Shrubs or lofty trees, stems, rarely, short and prostrate, diœcious or, rarely, monœcious. Leaves dimorphic, linear, and distichous, or subulate or scale-like, quadrifariously imbricating. Male catkins terminal, short, sessile, usually consisting of few small imbricating stamens, rarely long and acuminate: anthers sessile, two-celled. Female of one or more scales, one or two of which bear a naked inverted ovule. Fruit, a seed invested at the base by a membranous cup, and seated on a coriaceous or fleshy receptacle.

GENUS 4. *PODOCARPUS*, *L'Heritier*.

Trees or shrubs, diœcious or, rarely, monœcious. Leaves sometimes dimorphic, distichous or scattered, or subulate, spreading or imbricated. Flowers axillary or terminal. Male catkins solitary or racemed, rarely spiked: stamens numerous, imbricate; anther-cells, two. Female of two, rarely four, elongate scales, forming a two- to four-toothed receptacle, usually pedunculate; one or more of the scales carry a naked inverted ovule adnate to its face, but usually only one ripens into fruit. Fruit, a drupe or seed seated on a fleshy or dry receptacle.

GENUS 5. *AGATHIS*, *Salisbury*.

Lofty monœcious trees with broad flat leaves, the branches often whorled. Flowers with a very short stout peduncle, and usually three or four bracts, forming a kind of cup at the base of the catkin. Male: 1 in. to 1½ in. long; stamens numerous, closely imbricating; connective peltate; anther-cells, five to twenty, pendulous. Female catkin ovoid or glandular: scales numerous, each with a single inverted ovule. Fruit, a woody cone, which falls to pieces as soon as the seeds are ripe.

CLASS 2. MONOCOTYLEDONS.

ORDER I. LILIACEÆ.

HERBS, rarely shrubs or trees, sometimes scandent. Flowers usually bisexual: perianth inferior, six-leaved, free or coherent; stamens, six, free or epiphyllous; anthers opening inwards; ovary superior, three- or, rarely, one-celled; style long or short; stigma three-lobed; ovules, one or more in each cell. Fruit, a three-celled three-valved capsule, membranous and coriaceous, or a berry, one- to three-celled; seeds few or many, globose, flattened or angled, endosperm fleshy, embryo terete.

GENUS I. CORDYLINE, *Commerson*.

Trees or shrubs, stem sometimes absent. Leaves alternate, with broad bases, crowded at the ends of the branches, mid-rib prominent or obscure. Flowers on much-branched panicles: perianth campanulate, spreading, six-leaved, cohering at the base; stamens epiphyllous; ovary superior, three-celled; style short, simple; stigma three-lobed; ovules numerous. Fruit, a berry, globose or compressed, three-celled, few- or many-seeded; seeds angular, convex at the back; pedicels, three-bracteate.

A GLOSSARY OF DERIVATIONS

OF THE

PRINCIPAL GENERIC AND SPECIFIC NAMES ADOPTED IN
THIS WORK, COMBINED WITH AN INDEX.

- Acerosa*, p. 213. In reference to the needle-shaped leaves.
Ackama, p. 113. Derived from the Native name.
Acutifolius, p. 63. From the acute or pungent leaves.
Agathis, p. 143. From the Greek, signifying a cluster; probably in allusion to the clustered anthers.
Alectryon, p. 183. From the Greek, signifying *a cock*, the scarlet arillus resembling a cock's comb.
Alpinus, p. 199. From its growing in alpine situations.
Angustifolia, p. 287. From the narrow leaves.
Apetala, pp. 11, 37. From its being destitute of petals.
Apiculata, p. 4. From the leaves having a short projecting point at the apex.
Arborea, *arborescens*, pp. 45, 275. From the tree-like habit.
Aristotelia, p. 223. In memory of the Macedonian philosopher, Aristotle.
Ascarina, p. 269. From the Greek name of a small white worm which the anthers resemble.
Australis, pp. 143, 295. From its growing in the Southern Hemisphere.
Avicennia, p. 271. In honour of *Avicenna*, a famous Oriental physician.
Avicenniæfolia, p. 219. From the leaves resembling those of *Avicennia*.
Axillaris, p. 1. In reference to the flowers springing from the axils of the leaves.
Baueriana, p. 109. In honour of *Francis Bauer*, a celebrated botanical draughtsman.
Betulinus, p. 207. From its resembling a species of *Betula*.
Bidwillii, pp. 57, 159. In honour of *Bidwill*, an enthusiastic New Zealand explorer and botanist.
Blairii, p. 97. In compliment to *W. N. Blair, C.E., &c.*
Brexioides, p. 79. From its resembling a species of *Brexia*.
Brunoniana, p. 293. In honour of *Robert Brown*, the great English botanist.
Bullata, p. 273. From the tumid leaves.
Carpodetus, p. 77. From the Greek, signifying *fruit* and *bound*, from the fruit being girt by the calyx.
Cliffortioides, p. 201. From its resemblance to some species of *Cliffortia*.
Colensoi, p. 189. In honour of *W. Colenso, F.R.S.*
Colorata, p. 2. From the leaves being coloured or blotched.
Coprosma, pp. 109, 187. Name from the extremely unpleasant smell of some species.

- Cordyline*, p. 295. From the Greek, *a club*.
- Coriaria*, p. 289. From *corium*, leather, the bark containing tannin.
- Corymbosa*, p. 141. From the arrangement of the flowers in corymbs.
- Corynocarpus*, p. 171. From the Greek, *a club* and *fruit*, the berries being somewhat club-shaped.
- Costatum*, p. 277. Ribbed; in reference to the numerous leaf-veins.
- Crassifolium*, p. 59. In reference to the thick leaves.
- Cunninghamii*, pp. 103, 225. In honour of *Allan Cunningham*, a celebrated Australian and New Zealand botanist.
- Cupressinum*, p. 29. From the resemblance of the leaves to those of a cypress.
- Cyathodes*, p. 213. From the Greek, *a cup*; in reference to the cup-shaped disc in which the ovary is seated.
- Dacrydioides*, p. 41. From the resemblance of the leaves to those of some species of *Dacrydium*.
- Dacrydium*, pp. 29, 57, 165, 167, 169, 189, 191. From the Greek, *a tear*; in reference to the weeping habit.
- Dentata*, *dentatus*, pp. 217, 17. From the leaves being toothed.
- Discaria*, p. 283. From the Greek, *a disc*; from the broad disc surrounding the ovary.
- Dodonæa*, p. 27. In honour of *Rambert Dodoens*, a German botanist of the sixteenth century.
- Doniana*, p. 157. In honour of *G. Don*.
- Dracophyllum*, p. 215. From the Greek, *a dragon*, and a leaf, from the close likeness between this plant and *Dracæna*.
- Drimys*, p. 1. From the Greek, *pungent*; in reference to the pungent taste of the leaves.
- Dysoxylum*, p. 115. Apparently in allusion to the double seeds.
- Edgerleyi*, p. 73. In honour of *R. Edgerley*, a New Zealand explorer and botanist.
- Elæocarpus*, pp. 17, 19. From the Greek, *an olive* and *fruit*, the berry resembling an olive.
- Entelea*, p. 45. From the Greek, *perfect*; in reference to all the stamens being fertile.
- Ericoides*, p. 123. Resembling some species of *Erica* in habit.
- Eugenia*, p. 249. In compliment to *Prince Eugène, of Savoy*, a patron of botany.
- Eugenioides*, p. 81. From the resemblance to some species of *Eugenia*.
- Excelsa*, *excelsum*, pp. 49, 183. In reference to the lofty habit of growth.
- Excorticata*, p. 53. From the bark peeling off in loose papery flakes.
- Fagus*, pp. 91, 97, 175, 179, 201. The Greek name from a word meaning *to eat*.
- Ferox*, p. 35. In reference to the thick sharply-toothed leaves.
- Ferruginea*, p. 163. From the rust-coloured appearance of the leaves when dry.
- Florida*, p. 261. From the profuse habit of flowering.
- Fuchsia*, p. 53. In honour of *Leonard Fuchs*, a celebrated German physician.
- Fusanus*, p. 137. Transferred from the Greek—an ancient name of the *Euonymus*.
- Fusca*, p. 179. From the deep-brown colour of the stipules.

- Glauca*, p. 195. Referring to the pale-bluish green tint of the leaves.
- Gracilis*, p. 243. From the graceful habit of the plant.
- Grandiflora*, p. 85. From the large flowers.
- Griselinia*, p. 67. In honour of *F. Grisellini*, an Italian botanist.
- Hallii*, p. 13. In compliment to *Mr. J. W. Hall*, an enthusiastic cultivator of New Zealand trees.
- Hedycarya*, p. 217. Greek, *sweet* and a *nut*.
- Hoheria*, p. 87. Derived from the Native name *houhere*.
- Hookerianus*, p. 19. In honour of *Sir Joseph D. Hooker*.
- Intermedium*, p. 167. Partaking of the character of two species.
- Ixerba*, p. 79. An anagram of *Brexia*, a closely allied plant from Madagascar.
- Kirkii*, p. 191. In honour of *T. Kirk, F.L.S.*
- Knightia*, p. 49. In honour of *T. A. Knight, F.R.S.*, a noted writer on vegetable physiology.
- Lætum*, p. 253. In allusion to the shining leaves.
- Lævigata*, p. 171. In allusion to the smooth leaves.
- Lanceolata*, p. 107. From the long narrow leaves resembling the head of a lance.
- Latifolium*, p. 251. In allusion to the broad leaves.
- Laurelia*, p. 129. From the resemblance to a laurel.
- Laxifolium*, p. 169. In reference to the scattered or distant leaves.
- Leptospermum*, pp. 123, 235. From the Greek, *slender* and a *seed*.
- Libocedrus*, pp. 157, 159. From the Greek, signifying *incense* and *cedar*.
- Litsea*, p. 15. From the Japanese name of a species belonging to this genus.
- Linariifolia*, p. 187. From the leaves resembling those of some species of *Linaria*.
- Littoralis*, pp. 69, 209. In reference to the littoral habitat of the plant.
- Longifolium*, p. 215. Referring to the long narrow leaves.
- Lucida*, p. 67. From the glossy or shining leaves.
- Lyallii*, p. 279. In honour of *Dr. Lyall*, surgeon to the New Zealand surveying expedition under Captain Stokes, H.M.S. "Acheron."
- Maire*, p. 249. The Native name.
- Mantellii*, p. 119. In compliment to the *Hon. W. B. D. Mantell, F.G.S.*
- Melicope*, pp. 117, 121. From the Greek, signifying *honey*, and a *division*, from the honey-secreting glands round the ovary.
- Melicytus*, p. 3. From the Greek, *honey* and a *cavity*, in allusion to the five scales behind the anthers.
- Menziesii*, p. 175. In honour of *Dr. Menzies*, surgeon to Vancouver's Expedition.
- Meryta*, p. 245. From the Greek, *to roll up*; in allusion to the appearance of the male flowers in certain species.
- Metrosideros*, pp. 99, 237, 241, 261, 263. From the Greek, *heartwood* and *iron*; referring to the hardness of the wood.
- Microphylla*, p. 85. In reference to the small leaves.
- Montana*, p. 39. In reference to the preference for hilly or mountainous situations supposed to be exhibited by this plant.
- Myoporum*, p. 253. From the Greek, *to shut* and a *pore*; in reference to the leaves being dotted with cavities.

- Myrsine*, pp. 23, 25. Transferred from the Greek, formerly applied to the myrtle.
- Myrtus*, pp. 127, 185. The Greek name in allusion to the perfume.
- Novæ-Zelandiæ*, p. 129. From its having been first observed in New Zealand.
- Nivalis*, p. 65. From the plant growing in the vicinity of snow.
- Obcordata*, p. 127. From the heart-shaped leaves being notched at the apex.
- Officinalis*, p. 271. From the supposed medicinal virtues of the plant.
- Olea*, pp. 37, 39, 103, 107. From the Latin *olea*, oil; in reference to the value of the oil obtained from the fruit.
- Olearia*, pp. 47, 205, 219, 225, 297. From *olea*, an olive, the foliage often resembling that of some species of *olea*.
- Panax*, pp. 73, 211. From the Greek, *everything* and *a remedy*, on account of the reputed virtues of a Chinese species.
- Pedunculata*, p. 221. In reference to the flowers being carried on peduncles.
- Pennantia*, p. 141. In honour of *Thomas Pennant*, an eminent Scotch naturalist.
- Persoonia*, p. 135. In compliment to *Dr. D. C. H. Persoon*, a native of Cape Colony, and a noted botanist.
- Phyllocladus*, pp. 9, 195, 199. From the Greek, *a leaf* and *a branch*; from the curious phyllodia resembling leaves.
- Pisonia*, p. 293. After *William Pison*, a Dutch botanist and traveller in Brazil.
- Pittosporum*, pp. 21, 75, 81. From the Greek, *pitch* and *a seed*; from the black viscid secretion about the seeds.
- Plagianthus*, pp. 207, 279. From the Greek, signifying *oblique*; in reference to the usually unequal sided petals.
- Podocarpus*, pp. 5, 13, 41, 63, 65, 163, 227. From the Greek, signifying *a foot* and *fruit*; in reference to the thick footstalks of the fruit of some species.
- Polymorpha*, p. 241. Passing through many changes or forms.
- Pomaderris*, p. 11. From the Greek, signifying *a covering* and *the skin*; in reference to the persistent calyx which loosely covers the ripe capsules.
- Populnea*, p. 87. From the leaves resembling those of the poplar.
- Prostrata*, p. 85. From the prostrate stems.
- Pseudopanax*, pp. 35, 59. From the resemblance to a true panax.
- Quintinia*, p. 255. Named in compliment to *La Quintinie*, a French botanist and writer on horticulture.
- Racemosa*, p. 133. From the racemose arrangement of the flowers.
- Ralphii*, p. 185. In honour of *Dr. Ralph*, a collector of New Zealand plants.
- Ramiflorus*, p. 3. From the much-divided inflorescence.
- Robusta*, p. 263. In reference to the stout or robust habit.
- Rosæfolia*, p. 113. From the leaves resembling those of the rose.
- Rotundifolius*, p. 233. From the round leaves.
- Ruscifolia*, p. 289. From the leaves resembling those of a species of *Ruscus*.
- Salicifolia*, p. 243. From the willow-like leaves.
- Salicina*, p. 23. From the resemblance to a willow.
- Scoparium*, p. 235. In allusion to the thin branches or twigs which are sometimes used as besoms.

- Senecio*, p. 233. From *senex*, an old man; in allusion to the white pappus of many species.
- Serrata*, *serratus*, pp. 77, 255. In allusion to the toothed margins of the leaves.
- Sideroxylon*, p. 277. From the Greek, signifying *iron* and *wood*; in reference to the hardness of the wood of many species.
- Simplex*, p. 121. From the entire leaves of the mature state.
- Sinclairii*, p. 245. In honour of *Dr. Sinclair, R.N.*, an accomplished New Zealand botanist.
- Silvicola*, p. 131. From the species growing in woods.
- Solandri*, p. 91. In honour of *Dr. Solander*, who accompanied Captain Cook to New Zealand in 1769.
- Sophora*, p. 83. A modification of the Arabic name *Sophera*.
- Spectabile*, p. 115. In allusion to the showy flowers.
- Spicata*, p. 5. From the flowers being arranged in spikes.
- Tarairi*, p. 71. From the Native name.
- Tawa*, p. 257. The Native name.
- Tenuifolium*, p. 75. In reference to the thin leaves.
- Ternata*, p. 117. From the leaflets being arranged in threes.
- Tetraptera*, p. 83. In allusion to the four-winged pods.
- Tomentosa*, p. 237. Covered with short close cottony hairs, usually white.
- Toro*, p. 135. The Native name.
- Totara*, p. 227. The Native name.
- Toumatou*, p. 283. A corruption of the Native name *tumatukuru*.
- Traillii*, p. 297. In honour of *Mr. Charles Traill*, of Stewart Island, an enthusiastic naturalist.
- Trichomanoides*, p. 9. From the resemblance of the phyllodes to the leaves of the maiden-hair fern.
- Urvillei*, p. 25. In honour of *Admiral d'Urville*, a French botanist.
- Veronica*, p. 243. From the Greek, *the sacred picture*, because a European species was said to bear a representation of our Saviour in the flowers.
- Viscosa*, p. 27. From the leaves being viscid or glutinous.
- Vitex*, p. 209. An old Latin name of unknown derivation.
- Vulgaris*, p. 87. Common.
- Weinmannia*, pp. 131, 133. Named in honour of *J. J. W. Weinmann*, a noted German writer.
- Westlandicum*, p. 165. From the plant having been originally observed in the County of *Westland*.

A G L O S S A R Y
OF THE
BOTANICAL TERMS USED IN THIS WORK.

Achene. A small, hard, dry, indehiscent, single-seeded fruit.

Acuminate. Applied to a leaf suddenly narrowed at the top and then prolonged into a point.

Adherent. See *Adnate*.

Adnate. Applied to the union of organs of different kinds, as of the ovary with the calyx.

Alternate. One after another; applied to leaves when placed singly instead of in pairs; also to stamens when alternating with petals instead of standing before them.

Anatropous. Inverted; applied to ovules.

Anther. The pollen-bearing part of a stamen.

Apiculate. Ending in a small point.

Apiculus. A short-pointed tip.

Appressed. Applied to objects closely pressed to each other for their entire length, as hairs against the back of leaves, leaves against the stem, &c.

Arillate. Applied to seeds having an arillus.

Arillus. A membranous pulpy or fleshy appendage growing from the funicle and enclosing the whole or a portion of a seed.

Axil. The angle between the stem and leaf or other organ.

Axile. Belonging to the axis; applied to placentation when the ovules are attached to the axis of an ovary with two or more cells.

Axillary. Growing in the axil.

Berry. A fruit in which the whole pericarp is fleshy or pulpy, except the outer skin or rind.

Bract. One of the upper leaves of a plant in flower when differing from the stem-leaf in size, shape, colour, or arrangement.

Calyx. The outer series of floral leaves.

Campanulate. Bell-shaped.

Capitate. Head-shaped or collected into a head.

Capsule. A dry fruit-vessel of two or more cells splitting along regular lines.

Carpel. A pistil or a complete portion of a compound pistil, whether separable or not.

Catkin. A flower-spike of unisexual flowers destitute of perianths.

Cinereous. Of an ash-grey colour.

Ciliated. Bordered with thick hairs or fine hair-like teeth.

Cladode. A branch modified to resemble a leaf and discharge its function.

- Clavate.* Club-shaped.
- Coccus.* One of the portions into which a lobed fruit with single-seeded cells separates when ripe.
- Coniferous.* Cone-bearing.
- Connective.* That portion of an anther which unites two cells not closely contiguous.
- Connate.* Cohesion; applied to the union of organs of the same kind, as petals with petals.
- Cordate.* Heart-shaped leaves with the petiole at the broader and notched end.
- Coriaceous.* Leathery in texture.
- Corolla.* The inner series of the perianth, composed of petals which are usually coloured.
- Corymb.* An inflorescence in which the branches and pedicels, though starting from different points, attain the same level, forming a flat-topped panicle.
- Costa.* A rib.
- Cotyledon.* The first leaf or first pair of leaves of the embryo.
- Crenate.* With regular blunt rounded teeth.
- Crenulate.* With very small rounded teeth or crenatures.
- Crustaceous.* Hard and brittle in texture.
- Cuneate.* Wedge-shaped.
- Cyme.* A branched flower-cluster, especially if broad and flattish, in which the central flower opens first.
- Deciduous.* Falling or subject to fall in season, as petals and bracts after flowering, leaves in autumn, &c.
- Decussate.* In pairs; alternately crossing at right-angles.
- Deflexed.* Sharply turned or bent downwards.
- Dehiscence.* The opening of an anther or capsule to liberate pollen or seed; usually by means of valves, slits, or regular lines.
- Dehiscent.* Opening by valves or regular lines to liberate the seed.
- Diadelphous.* Applied to stamens united by their filaments into two clusters, or in certain Leguminosæ, into a cluster of nine and one free stamen.
- Dichotomous.* Two-forked.
- Didymous.* Twin; found in pairs.
- Didynamous.* Applied to stamens arranged in two pairs, one pair being shorter than the other.
- Dimorphic.* Occurring under two forms.
- Diocious.* Having the male and female flowers on separate plants.
- Disc.* A modification of the floral receptacle within the calyx or within the corolla or stamens: round openings on cell-walls are sometimes termed discs.
- Distichous.* Arranged one above the other in two rows.
- Drupe.* A fruit consisting of three layers, enclosing a single seed, as in the peach. The outer skin is the epicarp, the pulpy middle layer the sarcocarp, and the hard stony layer the endocarp.
- Embryo.* The rudimentary plant formed in the seed.
- Endocarp.* The inner layer of the ovary; the stony layer surrounding the seed in a peach or plum.
- Endosperm.* The albumen or nutritive matter in which the embryo is often embedded in the seed. The term is usually restricted to the albumen

formed within the embryo sac, as in the majority of seeds: when formed outside the sac it is termed *perisperm*.

Ensiform. Sword-shaped.

Epigynous. Inserted on the ovary.

Epiphyllous. Inserted or growing upon leaves.

Epiphytic. Growing on other plants by way of support, but not parasitic.

Exserted. Protruding beyond, as stamens beyond the perianth.

Exstipulate. Destitute of stipules.

Extrorse. Directed outwards.

Fascicle. A bundle or cluster.

Filament. The stalk or support of any anther; any fibre-shaped or threadlike body.

Filiform. Thread-shaped.

Flabellate. Fan-shaped.

Floret. A small flower; one of a cluster.

Foliaceous. Leaflike in texture or leaf-bearing.

Follicle. A fruit of a single carpel opening along one suture.

Fulvous. Tawny; a mixture of orange yellow and grey.

Funiculus. The stalk by which the ovule or seed is attached to the placenta.

Genus. A special group of closely-related species: the name of the genus with that of the particular species constitute the systematic name of the plant.

Geminate. Two side by side in pairs; a twin.

Gibbous. Unequally swollen, tumid, or protuberant.

Glabrous. Smooth; without hairs of any kind.

Glandular. Bearing glands, or of the nature of glands.

Glaucous. Of a pale-bluish green.

Hilum. The scar left on the seed where it separates from the funicle.

Hispid. Thickly covered with rather stiff hairs.

Hypogynous. Inserted on the floral receptacle or beneath the pistil.

Imbricating. Overlapping like the scales of a fish.

Indehiscent. Applied to fruits which do not open along regular lines to liberate the seeds.

Inferior. Said of one organ when below another. An inferior calyx is one below the ovary or free; applied to the radicle of the embryo when pointing towards the base of the fruit.

Inflorescence. The arrangement of the flowering branches and of the flowers upon them.

Internode. The space between two nodes.

Introrse. Turned inwards.

Involucre. A series of bracts closely placed round a flower-cluster, and arranged in one or several series.

Laciniate. Cut into long narrow lobes.

Lamella. A thin plate.

Lamina. The blade or spreading part of a leaf, &c.

Lanceolate. Shaped like a spear-head, narrower than oblong, and tapering to the apex or towards both ends.

- Lepidote.* Clothed with small scurfy scales, usually consisting of matted hairs.
- Linear.* Narrow, with parallel margins, at least four or five times as long as broad.
- Membranous.* Like a membrane: thin, rather soft, and pliable.
- Micropyle.* The point in a seed which indicates the position of the orifice of the ovule.
- Monadelphous.* Applied to stamens united by their filaments into one set or cluster, forming a tube, usually sheathing the pistil.
- Monœcious.* Having the male and female flowers distinct but on the same tree.
- Monopetalous.* One-petalled or a corolla of coalescent petals.
- Monophyllous.* One-leaved.
- Node.* The part of a stem from which a leaf is given off.
- Obcordate.* Applied to inverted heart-shaped leaves with a notch at the apex.
- Obtuse.* Blunt or rounded at the end.
- Orbicular.* Applied to a flat body with a circular outline.
- Ovary.* The enlarged base of the pistil; the portion which contains the ovules.
- Ovate.* The shape of the longitudinal section of a hen's egg.
- Ovule.* A small body contained in the cell of the ovary and ultimately forming the seed.
- Paleaceous.* Applied to membranous chaffy scales clothing certain receptacles, &c.
- Panicle.* A flower-cluster in which the axis is irregularly divided into branches bearing two or more flowers.
- Pappus.* A ring of hairs or scales round the top of a fruit.
- Parietal.* Attached to the inner surface of an ovary.
- Partite.* Divided nearly to the base.
- Patent.* Spreading widely.
- Pedicel.* The stalk supporting a single flower of a raceme, &c.
- Peduncle.* The stalk of an inflorescence.
- Peltate.* Applied to leaves attached to the petiole by the under surface instead of the base.
- Pentadelphous.* The stamens arranged in five sets or clusters.
- Perfect.* Applied to flowers containing both stamens and pistil.
- Perianth.* The outer envelope of the flower, whether consisting of calyx or corolla or both.
- Persistent.* Applied to any part of the flower that remains attached to the ripe fruit.
- Petal.* A corolla leaf.
- Petiole.* The foot-stalk of a leaf.
- Phyllode.* A flat bladeless petiole usurping form and functions of a leaf-blade.
- Pilose.* Hairy, with soft distinct hairs.
- Pinnate.* When several leaflets are arranged one after the other on each side of the mid-rib or petiole.
- Placenta.* That part of the ovary which carries the ovules.
- Plane.* With a flat surface.
- Pollen.* The fertilising cells or grains contained in the anthers.
- Polygamous.* Having male, female, and perfect flowers on the same or different plants.

- Polymorphic.* Passing through many forms or stages.
- Proterogynous.* When the stigma matures earlier than the anthers of the same flower.
- Puberulous.* Minutely pubescent.
- Pubescence.* Short soft downy hairs.
- Pungent.* Terminating in a stiff sharp point like a prickle.
- Pyriform.* Pear-shaped.
- Quadrifarious.* Arranged in four vertical ranks.
- Quinquefoliolate.* Having five leaflets.
- Raceme.* An inflorescence in which the flowers are borne on pedicels along a single undivided axis.
- Radicle.* The base of the future root of the embryo.
- Rhachis.* The axis of an inflorescence or of a compound leaf.
- Rhomboid.* Resembling a rhombus in shape.
- Reniform.* Kidney-shaped.
- Reticulate.* Resembling a network.
- Retuse.* Having a shallow notch at a rounded apex.
- Samara.* An indehiscent winged fruit.
- Sarcocarp.* The succulent or fleshy part of a stone fruit.
- Scabrid.* Slightly rough to the touch.
- Scandent.* Climbing.
- Scarious.* Membranous, thin, dry, or shrivelled; not green.
- Sepal.* A leaf or segment of a calyx.
- Serrate.* With regular-pointed teeth like a saw.
- Serrulate.* With very small fine teeth.
- Sessile.* Inserted on the stem without a stalk of any kind.
- Simple.* Consisting of a single piece.
- Spathulate.* Oblong, with the lower part narrow and tapering, resembling in shape a chemist's spatula.
- Species.* An assemblage of individual plants bearing a sufficient resemblance to each other to warrant the conclusion of their descent from a common ancestor.
- Spinulose.* Furnished with diminutive spines.
- Stamen.* The anther with its filament, or the anther alone when sessile.
- Staminodium.* An abortive stamen.
- Standard.* The upper petal of a papilionaceous corolla.
- Stellate.* Arranged like the rays or points of a star.
- Stigma.* That part of the carpel which receives the pollen for the fertilisation of the ovules; it is usually situate at the top of the style.
- Stigmatiferous.* Bearing stigmatic cells.
- Stipitate.* Borne on a special stipe or stalk.
- Stipule.* A leaf or scale-like appendage at the base of the leaf-stalk or at the node of the stem.
- Strict.* Very straight, narrow and upright, or close.
- Style.* That portion of a pistil or carpel between the ovary and the stigma.
- Squarrose.* Rough, with spreading or projecting points.
- Subulate.* Awl-shaped.

- Superior.* Growing or placed above: as the upper petal in the corolla of a lateral flower; also applied to the ovary when free from the calyx; to the calyx when united with the ovary; to the radicle of the embryo when pointing towards the apex of the fruit.
- Syngenesious.* Applied to anthers cohering longitudinally by their margins.
- Terete.* Cylindrical or nearly so.
- Testa.* The outer coat of the seed.
- Tetragonous.* Four-angled.
- Tetramerous.* Consisting of four parts or members arranged in a circle.
- Tomentum.* Short soft dense cottony hairs.
- Trichotomous.* Divided into three nearly-equal branches springing from a common point.
- Trifoliolate.* Of three leaflets.
- Trigonous.* Obtusely three-angled.
- Trimorphic.* Passing through three different forms or stages.
- Triquetrous.* Acutely three-angled.
- Truncate.* Abruptly terminated, as if the extremity were cut off.
- Tuberculate.* Bearing small knobby projections or excrescences.
- Tumid.* Having a blistered appearance; swollen.
- Turbinate.* Top-shaped.
- Turgid.* Swollen.
- Umbel.* A flower-cluster in which several pedicels spring from the same point, and are about the same length.
- Umbellule.* A partial or secondary umbel.
- Urceolate.* Hollow and contracted at or below the mouth like an urn.
- Utricle.* A thin rather loose pericarp, containing a single seed.
- Variety.* A modification of a species.
- Valvate.* Opening as if by valves, as some anthers and most dehiscent fruits; also applied to sepals, petals, &c., when they are in contact without overlapping.
- Versatile.* Turning freely on a support.
- Verticillate.* Arranged in whorls.
- Viscid.* Sticky, adhesive.
- Villous.* Having long soft hairs, not matted.
- Whorl.* Several branches or leaves proceeding from the same node, arranged regularly round the stem.

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