THE FOREST FLORA OF NEW SOUTH WALES.

BY

J. H. MAIDEN

GOVERNMENT BOTANIST
AND DIRECTOR OF THE BOTANIC GARDENS,
SYDNEY.

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[The names of Synonyms or Plants incidentally mentioned are in *italics*.]

* Since described as a new species, *Eucalyptus Deanei*, Maiden. Proc. Linn. Soc. N.S.W., 1904.

† Identified by Sir George King as *F. glabella*, Blume, of which *F. nesophlylla*, Miq., is a synonym.

* Mr. H. G. Smith has shown that the earthy deposit attributed to the timber of Grevillea robusta really belongs to the above species. (Proc. R. Soc., N.S.W., 1903.

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Published by Authority of the

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PART I.

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J. H. MAIDEN,

Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney

PART I.

Published by the Forest Department of New South Wales, under authority of The Honourable the Secretary for Lands.

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PREFACE.

THERE are about 450 trees in New South Wales, including Eucalypts. Until the State is more fully explored from a botanical point of view, we shall not be in a position to precisely define the number of species of plants indigenous to New South Wales which attain a height of, say, 25 feet.

It is felt that nought but good can spring from an extended knowledge of these trees, and of the timbers and other products yielded by them. The object of this work is to depict the botanical characters of each tree, and to furnish all the available information in regard to it. There is no doubt that residents in the bush will welcome means of testing the information thus given, and of adding to the stock of knowledge.

This country has been settled for little more than a century, and the greater part of it for less than that. We possess a large endemic vegetation, and it is not a matter for surprise that our knowledge of many of our trees comes far short of that of those of long settled countries. When we have precision in the discrimination of our trees and of our timbers, accurate knowledge of them by the timber-getter, saw-miller, timber merchant, and user generally will advance by leaps and bounds.

Again, some of the trees are remarkable for their beauty, and many of them are of high botanical interest. Large numbers of them have already been proved to be of considerable economic importance. I have long been of opinion that the better our timbers and trees are known, the better many of them will be esteemed.

Let us first consider the living tree. If we know our trees better, the first step will have been gained towards what has been understood as a "botanical survey" of our forests. Of very few species do we know the precise geographical range. Then, in particular districts, we require to know the approximate sizes of the trees, and the number to the acre of merchantable trees; when they flower (this is of interest to bee-keepers and others); when they fruit (this is of interest to seed-getters and those who desire to propagate them, and whose efforts are often nipped in the bud through inability to obtain seed).

The economic importance as regards their planting in special situations, *e.g.*, as wind breaks, on the sea coast, in swampy land, in the arid interior, has not yet been realised. It is a fact that exotic trees are often cultivated simply because their seeds are more readily obtainable than those of the native species.

What do we know of the problems underlying the ringbarking of many species? There is much room for research here, which will be aided when people are able to diagnose the trees with precision.

Now let us consider the trees from the point of view of their timber. Have we not much to learn in regard to their durability? For example, as fence-posts, for mining, and other purposes. Closely associated with this are problems concerning methods for the artificial preservation of timber. Then we require many more experiments on the strength of timber, and in regard to its seasoning. How little do we really know about timber pests, and the best methods of combating with them, *e.g.*, the Teredo (Cobra), the white ant, and dry rot.

Directly proceeding from the above, have we not much to learn in regard to the adaptability of our timbers to some of the commonest uses; and in regard to special uses, let me draw attention to wood-paving, an industry which can be much developed; parquet flooring; timbers for carriage-building; for wood-engraving (of much less importance than formerly); for carving; for the backs of brushes; for wine and other casks; for butter kegs and boxes.

Then there are important possibilities in regard to the utilisation of our timbers for wood-pulp, and to a less extent for fish-curing. Again, much of our knowledge in regard to the value of the ashes of timbers is quite superficial.

I am satisfied that a useful minor industry to be explored is that of walking-sticks and umbrella handles. And this list might be extended to a wearisome length.

It is hoped that this work will merit the support of all classes of citizens, not only those engaged in the pursuits of forestry and the various industries connected with timber, but all gardeners and amateurs who plant trees; also botanists, and those who are content with the less pleasing designation of lovers of flowers and of our vegetation.

It is proposed to issue this work in parts, each part consisting of four plates (and occasionally five or six, where there is necessity for two or three plates to depict a particular species). About eight parts may be issued during the year. The price is one shilling per part, or ten shillings per dozen parts, payable in advance. Each part will be complete in itself.

If the support of the public should render such a course necessary, publication of the work will be expedited.

The plates are executed by Miss Margaret Flockton, and I have received valuable aid from Mr. Ernst Betche and Miss S. Hynes, my botanical assistants at the Botanic Gardens.

The work is issued at the cost and under the auspices of the Forest Department.

J.H.M.

December, 1902.

M. Flockton, del. et lith.

THE SILKY OAK.
(Grevillea robusta, A. Cunn.)

No. 1.

Grevillea robusta, A. Cunn.

The Silky Oak.

(Natural Order PROTEACEÆ.)

Botanical description.—Genus, *Grevillea,* R.Br.

Flowers.—Hermaphrodite.

*Corolla**.—Irregular or regular, the tube revolute or curved under the limb or straight and slender, the limb globular or rarely ovoid, usually oblique, the laminæ usually cohering long after the tube has opened.

Anthers.—All perfect, ovate, sessile in the base of the concave laminæ, the connective not produced beyond the cells.

Hypogynous glands.—United in a single semi-annular or semi-circular gland occupying the upper (often the shortest) side of the torus or rarely completely annular surrounding the ovary, or altogether wanting.

Ovary.—Stipitate or rarely sessile, with two amphitropous ovules laterally attached about the middle.

Style.—Filiform or somewhat dilated, usually long and protruding from the slit on the lower side of the perianth tube before the summit is set free from the limb, ultimately straightened and erect, or in a few species of *Lissostyles* and *Conogyne* remaining hooked; more or less dilated at the end into a straight oblique or lateral cone or disk bearing the small stigma in the centre of the disk or at the summit of the cone.

Fruit.—A follicle, usually oblique with the ventral suture curved, either coriaceous and opening along the upper margin, or rarely woody and opening almost or quite in two valves.

Seeds.—One or two, flat orbicular or oblong, bordered all round by a membranous wing or narrowly winged at the end or outer margin only or entirely wingless. Hard shrubs or trees.

Leaves.—Alternate, very diversified in shape.

Flowers.—In pairs along the rhachis of a short and umbel-like or elongated raceme, rarely reduced to a single pair; the racemes either terminal or also axillary, rarely all axillary. The indumentum usually consists of closely appressed hairs attached by the centre, rarely of erect or spreading hairs, and then usually forked at the base or clustered. (B.Fl., v. 417.)

The genus *Grevillea* is a very large one, approaching 200 species. It is almost peculiar to Australia, seven or eight species occurring in New Caledonia. It includes many beautiful flowering plants; occurs in the dry interior and the moist coast districts. Most of the species are small shrubs. *G. robusta* is the largest of the genus.

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* Bentham used the term "perianth," but it is no longer employed in descriptions of the *Proteaceæ*. It is clearly the corolla, the calyx being wanting. Proof of the correctness of this view is obtained by comparing the *Proteaceæ* with the nearly allied *Loranthaceæ*, in which the calyx is often still visible as a truncate rim.

Botanical description.—Species, *G. robusta.*—A. Cunn., in R.Br., Prot., Nov. 24.

A tree sometimes small and slender, sometimes robust and 80 to 100 feet high, the young branches hoary or ferruginous-tomentose.

Leaves.—Pinnate with about eleven to twelve pinnatifid pinnæ, the secondary lobes or segments entire or again lobed, lanceolate or rarely linear, often above 1 inch long, the margins recurved, glabrous above or sprinkled with appressed hairs and obscurely veined; silky underneath, the whole leaf 6 to 8 inches long and nearly as broad.

Racemes.—Secund, 3 to 4 inches long, solitary or several together on very short leafless branches on the old wood.

Pedicels.—Slender, about half inch long, glabrous as well as the rhachis. Corolla glabrous outside and in, the tube nearly 3 lines long, scarcely dilated at the base, revolute under the ovoid limb.

Torus.—Slightly oblique.

Gland.—Prominent, semi-annular.

Ovary.—Glabrous, stipitate.

Style.—Long.

Stigmatic disk.—Somewhat oblique, with a central cone.

Fruit.—Broad, very oblique, 8 or 9 lines long.

Seeds.—Winged all round. (B.Fl., v. 459.)

Botanical Name.—*Grevillea.*—Robert Brown, in his *Prodromus Floræ Novæ-Hollandiæ,* dedicates the genus to "Caroli Francisci Greville, viri omnibus titulis nobilis, rei naturalis Mineralogiæ præcipue et Botanices docti cultoris et patroni." This was the Right Hon. C. F. Greville, an active patron of botany at the beginning of the 19th Century. I have quoted the original dedication, because Pritzel and some other authors say the genus was named in honour of Robert Kaye Greville, author of well-known works on Cryptogams. Personally, I hope the genus will keep the memory green of both good men. *Robusta* (Latin), strong and firm, in allusion to the size of this species, unusual for a *Grevillea.*

Vernacular Name.—Hooker (*Bot. Mag.*, t. 3184) says: "From its deeply dissected foliage and the silkiness of the underside, it has obtained the name of 'Silk Oak' among the pine-cutters of Moreton Bay." When split on the quarter this timber shows a handsome oak-like grain, the prefix "silky" being either because of the silky underside of the leaves, or on account of the bright appearance of the freshly split wood. Hooker's statement, written in 1832, may be the true explanation of why the name was originally applied. On the northern rivers I have known it to be called "White Silky Oak" and "Black Silky Oak," though I have not been able to clearly understand the difference.

Aboriginal Names.—It was formerlly called "Warra-garria" by the aborigines of the Richmond and Clarence Rivers, and "Tuggan-tuggan" by those of Southern Queensland (W. Pettigrew), "Koomkabang" of those of Bundaberg, Queensland (Keys).

Synonym.—*G. umbratica*, A. Cunn. (Meissner in De Candolle's Prodromus, XIV, 381.)

Leaves.—The graceful fern-like foliage of this plant causes it to be cultivated as a pot plant for table adornment. In Ceylon the tree is much planted, and the *Tropical Agriculturist* says :—

> We have just heard from a mid-Dimbula planter of *Grevillea* leaves being used as a substitute for paddy straw, as a bedding for cattle, sheep, pigs, and even for horses. The trees are lopped up, the branches carried to the store, where the leaves speedily drop off and are used for bedding for cattle, etc., with satisfactory results, especially in an economical point of view.

With us the tree is semi-deciduous.

Bentham points out that under cultivation the leaf is sometimes a foot long, almost tripinnate, with numerous pinnæ and narrow acute segments.

Tassi, in *Bull. Lab. ed Orto Botanico di Siena*, Fasc. 2–3, Tav. XI, 1, 2, depicts sections of a leaf and petiole.

Flowers.—The tree bears a profusion of orange-yellow flowers which, like those of most members of the Natural Order to which it belongs, are rich in honey, and hence are sought after by bees. They add greatly to the ornamental character of the tree which, in full bloom, is a striking object.

Fruit.—This is sufficiently described by the plate. The winged seeds are very light, are suddenly released from the follicle, and are blown away by the wind. As the trees are a considerable height it is not always easy to collect the seed just as it ripens, and hence it is always expensive.

Timber.—Its chief characteristic is its fissility. It is light in colour, and has a handsome oak-like figure.

Although distinctly a pretty wood, yet on account of its lightness of colour it has not the same rich appearance as many proteaceous timbers. It is moderately hard, and works well. Two well-seasoned slabs of this wood have weights which correspond to 38 lb. 14 oz. and 36 lb. 2 oz. respectively per cubic foot. In the Sydney Mint experiments, 1860, the specific gravity is given at ·564, equivalent to a weight of 35 lb. 4 oz. per cubic foot.

Gamble, *Manual of Indian Timbers*, page 318, describes an Indian grown specimen in the following words :—

> *Grevillea robusta* has a rough bark, 3-16th inch thick. Wood hard, light reddish brown, sapwood greyish white. Pores moderate sized, scanty, in concentric patches of white tissue. These concentric patches are interrupted by the medullary rays, and bend outward where they meet the rays, so that the concentric bands have a wavy outline. Medullary rays broad and very broad, very prominent on the radial section, showing a beautiful silver grain. The heart-wood seems durable, but the sap-wood decays quickly. It would be a handsome furniture wood.

Perhaps the New South Wales timber which has been spoken of more than any other for wine casks is the silky oak. Mr. Thomas Hardy, of South Australia, placed shavings of this wood in light wines for two months without affecting the taste and colour of the latter. He pronounces the wood suitable in other respects, and therefore suitable for casking wine, and the opinion of an authority so eminent must carry great weight. Silky oak would not leak when split on the quarter, and Mr. Hardy has been instituting inquiry as to whether the staves would leak when the wood was cut across the grain. Silky oak appears too porous to hold such liquids as spirits.

Formerly it was used to a large extent on the northern rivers of our own State, and still in Northern Queensland, for tallow casks. It has also been largely used for butter-kegs. It does not appear to be affected by long immersion in brine, nor does butter placed in contact with it for any reasonable period acquire any appreciable taste of the wood. For all these purposes it must be cut or sawn on the quarter, to avoid leakage or soakage. In the old days, before the advent of galvanised iron, it was almost exclusively used in the Northern districts for milk-buckets and dairy utensils, for which purpose it gave great satisfaction. The extension of the use of butter-boxes is causing butter-kegs to be superseded, and therefore increased attention should be given to the utilisation of this timber for dairy appliances of various kinds, *e.g.*, hands, pats, and rammers for butter. If our timber merchants would study the special requirements of butter factories and firms and companies which deal wholesale in or export this important commodity, they would find that it would be to their advantage.

Its pretty grain renders it a suitable wood for certain picture frames, and Mr. R. D. Hay suggests that it is specially suitable for engravings and photographs.

Now that *Grevillea robusta* is getting scarce, I would like to draw public attention to what I believe to be a perfect substitute for it. The commonest tree in the Dorrigo Forest Reserve is one known to botanists as *Orites excelsa*, and its wood usually passes as silky oak. I examined the timber carefully in the forest, and brought a few pieces to Sydney. Everybody I have shown them to pronounces them to be silky oak. At the present time, if there is any difference between the *Orites excelsa* timber and that of *Grevillea robusta*, I do not know what it is, and it is evidently not of a superficial character. I was pleased to make this discovery, as there is a perfect mine of the silky oak in the Dorrigo. There are millions upon millions of feet of it, and at present not a stick is used. But even if it be not used for wine casks, the time will come when it will be used for butter or tallow casks, or for some other humbler yet useful purpose.

The Dorrigo is not the only place on the northern rivers, by any means, in which this second silky oak can be abundantly obtained. The difficulty in the way hitherto has been the cost of carriage, but roads into these places are being gradually opened up.

The following is an extract from the *Tropical Agriculturist* of Ceylon :—

. . . . But we were greatly interested in a stable door composed of fine planks of a Grevillea tree, certainly not more than sixteen years old (if that), which had been cut down and converted into timber. Made into the door when freshly sawn, this valuable wood had subsequently seasoned without in the least warping. Such being his experience we were not surprised to learn that the owner intended to cut down some of the older Grevillea trees which can be spared from the large number at Lorne, to be converted into floor boards.

Exudations.—For an account of a gum-resin from this well-known tree see Fleury.* Maiden† shows that the silky oak belongs to the small list of trees that exude both a gum and a resin. Lauterer‡ also gives an account of the resin. A research on the interesting exudation from this well-known species is a desideratum.

The substance was exhibited in the New South Wales Court, Paris Exhibition, 1867.

The following are some notes on the exudation by Mr. W. Baeuerlen, who collected it for me on the northern rivers :—" When quite fresh and soft it is of a peculiar yellow colour, but on hardening it assumes something of a flesh or wine colour. It has an extremely disagreeable smell. . . . The local opinion is that there is more gum during very rainy weather than during drier times. The country people look upon it as a nuisance, as it sticks to the horses' manes when they rub themselves against the tree."

A few years ago a Sydney timber merchant sent to me a quantity of material which "looked like whiting," and which was found in the middle of a log of silky oak he was cutting up. Earthy-looking deposits in timber are rare, hence it was subjected to chemical examination.§ Mr. Smith continued the research‖ by examining the sap, collected as fresh as it was possible to obtain it, logs being cut into short lengths and allowed to drain into a receptacle. He detected butyric acid in the sap, which substance does not appear to have been previously found in the sap of any tree. The succinic acid contained in the solid substance described in the former paper was probably derived from the natural oxidation of butyric acid.

Mr. R. D. Hay informs me that in the Dorrigo the Carabeen (*Sloanea Woollsii*, F.v.M.) is disliked by the sawmillers, because of a deposit (locally known as "flint") in the log, near the heart, which injures the saw. This deposit resembles lime in appearance, is clipped by a knife with difficulty, and has not yet been subjected to chemical analysis.

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* Fleury, G.—" *Grevillea robusta* gum-resin." *Journ. Pharm.* (5) ix, 479. *Journ. Chem. Soc.*, xlviii, 238. Investigation of a gum-resin found on some trees of *Grevillea robusta* in Algeria.

† Maiden, J. H.—" Gums and a resin produced by Australian Proteaceæ." *Proc. R.S., S.A.*, 1889, page 54.

‡ Lauterer, J.—" Gums and resins exuded by Queensland plants chemically and technologically described." From pages 35 to 80 of F. M. Bailey, *Botany Bulletin*, No. xiii (April, 1896), " Contributions to the Queensland Flora."

§ Maiden, J. H., and Smith, H. G.—" On a natural deposit of Aluminium Succinate in the timber of *Grevillea robusta*, R.Br. *Proc. Roy. Soc., N.S.W.*, 1895, page 325.

‖ Smith, H. G.—" On the constituents of the sap of the Silky Oak," *Grevillea robusta*, R.Br., and the presence of butyric acid therein. *Ib.* 1896, 194.

We know so little about the accumulation of "earthy" matter in the stems of trees that the following information in regard to such substances in Indian timbers is valuable.

Presumably the lime must be taken up in solution by the roots in large quantities, and then deposited in the manner described.

Some white marks on the cut stump of an Asan tree (*Terminalia tomentosa*, W. and A.) caught my eye, and these on examination proved to be sections or laminæ of calcareous matter, which alternated with the ordinary rings of woody growth. How this calcareous matter found its way into such a position it is difficult to say; but its occurrence is, perhaps, not more singular than that of silica in the joints of bamboos, where, as is well known, it sometimes forms what is called "tabasheer." The rocks about were gneisses and schists, and I could discover nothing in the soil to account for the peculiarity.

About a year previously, or in April, 1870, the fact of the occurrence of calcareous masses in timber had been brought to the notice of the Asiatic Society of Bengal by Mr. R. V. Stoney, who stated that many trees in the Orissa Tributary Mehals have pieces of limestone (or calcareous tufa) in fissures in them; but principally Asan (*Terminalia tomentosa*, W. and A.), Swarm (*Zizphus rugosa*, Lam. ?), Sissu (*Dalbergia sissu*, Roxb.), and Abnus (*Diospyros melanoxylon*, Roxb.). In some cases, irregular-shaped pieces, 7 inches long by 2 inches thick, were met with in the trunks at a height of about 6 feet from the ground. By the natives the lime is burnt, and used for chewing with pawn. On examination it was found that there was no structure in these masses which would justify a conclusion that they had been formed by insects. Some included portions of decayed wood seemed to be cemented together by the lime. Though I have not had an opportunity of consulting many botanists on the subject, I believe it to be the case that the occurrence of deposits of carbonate of lime in timber has not been met with elsewhere. Oxalate of lime is sometimes met with in vegetable tissues; but in the form of carbonate, I am informed, however, that there is no record case of lime have been found, and such also appears to have been the opinion of the late Dr. Kurz. (J. Ball in *Nature*, xxi, 376.)

Following is information supplementary to the preceding :—

That *Terminalia tomentosa* contains calcareous matter has been known to natives, and a reference to Tennent's "Ceylon," i, 99, will show that they make a practical use of their knowledge by using the ashes of the bark as the substitute for lime, to chew with betel. Another southern tree which contains an alkali in its bark is *Avicennia tomentosa*. Again, as regards Mr. Stoney's observation of calcareous masses in timber, which was brought to the notice of the Asiatic Society of Bengal in 1870 as a fresh discovery, it seems strange that the learned body in question did not know that the existence of such concretions, so far as from being very rare, is an occasional and well-known phenomenon. Thus, in the *Madras Journal of Literature and Science* for April–September, 1858, page 142, Prof. Mayer gives a qualitative analysis of the concretion of the kind found in a teak log. It consisted chiefly of magnesia, with potash, lime, silica, and a trace of iron. The substance, he says, "must be looked on as a mixture, and not a true chemical compound." Again, he observes, "as a whole the substance thus hardened is insoluble in cold, and but slightly so in water of higher temperature. At 212 deg., however, there is sensible action after a time. In diluted hydrochloric acid solubility ensues, hastened by increased temperature. Solution is attended by a slight effervescence, some carbonic acid being liberated." He then proceeds to give an explanation of the process by which such mineral matters may be taken up from the soil and deposited in the tree. So far as I know the occurrence of such concretions in India was first brought to notice by Lieutenant, now Colonel Hawkes, of the Madras Army, in 1858. He had seen them only in teak logs, and remarked that they generally occur "in what carpenters call a shake in the wood, but with this exception the logs are perfectly sound, and no communication whatever with the external air has been observed." (G. Bidie, Madras, *Nature*, xxii, 169.)

Size.—It rarely attains a height of more than 60 feet to 80 feet, and a stem diameter of more than 2 feet or 3 feet. But its sapwood is small and there is little waste. Given even moderately favourable conditions it is a very rapid grower, at all events for the first few years. I do not think it is a long-lived tree, at all events as regards cultivated specimens, usually exhibiting signs of senile decay after fifty years.

Habitat.—In the brush forests of the Clarence River northwards up to Northern Queeensland, but not extending many miles back from the coast.

Under cultivation not only in our own State, but in other parts of the world, it has shown that it is drought-resistant to an extent that would hardly be supposed from consideration of the localities with ample rainfall in which it is indigenous. This affords an illustration of the fact that in acclimatisation experiments one must not adhere too slavishly to the climate and soil conditions of a plant in its original habitat.

The *Tropical Agriculturist* states that, "certainly for beauty of foliage, for tenacity of vitality (it scarcely ever fails in planting), for fair rapidity of growth and value of timber at a comparatively early age, it is one of the most valuable gifts which Australia has bestowed on Ceylon. It flourishes from sea level to 6,000 feet, and we do not wonder at its popularity and wide diffusion. If a *Casuarina* or a *Frenela* is allowed to grow somewhat big in the nursery it almost infallibly dies when planted out, while the Grevillea flourishes equally as a seedling, a well-grown plant, or as a stump.

The faith felt in the beneficial influence of Grevilleas, planted along with tea especially, continues to gather strength among Ceylon planters. These trees afford shelter from the wind, supply an ample litter with fallen leaves, and the roots penetrate and open up what is often a hard subsoil."

For notes in its growth in Jamaica, see the *Bulletin of the Botanical Department of Jamaica.*

Propagation.—From seed, which readily germinates. This tree has been recommended for street-planting. Its semi-deciduous character is against it for that purpose according to some ideas, but it is a tree concerning which any other fault can scarcely be found. Its fern-like foliage is of great beauty, while the tree is hardy if allowed the shelter of other trees.

EXPLANATION OF PLATE.

A. Flower-bud.

B. Expanded flower.
- *a.* Corolla.
- *b.* Ovary, which is stipitate.
- *c.* Style.

C. Petal (Bentham's perianth-lobe), with sessile anther.

D. Stigma.

D. Pedicel with ovary, the corolla removed.
- *a.* Pedicel.
- *b.* Stipitate ovary.
- *c.* Semiannular disc.

F. Follicles showing the dehiscence,

G. Seed, winged all round.

No. 2.

Ficus rubiginosa, Desf.

The Rusty Fig.

(Natural Order URTICACEÆ.)

Botanical description.—Genus, *Ficus,* Linn.

Flowers.—Unisexual, minute, enclosed in a hollow globular ovoid or pear-shaped receptacle called a fig or synœcium; the minute orifice enclosed by bracts turned inwards, or the first rows erect outwards.

Male flowers.—Usually near the mouth of the receptacle, very rarely in separate receptacles, and often very few.

Perianth.—Of three to six lobes or segments, imbricate in the bud, rarely reduced to a single one.

Stamens.—One, two, or rarely more, opposite the perianth segments; anthers two-celled or the cells confluent at the apex.

Female perianth.—Usually with narrower segments than the male, and very much reduced or almost none.

Styles.—Usually lateral, at least after the growth of the ovary, filiform with a terminal peltate, oblique or elongated and with unilateral stigma, sometimes unequally two-branched in species not Australian.

Ovule.—Pendulous or laterally attached near the top.

Fruiting receptacle.—Usually enlarged, but remaining closed, the small seed-like nuts surrounded by the membraneous or succulent persistent perianth.

Embryo.—Curved in a fleshy albumen, usually rather scanty. Trees or shrubs with the juice usually milky.

Leaves.—Alternate or opposite, entire or lobed, penniveined, and usually more or less distinctly three-nerved at the base.

Stipules.—Usually very deciduous, convolute on the young buds.

Receptacles.—Usually in pairs or solitary by the abortion of one of each pair, either axillary or on the old wood, and then often forming clusters or racemes on short leafless branchlets.

Bracts.—Usually three, often small and scale-like, either at the base of the receptacle or along the pedicel below it. Bracts within the receptacle subtending the flowers usually very numerous, varying with the perianth in consistence and colour, those near the orifice of the receptacle usually rather larger, without flowers, and closing the orifice, the outermost rows sometimes exserted and erect, but usually horizontal and inflexed, those subtending the flowers sometimes very minute or replaced by hairs or setæ or obsolete.

Male flowers.—Usually fewer than the females, and in the upper part of the receptacle, sometimes numerous and intermixed with the females or in separate receptacles. (B.Fl., vi. 160.)

M. Flockton, del. et lith.

THE RUSTY FIG.

(Ficus rubiginosa, Desf.)

Botanical description.—Species, *F. rubiginosa*, Desf., Vent., Jard., Malm., t. 114.

A tree of considerable size, with spreading branches, throwing out woody roots, which descend to the ground, forming pillars as in the Indian Banyan Tree* (*F. indica*), the young shoots and petioles more or less ferruginous pubescent.

Leaves.—On petioles of ½ inch to 1 inch, oval or elliptical, obtuse or very shortly and obtusely acuminate, entire, rounded or very slightly cordate at the base, 3 to 4 inches long, and 2 to 2½ broad when full grown, coriaceous, glabrous above, more or less ferruginous-pubescent underneath, with numerous parallel very divergent primary veins, of which ten to twelve on each side of the mid-rib are rather more prominent than the others, and the basal pair more oblique.

Stipules.—Narrow-acuminate.

Receptacles.—Axillary, mostly in pairs, on thick broadly terminate peduncles of 1 line or rather more, globular, about 4 or 5 lines in diameter, usually marked with prominent warts.

Subtending bracts.—Broad, membraneous, about 2 lines in diameter, very deciduous.

Male flowers.—Intermixed with the females.†

Bracts.—Acuminate, brown as well as the perianths.

Anther-cells.—Confluent at the apex into a single reniform cell, and at length very divergent so as to appear to open transversely.

Stigma.—Linear and acute, not very long. (B.Fl., vi. 168).

Botanical Name.—*Ficus*, Latin, a fig or fig-tree; *rubiginosa*, Latin, rusty.

Vernacular Names.—"Port Jackson Fig," "Illawarra Fig," from the best known localities. "Rusty Fig," because of the ferruginous appearance of the young shoots, &c. "Native Banyan," "Narrow-leaved Fig," "Small-leaved Fig," in comparison with the "Large-leaved Fig" (*F. macrophylla*).

Aboriginal Names.—"Dthaaman" of the Port Jackson aborigines. The late Sir William Macarthur, in his catalogue of exhibits for the London Exhibition of 1862, gives the name "Baira" to the "Small-leaved Fig" and "Warrauka" to the "Smallest-leaved Fig." Both aboriginal names probably refer to this species, but the tribes who used the names are not mentioned, and the "Baira" is simply referred to as "another giant of the cedar brushes," and "Warrauka" as "the largest tree of the cedar brushes." "Pingy" of the Port Curtis (Queensland) blacks (C. Hedley).

Synonyms.—

F. australis, Willd., Sp., Pl. iv, 1138.

Urostigma rubiginosum, Gaspar, Nov. Gen., Fic. 7, quoted in his *Ricerch. Caprif*, 82, t. 7, 6 to 13.

By nurserymen this tree is commonly known as *F. australis*.

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* This refers more particularly to the Banyan of Lord Howe Island (*F. columnaris*, F.v.M. and Moore), considered to be a form of *F. rubiginosa* by Bentham.

† And a few gall-flowers.—J.H.M.

The species is very largely cultivated in New South Wales, and the plants display a considerable amount of variation. For example, there is an entirely glabrous form in the Sydney Botanic Gardens, which has been labelled *F. lucida* for many years. I can find no authority for this name, and it should be called *F. rubiginosa*, Desf., var. *lucida*, Hort. Syd.

Leaves.—The Moreton Bay Fig (*F. macrophylla*, Desf.) is an excellent fodder plant, cattle and horses eating the leaves, young twigs and figs with great zest. For further particulars, see *Agricultural Gazette*, 1893, page 609, and 1894, page 206.

The Small-leaved Fig (*F. rubiginosa*, Desf.) is less used for this purpose, probably because it is less frequently planted, but it appears to be of equal value as a fodder plant, and doubtless other of our native figs may be put to similar uses. I have known cows fed all the year round on leaves and figs which dropped from these trees.

Flowers.—The structure of the inflorescence of *Ficus* can be ascertained by the student by reference to most text-books in which the common edible fig (*Ficus Carica*) is dealt with. There are excellent figures, for example, in Kerner and Oliver, ii, 157. Those who have the opportunity should refer to Sir George King's magnificent work on "The species of *Ficus* of the Indo-Malayan and Chinese countries," in the *Annals of the Royal Botanical Garden, Calcutta*. The flowers of *F. rubiginosa* are depicted on our plate.

Fruits.—At page 8 Bentham calls the fruit of a fig a Synoecium, Kerner and Oliver a Synconium, Prantl and Vines and Warming and Potter a Syneonus. The "Fig" consists of the fleshy axis of the inflorescence, which is deeply concave, and on the inner surface of which the minute flowers (which later on develop into achenes or "seeds"), are borne. The cavity at the end of the fig farthest away from the stalk is enclosed by small bracts. The name Receptacle seems to be as descriptive and as convenient as any to apply to the "Fig." The fruits of *F. rubiginosa*, which are full of seed, were an article of food of the Port Jackson natives, but the early colonists found them "very nauseous." Mr. C. Hedley states that they are eaten by the Port Curtis (Q.) blacks.

Fibre.—The fibre of the root of this tree is of great durability, and is used by the aborigines in the fabrication of their scoop fishing-nets. The inner bark forms a loose fabric taken off carefully. A similar fibre is produced, and more abundantly, by *F. macrophylla*.

Trunk.—This and other figs in our northern forests have plank-like or buttress-like expansions of the stem, near the root, which are sometimes as deep as horse-stalls. The following description of certain trees in the Malay Archipelago will directly apply to our fig :—

Others, again, and these are very characteristic, send out towards the base flat and wing-like projections. These projections are thin slabs radiating from the main trunk, from which they stand out like buttresses of a Gothic cathedral. They rise to various heights on the tree, from 5 or 6 to 20 or 30 feet. They often divide as they approach the ground, and sometimes twist and curve along the surface for a considerable distance, forming elevated and greatly compressed roots. These buttresses are sometimes so large that the spaces between them, if roofed over, would form huts capable of containing several persons. Their use is evidently to give the tree an extended base, and to assist the subterranean roots in maintaining in an erect position so lofty a column, crowned by a broad and massive head of branches and foliage.—("Tropical Nature and other Essays," Wallace, page 31.)

Timber.—The timber is soft, brittle, and spongy ; it is, however, sometimes used for packing-cases. It is light in colour as well as in weight, and although sometimes it shows a pretty grain, it would be waste of labour to spend much time upon it. A well-seasoned slab of this wood had a weight which corresponds to 28 lb. 8 oz. per cubic foot.

Exudations.—This fig, like others of the genus, exudes a juice when the bark is wounded. It is neither a gum or a resin, but belongs to what may be called the "India-rubber Group." It consists of a dried milky juice or latex (of which examples are afforded by other natural orders common enough in Australia, *e.g.*, *Euphorbiaceæ* and *Asclepiadaceæ*). For information in regard to the physiology of the subject see the text-books, such as *Botany*, by Sachs (Vines), pp. 85, 94, &c. It is put to no useful purpose as regards our native species. It has formed the subject of De la Rue's and Muller's chemical investigation.*

The official catalogue of New South Wales exhibits (Paris, 1855) contains the following information in regard to this particular specimen :—

Perforated waxy substance, exuded from the bark of the native fig, *Ficus ferruginea* (an obsolete name, and the substance is attributed by Sir William Macarthur to *F. rubiginosa*), exhibited by W. Stephenson, Esq., surgeon, from the Manning River. A remarkable substance, possessing the properties of gutta-percha and bird-lime combined, and which can be obtained in the Colony in any quantity. It softens by heat like gutta-percha, and like that substance can be moulded into any shape while warm, which it retains when cold, but becomes brittle. When very hot it is so strongly adhesive that it cannot be touched by anything without sticking most obstinately to it.

Mr. P. L. Simmonds said of the specimen :—

An elastic gum-resin from an Australian Ficus was shown at the Paris Exhibition of 1855 in the New South Wales collection, in small tears of a dingy appearance, which might prove useful. A large portion dissolves in warm linseed oil, but spirits of wine does not act readily upon it. By mastication it becomes tenacious, and bleaches thoroughly.

From the above and from statements in the original paper, there is no doubt that the substance acted upon was picked already dried from the trees, and, on

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*Rue (W. De la) and Muller (H.)—"On the resin of *Ficus rubiginosa* and a new homologue of Benzylic Alcohol." *Phil. Trans.*, Vol. 150, 43 (1860). *Journ. Chem. Soc.*, xv, 62 (1862). *Watt's Dict.*, ii, 646, and v, 645. (Sycocerylic acid, &c.) *see Gmelin*, xvii, 43, for fuller bibliography. An exhaustive chemical research on a sample of dried latex from the Manning River. A resin, called by the authors Sycoretin, is found in it, and this resin and its derivatives are described at length.

account of the delay in experimenting upon it, it was a very old specimen when analysed. I procured a small quantity of the milky juice (latex) of this species, and obtained it *quite fresh.* It was obtained in the spring by auger holes well through the bark. Whether a tree will yield any liquid at a particular time is uncertain, and can be ascertained only by tapping. It apparently in no way differs from the Moreton Bay fig juice (*F. macrophylla*), so familiar to the people of New South Wales. It was of the consistency and colour of thick cream and perfectly homogenous when freshly exuded. It gradually separates in two layers—a creamy or grey-coloured portion and a brown liquid of hardly higher specific gravity than water. Both layers continue to darken in colour. Analysis of this milky juice, completed within a month of exudation, remains a desideratum. A specimen I sent to Professor E. H. Rennie, of Adelaide, was examined by him and Mr. Goyder.*

The following letter† was written at my instigation to the Director of the Royal Gardens at Kew, by the Minister for Mines and Agriculture :—

You are aware that ever since the paper of Warren de la Rue and Hugo Muller (*Phil. Trans.*, 1860; *Journ. Chem. Soc.*, 1862, p. 62; Watts' Dict., ii, 646) spasmodic attempts have been made to extract the caoutchouc which is contained in the juices of our native figs, notably *F. rubiginosa* and *F. macrophylla.* The latest and most serious attempt to ascertain the chemical composition of these juices is a paper by Professor Rennie and G. Goyder, entitled, "The Resins of *Ficus rubiginosa* and *F. macrophylla.*" (Preliminary Notice); *Journ. Chem. Soc.*, lxi, 916.

In order to satisfactorily ascertain whether extraction of the caoutchouc from these fig-tree juices can be profitably carried on in New South Wales, I am anxious to learn of the most approved method of dealing with juices of this class. I have read with interest the following articles in the *Kew Bulletin* :—

(a) Lagos Rubber (*Ficus Vogelii*, Miq.); November, 1888, p. 253.

(b) West African Rubbers; March, 1889, p. 63.

(c) Lagos Rubber; May, 1890, p. 89.

These all refer to *Ficus* juices, and it is perhaps a fair inference that our trees should be dealt with similarly to the West African ones, and that the resulting products are similar.

I gather from the above reports that the experiments of Mr. Alvan Millson at Lagos, in the matter of extraction of the India-rubber (caoutchouc) from the Ficus juices, are not altogether satisfactory, and some friendly criticism was given by the India-rubber, Gutta-percha and Telegraph Works Company of Silvertown (page 258, November, 1888). But neither in this nor in subsequent issues of the *Kew Bulletin* do I find explicitly stated what is the method recommended for the treatment of the Ficus juice. At certain seasons of the year the juice (latex) of our native figs flows freely and abundantly if the tree be cut with an axe. This juice could be readily collected in kerosene tins. I shall be glad if you will kindly inform me how this juice should be treated, and in what quantity, and in what condition, should the sample be that I sent to London, with the view of obtaining expert opinion in regard to the probable commercial value of the article.

By this post I send you a specimen of Ficus juice, and also one of crude caoutchouc "obtained by evaporation," by a correspondent of this Department. They are small specimens, and I have not broken the seal since I have received them, as fermentation may be set up. I do not know whether they will be of any assistance to you in giving me the advice I ask for, as I presume you will require to see the caoutchouc prepared according to the method you will suggest; meantime any information will be much appreciated.

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* Rennie (E. H.) and Goyder (G.)—"The Resins of *Ficus rubiginosa* and *F. macrophylla* (Preliminary Notice).' *Journ. Chem. Soc.*, lxi, 916.

† "Native Juices and Caoutchouc (India-rubber)." *Agricultural Gazette*, N.S.W., November, 1894, page 759.

The following is an extract from the reply of the Director :—

The problem which the Department of Mines and Agriculture has before it is precisely similar to that which baffled the Government of Lagos in the case of *Ficus Vogelii*, and I am in possession of no further information upon it. There is no general method known for separating the caoutchouc from the "milk" in which it is mechanically suspended. The methods in practical use vary in different countries and with different kinds of trees from which the milk is drawn. Samples of milk have been repeatedly sent to this country for further investigation of the problem—How best to produce "coagulation"? But this can only be advantageously studied on "fresh samples." When they reach this country they have ordinarily undergone so much alteration that no practical results are attainable.

The following is an extract from the report of the India-rubber, Gutta-percha, and Telegraph Works Company of Silvertown, on the samples enclosed in the Minister's letter to the Director of Kew :—

No. 1 was contained in a wide-mouthed bottle, and was in the form of a solid ; a sample we return as requested. It yielded about 7 per cent. of the substance closely resembling india-rubber, and about 73 per cent. resin. It is probably of no use as a source of india-rubber.

No. 2 came to hand in the form of a milky liquid, and yielded, after being evaporated to dryness, 7 per cent. of a substance similar to caoutchouc and 89 per cent. of resins. We send you a sample of the dried juice. This was simply evaporated in a dry vessel without heat, which would be the best way of obtaining it, should it be hereafter found to have a commercial value.

We also send samples of the resins extracted by alcohol.

In the above report we have not been able to give you an estimate of the value of these materials, as it is impossible to do so with such small samples ; we should require at least 28 lb. of each.

Experiments at the Hamma Garden near Algiers, to obtain a coagulable latex from *F. macrophylla* have been abandoned, only negative results having been obtained. (*Rev. des Cult. Coloniales*, 20th September, 1901, page 188.) *F. rubiginosa* yields a similar juice, and it seems to me that it is waste of time and money to further attempt to obtain india-rubber, on a commercial scale, from either of the trees in question.

I am of opinion that the Asiatic *Ficus elastica* is the only species of fig which, if planted in the warmer coast districts of New South Wales, promises to be commercially important as a source of india-rubber in this State.

Roots.—Everyone has noticed the long, slender, aerial roots that hang from the branches, and which are more abundant and robust in warm, moist localities. In Lord Howe Island a fig looked upon by some botanists as specifically identical with our Port Jackson fig is called the banyan, as its aerial roots descend to the ground and form secondary stems, just as in the case of the well-known banyan of India.

On the Northern rivers these fig-trees often begin life on the moist bark of another tree, and their aerial root system attains great development. It is a common thing to see a huge tree being completely enveloped in the aerial roots of a fig, which finally smother the host tree out of existence so completely that it would not be known that the fig is taking the position of another unless the process of strangling had been observed.

Even in colder New England Mr. A. R. Crawford noticed trees sending down aerial roots 30 feet distant from the main stem, some nearer forming new stems, others 30 feet in height descending along Angophora stems, enclosing and suffocating them.

Size.—Planted trees as ordinarily seen are not large; but in its native forests this species may attain a great size, up to 100 and even 150 feet, and with a trunk diameter of 6 feet and more. There are some fine specimens near Dapto; but it attains its greatest dimensions on the Northern rivers.

Habitat.—Chiefly in the coastal districts, but extending as far west as near Narrabri, Tamworth, and Jenolan Caves. Northerly its extends into Queensland, southerly to Bateman's Bay; but its range in that direction is not defined. Westerly we require more localities before we can define its "curving boundary."

Propagation.—Readily from seed. In the brushes it originates as an epiphyte upon some tree, and as it grows it envelops its host, and finally destroys it with its plastic, spreading trunk and roots.

EXPLANATION OF PLATE

A. Gall flower.

B. Female flower.

C. Male flower.

D. A receptacle (fig).

E. Longitudinal section of the same.

M. Flockton, del. et lith.

THE TURPENTINE-TREE.

(*Syncarpia laurifolia*, Ten.)

No. 3.

Syncarpia laurifolia, Ten.

The Turpentine-tree.

(Natural Order MYRTACEÆ.)

Botanical description.—Genus, *Syncarpia*, Ten.*

Calyx-tube.—Turbinate or campanulate, adnate to the ovary at the base, the free part erect or dilated ; lobes four or rarely five, persistent.

Petals.—Four or rarely five, spreading.

Stamens.—Indefinite, free, in one or two series, sometimes interrupted between the petals, filaments filiform ; anthers versatile, cells parallel, opening longitudinally.

Ovary.—Inferior, flat-topped or convex, scarcely depressed round the style, two or three celled, with one or several ovules in each cells ; erect on a basal placenta.

Style.—Filiform, with a small stigma.

Capsule.—Included in and adnate to the calyx-tube, opening loculicidally in two or three valves.

Seeds.—Linear-cuneate, testa thin, embryo straight, cotyledons plano-convex, longer than the radicle.

Leaves.—Opposite, penniveined.

Flowers.—In dense globular heads, either solitary on axillary peduncles or forming terminal panicles. (B.Fl., iii, 265.)

Botanical description.—Species, *S. laurifolia,* Ten. in Mem. Soc. Ital. Sc. Modena, xxii, t. 1.

A large tree, the young shoots and underside of the leaves more or less hoary pubescent or glaucous.

Leaves.—Appearing sometimes in whorls of four, from two pairs being close together, from broadly ovate, to elliptical-oblong, obtuse or obtusely acuminate, glabrous above, 2 to 3 inches long, on petioles of $\frac{1}{4}$ to $\frac{1}{2}$ inch.

Flowers.—White, united, six to ten together in globular heads, on peduncles of $\frac{3}{4}$ to 1 inch at the base of the new shoots, with two to four bracts close under the head, either short and scale-like or leaf-like, and exceeding the flowers.

Calyces.—Connate at the base, the free parts broadly campanulate, softly hoary-pubescent, 1 to $1\frac{1}{2}$ lines long, lobes short, broad and obtuse.

Petals.—Broadly ovate or orbicular, about $1\frac{1}{2}$ lines long.

Stamens.—Three to four lines long, in about two rows round a flat disc fully 3 lines in diameter.

Ovary.—Flat-topped, tomentose, three-celled, with rather numerous ovules in each cell, erect on an oblong placenta.

Fruiting heads.—about $\frac{1}{2}$ inch in diameter, the calyces connate to about the middle. (B. Fl., iii, 265.)

Bentham recognises a variety, *glabra*, "Quite glabrous, even the calyx. Flowers rather small. Hastings River."

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* See Tenore "Sopra i due nuovi genera Syncarpia e Donzellia," Modena, 1840 (4to), a work I have not been able to consult.

Botanical Name.—*Syncarpia*, indirectly from two Greek works, *sun*, together, and *karpos*, a fruit, in allusion to the heads of fruits which have their calyces joined or grown together (connate). This may readily be seen from the figure.

Vernacular Name.—"Turpentine-tree." It is so-called because of the resinous exudation which flows from between the bark and the wood when the timber is cut into. It is an unfortunate name, as it suggests inflammability, and turpentine is one of the most uninflammable of timbers. In some districts the fresh red-coloured turpentine is called "red-turpentine" to distinguish it from the chocolate or dark-brown coloured timber known as "black turpentine." They are the same timber, the latter either being over-matured, or suffering from incipient decay. In the Gosford district the name "silky turpentine" is applied by timber-getters to turpentines in which the bark is thinner and stringy, and the wood comparatively light in colour when freshly cut.

Turpentine timber has scarcely any odour, but I have known of perfectly well-authenticated instances in which men, insisting that turpentine timber is so-called because of an odour of turpentine, were obliged by accommodating timber-getters who sprinkled their logs with turpentine prior to inspection.

Aboriginal Names.—The tree was called Booreeah by the Illawarra blacks (Macarthur), Burra Murra by those of the Ulladulla district (Forester Allan), and Killa Warra by the Brisbane Water blacks, according to the late Sir William Macarthur; "Pearbbie" of those of Frazer's Island (Queensland).

Synonyms.—

Metrosideros glomulifera, Sm., in. *Trans. Linn. Soc.*, iii, 269.

Tristania albens, A. Cunn., in Bot. Reg. under n. 1839; DC., *Prod.*, iii, 210.

Kamptzia albens, Nees., in Nov. Act. Nat. Cur., xviii, Suppl., Praef., 9, t. 1.

Metrosideros procera and *M. propinqua*, Salisb., *Prod.*, 351?

The distinction between the genera *Syncarpia* and *Metrosideros* is so important, as a matter of classification, that I propose to clearly state the case.

Turning to Bentham and Hooker's *Genera Plantarum*, vol. i, p. 694, we have—

Syncarpia.—Flores in capitula globosa pedunculata conferti v. coaliti. Stamina libera. Ovula 1-∞, erecta.

Metrosideros.—Stamina libera, exserta. Ovula ∞- seriata, horizontalia v. ascendentia, placentam dense obtegentia.

Syncarpia is, in the above work, confined to the two species *S. laurifolia* and *S. leptopetala*, which are, however, very different from each other, as will be seen from the following extract:—

"S. laurifolia (Specie normali), *Calyces connati, ovarium* 3-*loculare, loculis multi-ovulatis.*

"S. leptopetala, *Calyces liberi et ovarium* 2-*loculare, loculis* 1-*ovulatis.*" (*Op. cit.*, i, 709.)

Syncarpia laurifolia is the only true *Syncarpia* (according to the meaning of the word). *S. leptopetala* was united with this genus *before* its fruits were known, and left under this genus in the *Genera Plantarum* and *Nat. Pflanzen-Familien.* The latter work followed Bentham in the Order Myrtaceæ apparently uncritically.

Mueller abolished the genus *Syncarpia* altogether, and unites both with *Metrosideros.*

Bailey retains *Syncarpia leptopetala* under that genus, and adds a third species, *Syncarpia Hillii*, which is a true *Syncarpia.*

In my opinion, *Syncarpia laurifolia* and *leptopetala* should not be kept under the same genus; either *Syncarpia* should be confined in New South Wales to *laurifolia*, and *leptopetala* united with *Metrosideros*, or both should be united with *Metrosideros* and *Syncarpia* reduced to a section of it.

The view I take is to retain the name *Syncarpia laurifolia* for the turpentine-tree, and to place *Syncarpia leptopetala* under *Metrosideros.*

Following is Banks' original definition of *Metrosideros.* I then give Sir J. E. Smith's comments on the species, and description of *M. glomulifera.* Smith's original specimens and also those of Salisbury's *M. procera* and *M. propinqua* were all collected by David Burton.*

Neither work being readily accessible, it will be convenient to many to have the extracts in question.

Metrosideros.—"Calyx monophyllus, quinquedentatus. Cor. pentapetala. Stam. numerosa, discreta, calyci inserta. Styl. unicus. Capsula calycis ventre corticata, infra floris receptaculum posita, tri-l, quadrilocularis. Semina immatura numerosissima, lineari-paleacea; matura paucissima, rotundata aut angulata." (Banks, in Gærtner *de Fructibus*, i, 170, 1788.)

Metrosideros.—Banks, mss. Gærtn., sem., t. 34, f. 2. *Leptospermum*, Forst., Gen., 36, t. 36, f., a-e and m-t. *Icosandria monogynia*, after *Fabricia.* Char. Gen.—Calyx, 5-sidus, semisuperus, petala 5. Stamina longissima, exserta. Stigma simplex. Capsula 3-vel 4 locularis.

That this is a most distinct natural genus from *Leptospermum* as above defined there can be no doubt, though some great botanists have united them. Sir Joseph Banks, however, and Dr. Solander were well aware of their difference, and characterised *Metrosideros* by its very long stamina. The stigma being simple and small, not capitate or depressed, scarcely dilated, I beg leave to propose as a very certain

* Burton was Superintendent of Convicts at Parramatta, at least from 1st May, 1790. He died at Parramatta, 13th April, 1792. See *Historical Records of New South Wales*, vol. 2. Hooker, *Introd. Fl. Tasmania*, was not aware under what circumstances Burton collected in Australia. He doubtless collected between Sydney and Parramatta.

and constant mark of distinction. The habit, moreover, is totally different from *Leptospermum*, and agrees with that of *Melaleuca*; at least this is the case with such species as have alternate leaves, and those with opposite ones have no resemblance to *Leptospermum*.

The petals are concave, nearly sessile, deciduous, generally less coloured than the stamina. The capsule has most generally three valves, and as many cells, rarely four. I believe it might safely be defined *trilocularis* absolutely, but I have mentioned the number four in deference to Gærtner until I can determine and examine all his species, which are very obscure. His *gummifera* is an *Eucalyptus*, and some of his others are very doubtful. The species of this genus, described as *Melaleuca* by the younger Linnæus, and Dr. G. Forster, are also much confused, these authors having mutually misunderstood each other so often and formed their definitions so loosely, that, with most of their original-named specimens before me, I can hardly clear up every doubt, nor can I at present determine how many of Forster's species are among Gærtner's.

*   *   *   *   *   *   *   *

M. glomulifera, foliis oppositis, ovatis, reticulate-venosis subtus pubescentibus, capitulis lateralibus pedunculatis, bracteisque, tomentosis.

Gathered near Port Jackson by Mr. David Burton. It is a tree with round opposite branches. Leaves opposite, on shortish downy footstalks, ovate, entire, a little waved, reticulated with numerous veins, clothed with short soft down on the underside. Flowers greenish-yellow, clustered in little globular heads, which stand on simple downy footstalks about an inch long, growing laterally (mostly opposite to each other), just above the insertion of the uppermost leafstalks and contrary to them. Each head of flowers is accompanied by a pair of oblong downy bractæ, and the calyx is also downy.

This species is but slightly aromatic. It is said to be very rare. (Smith in *Trans. Linn. Soc.*, iii, 269, 1797.)

Metrosideros is from two Greek words, *metra*, the heart of a tree, and *sideros*, iron, in allusion to the hardness of the timber. *Glomulifera*, from *glomulus* (Latin), a little round heap, in allusion to the flowers and fruit-heads.

Leaves.— Somewhat laurel-like, as the specific name denotes. The underside of a dirty white, often with small black patches, caused by a minute fungus.

Flowers.—White, and in small round balls, consisting of a number of individual flowers joined together by their calyces.

Fruit.—Hard and woody, and containing abundance of the brown dust-like seed, which sheds as soon as the fruits get dry. On the fruit are often seen globules of the so-called "turpentine."

Bark.—The bark is of a flaky, fibrous character, and often of a considerable thickness. It is of a brown colour. In large trees it has a furrowed appearance. The bark of our turpentine-tree does not appear to be put to any useful purpose,* but the Hon. W. Pettigrew states that the bark of the Peebeen (*S. Hillii*) is used by the natives of Wide Bay (Queensland) for the purpose of making canoes.

Timber.—In colour it is usually dull red, but it varies to brown or purple-brown. It has a neat and perhaps characteristic grain. Mr. Augustus Rudder says :—"I believe that this timber might be used to advantage in cabinet work, as some of it is handsome, and takes a good polish, and only, I believe, requires proper treatment to make it more highly esteemed for many purposes." It has been successfully used by local billiard-table manufacturers for table-legs.

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* With the exception, an important one, of a covering to the logs. See pp. 22 and 26.

It is said to be comparatively soft and brittle, but perhaps there is some mistake in this, as I have always found it to be as hard as the average myrtaceous timbers, and it is not brittle when the sap-wood is removed. In Professor Warren's work on Australian Timbers there are a number of tests of the strength of this timber.

Like many other myrtaceous timbers, such as myrtles, turpentine is very liable to rend in drying. It also warps when much exposed, unless seasoned with unusual care; this is a drawback to its use for uprights in buildings. In the Jurors' Reports, London International Exhibition of 1862, it is stated to be "the best wood for railway sleepers." At the present day, however, it is never knowingly used for such a purpose, its tendency to warp and rend being against it. Mr. Rudder, however, states that its tendency to warp as sawn stuff is "entirely obviated by a few weeks' soakage in water, and I have seen it after this treatment free from cracks. It steams remarkably well, so much so, that I have observed stout planking successfully turned edgeways at an angle of over 30 degrees."

It is very abundant, as its chief utilisation at the present time is for piles and hewn posts and rails, since saw-millers dislike it exceedingly, as it rapidly dulls their saws. It would be very desirable to subject it to proper microscopic examination; possibly this might throw light upon this property of turpentine. It is not easy to burn, except with a good draught. In such situations as pillars, girders, &c., in buildings it usually only chars, and is in consequence easily extinguished—a very useful property in buildings. I was informed that, in a very large fire in Sydney, surprise was expressed that the building was not gutted, for the wooden girders and joists were put to a very severe test. It was believed that the girders were ironbark, and they were so specified, but the contractor substituted turpentine without anyone being any the wiser. This pious fraud was, however, the means of minimising the destructive effects of the fire. It is very resistant to white ant, but it must be remembered that no timber is absolutely white-ant proof, as white ants, if put to it, will probably eat any timber on the face of the globe. To sum up, its chief recommendation is its durability, resisting decay in the ground, whether from white ant or other causes, while it is one of the best timbers we have for resisting marine borers, especially if the bark be intact. It is very difficult to burn, a great recommendation to its use in buildings. It will thus be seen that the properties of turpentine, those at least which give it its value, are mostly of a negative character.

Its principal use is, besides those indicated in the foregoing paragraphs, as a second-class timber for wood-paving.

At this place I give the substance of a report on this timber, particularly with reference to its resistance to Cobra (Teredo) made by Mr. J. V. de Coque and myself, and ordered by the Legislative Assembly to be printed on the 29th October, 1895.

Introductory.

We visited the Hawkesbury district in December, 1894, and in March last. The local timber suppliers distinguish two turpentine timbers (botanically identical) in this district, viz. :—The swamp turpentine, growing on the flats, and also the hill turpentine, which latter they consider the better timber of the two in point of durability.

In June-July of this year we made most careful investigations at all the timber centres between Hexham and Kempsey, interviewing the timber suppliers, owners of saw-mills, and residents of the different districts, inspecting several bridges and jetties where turpentine timber was in use, visiting the various forests containing turpentine timber, and having several trees felled for our inspection.

The evidence we obtained from many of the leading timber suppliers is of a most conflicting nature, rendering our task of sifting it no easy one. As the bulk of the piles and girders of turpentine used in public works is supplied from the districts we traversed, we deemed it advisable to make every effort to arrive at a satisfactory solution of the following important points :—

1st. Does the true turpentine resist the attacks of cobra when used in piles, girders, &c., in public works?

2nd. Are there two varieties of turpentine timber, one cobra-resisting, the other not?

3rd. Have any other timbers been substituted for turpentine timber and used for piles, &c.?

We propose herewith to submit notes on various points connected with the turpentine question and, at the close of our report, to submit our recommendations and findings.

II.—*Characteristics of Turpentine Timber.*

The following notes may be convenient :—Turpentine is, for a hardwood, soft when green, but hard when dry. It is of a sandy or gritty nature, rapidly dulling the saws; hence saw-millers do not like it.

It splits and shrinks badly in sawn sizes free from bark, unless some attention is given to seasoning it.

It is very durable when placed in the ground, and a great recommendation for many purposes is the difficulty of burning it.

An illustrated article on the subject will be found in the *Agricultural Gazette* for July, 1894, so that it may not be necessary to amplify the above particulars.

III.—*Black and Red Turpentine.*

At a very early stage of our inquiry we found it necessary to clearly understand what are the differences between black and red turpentine. The terms are not used in all parts of the Colony, the word "turpentine" being simply employed in some places. No one whom we questioned knew what differences in the trees corresponded to differences in the colour and appearance of the timber, although two different kinds of turpentine were recognised readily enough in most districts.

Black turpentine was originally so called to distinguish it from white turpentine, an old name of tallow-wood, a name which still lingers in the Port Stephens district amongst the old hands.

We felled turpentines growing a few yards from each other. The timber of small, youngish trees is of a fresh, sound, light red colour, and the timber is known as red turpentine, while the timber of the very old and large trees is of various shades of dark red up to purple brown, chocolate, and nearly black; this is black turpentine. There is no botanical difference between them; they simply present, in our opinion, different stages of growth or maturity of the same timber. We look upon black turpentine as over-matured timber, and perhaps in some cases the product of trees which have been injured, or whose growth has been interfered with in some way. We look upon red turpentine as timber thoroughly sound and full of life. In the Port Macquarie district we found it recognised that the bark of red turpentine is tougher, and the oleo-resin far more abundant than in the black.

Black turpentine is usually used for punt-bottoms, because of its size; red turpentine for piles.*

* As a rule this diversity of colour applies only to the fresh timber, all turpentine tending to dry to a uniform lightness of colour.

IV.—*Miscellaneous Notes on Turpentine, chiefly obtained on the Northern Rivers.*

The following notes on turpentine, with especial reference to its powers of resistance to cobra, will be found interesting, although somewhat contradictory :—

Turpentine is excellent for the bottoms of punts; it is put in green, and coppered. (Mr. Breckenridge, Failford.)

Mr. J. Wright, Tuncurry, prefers red turpentine to black. Turpentine piles at Mr. Wright's wharf have been eaten off by cobra in ten and a half years.

Mr. Miles, Forster, says that the black turpentine is more cobra-resistant than the red turpentine.

The wharf at Ghinni Ghinni, on the Manning River, built about four years ago, has the turpentine piles now nearly eaten through. These piles were obtained from Sandy Creek, about 3 miles north-west of Wingham. The timber-getter who procured these piles states :—"I have also used turpentine timber that was got on the Lower Manning to build a punt with, and it did not resist the cobra."

Mr. Walters, of Coopernook, writes :—"I know you are aware there are two kinds of turpentine, viz., red and black; both kinds are used in Sydney Harbour. I say the black is 50 per cent. before the red for piles, and yet the Department uses both kinds, and does not make any objection to contractors using the red kind as well as the black."

Mr. Walters further states that black turpentine is difficult to cut, and ruins the saws. He will have nothing to do with it, while red turpentine readily cuts—cuts like cheese. Mr. Walters coppers his punts.

The following correspondence and notes in regard to red and black turpentine are interesting :—Messrs. Mackay and Bibby, of the Laurieton Steam Sawmills, write to Mr. Forester Brown of Port Macquarie :—"In reply to your inquiry as to why some piles said to be turpentine are fairly free from cobra, whilst others are riddled with them, the matter is, I think, easily explained. There are two distinct kinds of turpentine, viz., red and black, and as I have used both I am in a position to say positively that black turpentine for piles is practically useless, and the cobra will attack it freely, whilst red turpentine will resist cobra for years, and very rarely enter further than the sap. These facts have come under my personal observation during the last twelve years. I find also that red mahogany and tallow-wood are good woods in the water, but of course not equal to turpentine." In conversation with us Mr. Mackay stated that "black turpentine should always be discarded, as it has not a quarter the life of the other."

The same gentleman looks upon black turpentine as an abnormal or diseased state of red turpentine.

Mr. Johnston, of Wauchope Sawmill, states that he built a steam-punt (the "Maori") for logs for Messrs. Mackay and Bibby, of Laurieton, the flat bottom of forest turpentine (*Syncarpia laurifolia*). He called it "black turpentine." He saw the timber growing himself; got it under North Brother Mountain at Laurieton. The punt has been cleaned every year, and has lasted now eleven years free from cobra. Also that there had been no borer in it up to five years in use.

To this statement Mr. Mackay replies :—"I cannot tell you the difference between the black and the red wood either by the leaves or bark; but I am sure Mr. Johnston is mistaken about the black turpentine being used in the steam punt he built so long ago. That punt is still at work, and was on our slip last Christmas, and the planks were apparently as good as when they were first built. I am sure that the black turpentine is not what we get for planking and piles."

Mr. Laurie agrees with Mr. Mackay that the red timber is the better—has more oleo-resin.

The life of turpentine piles was stated to us to be ten years at Laurieton. We saw turpentine piles at Laurieton saw-mills down five years. They had been only superficially injured then. At the same time we were informed that turpentine is hardly more durable than many other timbers if the bark be stripped. Coppering is the only cure.

Red turpentine is not only used here for piles, but also for punt bottoms, which are painted with copper paint about every twelve months. (Mackay.)

We observed that the standing-ways for the punt slip at Laurieton were quite sound after having been down seven years. They are of red turpentine.

We were subsequently informed that Rogers' punt, at Laurieton, which was built about eleven years, and has the bottom cleaned sometimes once or twice a year, was riddled with cobra. The bottom was not painted. We did not see this punt.

There is any quantity of turpentine in the Laurieton district, but it is rarely cut, as it dulls the saws.

Mr. Cain, timber merchant, of Wauchope, Hastings River, writes to Mr. Forester Brown :—"There are two kinds of turpentine—one grows in the brushes and has a very long stringy bark and very red timber, and the other grows out on the clear, and has a very thin scaly bark, and the timber is very dark inside. I cannot tell you, for certain, which is the timber that the cobra riddles. I have been asked the question by ———, but I think it is the turpentine that grows on the clear that the cobra will eat, but I am not certain."

At Port Macquarie we made careful inquiries at Hibbard & Son's Mill, in company with Mr. Forester Brown, and Mr. Hibbard, jun., spared no pains to give us information.

Here the punts for up-river work are made of 2½-inch turpentine planking, covered with tar and felt. Below this a sheath of 1-inch turpentine planking is placed to take off chafing, and to avoid the cost of coppering The inch planking is stripped off about every seven years.

The punts go into fresh water, but remain there a few hours at the most. The inch planking is cleaned from barnacles about every two years.

The punt slip at Hibbard's wharf consists of red turpentine and has been down fifteen years. It has gone below high-water mark. Between high and low water it is practically intact. It is partly covered with tallow-wood, which has been eaten away to about the same extent as the turpentine. Mr. Hibbard is of opinion that turpentine is undoubtedly the most cobra-resistant timber we have.

Rudders for droghers are made by Mr. Hibbard out of turpentine, showing that people have a leaning towards the timber.

It is all red turpentine at Port Macquarie; black turpentine is never used. A timber-getter here (Mr. Kilmorey, senior) says that "the turpentine, cut from swampy or moist land, is very soft to cut, has a thin bark, resin runs out like native honey, and that bees do not swarm to it when felled like they do to that which grows in the forest."

The fender piles of Greenhills Wharf, West Kempsey, are eaten off between high and low water. They are of squared turpentine. The other piles are of ironbark, coppered. This wharf marks our northernmost limit, this trip.

The Government jetty at Coff's Harbour was stated to have been over twelve months building, and before it was finished, the turpentine piles first driven were stated to have been attacked by cobra.

Mr. G. Harriott says "that the 'Byron Bay' wharf piles, of forest turpentine, were riddled with cobra in a few years, and adds, that turpentine growing in the brushes smell stronger (when cut into) of turpentine than the other." As regards the turpentine piles at Byron Bay, we attach a copy of a letter written by Mr. C. W. Darley, late Engineer-in-Chief for Harbours and Rivers, to the Forest Department, and forwarded for our information. It not only shows that Mr. Harriott's statement must be considerably modified, but gives additional information of a valuable character.

"Two pieces of pile, recently taken from the Byron Bay jetty—one cut at low water and the other at 5 feet below low water—show how well turpentine will resist the *Teredo navalis* (cobra) in sea water. The pile from which the specimens were taken was driven about eight years ago. From them it can be clearly seen that while the *Teredo* attack, and to a great extent destroy, the sap-wood, they fail to touch the red heart-wood. They also show that the *Teredo* are not nearly so active a little distance below low water as they are at low water. Experiences teaches me that it is only in pure salt water that the worm avoids the heart-wood of turpentine, for in rivers where fresh water is in excess of the salt water the *Teredo* will penetrate the same wood rapidly. It is a question, however, whether the worm is really the same, and steps are now being taken (October, 1894) to test this question."

V.—The Bark of Turpentine.

It has been stated that cobra never goes through the bark, or rather the bark, plus the layer of oleo-resin, which is reputed to be the great protector of the timber against cobra. Mr. Laurie, of Laurieton, says that the bark of any timber, even gum, gives increased resistance to cobra; in fact, that every tree will resist the pest more or less, provided the bark be intact. He is of opinion that turpentine is still the best, though it is far from being absolutely resistant.

Local opinion at Port Macquarie is in favour of turpentine, mahogany, and ironbark for piles, so long as the bark remains sound.

At the same time, on the Macleay River, we found turpentine piles, bark or no bark, destroyed by cobra in five years.

Mr. Forester M'Donald, of Kempsey, looks upon turpentine as only effective so long as the bark is intact. He would prefer other timbers—ironbark, for example, and preferably old seasoned, ringbarked timber—to turpentine for piles.

Mortise holes, which cut through the bark of a turpentine pile, are a common cause of mischief, allowing cobra free access into the timber.

Mr. Sydney Verge, of Kempsey, draws attention to the fenders on coppered piles, by means of which cobra can get up into the pile by a circuitous route. This seems to us a matter worthy of attention, for cobra, like white ants for timber and sugar ants for saccharine delicacies, will find out the weak spots in the defences by an instinct that never fails.

And now we come to a very important matter.

We are satisfied that if round piles of turpentine are driven in cobra-infested waters, with bark attached and uninjured, they will resist the attacks of cobra for a period largely dependent on the bark remaining intact and closely adherent, but, at the same time, we deem it practically impossible to procure and drive any number of turpentine piles without injuring the bark more or less, and the smallest injury to the bark of the timber renders it more vulnerable to cobra. When the manner of procuring piles and conveying them to the work for which they are intended is taken into consideration, it is easy to see they cannot escape injury to their bark even under the most favourable considerations, viz., when the sap of the trees is down, and the bark consequently closely adherent to the log. The falling of the trees in the first instance, the hauling and spare chaining to the waggons, the friction of the waggon chains in road transit to the water's edge, the rough handling they receive in loading and unloading on vessels, and lastly, the action of the pile monkey in driving the piles to their required depth, cannot fail to more or less injure and separate the bark.

In the course of our investigations we saw turpentine piles, intended for Government wharves, with strips of bark torn off from end to end, and in some stacks we could not find a single log whose bark was intact. So that if the adherence of bark to the log is to be made a condition of contract, it should be enforced, and not dealt with as if it were a matter of slight consequence.

VI.—Cobra and Turpentine.

Cobra is the common name (it is an aboriginal name, *see* Backhouse, "Narrative of a Visit," &c., p. 366) by which certain bivalve molluscs belonging to the genus *Teredo*, and included in the family *Pholadidæ* are usually known. *Teredo navalis* is one of the most common and destructive species. It is generally about a foot in length, but sometimes grows over 2 feet 6 inches. Fourteen species of *Teredo* are known, some occurring at low water, some being found at a depth of 100 fathoms. They are very widely distributed, occurring from the coast of Norway to the tropics.

In addition to cobra, what are known as "borers" often do a good deal of damage to piles and timber-work below tide mark. Those found by us at Port Macquarie are isopods, belonging to the genus *Sphæroma*, the members of which are distributed all over the world.

We believe that no timber has absolute power of resistance to cobra. That being our conclusion, it remains a matter for consideration to what extent the lives of timbers (turpentine or others) may be prolonged. At Cundletown wharf, on the Manning River, where there is a Government punt-slip, and where Mr. Kenny repairs punts, boats, &c., under the direction of Mr. F. W. Baker, the Engineer for Roads of the district, we found pieces of turpentine a mass of cobra-turpentine logs, a repulsive mass of writhing cobra—the logs now consisting of very much more animal than vegetable matter. Prickly tea-tree* logs were also in a similar condition. Tallow-wood is here considered to be the most resistant timber to cobra.

Prickly tea-tree is considered at Kempsey to resist cobra better than turpentine, and at Laurieton we were shown small piles for a boat-wharf made of prickly tea-tree which had been down fifteen years, and which were quite sound. What the particular local conditions were in these cases we do not know, but, while we readily admit the high resistant power of prickly tea-tree, we frequently observed it riddled by cobra.

Anywhere within the influence of the tides on our coastal rivers and creeks, timber is attacked by cobra, and there is the most abundant and most convincing evidence that cobra is more injurious in tidal waters than in pure salt water.

In the northern rivers of this Colony, a reason why the effects of the cobra are so disastrous is doubtless because of the increased warmth of the water, which favours the growth of the pest.

The following appear to us militate against the growth of cobra :—

1. Pure salt water.
2. Fresh water.
3. Foulness of water.

Mr. C. W. Darley (late Engineer of Harbours and Rivers) writes to the Forest Department:— "In pure sea water I have reason to believe that the redwood of turpentine will resist the *Teredo* for many years (I can speak for twenty years at least), but when there is some fresh water mixed with the salt water, as up rivers, I find the worm will go through and destroy turpentine piles within a year in some cases."

Piles are more or less attacked in pure salt water, as witness the case of the piles at Coff's Harbour, Wallis Lake, &c. While cobra may flourish in clean sea water, the case of piles in the polluted waters of parts of Sydney Harbour is not a fair test of the resistance of timber to cobra.

A punt working in salt water may subsequently pass over muddy flats, which scrape off everything. The punt is all right in fresh water, in which cobra cannot, of course, live; hence the variation in the, reports in regard to the resistance of turpentine to cobra. In examining specific instances of reputed resistance to cobra, we often find the circumstances very complex, and we are often without sufficient data to compare them.†

VII.—Turpentine Substitutes.

It occurred to us that perhaps the different reports as to the durability of turpentine might, in a measure, be owing to the substitution of some other timber; accordingly throughout the trip we kept this matter under notice.

We found on inspection of forests the true turpentine (*Syncarpia laurifolia*), also the brush or bastard turpentine (*Rhodamnia trinervia*) growing side by side, the latter bearing, in the Hawkesbury district, a strong resemblance to the former in colour of timber and bark. In no other part of the Colony visited by us have we seen the resemblance so strong. The leaf of the brush turpentine is readily known by its three prominent veins or nerves.

As, however, but a very small proportion of the turpentine timber used in public works in the Colony has come from this district, and finding no evidence to show that the brush turpentine was in use as a substitute for turpentine, also that it rarely if ever attains pile size among the northern rivers, we do not now attach much importance to the matter.

Brush turpentine in the Port Stephens and Manning River districts never seems to attain any size, but always accompanies true turpentine.

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* *Melaleuca styphelioides.*

† Since the above was written an excellent paper has been published by Mr. C. Hedley, entitled "The Marine Wood-borers of Australasia and their work" (*Proc. Aust. Assoc. Adv. Science*, viii, 237, Melbourne, 1900), which is full of useful information.

In the Port Macquarie district brush turpentine has the bark much like that of red mahogany, and could not easily be mistaken for turpentine. Mr. J. M'Inerney has seen red mahogany with a bark, resembling that of true turpentine ; this is particularly the case with timbers of pile size. It is sometimes sent down for that timber, and gets riddled very quickly by cobra.

The bark of turpentine is tough as compared with brush turpentine. The blacks have the same name for the two trees. Mr. Booth would as soon have red mahogany as turpentine for piles.

There is no brush turpentine large enough for piles in the places where the turpentine piles are obtained in the Port Macquarie district. It is quite possible that young tallow-woods, and even young stringybarks or white mahoganies, might occasionally be substituted for turpentine through ignorance, but the mistake would easily be rectified by any judge of timber.

We do not think that any wilful attempt has been made in the past to substitute other hardwoods in lieu of turpentine for piles, &c. In point of fact turpentine timber is so plentiful throughout the Colony that there is little or no inducement to unprincipled timber suppliers to substitute any other timber for it.

VIII.—Summary of Findings and Recommendations.

To the 1*st Question*,—Does the true turpentine resist the attacks of cobra when used in piles girders, &c., and in public works ?

Our answer is that turpentine is not an absolute resistant to cobra, either in pure salt water or in tidal waters, whether the bark is on or not. The turpentine will resist the cobra as well, or better, than any other hardwood, providing the bark remains uninjured.

That cobra is much more active in attacking turpentine in tidal waters, where salt and fresh water mix, than in pure salt water.

To the 2*nd Question*,—Are there two varieties of turpentine timber, one cobra-resisting, the other not ?

Our answer is, that there are two turpentines of the same species, called the black and the red, but, although frequently no sufficiently sharp line of demarcation exists between the two timbers for us to single one variety for special commendation, we would prefer typically red turpentine. There is also a brush turpentine, whose botanical name is *Rhodamnia trinervia,* somewhat similar to true turpentine, but we found no evidence to show that it had been substituted for true turpentine, and we failed to find any inducement to timber-getters to do so.

To the 3*rd Question*,—Have any other timbers been substituted for turpentine and used for piles, &c. ?

Our answer is, that we found no evidence that such is the case. Further, we failed to find any inducement to suppliers to do so, as turpentine is very plentiful in the coast districts.

We recommend,—

(*a*) That in pure salt water, in special instances where it is known that cobra is not very active, also in very foul salt water, such as around Pyrmont and Glebe Island bridges, the use of turpentine piles be continued, providing they are driven with their bark attached and uninjured. In cases of outside piles, exposed to the friction of the sides of vessels, some protection or guard should be adopted to prevent damage to the bark of the piles.

(*b*) That where turpentine piles are specified to be with the bark on, the condition should be rigorously enforced, piles found to show defect in the bark below high-water mark being condemned as unfit for use.

(*c*) That turpentine piles be, as far as possible, felled when the sap is down, and the bark closely adheres to the log.

(*d*) That in unpolluted tidal waters, turpentine piles be protected by metal sheathing.

Speaking more generally, and taking into consideration the fact that turpentine is not absolutely resistant to cobra, and the very great expense the Department of Public Works is annually put to in replacing cobra-infested timber, we recommend that for the future the use of turpentine timber, either with or without bark, or in squared or sawn sizes, when placed in any position in which cobra is known to be active, should be discontinued in the public works of this Colony, unless it is absolutely protected throughout its entire face and ends by copper or some other equally satisfactory protective covering.

We would recommend the sheathing of turpentine piles, without any exception whatever, if the question of expense did not stand in the way, and the only exceptions we recommend are those of piles on the coast and in parts of Sydney Harbour, as already stated.

The cost of coppering piles, or rather the increase of the practice of coppering piles, will at once claim attention ; but we would observe that the expense of the piles themselves is not the only consideration. If they are eaten through, the superstructure may have to be replaced, perhaps at a cost many times exceeding that of the piles themselves. The matter of the life of a pile involves other considerations than that of the durability of a post in fencing which carries no superstructure.

Turpentine is plentiful in most of the coast forests of New South Wales. It is essentially a pile timber, growing as it does in suitable sizes, straight and even in the barrel, and up to 90 and 100 feet in length, and it is the cheapest class of hardwood procurable in the round in the Colony. If the timber be coppered there will be no necessity, except in rare instances, to use coppered ironbark for piles, and the drain on ironbark for this particular work will be very largely reduced. We desire to encourage the use of turpentine for piles, but subject to all the precautions we have indicated.

Commenting on this Report, Mr. C. W. Darley, late Engineer for Harbours and Rivers, New South Wales, who gave especial attention to the subject of turpentine timber and cobra, wrote to me—

There is one portion which, from long experience and observation, I must remain at issue with your conclusions. I refer to your conclusions set forth in clause V that the bark will afford protection to the piles. I had in my old office a bag full of samples of bark and wood cut from turpentine piles under water, showing the worm-holes passing through the bark and into the timber (sap-wood only)—indeed some samples rather indicated that they had a weakness for the bark-covered portions. It may be that where the bark is *closely adherent* they pass through, but when at all loose they do not. I have never yet met with a case when Teredo sinking in one piece of wood has passed out into an adjoining piece even though in close contact—for instance, I have seen dozens of defective planks removed from punts, and never detected a worm passing from the bad one to those adjoining or to the planks inside. In 3-inch planking the caulking would perhaps only go half-way as shown in rough sketch,* having 1½-inch of wood in close contact.

I never saw this joint crossed. May it not be the same with the bark if still loose it forms such a joint, while if it is closely adherent the worm may pass as shown by the samples I had in my possession, now all lost I fear. I never troubled about the bark being kept on after the piles were brought on to the ground and passed. I looked to the bark as one of the means for identifying the timber only, and I have never yet seen any difference in life between those driven with or without the bark. All are equally liable to be damaged as far as the sap-wood goes.

When deciding to use *sheathed* piles I would never think of using turpentine, as they invariably run much larger in the girth at the butt for (say) a 40-foot pile than ironbark, as a rule, indeed, quite 50 per cent. larger. So when sheathing is paid for at 1s. 6d. per super. foot, the extra price of the timber is soon covered by the saving in sheathing.

Exudation.—If the tree be wounded, there exudes a brownish liquid resin. If it be desired to collect this substance in quantity, the best way is to fell the tree and to cut it into logs, which may be inclined. The resin will exude, forming a ring between the wood and the bark, and may be scraped off or drained into a suitable vessel. It belongs to the class of bodies known as "oleo-resins." It has been

* Not reproduced.

partly examined by Professor E. H. Rennie, of Adelaide, who obtained an acid from it by boiling with potash, which is not cinnamic acid, but other duties have prevented the completion of the research. It is stated that the native bees use the oleo-resin for the purpose of varnishing the interior of cavities in the trees before starting to build their nests. It is a substance of special interest for its own sake, apart from the fact that it is one of the few exudations from our Australian Myrtaceæ that are not kinos.

Size.—From 120 to 180 feet is no uncommon height for this tree to attain. It often measures 20 to 30 feet in circumference, with great length of bole; but such magnificent specimens are, within easy range of Sydney, usually found in gullies difficult of access.

Habitat.—It extends throughout the coast districts from the Tweed to the Ulladulla district, arriving at its greatest luxuriance in deep gullies containing good soil, in which situations it is also found well into the mountains. Its southern limit is the head of Cockwhy Creek, between Ulladulla and Bateman's Bay. It extends into Queensland. The return herewith gives valuable information concerning turpentine, and is a guide to the distribution of this timber.

No. of F.R.	County.	Area in acres.	No. of F.R.	County.	Area in acres.
43a	Camden	59	5,612	Hunter	22,000
78	,, ...	202	33	Macquarie...	21,000
172	,, ...	170	34	,, ...	10,000
173	,, ...	100	144	,, ...	12,242
203	,, ...	250	233	,, ...	280
207	,, ...	650	234	,, ...	610
209	,, ...	1,000	235	,, ...	3,840
211	,, ...	34	46	Northumberland	15,267
219	,, ...	50	69a	,, ...	6,394
27,726	Cook	6,080	70	,, ...	32,822
110	Cumberland	3,506	128	,, ...	1,280
112	Dudley	2,453	136	,, ...	440
158	,, ...	79,680	216	,, ...	9,478
3,753	,, ...	16,000	217	,, ...	3,000
14,537	Dudley and Raleigh ...	43,616	5,310	,, ...	970
196	Durham	10,000	14,972	,, ...	6,150
201	,, ...	22,440	249	Rous	15,006
202	,, ...	35,485	129	St. Vincent	500
642	Fitzroy	33,638	10,616	,, ...	43,295
13,362	Gloucester	3,730	29,370	Westmoreland	70,500
58	Hunter	6,120			

Propagation.—From seed, which is very freely produced. This tree is one of the best indigenous shade-trees in the State. It is gregarious, and its noble, leafy head makes it an ideal tree under which to put garden seats, or to serve as shelter trees for men or animals in a paddock, or as specimen trees, to give a park-like appearance to the land. It is one of those trees that should always be spared in clearing operations, unless its room is actually wanted. It is so different in appearance to the ordinary run of gum-trees that the occurrence of turpentines is often a relief to the eye. My experience tends to show that turpentines have a large number of roots near the surface, which, if disturbed, readily kill the tree. I would not, however, like to generalise on this point. I have seen some experiments on pollarding the turpentine. The trees were cut in the month of May, and have freely sent forth leaf-buds a considerable distance down the trunk, giving the tree quite an ornamental appearance. Where a tree is growing too large, and it is not necessary to absolutely remove it, the experiment I have indicated might be made.

EXPLANATION OF PLATE.

A. View of individual flower, seen from above.
- *a.* Petal.
- *b.* Sepal (calyx-lobe).

B. Flower seen from below.
- *a.* Petal.
- *b.* Sepal.

C. Flower with stamens removed
- *a.* Bract.

D. Stamen.

E. Pistil.

F. Transverse section of ovary

G. Cluster of fruits.

H. Longitudinal section of a head of fruits.

M. Flockton, del. et lith.

THE NARROW-LEAVED PITTOSPORUM.

(Pittosporum phillyræoides, DC.)

No. 4.

Pittosporum phillyrœoides, DC.

The Narrow-leaved Pittosporum.

(Natural Order PITTOSPORACEÆ.)

Botanical description.—Genus, *Pittosporum,* Banks.

Petals.—Usually connivent or cohering in a tube at their base or above the middle.

Anthers.—Ovate, oblong.

Ovary.—Sessile or shortly stipitate, incompletely or almost completely two-celled, or rarely three to five celled.

Style.—Short.

Capsule.—Globose, ovate or obovate, often laterally compressed; the valves coriaceous or thick and hard, bearing the placentas along their centre.

Seeds.—Thick or globular, not winged, often enveloped in a viscous liquor.

Shrubs or trees, glabrous, or rarely tomentose.

Leaves.—Usually evergreen, entire or minutely toothed, the upper ones frequently collected into a false whorl.

Flowers.—Not large, axillary, or terminal; solitary or in close corymbose panicles. (B.Fl., 1, 109.)

Botanical description.—Species, *phillyrœoides,* DC.*—Prod. i, 347. Putterlick in Pl., Preiss. i, 192; F. Mueller, Pl. Vict. i, 72.

A small, graceful tree or slender shrub, quite glabrous in all its parts.

Leaves.—Usually oblong or linear-lanceolate, with a small, hooked point, 2 to 4 inches long, quite entire, narrowed into a petiole, thick coriaceous and indistinctly veined, but in some forms short and broadly oblong, in others long and narrow.

Pedicels.—Axillary, solitary, or in sessile or shortly pedunculate clusters or umbels, or the uppermost forming a terminal cluster.

Flowers.—Yellow, usually about 4 lines long, often dioecious, the females rather larger and fewer together than the males.

Sepals.—Short and very obtuse.

Petals.—United to the middle or still higher, spreading at the top.

Ovary.—Pubescent, almost completely two-celled, with six to eight ovules in each cell.

Fruit.—Ovate or round cordate, much compressed, quite smooth, varying from 4 to 9 lines in length, but usually about ½ inch.

Seeds.—Few, dark or orange-red. (B.Fl. i. 112.)

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* A. DC.'s original spelling is "*phillirœoïdes.*"

Botanical Name.—*Pittosporum* (Greek), *pitte* to pitch; *sporos* a seed, the seeds being sticky and sometimes black, like pitch; *phyllyræoides*, with leaves like the common *Phillyrea angustifolia*, Linn., of Europe.

Vernacular Names.—Sometimes called "Butter Bush" in Northern Australia, perhaps because of the greasy appearance of the seeds; but that is merely surmise. "Willow Tree," or "Native Willow," of many parts of Australia, on account of its graceful, Willow-like foliage and habit. Called "Poison-berry Tree" in South Australia. The berries are not poisonous, only bitter. Miss M. A. Clements, of Palesthan, Condobolin, informs me that owing to the bitterness, or rather acridity, the tree is sometimes known as "Quinine Tree." We have, of course, several so-called "Quinine Trees." She also states that some people call it "Bell's Orange."

Synonyms.—

P. angustifolium, Lodd.; Bot. Cab., t. 1859.

P. longifolium and *P. Roeanum*, Putterl.; *Syn. Pittosp.*, 15, 16.

P. ligustrifolium, A. Cunn.; in Putterl., in *Pl. Preiss*, i. 190.

P. oleifolium, A. Cunn.; in Putterl., *Syn. Pittosp.*, 17.

P. acacioides, A. Cunn.; in *Ann. Nat. Hist.*, ser. 1, iv, 109.

P. salicinum, Lindl.; in Mitchell's *Tropical Australia*, 97.

P. lanceolatum, A. Cunn.; in Mitch., l.c. 272 and 291.

The plant is somewhat variable, hence some of the synonyms. Allan Cunningham, who actually collected, made three species, and Putterlick, the monographer of the genus, added to the number.

Leaves.—In times of scarcity this tree is of great value, as it withstands the drought, and sheep and cattle browse upon its foliage. Stock are so partial to it in the interior districts that it is in danger of extermination in parts, and it is a tree which should be conserved.

Fruits.—The fruit is of a yellow or orange colour, and is very ornamental when it dehisces and exposes its contents of small, more or less angular, sticky, red seeds.

"The seeds are very bitter to the taste, yet the aborigines in the interior of South Australia were in the habit of pounding them into flour for use as food." (Tepper.) Mr. J. R. Chisholm, p. 31, says they are not eaten by the aborigines of Northern Queensland.

Timber.—Wood close grained, light in colour, and very hard. Useful for turnery, and possibly for wood-engraving. "Specific gravity, 767." (*Report, Victorian Exhibition*, 1861.)

The tree being so small, its timber can never be of commercial importance.

Exudation.—The genus *Pittosporum* is one which yields both gums and resins. See Maiden.* The present tree is referred to in the following paragraph :—

"Several Acaciæ useful . . . . for their gum, but the latter is even excelled in clearness and solubility by that obtained from *Pittosporum acacioides*." (Mueller, *First General Report*, 1853, page 6.)

I have not received many specimens of the gum; it is of scientific rather than of general interest.

Size.—It rarely exceeds 25 to 30 feet in height, and is as a rule much smaller. Ten inches in diameter is the maximum authenticated measurement of the trunk known to me.

Habitat.—It occurs in every State of Australia. It is a native of country with a small rainfall, and hence flourishes in the arid interior. In our own State it is not found near the coast, though in some other States this does not hold, as it occurs in places which have a sparse rainfall, although near the seaboard. In New South Wales it has been found by Mr. R. H. Cambage in the Tamworth district, the most easterly locality known to me. It should be looked for in the Page River country (near Scone), where a number of stragglers of the Western vegetation have already been found.

Propagation.—The seeds germinate readily. It grows well in the Sydney district in spite of the heavy rainfall. The ground must be well drained for it to flourish.

An Aboriginal Legend.—Some years since, a valued North Queensland correspondent, Mr. J. R. Chisholm, gave me the following legend in regard to our tree. These are his words :—

Years ago I was walking along Prairie Creek with a black boy companion. It was just about the time we took up the country. Passing a little patch of scrub I noticed these berries. I asked the black if they were edible, or, as I put it, "black fellow tuckout that one"?

"Baal, baal," he replied, and he added shortly afterwards "that one mother belonging to gin."

I asked how, and he gave me the legend, taking care to impress upon me that it was a long time ago. No one lived in the country at that time, but this bush grew along the creek, as it does now. One day one of the berries opened, and out of it came a beautiful young gin. Very beautiful indeed, and stately, and she lived on the creek by the waterholes alone, hunting sugar-bags and trapping duck, and getting fat grubs from the trees. So she lived quietly through many months, or even years, all the time pining for some mate, until one day she was strolling along past another patch of scrub, when lo and behold she noticed a bush with seed-pods upon it, and while she watched a seed-pod opened and out of it came a young blackfellow.

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* Maiden, J. H., "Notes on the exudations yielded by Australian species of Pittosporum." *Proc. Aust. Assoc. Adv. Sci.*, iv, 289.

He was a fine built able young fellow, just about her own age, and without any ado she bade him good-day, and entered into conversation with him, and he walked with her to the camp by the waterhole. There the two became good friends and lived together, and after a time she gave birth "to a son and a daughter, and as they grew up they went lower down the creek, and settled on the same lines, and were happy."

That is the legend as I got it. I asked him to show me the other bush, but he did not know it, saying that "Old man Jimmy" would show me, and since that time I have never met Jimmy in the neighbourhood.

If I remember rightly, there is a tree origin belief among the Hindoos, and I have heard similar legends among the natives of Borneo.

EXPLANATION OF PLATE.

A. A single flower.

B. The flower opened out, showing petals, stamens, and ovary.

C. A stamen.

D. View of pistil with calyx.
- *a.* Stigma.
- *b.* Style.
- *c.* Ovary.
- *d.* Calyx.

E. Cluster of fruits, capsules, dehiscing, showing the seeds.

Sydney: William Applegate Gullick, Government Printer.—1902.

THE FOREST FLORA

OF

New South Wales.

J. H. MAIDEN.

Published by Authority of the

Government of the State of New South Wales.

PART II.

Sydney: William Applegate Gullick, Government Printer—1903.

The FOREST FLORA

OF

NEW SOUTH WALES.

J. H. MAIDEN,
Government Botanist of New South Wales and Director of the
Botanic Gardens, Sydney.

PART II.

*Published by the Forest Department of New South Wales, under authority of
The Honourable the Secretary for Lands.*

Published by Authority of
THE GOVERNMENT OF THE STATE OF NEW SOUTH WALES.

Sydney:
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M. Flockton, del. et lith.

THE WOOLLY BUTT.

(*Eucalyptus longifolia*, Link.)

No. 5.

Eucalyptus longifolia, Link.

The Woolly Butt.

(Natural Order MYRTACEÆ.)

Botanical description.—Genus, *Eucalyptus,* L' Héritier.

Calyx-limb.—Concrete into a lid (operculum), separating circumsciss from the tube.

Petals.—None (or concrete with the calyx-lid).

Stamens.—Numerous, in several rows, mostly free, usually inflexed in the bud

Ovulary.—Two to six celled.

Style.—Undivided.

Fruit.—A capsule, opening at the top into 3 to 6 valves.

Seeds.—Numerous, but comparatively few fertile.

Hardwood trees, usually quite glabrous.

Leaves.—Usually alternate, mostly vertical, and more or less falcate; usually thick, pinnately veined, almost always with an intermarginal vein. The leaves on the young seedling plants usually opposite, differently shaped and glaucous.

Flowers.—Usually white, in simple or paniculate umbels, and without bracts.

Botanical description.—Species, *E. longifolia,* Link and Otto.

Following is the original description:—

217. *E. longifolia.*—Foliis lanceolatis basi inæqualibus hinc rotundatis acumine incurvo, ramulis axillaribus apice multifloris. Hab. in Australia. T. Rami rubri. Fol. deflexa ut in multis, petiolo 12″ longo, lamina 6′, ad ped lg. 1′ 8″ lata, basi inæqualia pracsertim inferiora rami, quæ quoque breviora latiora, longissime acutata punctata. Rami 1–2′ lgi. deflexi tum foliis 2 brevibus instructi inter quos pedunculi tres 1′ 6″ longi. Operculum conicum. Aff. E. resiniferæ at ped. longiores. (Link in *Enum. Hort. Berol.* ii, 29.)

Following is the description by Bentham, taken from his "Flora Australiensis":—

E. longifolia (*Link and Otto, Ic. Pl. Sel.* 97, *t.* 45).*—A tree with a rough fibrous persistent or partially deciduous bark (*F. Mueller*), somewhat smooth or fibrous and wrinkled according to the age of the tree (*Woolls*).

Leaves.—Lanceolate, usually long and falcate, often exceeding 6 inches, the veins fine and divergent, but rather distant, the intramarginal one not far from the edge.

Peduncles.—Axillary or lateral, usually recurved with three, or very rarely four, rather large pedicellate flowers.

Calyx-tube.—Turbinate, thick and hard, sometimes slightly angular, 4 to 5 lines long, and as much in diameter.

* This excellent plate precludes all doubt as to the identity of Link and Otto's species.

Operculum.—Thick and hard, conical, about as long as the calyx-tube, or sometimes longer.

Stamens.—Fully $\frac{1}{2}$ inch long, inflected in the bud; anthers ovate-oblong, with distinct parallel cells.

Ovary.—Rather shorter than the calyx, convex in the centre. Fruit somewhat pear-shaped, truncate, nearly $\frac{3}{4}$ inch long, straight or scarcely contracted at the orifice, the broad rim prominent, the capsule slightly sunk, but the valves sometimes protruding, or the whole fruit is shorter with a flat rim. (B. Fl. iii, 226.)

Botanical Name.—Eucalyptus, from two Greek words—*eu*, well, *kalypto*, I cover, in allusion to the little cap (usually more or less conical) which well covers the unexpanded flower, and which is thrown off as the flower opens. *Longifolia*, of course, means long-leaved, and the leaves of this tree are frequently very long, especially, as Rev. Dr. Woolls has pointed out, when young and growing near water. In exceptional cases, other gum-trees have very long leaves too; for instance, some years ago I received from the southern part of this State some which almost measured 17 inches without the stalk. They came from a tree locally known as "Mountain Gum" (*Eucalyptus goniocalyx*).

Vernacular Name.—"Woolly Butt": The bark is of a dirty grey, brittle, fibrous character, and was thought to be of woolly texture. It often resembles box bark a good deal.

The name "Woolly Butt" is, of course, descriptive of the bark, but it is not a perfectly happy one. I have frequently seen trees with barks more woolly than that of the "Blackbutt." It has this advantage, however, that the term "Woolly Butt" is, so far as I know, never applied to any other gum-tree, although there is another native tree growing in the northern part of this State, to which I have also heard the name applied. I allude to the "Brush" or "Scrub Box" (*Tristania conferta*).

This tree often goes by the names of "Peppermint" and "Redwood" in the South Coast district, the latter name being used for obvious reasons, and the former because the bark resembles that of another Eucalyptus tree, known as "Peppermint," both in texture and being persistent to the ultimate branches.

The use of these names on the South Coast is not a little puzzling. "Woolly Butt" is the common name in the Sydney district, but "Peppermint" or "Redwood" is in most general use from, say, Shoalhaven to Moruya, while "Woolly Butt" is most commonly in use from Moruya to Victoria. At the same time, I have heard the three names used indiscriminately over a large area of the South Coast. It affords an excellent practical reason why botanical names should be used for timber trees wherever possible. Confusion in names of timbers leads to trade disputes and uncertainties and accusations of bad faith in many ways.

Recent examination of the original herbarium specimens shows that the late Sir William Macarthur called it "Rough-barked Gum," in his Exhibit No. 25 of the London International Exhibition of 1862 (N.S.W. Timbers).

Aboriginal Names.—The late Sir William Macarthur stated that the aborigines of Illawarra called it "Burram-burrang." (I have examined the original herbarium specimens sent by him to the London Exhibition of 1862.) To the same Exhibition (and also to that of Paris, 1855) he sent specimens labelled "Woolly-butt of Illawarra." The aboriginal names were given by him as "Ngaouli" or "Gnaoulie." Mr. Forester Allan, of Moruya, gives the aboriginal name of this timber on the South Coast as "Mudione." I am unable to state what tribes used the names in question.

Synonym.—*E. Woollsii*, F.v.M.

Arborea, foliis alternis modice petiolatis angusto-v. subfalcato-lanceolatis chartaceis concoloribus distincte patentimque penniveniis, vena peripherica a margine recurvulo vix aut paulo remota, umbellis axillaribus terminalibusque 2-4-floris, pedicellis pedunculo brevioribus, alabastris majusculis pallidis, calycis tubo obconico-campanulato longitudinem operculi rite conici exangulati vix aequante, antheris subovatis, stylo stamina subaequante, fructibus semiovato-companulatis laevibus quadriloculatis, margine fructus adscendente orificium late cingente, vertice capsulae leviter convexo incluso, seminibus apteris.

Prope pagum Smithfield Novae-Cambriae australis. Woolls. Arbor "Woollybutt" nomine distincta. Cortex partim secedens. Folia $2\frac{1}{2}$-5″ longa, $\frac{1}{2}$-1″ lata, sensimlonge in apicem acutata, vix v. parce pellucido-punctata. Pedunculi satis graciles, $\frac{1}{2}$-1″ longi, teretiusculi v. compressi. Pedicelli longitudine $1\frac{1}{2}$-8‴ variantes, sensim in calycem transientes. Calycis tubus 4-6‴ longus, primum lividus, demum squalide cinereo-fuscus, rugulosus, modo exangulatus, modo 2-4 costatus, margine leviter recurvus. Operculum circiter semunciam longum, basi 4‴ latum, neque costatum, nec nitens neque constrictum, nec valde acutatum. Filamenta longiora semipollicem vix excedentia, sicca flavida. Antherae $\frac{1}{3}$-$\frac{1}{2}$‴ longae. Stylus saltem exsiccatus plus minusve compressus. Fructus semipollicares v. paulo breviores, interdum in formam turbinatam vergentes, margine pallido 1-$1\frac{1}{2}$‴ lato circum orificium cincto. Valvae detoidae, infra marginem insertae, 1‴ parum longiores. Semina sterilia angulata, clavato-filiformia $\frac{2}{3}$-1‴ longa; fertilia nigrescentia, subovata. Species rara, ut videtur nullibi descripta, *E. cosmophyllae et E. longifolia* forsan approximanda. (Mueller's *Fragmenta*, ii, 50.)

Leaves (Oil).—The leaves have already been referred to. They are not rich in oil and have rarely been distilled. The oil is viscid, has an aromatic cooling taste and camphor-like odour. Sp. gr., 0·940; boiling temperature, 194–215°, according to the late Mr. J. Bosisto.

Fruit.—This species can readily be determined from its fruit, which are usually in threes. They are the largest fruits of any of the eastern Australian species, and the shape is characteristic. Their size, and the sculpture of the rim, vary somewhat.

Bark.—The bark is persistent or partially deciduous and has a greyish appearance; the young trees being very much like the box-tree (*E. hemiphloia* or *Bosistoana*).

Timber.—Dark red, of a wavy grain, rather heavy, and not unlike red ironbark in general appearance, for which more valuable timber it is sometimes substituted. It is a very durable timber, but deficient in strength and elasticity, particularly near the heart. Many of the trees are also faulty, and hence it is not a favourite with saw-millers.

I look upon it as a really valuable timber for wood-paving. It is not our best timber for the purpose, but is is of proved value under very trying circumstances as regards exposure. Like red mahogany and others of our timbers, it belongs to the jarrah class. Although it has been passed off as ironbark sleepers and even girders, it is an inferior timber to ironbark on account of its comparative brittleness, a defect which would not in any way affect its usefulness for wood-blocking.

It is used principally for fencing posts, for which purpose it is well adapted. I have known posts that were thirty years in wet marshy land which, when taken out, were quite fresh looking, showing no sign of decay. It is a splendidly durable timber for wet ground.

In 1892 a friend wrote to me:—

There is a fence on my brother's land at Jamberoo that was erected in 1851, and is consequently over fifty years in existence—post and rails of woollybutt, and a portion of it still in a good state of preservation, likely to last for many years. Much, of course, depends on the state of the timber, where it is cut down, and the time of the year when this is done. The timber of the fence referred to was taken from a sound, healthy tree that had not begun to decay, and it was cut down in the winter. As a rule fences last longer on moist or swampy ground.

In many parts it is used for house blocks, as white ants do not like it, nor is it liable to dry rot.

It was formerly largely palmed off as red ironbark, but while inferior to that timber on account of its comparatively brittle nature, its durability in and on the ground will always commend it to those willing to employ our native timbers on their merits.

Exudation.—Like most other Eucalypts, it produces an astringent gum, or, to speak more accurately, a kino. This kino has the property of forming a muddy solution in water, and hence falls into my turbid group of kinos. As soon as it is dry it becomes exceedingly brittle, and readily reducible to a fine powder by mere pressure of the fingers.

Size.—It is a large forest tree. Mr. Andrew Murphy says that at Wyong it "grows very large—8 or 9 feet in diameter—and a great height." The late Mr. Forester Benson, of Bega, says: "I have seen trees fully 180 feet in height and 5 feet in circumference." Mr. Forester Allen, of Moruya, gives the height of the trees at from 80 to 150 feet with a diameter of 2-5 feet.

Habitat.—It is very plentiful on the coast, especially in the County of Dampier.

The most northerly locality known to me is Raymond Terrace, north of the Hunter River. Mr. A. Murphy, of Woy Woy, knows of only three places where it occurs in his district, viz., 3 miles from Gosford, also 2 miles from Wyong, and near Wyee. In the western suburbs of Sydney, *e.g.*, Strathfield, Homebush, Druitt Town, and thence coastwards, it is common enough, but it is most developed along the south coast, into Victoria.

It is largely developed in the County of Dampier. The following notes of specific localities will be useful :—

New South Wales.

Ashfield, Strathfield, Homebush to Liverpool-road, very abundant; Bankstown, Cabramatta, Parramatta, Penrith (N.B.—The western range is at present unknown), Appin, Wollongong, Picton, Nowra (with unusually narrow leaves), Bateman's Bay, Moruya, Bega, Bowning (with smaller fruits), Wolumla, Twofold Bay (No. 269 of S. Mossman in herb. Cant.). On the Timbilica River. The best specimens on clay flats; it rarely occurs on ridges, and rarely more than 5 miles from the coast.

Victoria.

St. John, East Gippsland.

EXPLANATION OF PLATE.

Twigs showing adult foliage and buds, flowers and fruit :—

A. Sucker-foliage.

B. Anther.

C. A small-fruited form.

Note that the fruits are usually in threes.

No. 6.

Alphitonia excelsa, Reissek.

The Red Ash.

(Natural Order RHAMNACEÆ.)

Botanical description.—Genus, *Alphitonia*, Reissek.

Calyx.—Five-lobed, spreading.

Petals.—Involute.

Stamens.—Five, included in the petals.

Disk.—Thick, filling the calyx-tube.

Ovary.—Immersed in the disk, two or rarely three celled, tapering into a shortly lobed style.

Drupe.—Globular or broadly ovoid, the epicarp of a dry, mealy or somewhat corky substance; endocarp of two or three hard coriaceous nuts or cocci, opening inwards by a longitudinal slit.

Seeds.—With a shining hard testa, completely enclosed in a membranous brown shining arillus, open at the top, but with the edges folded over; albumen cartilaginous or horny; cotyledons flat.

Tree.—Leaves alternate, penninerved. Cymes dichotomous, many-flowered. Seeds often persisting on the torus after the pericarp has fallen off.

Botanical description.—Species, *A. excelsa*, Reissek, in Endl. Gen., 1098.

A tall hard-wooded timber-tree, the young branches, petioles, and inflorescence hoary or rusty with a close tomentum.

Leaves.—Petiolate, varying from broadly ovate or almost orbicular and very obtuse, to ovate or lanceolate and acute or acuminate, usually 3 to 6 inches long, entire, coriaceous, glabrous or slightly hoary above, white, or rarely rust-coloured underneath with a close tomentum, the parallel pinnate veins very prominent.

Flowers.—Two to three lines diameter, in little umbel-like cymes, arranged in dichotomous cymes in the upper axils or in a terminal corymbose panicle. Calyx tomentose.

Disk.—Broad and nearly flat.

Fruit.—Three to four lines diameter, or sometimes rather larger. (B.Fl., i. 414.)

Botanical Name.—*Alphitonia*, from the Greek alphiton signifying "baked barley-meal," in allusion to the mealy nature of the epicarp; *excelsa*, Latin, signifying "high."

M. Flockton, del. et lith.

THE RED ASH.

(*Alphitonia excelsa*, Reissek.)

Vernacular Names.—"Red Ash," "Leather Jacket," and "Coopers' Wood." In the Illawarra district of New South Wales it is called "Humbug."

Its general name is "Red Ash," owing to the frequently bright red appearance of the heart-wood. Occasionally also it is called "Mountain Ash." For obvious reasons it is sometimes known as "Coopers' Wood," while its smooth compact bark is alluded to in the name "Leather Jacket."

Aboriginal Names.—The late Sir William Macarthur gave the name "Murrung," in use by the aboriginals in the Illawarra district, and Mr. Charles Moore gave "Nono Gwyinandie," as in use on the Clarence River many years ago. In northern New South Wales an aboriginal name was also "Culgera-culgera," while some Queensland ones called it "Mee-a-mee." Mr. Forester Mecham gave its aboriginal name on the Bellinger as "Coraminga."

Synonym.—*Colubrina excelsa*, Fenzl. in Huegel, Enum. 20.

Fruit.—Three to five lines in diameter, described by Asa Gray as a globose, baccate drupe, girt at the base with the persistent circumscissile tube of the calyx, which forms a kind of cupule.

The colour of the fruit is a dull bluish-black, which contains shiny reddish-brown seeds embedded in a brown powdery substance.

Bark.—On observing a statement that Red Ash bark had been used for tanning, I investigated a sample from Bangley Creek, Cambewarra. It yielded 32·9 per cent. of extract, but only 8 per cent. of tannic acid, and the comparatively high percentage of 3·75 of gallic-acid and impurities. The bark powders well, and yields but little fibre; the powder is, however, of a dark brown colour. The colour of the liquor is deep for a bark yielding such a low percentage of tannic acid, but the liquid remaining after extraction of the tannic acid by hide powder is of a light reddish-brown colour, differing from the colouring matter of Acacia barks, which is entirely removed by hide powder. This points to the fact that skins tanned with Red Ash bark would not turn out so dark a colour as would be expected from examination of the liquor.

Timber.—When a log is freshly cut it is of a pale colour, and looks simply like Ash. It is straight in the grain, works easily, and is somewhat tough. But in the course of a few weeks or months the heart-wood darkens, the sapwood retaining its original pale colour. According to age of tree, length of exposure or seasoning, this heart-wood may change to brown-reds of all depths of tint and even to bright red of a very ornamental character. The meaning of the name "Red Ash" is thus explained. When I first gave attention to this timber some years ago, I had a piece so fiery red that I did not believe the colour was natural, and planed the surface, only to find the colour was skin deep, but it returned, in course of time, to its original deep colour. This colouration has not yet been carefully examined, and we are, therefore, unable to give a satisfactory explanation of it. The colouring of Red Ash, like the colouring of a meerschaum pipe, takes time, and this is, of course, a drawback. I know of no other New South Wales timber which has such a striking colour. Another drawback is, of course, its superficial nature. For instance, when used for furniture, if it be touched with a plane the pale-coloured timber is exposed, making the timber look patchy, until, after the lapse of months, the timber becomes of a uniform deep red colour. A slab of the wood which had been seasoned over twenty-five years (having been exhibited at the London International Exhibition of 1862) has a weight which corresponds to 53 lb. 5 oz. per cubic foot.

Following are reports on this timber made by some New South Wales foresters a few years ago :—

Used only in a small way here for staves. (Mr. Forester Martin, Gosford.)

Timber pinkish, sometimes with beautiful figure, hard and tough and very lasting, even on exposure to the weather. The surface of the heart-wood turns quite red after short exposure to the sun. It is not very generally known. I have seen it used for ribs of vessels. I believe it to be excellent for coach-building, and generally well adapted for cabinet work. (Mr. Forester Rudder, Booral.)

This is a very handsome timber, splits well, and is durable and tough. It makes good staves, axe-handles, &c., also palings, shingles, and besides, lasts well in the ground. It takes a very fine polish, and is often used for cabinet work, as it shrinks very little. It makes a good lining for a house. I have been shown a house twenty years old lined with this timber sawn green. The wood has not shrunk, and is still sound. It has a pleasant smell when fresh cut. It is a splendid firewood. It was used by the aboriginals for light spears. (Mr. Forester Deverell, Glen Innes.)

Mr. Walter Hill, of Queensland, says of it :—

The wood is hard, close-grained, durable, and will take a high polish. It is suitable for gun-stocks, and a variety of other purposes.

Size.—Height, 40–80 feet; diameter, 20–30 inches, in the Gosford district.

On the coast up to 2 feet in diameter; height, up to 60 or 70 feet; very exceptional up to 3 feet in diameter. (Mr. Forester Rudder.)

Habitat.—Found in the coast and mountain brushes from the Shoalhaven northwards from south to north of Queensland. In New South Wales the most westerly localities known to me are Boggabri (J.H.M.) and Attunga, 12 miles north-west of Tamworth (R. H. Cambage). These are both west of the Dividing Range; it is usually found east.

Following are some notes by foresters :—

Not plentiful in my district; found only in brush forests on Jilliby, Wyong, and Mount Cook Creeks. (Mr. Forester Martin, Gosford.)

Habitat east of Dividing Range, chiefly skirts of brushes, brushes bordering streams and water-courses, sometimes in the open on sandy lands; in a dwarf form more on land on scrubby mountain tops and slopes. (Mr. Forester Rudder, Booral.)

A plentiful scrub wood, Kempsey district. (Mr. Forester Macdonald, Kempsey.)

As regards Queensland, it is a very widely spread and handsome tree, equally abundant on the coast and in the interior. It is one of the very characteristic trees of the "Brigalow" scrubs (Ten. Woods, *Proc. Linn. Soc., N.S.W.*, vii, 139). It is as common in the dense tropical jungle as in the desert. This feature is quite exceptional, for there is little else common to the two floras.

It extends to numerous islands in the Pacific Ocean, and also to Borneo. Seemann (*Flora Vitiensis*) speaks of it as "as a very common and variable species, often attaining a considerable height, and yielding useful timber." Found at South Cape (New Guinea). Coll. Rev. Jas. Chalmers (Mueller).

EXPLANATION OF PLATE.

A. Flower.
- *a.* Sepal.
- *b.* Petal, including the stamen (*c*).
- *d.* Disk, filling the calyx-tube.
- *e.* Lobed style.

B. Vertical section of flower.
- *a.* Sepal.
- *b.* Petal, including the stamen (*c*).
- *d.* Disk, filling the calyx-tube.
- *e.* Lobed style.

C, C^1. Different views of stamen.

D. Petal, including the stamen.

E. Fruit, showing the rim or cupule.

F. Fruit dissected to show the two nuts or cocci.

G. The nuts or cocci, showing the method of attachment.

H, I, J. Views of seeds.

No. 7.

Doryphora sassafras, Endl.

The New South Wales Sassafras.

(Natural Order MONIMIACEÆ.)

Botanical description.—Genus, *Doryphora*, Endl.

Flowers.—Hermaphrodite.

Perianth-tube.—Campanulate, segments six in rows.

Stamens.—Usually six perfect, opposite the perianth-segments round the orifice of the tube, with six to twelve staminodia within them.

Filaments.—Short, with a wing-like appendage on each side.

Anthers.—Extrorse, with two distinct cells opening from the base upwards in convex valves, the connective produced into a long linear-subulate appendage.

Carpels.—Several at the base of the tube, with one ascending ovule in each cell.

Style.—Long, slightly lateral. Fruiting carpels included in the persistent perianth-tube, the segments deciduous, each carpel growing out laterally, so that the long plumose style appears almost basal.

Seed.—Not seen perfect.

Tree.—Leaves toothed. Flowers three together on short axillary peduncles. The whole plant highly aromatic.

Botanical description.—Species, *D. sassafras*, Endl., *Iconogr.*, t. 10.

A tree of considerable size, glabrous, except the inflorescence or the young shoots hoary-tomentose.

Leaves.—Petiolate, ovate, elliptical, or oblong-lanceolate, acuminate, coarsely toothed, narrowed at the base, 2 to 4 inches long, nearly smooth on the upper side, prominently penniveined, and reticulate underneath.

Peduncles.—Two to three inches long, with a pair of very deciduous bracts of 3 to 4 lines close under the flowers.

Perianth-tube.—About 1 line long when in flower, enlarged and irregularly split when in fruit, segments about 4 lines long, lanceolate, very acute.

Anther-appendages.—Nearly as long as the perianth-segments. Carpels slightly hairy, the styles lengthening after fecundation into long plumose awns.

Although the embryo has been described by Endlicher in his Genera Plantarum, it is doubtful whether he had seen it, for throughout that work the tribual characters are repeated under each genus without his having always verified them in each case, and the seed is not figured in his Iconographia, t. 10. In the 2nd Suppl. to the Genera, p. 35, he proposes to substitute the name of *Learosa* (Reichb. *Nomencl.* 2612, a work I can find no record of) for *Doryphora*, the latter being pre-engaged by Zoologists, a plea now insufficient for changing a botanical name. (B.Fl., v. 283.)

M. Flockton, del. et lith.

THE NEW SOUTH WALES SASSAFRAS.

(*Doryphora sassafras*, Endl.)

Botanical Name.—*Doryphora*, Greek, Doru (a spear), phero (I bear), perhaps in allusion to the long appendage to the anther; *sassafras*, because its odour is reminiscent of that of the well-known Sassafras of North America.

Vernacular Name.—Sassafras, or by ignorant people Sassafrax. Sometimes it is called Black Sassafras. Professor C. S. Sargent says that Sassafras was first used as a popular name by the French in Florida, and when the genus, which had been included by earlier botanists with *Laurus*, was distinguished by Nees ab Esenbeck, he adopted Sassafras as its name.

I would suggest the name New South Wales Sassafras for *Doryphora*, as it is mainly developed in this State, *Atherosperma*, another Sassafras, being more abundant in Tasmania and Victoria, and *Cinnamomum Olivieri* in Queensland.

Aboriginal Names.—The following are, or were, some of its New South Wales aboriginal names:—"Caalang," of those of Illawarra; "Tdjeundegong," of those of Brisbane Water; "Boobin," of those of the Northern districts of New South Wales.

Leaves.—The tree has dense bright glossy foliage and aromatic odour, filling the brushes with a delicious fragrance.

Flowers.—The flowers are pure white and star-like, forming a beautiful display in contrast to the dark, shining foliage.

Bark.—This is our common New South Wales Sassafras, and tea is commonly made from its bark at the present day in the coastal districts. The aromatic flavour is not unpleasant, although it requires practice to really like it. Besides a mere beverage, it is also used as a tonic medicine. The odour is rather fugacious. It is taken in the form of an infusion. Dr. T. L. Bancroft, however, informs the writer, "I have tried the bark on frogs, and found it to be inert."

Timber.—If properly dried before being put into a building as a ceiling, lining, or flooring boards, it is a valuable timber, but it takes a long time to dry; it is not much used for joinery work, as it will not stand glueing. I know a chest of drawers the inside of which is made of it, and it is perfectly sound after thirty years, white ants will not touch it; it is now being tried as weather-boards, but I am afraid it will require a lot of paint, as it is so open-grained. It is sometimes used for packing-cases. It is of a canary yellow colour when quite fresh, but it becomes dirty looking with age. It is fragrant, and disagreeable to vermin.

There is no question as to its durability in some situations. The following are extracts from three letters referring to it. In judging white-ant proof timbers one must bear in mind that white-ants, if put to it, will eat anything, but that the prefer some timbers to others, and will leave some timbers quite intact while eating those that are more palatable.

During the month of February, 1865, I laid a floor of this sort of timber in Booral. The situation was on a very low damp condition, and though the floor had been in contact with the hardwood slabs of the wall, and these so thoroughly worried with the white ants as hardly to be able to stand on end, and have had to be taken away, the floor boards have been but 3 inches above the ground, and now, notwithstanding all these drawbacks, the boards when taken up are found to be as sound as ever; they were relaid again, and look as if they would last another twenty years. Now what insect can contend with the essential oil of this timber? Not one, I believe.

A Wollongong correspondent writes:—

To-day whilst clearing out the storeroom a small case was shifted (it was resting on the damp floor); in doing so the bottom fell out. The white ants had eaten it out. I find the box to be made of a deal sides, the ends of English elm or ash, and the partitions of Colonial sassafras.

The late Forester Benson wrote from Wyndham:—

The timber is very useful for indoor work. I was shown a large house on the creek, where all the rooms were lined with it, and it seems equally as well adapted for that purpose as pine. The window frames and some of the furniture are of mountain hickory, which appears to be a valuable timber for cabinet-making. I was informed that sassafras should be cut in the winter and stacked for some months, as it is liable to warp; also that it is free from the attacks from white ants.

Size.—It forms a large tree. Trees 60 to 80 feet high are quite common, and I have been given measurements from reliable people up to 120 feet high, and with a diameter up to 5 feet.

Habitat.—The Sassafras is confined to New South Wales and Queensland. The most southerly locality I have specimens from in this State is Myrtle Creek, Wyndham, County of Auckland. This is, of course, very close to the Victorian border, in which State it may be expected to be found. In Queensland it is as far north as the Logan River. It is found in brushes, hence in good soil in gullies throughout the coastal districts. It occurs for a considerable distance into the recesses of the mountain ranges of the Dividing Ranges and its spurs, but its precise range or "curving boundary" is unknown. I have it from as far west as Jenolan Caves, Mt. Wilson, and the Bowman and Barrington Rivers. I shall be glad of notes of any localities further west than those stated.

Propagation.—From seed.

EXPLANATION OF PLATE.

A. Flower.

B. Vertical section of flower.

C. Flower without perianth.

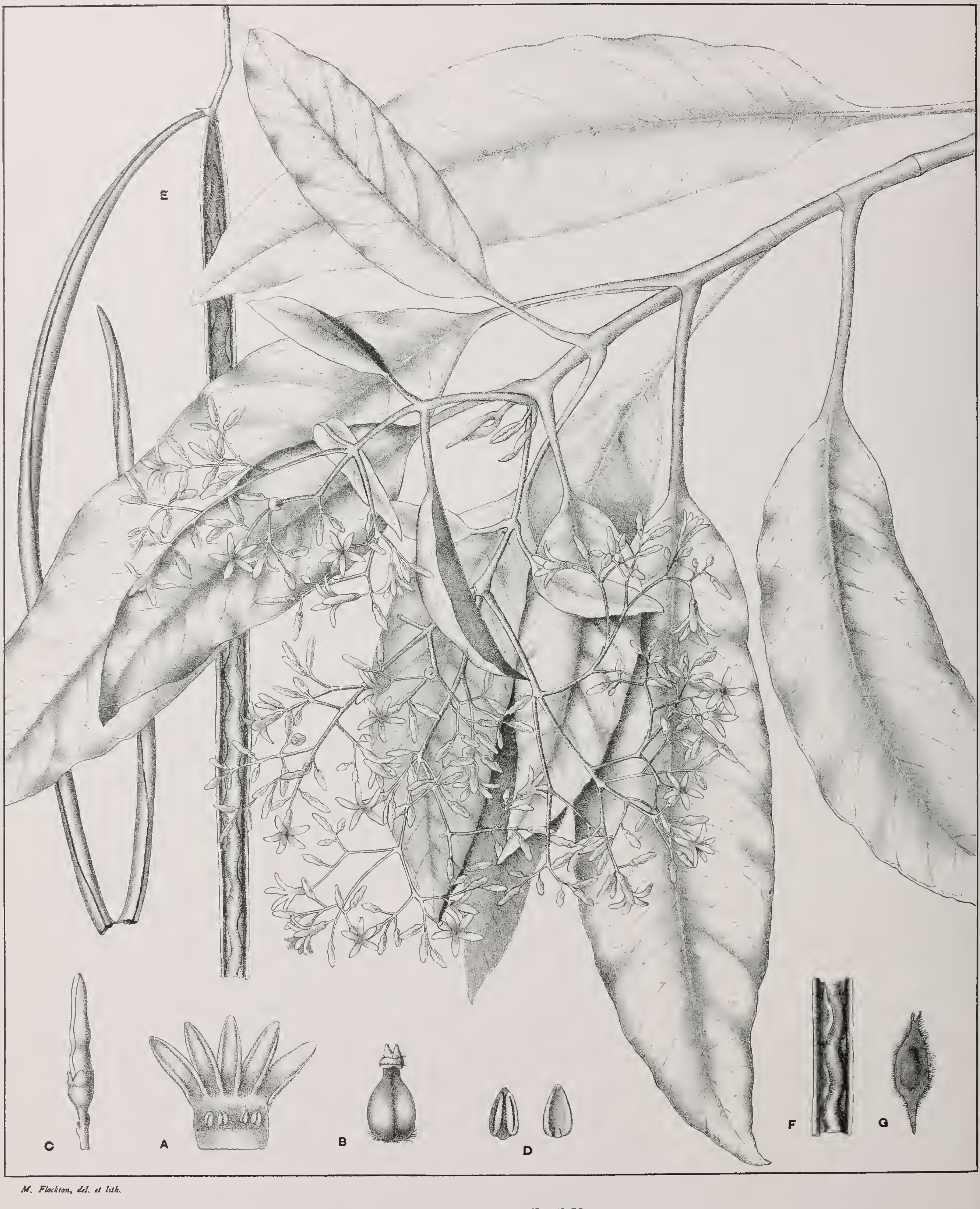
D. Stamen.

E. Staminodium.

F. Carpel.

G. Fruiting carpels included in persistent perianth tube.

H. Plumose, awn, and style.



M. Flockton, del. et lith.

A BITTER BARK.

(*Alstonia constricta*, F.v.M.)

No. 8.

Alstonia constricta, F.v.M.

A "Bitter Bark."

(Natural Order APOCYNEÆ.)

Botanical description.—Genus, *Alstonia*, R.Br.

Calyx.—Without any or with minute glands.

Corolla-tube.—Cylindrical, more or less swollen round the anthers, the lobes spreading, contorted in the bud, the throat without scales.

Ovary.—Of two distinct carpels united by the style.

Stigma.—Ovoid or conical.

Ovules.—Numerous; in about four rows in each carpel.

Fruit.—Of two long linear follicles.

Seeds.—Oblong, compressed, peltately attached, bordered with hairs of which those of each end are usually very long; albumen scanty.

Trees or tall shrubs with a milky juice.

Leaves.—In whorls of three or more, or, in a few species, opposite.

Flowers.—In terminal corymbose cymes, usually one in the axil of each leaf of the terminal whorl.

Bracts.—Small.

Botanical description.—Species, *A. stricta*, F.v.M., Fragm. i, 57.

A small shrub or tree attaining sometimes 40 feet, quite glabrous.

Leaves.—Opposite, on long petioles, mostly oblong-lanceolate, but varying from almost ovate to narrow-lanceolate, acute or acuminate, the primary veins distant, oblique, and not very prominent, 3 to 5 inches long.

Flowers.—Numerous, in corymbose cymes, either solitary and terminal or two together in the forks of the branches and shorter than the leaves.

Calyx-segments.—Ovate, almost acute, about ½ line long, with a few minute and irregular glands at the base inside.

Corolla-tube.—About 1 line long, glabrous, or slightly bearded inside at the base, the right-hand edges overlapping in the bud.

Follicles.—From 3 to 4 inches to twice that length.*

Seeds.—Linear, flat or concave, pubescent, 4 to 6 lines long, ciliate with long hairs at the upper end and shorter ones at the lower end. (B.Fl., iv. 314.)

Botanical Name.—*Alstonia*, in honor of Dr. Charles Alston, Professor of Medicine and Botany in the University of Edinburgh from 1740 to 1761; *constricta*, Latin, the top of the corolla-tube being constricted.

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* Exceptionally they are over a foot long.

Vernacular Names.—"Fever Bark," "Bitter Bark," "Quinine Bark," all in allusion to the bitter taste. It is known as "Whitewood" on the Herbert River, Queensland.

Aboriginal Name.—The native name of the tree at the Clarence was "Leeambil," according to the late Mr. J. F. Wilcox, of Grafton, quoted by the late Dr. George Bennett, in *Journ. Bot.*, v. 150. "Lacambie" is Mr. Charles Moore's spelling in the Catalogue New South Wales Timbers, London Exhibition, 1862.

Bark.—This yellowish-brown, often thick and deeply-fissured bark, is intensely bitter, and possesses valuable febrifugal and tonic properties. It is quoted in London drug lists. A decoction is sometimes sold in the colonies as "bitters." It has been stated that it is used by some English brewers of pale ale for export, as it produces neither headaches nor other ill effects of hops. I have heard of its use by foreign brewers. It tastes remarkably like Cinchona bark, and seems to partake somewhat of the properties of both quinine and strychnine. This drug is undoubtedly worthy of careful experiments by medical men.

From a pamphlet prepared by Dr. Joseph Bancroft, of Brisbane, for the Colonial and Indian Exhibition, 1886, I cull the following particulars in regard to his observations. He obtained the bark from near Dalby, Queensland, some time after 1868:—

It gives out to water and alcohol a yellowish principle, intensely bitter, and not easily made to assume any crystalline form. When the tincture is poured into water, the mixture becomes fluorescent, and excepting a slight yellowness, is not easily distinguished either by colour or taste from a solution of quinine. Its utility as a general tonic is established beyond all doubt. Indeed, if any powers are left, a debilitated stomach will respond to Alstonia. Alstonia has been used in the earlier stages of typhoid fever with considerable success. No unfavourable symptoms are produced by it, but patients complain of a bitter taste in the mouth, remarking that they consider themselves bilious. After fifteen years' experience of the use of Alstonia the writer is of opinion that there is no better or more generally useful tonic. The tincture made with 3 oz. of the bark to a pint of proof spirit is the form generally used, the dose being from five to ten drops. The powder in grain doses, made up with extract of liquorice, forms a convenient tonic pill. An alcoholic extract made by Mr. Staiger is a much more powerful remedy, but experiments are wanting to determine its special utility.

This action of *Alstonia* bark is described in a letter from Dr. A. W. Bixby to the *Therapeutic Gazette* (Detroit, U.S.A.), December, 1880, p. 369, as follows:—

Alstonia constricta (F.v.M.) has a wide range of application and action as a medicine. Its action resembles in many respects the combined action of quinine and nux vomica. It is an antiperiodic of the highest type, giving better satisfaction, to my mind, than quinine or cinchonidine. It is a cerebro-spinal stimulant and tonic; acts positively upon the great sympathetic nerve centres, and consequently increases positively and permanently the vital forces of the entire system. I prepare the system for its use by the administration of the proper sedative; then *Alstonia* seldom fails. Where quinine fails in chronic cases *Alstonia* often effects a speedy cure.

He further states:—

In typhoid, synochal, and puerperal fevers, where an antiseptic and nerve tonic is demanded, it answers well. I used it in the treatment of about seventy-five such cases last fall, and with the happiest results. In recent colds or coryza it is an excellent remedy. At the beginning of an attack of this annoying trouble two grain doses of the powder every two hours gives prompt relief. The whole system is soon reinvigorated; the secretions and excretions, which have been more or less suppressed, are re-established, and the patient is all right and feels well.

He concludes :—

I believe it will become a favourite with all who test it.

I have heard that the bark of *A. constricta* has been used as a remedy for worms in sheep with "splendid" results.

The bark contains, according to C. Palm, *Kopp u. Will Jahresb.*, 1863 ("Rinde eines australischen, der Familie der Apocyneen angehörenden Baumes"). Wolff, *Aschen Analysen*, i., 128.—A neutral resinous bitter principle, called by him *alstonin*, similar to *cailcedrin* and *tulucunin*, a volatile oil, smelling like camphor, an iron-greening tannin, gum, resin, fat, wax, protein substance, oxalic acid, and citric acid. The ash amounted to 6·06 per cent. of the bark, and an analysis of it is quoted in *Watts' Dict.*, vi., 1st suppt. 101.

Mueller and Rummel, in Wittstein's *Organic Constituents of Plants*, gives the following account of *Alstonin*, the alkaloid of the bark of *Alstonia constricta* :—

Alstonin differs from *ditamine* chiefly by its behaviour towards concentrated acids, and by its fluorescence, which has not been recorded of the other alkaloid.

The correctness of the above results has been disputed by Hesse, who expressed the opinion that the supposed alkaloid was a mixture of *chlorogenine* and *porphyrine*. (*Ber.* 1878, p. 2175.)

In June, 1879, Oberlin and Schlagdenhauffen* announced the isolation of two alkaloids from this bark, a crystallisable and an amorphous one. They found the bark to be soluble in ether to the extent of 1·038 per cent., and to this ethereal extract their attention was confined. In *Pharm. Journ.* [3], ix., 1059, is an abstract of their paper, and an account is given not only of the method of preparing these alkaloids, but also of their physical and chemical properties. The crystalline alkaloid occurring in silky tufts of brilliant, colourless, isolated, or stellate crystals, is styled *alstonine*,† while an amorphous nitrogenous residue, possessing alkaloid properties, obtained by spontaneous evaporation from the mother liquor, which yielded *alstonine*, is provisionally termed *alstonicine*.

In 1881 an exhaustive research on this bark was contributed by Hesse to the *Annalen der Chemie*, ccv., 360, of which a careful abstract appears in the *Pharm. Journ.* [3], xi., 775. Palm's *alstonin* (notwithstanding the alleged absence of nitrogen) was shown by Hesse to consist essentially of an alkaloid which he had obtained from the bark, and called *chlorogenine;* but as Palm's name had priority, Hesse called the alkaloid *alstonine;* but unfortunate confusion has arisen in Mueller and Rummel and Oberlin and Schlagdenhauffen (*vide supra*) also having given so descriptive a name to substances of different composition. The abstract above referred to gives a very lucid account of the overlapping of various researches, and shows how the different products obtained by different observers may be reconciled.

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* *Journal de Pharmacie et de Chimie*.

† Probably Hesse's *porphyrine*.

After this necessary preliminary statement, Hesse gives a full account of the preparation and properties of the alkaloids found by him. They are :—

1. *Alstonine* (synonymous with *chlorogenine*, and probably identical with Palm's *alstonin*). It is a brown, amorphous mass, which can be rubbed to a brownish-yellow powder. Merck (*Bulletin*, i, 5) speaks of this alkaloid as forming white, lustrous, silk-like crystals, easily soluble in ether, chloroform, or alcohol. It is nearly insoluble in cold water, somewhat soluble in hot water, to which it imparts an intensely bitter taste. It is an antiperiodic, antiseptic, and stimulant, thus uniting the properties of quinine and strychnine. It is employed in typhoid and lacteal fevers.

2. *Porphyrine*, a white powder found in very small quantity.

3. *Porphyrosine*, the examination of which is not yet complete.

4. *Alstonidine*, consisting of colourless, concentrically-grouped needles.

Hesse believes that this list by no means completely enumerates the alkaloids obtainable from this interesting bark.

It is one of the very few Australian barks which have, up to the present, been exhaustively examined. For a list of the researches on the subject see p. 21 of my "Bibliography of Australian Economic Botany (1892)."

There is also a paper in *Annalen der Chemie*, ccv., 360–371, abstracted in *Year-book of Pharmacy*, 1881, p. 172.

The list of substances obtained from Alstonia barks (including *A. scholaris*) are enumerated by Sohn at pp. 7 and 108, and comprise the alkaloids Alstonine, Ditamine, Echitamine, Echitenine, Porphyrine, and Alstonidine; also the non-alkaloidal, non-glucosidal Echitin, the wax-like Echicerin, and the aromatic body Echiretin.

As the bark is described in the Indian and Colonial Addendum to the Pharmacopœia (pp. 4 and 5), it may not be out of place to reproduce the description here.

The bark of *A. constricta* is usually in curved pieces or quills which may have a width of $2\frac{1}{2}$ inches (64 mm.) or more, and $\frac{1}{2}$ inch (12 mm.) in thickness. It is covered with a thick periderm varying from $\frac{1}{10}$ to $\frac{1}{4}$ inch ($2\frac{1}{2}$ to 6 mm.) in thickness, of a rusty brown colour, strongly rugose, and marked with large deeply-fissured reticula. It sometimes bears small white foliaceous lichens. Internally, the bark is of a cinnamon brown colour, and is marked with coarse longitudinal striæ. On transverse section, the bark exhibits the dark brown periderm, covering the inner orange-brown tissues, in which may be observed with a lens numerous small shining particles. The fracture is short and granular in the outer layers, but fibrous in the liber portion. It has a faint aromatic odour, and a very bitter taste.

Following is the most recent research, from a therapeutic point of view. I have condensed the paper* somewhat :—

The genus is peculiar to tropical countries, and the sap of all the species contain caoutchouc or some body allied to caoutchouc. *A. plumosa* and other species yield the body known as Fiji rubber. Only three species interest us, namely, *A. scholaris*, *A. spectabilis*, and *A. constricta*.

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* "Australian Bitter-bark (*Alstonia constricta*), and other species," by J. Gordon Sharp, M.D.; *Pharm. Journ.*, 23rd March, 1901, p. 362.

A. scholaris, R.Br. (*Echites scholaris*, Linn.), is a native of India, the Malay Archipelago, and tropical Australia. The wood of this tree has received the name *lignum scholare* on account of the slabs of the close-grained wood being used as school slates, the letters being traced upon them in sand. In Ceylon this light wood is used in making coffins. This tree which, as already mentioned, is widely diffused, attains a height of 50 to 80 feet, and has a furrowed trunk.

The Bark is known by the names dita bark, devil bark, and by the Indian names *pali-mara*, *lutiana*, *chatin*, and *satwin*. It is found in irregular fragments of $\frac{1}{8}$ to $\frac{1}{2}$ inch thick, and of a somewhat spongy texture, and having a coarse fracture. The outer surface is unevenly rough, and of a brownish-grey colour, while the internal layer is bright buff. It is important to bear these descriptions in mind, for several specimens have hitherto been placed on the market which are really *A. spectabilis*. The bark is not nearly so bitter as the barks from *A. spectabilis* and *A. constricta*. It has no aromatic, nor, in fact, any odour, and in this respect it differs from *A. constricta*. Underneath the rough external surface are cream-coloured patches which often peel off in flakes, and, indeed, two of the specimens I have are entirely made up of these cream-coloured patches. Mr. Holmes says he has often seen *A. scholaris* bark like these peelings, but really they are only part of the bark.

Chemical Tests for the Bark.—(1) If strong H_2SO_4 be applied to the inner layer of *A. scholaris* bark, a bright red colour is soon developed (ditamine test), which in a very short time changes to a dirty brown. This is a beautiful test if carefully applied. Should the inner layer happen to be blackened by dirt or age, carefully scrape away the dirt, then apply a drop of clear pure sulphuric acid to the clean spot. Wait one minute, remove the acid, by drawing the cleansed finger once across the acid, and if the bright red colour has not then developed, it will do so in a very few minutes. (Compare with *A. constricta* bark.) At first the colour often appears in small dots the size of a pin point, and then becomes general. *Note.*—The colour soon changes to dirty brown or some dark shade. (2.) Strong nitric acid applied to a similar surface gives very soon a yellowish spot (not bright red as in the case of *A. constricta* bark). If some of the nitric acid happens to have run in between the outer and inner layers, spots of dark blue may be seen. (3.) Tincture of iodine gives a black spot (compare with *A. constricta*).

Chief Constituents.—O. Hesse found three alkaloids ditamine, echitamine and echitenine. Ditamine has the formula $C_{16}H_{19}NO_2$. It is soluble in most of the fluids employed in exhausting drugs. It is readily soluble in dilute acids. I prepared ditamine or some such alkaloid from *A. scholaris* by exhausting the powdered bark with boiling methylated spirit, evaporating the spirit to low bulk, and adding very dilute acid to take up the alkaloids. The caoutchouc, which was present in abundance, was removed; then the fluid was filtered, treated with purified and washed animal charcoal to remove the small amount of colouring matters. After filtering, a very bitter fluid was obtained. I next added ammonia in excess, and there was thrown down a white precipitate, which was bitter in taste; but not nearly so bitter as alstonine, the alkaloid of *A. constricta*. This precipitate was washed, dried, and tested for ditamine. With strong H_2SO_4 it gave a bright red changing to various shades of violet on heating. With strong HNO_3 it gave a yellowish colour. These two tests, taken along with the precipitation from a mixture of all the alkaloids of *A. scholaris* by excess of ammonia point to ditamine. It is to be remembered that ditamine is white, while alstonine is brown in colour.

Action of Ditamine.—This alkaloid is said to possess an action like curarine—that is, it paralyses the motor nerve endings. I have not experimented with it; but I intend to investigate the exact pharmacology of both ditamine and alstonine.

Therapeutics.—Dita bark was introduced to Professor Christison's notice nearly forty years ago, but I have been unable to find out what he thought of it. The tincture was prepared by Mr. Macfarlan about the same time, so that it has been known in Edinburgh for a long time. Since then it has had ups and downs, but has never been a general favourite. It is, perhaps at best, a good general tonic, which may prove useful in debilitating diseases.

A. spectabilis, R.Br. (*Blaberopus venenatus*, De Cand.), yields the poelé bark of Java. It is closely allied to *A. scholaris*, and the one is sometimes mistaken for the other; but poelé bark is much more bitter—in fact, in this respect, it resembles *A. constricta*. It yields six times more ditamine than dita. It is a native of Java, Borneo, and the "Challenger" Expedition explorers found it in the South-eastern Moluccas. In that useful manual the "Treasury of Botany" it is stated that in Borneo the wood of a tree allied to *A. scholaris* is of a white colour near the root, and being very light is used for floats for nets, and household utensils, such as trenchers, corks, &c. This may be *A. spectabilis*. The two must be very much alike, for Robert Brown tells us that so learned a man as Rumphius confused the two species. The action of poelé bark is the same as dita, only it contains, as I have already mentioned, six times the amount of alkaloid ditamine.

Other species of this genus are met with in South America and the East Indies, and their barks are employed in the treatment of dysentery, diarrhœa, malaria, and debilitating diseases; but they only enjoy a local celebrity.

Alstonia constricta, F.v.M.—The bark is of chief interest to us; specimens vary a good deal in bitterness, and old specimens appear to have lost much of their bitterness. Some specimens have very little periderm.

This leads me to an important point and relates to the question of the wisdom of the compilers of the Addendum in making no distinction between *A. constricta* and *A. scholaris* so far as it deals with the tincture and infusion. The Indian bark may, it is true, be generally employed in India, and the Australian bark in Australasia; but the preparations are sure to be used to some extent in other Colonies and in the home countries, and if a medical man prescribes the tincture or the infusion of *Alstonia*, it is left to the option of the dispenser to supply what he likes. Now the *A. scholaris* preparations are light in colour and pleasantly bitter, while the *A. constricta* preparations are darker and very bitter, and if one pharmacist supplies the first, and his neighbour round the corner supplies the second, the next time the patient has his prescription dispensed, it may lead to confusion. It should be noted that the tincture and infusion are simply called tincture or infusion of alstonia—the specific name is not given. In my opinion the dose of the tincture made from *A. constricta* is too large. It should be 5 to 20 minims, and not $\frac{1}{2}$ to 1 fluid drachm as given in the Addendum. The dose of $\frac{1}{2}$ to 1 fluid drachm is appropriate for the *A. scholaris* preparation.

As to the determination of the relative bitterness of the two barks in a rough way, I do as follows:—I chew the bark and note by the watch the time of the development of the bitter taste, and also its intensity. The bitterness of *A. constricta* develops in ten seconds at the latest, and is intense; while *A. scholaris* does not develop bitterness before fifteen seconds at the earliest, and not usually till nearly twenty seconds, and at the end of this time it is only mildly bitter.

Tests applied to the Dry Inner Bark.—The following on being applied to the inner layer of the bark give:—(1) Solution of iodine—mahogany brown (compare *dita* bark). If a watery infusion be placed in a porcelain dish, and then iodine solution be added thereto and heat applied for ten seconds, a mahogany brown is obtained. On cooling, there may be observed on the bottom of the dish, in parts where the watery portion has evaporated, beautiful puce-coloured masses. (2) Strong $FeCl_3$, no characteristic reaction. (3) Chromic acid solution, no characteristic reaction. (4) Bromine solution, no characteristic reaction. (5) Strong H_2SO_4, no characteristic reaction. Compare *dita.* (6) Strong HCl, no characteristic reaction. (7) Strong HNO_3, a beautiful garnet red, and not so far removed from the so called blood-red of nux vomica bark. If a watery infusion have added to it a few drops of nitric acid (strong), the same delicate hue results, but soon changes to brownish-green. Compare *dita.*

Active Constituents of the Bark.—There are four alkaloids: (1) alstonine; (2) porphyrine; (3) porphyrosine; (4) alstonidine. Alstonine, the first, is very bitter, and is the only one of any great importance. Accepting O. Hesse's classification, alstonine is the alkaloid which was formerly known as chlorogenine. Its formula is estimated as $C_{21}H_{20}N_2O_4$. This was a brown amorphous powder nearly soluble in chloroform and alcohol, sparingly soluble in water and dilute acids, and insoluble in absolute ether. Some books describe the alkaloid as being of a golden brown colour; but Hesse simply says it is brown. Its solubilities are differently stated in different books. This may be owing to the fact that alkaloids more or less impure have been employed. My specimen was alkaline to litmus and its watery solution, yellowish brown, and fluorescent and bitter in the extreme. I tested it carefully with phenyl-hydrazin for sugar, but failed to get any reaction, so that in all probability there was no admixture of glucoside. It was difficult to believe that such a brown body did not contain some glucosidal colouring matter. (Peruvian bark is in colour much like bitter bark, and yet its chief alkaloid quinine is quite white.) Alstonine readily forms salts with most acids. I have only experience of the hydrochloride, which is fairly soluble.

Reactions of Alstonine.—This alkaloid was put through a large number of tests in the hope of finding some characteristic colour or other reaction. Heated with strong HCl, H_2SO_4, or HNO_3, a sweetish odour is developed. Strong H_2SO_4 by itself gives no particular reaction, but if a small crystal of cane sugar be added, a puce or garnet results. Like the bile salt tests, it must be carefully carried out in order to ensure success. Strong H_2SO_4 with a trace of HNO_3 gives a brownish red, while HNO_3 by itself strikes a bright reddish-brown or light brown, according to the accuracy with which the test is applied. Bromine may yield a snuff brown, and iodine a dark pink or garnet. Ammoniated silver nitrate gives nothing in the cold ; but when heated, a pinkish colour develops, and when examined by the microscope under alcohols, sheaf-like crystals are seen. In the same way ammoniated sulphate of copper gives irregular tubes. Heat and HCl, with most of the metallic salts in addition, give a purple brown or puce, the antimony reaction being especially beautiful. The purple brown or puce is also obtained with HCl and bichromate of potassium, while HCl and chromate of potassium give a greenish-brown HCl and ferrocyanide or ferricyanide of potassium give no particular colour test. These tests require accuracy and experience in application, and I have repeated each one again and again. I may here remark that alstonine costs nearly 4s. a gramme, so that for the present it is outside the range of practical pharmacy and therapeutics.

Pharmacology of Alstonine.—Although pharmacology and therapeutics are not generally discussed at these meetings, yet I find in old numbers of the Journal reference to these subjects at your meetings. Besides the aspect from which I have chiefly studied, the pharmacology of alstonine will, I believe, interest some of you. Let me first state my reasons for following my present line of investigation. *Alstonia constricta* has been stated to resemble both cinchona and nux vomica—in fact, occupying a position in therapeutics midway between the two. My experiments then were so planned that I might chance to find out the points of resemblance and difference to the two named drugs.

Action on the Small Life of Pond Water and Hay Infusion.—A drop of pond water in a cell and kept at summer temperature was examined by the microscope and found to contain such as *Closterium, Vorticella, Paramœcium, Amœba,* and others in active movement. Hay infusion was also placed in another cell and examined, and showed a field teeming chiefly with *Paramœcium* bounding across the field. These two slides were kept to compare with two similarly prepared slides, to which, however, alstonine alkaloid in solution had been added. The slide of pond water to which has been added 1 in 6,000 alstonine bears a report as follows :—Movements of inhabitants much slowed in fifteen minutes, and all evidently dead in two hours. The animalcules appear to ingest the alstonine, and gradually die, due to coagulation of their protoplasm. When the alstonine is first added, it acts as a stimulant, and the inhabitants rush across the field with increased activity, and even the lazy *Amœba* raises himself up ; but in a few seconds all is changed, and instead of bounding over the field the *Paramœcium* moves within a narrower circle, and more slowly, and finally dies. In *Rotifera* the alstonine seems first to paralyse the fine cilia.

With hay infusion much the same results. A solution equal to 1 in 6,000 of the total mass soon slows the movements, and in fifteen minutes the movements are greatly slowed, and in two and a-half hours only two or three appear alive in a whole field, and they only move with the utmost langour and at long intervals. In three and a-half hours the whole field becomes lifeless. The pigment is seen collected in the centre, leaving a clear rim. At the end of the experiment the two slides, to which no alstonine was added, show their denizens alive and highly active. Alstonine then appears to act like quinine by coagulating the protoplasm, but in its action on *amœba,* &c., it is only one quarter as toxic as quinine. Thus there is a sound reason for its employment in the treatment of malaria.

On Frog's Blood.—It is so difficult to keep blood *alive* for any time in experiments of the kind presently being pursued that my experiments on blood only bear a provisional interpretation. One in 27,000 alstonine in saline solution was found to slow very perceptibly the movements of the amœboid cells.

Action on Beetles.—I next desired to ascertain the action of the alkaloid on life higher than that found in hay infusion and ponds, and to compare it with quinine and strychnine. I selected the common black beetle or cockroach, as it is usually called, but in reality the churchyard beetle (*Blaps mortisaga*). It is a difficult matter to overcome the disgust of catching and handling this repulsive insect even to one well accustomed to handling frogs and toads. The insect, besides, is not easily caught unengorged, and that is what one wants. He is very lively, and on the first approach of danger makes for his retreat. For my experiments four wide-mouthed bottles were taken, well dried and provided with caps, so that plenty of air was admitted, and each bottle was provided with a tiny flat vessel nearly full of water.

(1.) Contained, besides, cane sugar in powder scattered all over the bottom, for the beetle, although no vegetarian, dearly likes sugar or sweets of any kind. In the midst of this nectarian repast the beetle was planted, and at the end of four days he was evidently enjoying himself when he was killed.

(2.) Contained 1 in 1,000 alstonine alkaloid diluted with powdered cane sugar. At the end of the thirty-six hours the beetle may die, but this is not always the case ; he sometimes may live two days. At other times one finds him at the end of thirty-six hours so lethargic that he lies and refuses to move even when touched with the blunt end of a piece of stick. In twelve hours the lethargy may wear off, and he moves a little; and in twelve hours later the paralysing action of the alstonine has passed off, and he becomes lively, but only for a time, till he evidently has again engorged himself.

(3.) Contained 1 in 5,000 pure strychnine diluted, as in the case of alstonine. Though it may appear strange, it is nevertheless true that strychnine had comparatively little effect on the beetle. At the end of two or even three days he may be as lively as when first caught.

(4.) Contained 1 in 1,000 quinine in sugar, as before. This experiment shows that quinine is more toxic to beetles than either strychnine or alstonine. At the end of twelve hours the beetle is dull, dazed, and unable to walk; and in twelve hours later he lies on his back, and when gently turned over walks feebly, and in thirty-six hours is dead.

Action on Crickets.—In this experiment the house cricket (*Acheta domestica*) was used. If catching a beetle is ticklish, capturing a live cricket without injuring him is a task nearly as difficult as getting hold of De Wet. You must sit and watch—may be for half an hour—in a dull light till he issues from his lair, and when he has ventured a sufficient distance, and has turned his back upon his place of retreat, you steal up behind him and slowly lower your body so as to rest on your heels, and then as slowly raise your hand so as to get right on the top of him, and then, as swift as lightning, pounce down on him—and then you find he has doubled back and has reached his hole, which he enters with a jubilant and sarcastic chirrup. I found crickets would not take the white sugar or quinine sugar and strychnine sugar, but readily took the nice chocolate brown alstonine sugar. Had the colour anything to do with their dislike? I nicely browned the cane sugar before starting my second set of experiments, and was successful. (1) Plain brown sugar with water trough as in the beetle experiments; crickets lived three days, and were well when they were killed. (2) 1 in 1,000 strychnine; dead generally in eighteen hours. (3) 1 in 1,000 alstonine; appear dead in thirty-six hours, but revive in a few hours, but finally die in fifty-four hours. (4) 1 in 1,000 quinine; experiments too few to be conclusive.

Action on Wasps.—For this the ground wasp (*Vespa vulgaris*) was principally employed. Catching a wasp is not an easy matter when your desire is to have one wasp in each bottle. You can, by alluring them, get eight wasps in one bottle, but the perversity of the wasp's nature does not allow of eight wasps in eight bottles. You have to catch them by hand. My plan was to wait in a sweet shop in the country about the end of August, put on a thick kid glove, and, when a wasp has comfortably settled down on a sweetmeat, to drop down on him and hold him gently by the head and in such a position that he could not put his body into stinging attitude; and, after having ascertained that he was uninjured, I dropped him into the prepared bottle. Till I got up to his tricks I found a wasp would send his sting so deeply into the thick kid glove that sting and poison gland were pulled away together. With practice a wasp can be so manœuvred that he is caught without injury. (1) Plain sugar without water; wasps live in this for three to four days and longer, and bore the cork of the bottle actively all the time. (2) 1 in 5,000 strychnine; do not die before two days, and bore the cork actively most of the time. (3) 1 in 1,000 quinine; only live twenty-four hours at most. (4) 1 in 1,000 alstonine; only live twenty-four hours, and may die in twelve.

Wasps in both the quinine and alstonine sugar bore the cork very lazily, and often lie dazed. Alstonine appears to affect the wasp's equilibrium, for as he walks he often misses his footing.

Action on Frogs.—The frogs were pithed—that is, sensibility was destroyed before any experiments were made. The action was found to be rather different from strychnine. The chief action was a marked irritability of the reflexes of the extremities, especially of the upper extremities, so that the poison evidently acts more directly on the upper part of the spinal cord.

This work is being carried on, and the results will be published in another quarter.

Therapeutics.—In the *Lancet* of 9th February, 1901, I have already expressed my views on this point, and I need only here shortly summarise the same. *Alstonia constricta* bark is a useful tonic, having some of the advantages of both Peruvian bark and nux vomica, without many of their disadvantages. It is particularly useful in influenza in tincture form and in the dose I have already mentioned. It acts on the skin and kidneys, and so aids in the elimination of the influenzal poisonous products, and thus it can be employed as soon as the acute symptoms have passed off.

Differential Reactions of *A. constricta* and *A. scholaris*, when the reagents are applied to the inner layer of the bark :—

	A. constricta.	*A. scholaris.*
Strong H_2SO_4	Nothing special.	Beautiful red.
Strong HNO_3	Almost blood red.	Yellowish green.
Tincture of iodine	Brown.	Almost black.

Timber.—Wood of a pale yellow colour, close in grain; warps in drying. (*Cat. Queensland Woods, Col. and Ind. Exhib.*, 1886.) This tree is largely sacrificed for its medicinal bark, and the timber is not used.

Size.—Diameter, 6–15 inches; height, 30–60 feet.

Habitat.—This species is apparently confined to New South Wales and Queensland, though it occurs far to the west in both States, *e.g.*, Darling River, New South Wales. It has not yet been recorded south of Port Jackson. It is found on the northern rivers, and localities connecting the coast and the dry interior are Attunga (R. H. Cambage) and Warrumbungle Ranges (W. Forsyth).

EXPLANATION OF PLATE.

A. Corolla opened out.

B. Ovary.

C. Unexpanded flower, showing the constriction of the corolla tube.

D. Sessile anthers.

E. Follicle.

F. Portion of E, enlarged.

G. A seed.

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OF

New South Wales.

J. H. MAIDEN.

Published by Authority of the

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J. H. MAIDEN,
Government Botanist of New South Wales and Director of the
Botanic Gardens, Sydney.

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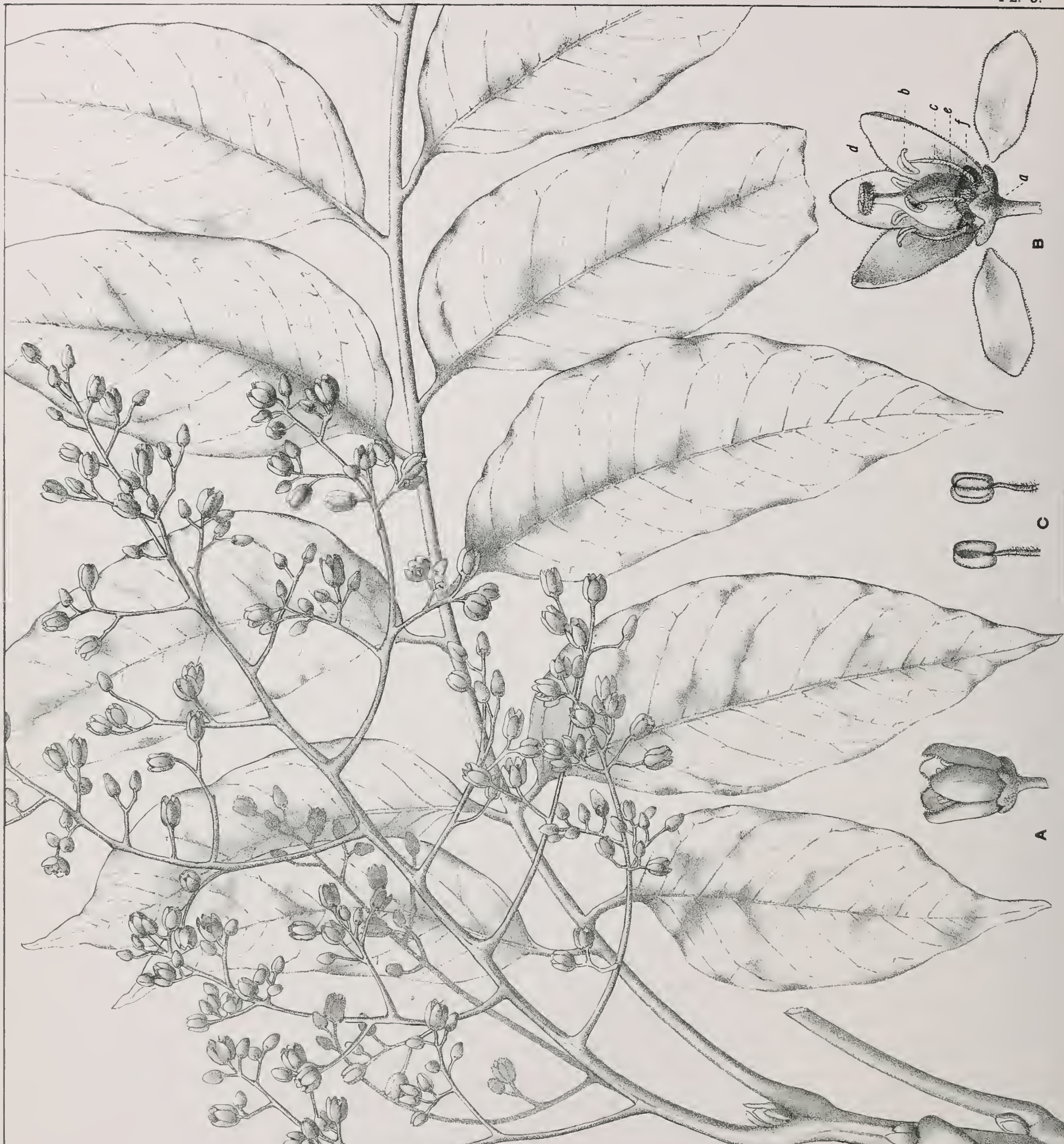

THE RED CEDAR (FLOWERS).
(*Cedrela australis*, F.v.M.)

No. 9.

Cedrela australis, F.v.M.

The Red Cedar.

(Natural Order MELIACEÆ.)

Botanical description.—Genus, *Cedrela*, Linn.

Calyx.—Small, 5-cleft.

Petals.—Five, imbricate. Disk thick or raised.

Stamens.—Four to six, inserted on the summit of the disk, alternating sometimes with as many staminodia, filaments subulate, anthers versatile.

Ovary.—Five-celled, style filiform, with a disk-like stigma.

Ovules.—Eight to twelve in each cell, in two rows.

Capsule.—Membranous or coriaceous, five-celled, opening in five valves, leaving the dissepiments attached to the persistent axis.

Seeds.—Flattened, winged; albumen scanty; cotyledons flat; radicle short, superior.

Tall trees. With coloured wood; leaves pinnate; flowers small, in large panicles.

Botanical description.—Species, *C. australis*, F.v.M.; *Fragm.* i, 4.

Leaves.—On rather long petioles, abruptly pinnate, in seven pairs, leaflets opposite, petiolate, somewhat obliquely oblong-ovate, the unequal base acute or the upper side rounded, the apex obliquely acute and pointed, glabrous on both sides.

Panicle.—Terminal, as long as the foliage, glabrous, pyramidal-branched, the branches not dense.

Flowers.—On rather long pedicels.

Calyx.—Obtusely five-sepalous (consisting of five obtuse sepals), the sepals and petals glabrous, slightly ciliate.

Column.—Hirsute.

Stamens.—Glabrous.

Ovarium.—Glabrous.

Capsule.—Oblong, glabrous.

Branchlets.—Glabrous, brownish, sparingly covered with lenticellae.

Leaves.—Twenty-seven centimetres long, the leaflets membranous, somewhat transparent, not punctate, attaining 1 decimetre in length and 5 centimetres in breadth, secondary veins rather transversely spreading (patulo-adscendentibus), scarcely prominent underneath, about fourteen, the petiolate about 1 millimetre long.

Rhachis.—With petiole, 27 centimetres long, terete, glabrous.

Panicle-branches.—Pedunculate, with short branchlets, the lower ones 15 centimetres long.

Petals.—Four millimetres long, membranous, obovate elliptical.

Ovarium.—Cone-shaped.

Capsule.—26-13 millimetres long. (Translation of original description in *Fragm.* i, 4.)

A

Botanical Name.—*Cedrela*, derived from *Cedrus*, the Cedar-tree of the ancients, whose timber was durable and had a very sweet smell; *australis*, Latin, southern (Australian).

Vernacular Name.—Universally known as "Red Cedar," the prefix being doubtless employed to distinguish it from "White Cedar" (*Melia azedarach*).

Aboriginal Names.—Called "Polai" and "Woolia" by the aborigines of Northern New South Wales; "Mumin" or "Mugurpul" by those about Brisbane; and "Woota" by those about Wide Bay, Queensland.

Synonym.—Bentham looks upon our Red Cedar as identical with *C. Toona*, Roxb., the Toon of India. It should be observed, however, that Baron Mueller differs from Bentham in considering the Australian "Cedar" specifically distinct from the "Toon." In any case the trees are so closely related that any property possessed by one is shared by the other. Casimir de Candolle agrees with Mueller in keeping our Red Cedar distinct from the Indian tree. The section which includes the two trees is divided by de Candolle into (a) *Ovarium glabrum*, which includes *australis*, and (b) *Ovarium cum columna hirsutum*, which includes *Toona*. Nevertheless, *australis* forms an exception, with *columna hirsuta*.

Harms (in *Natürl. Pflanzen Familien*) goes even further, separating the genus *Toona* from *Cedrela*. According to him—

Cedrela has a long disk (columna) much exceeding the ovarium in length. Seeds winged only on the lower side. All species confined to America.

Toona has a short columna, not exceeding the ovarium in length. Seeds winged on both sides or on the upper side only. All species confined to Asia and Australia.

Thus we have:—

Cedrela australis, F.v.M.—*Toona australis*, Harms.
Cedrela Toona, Roxb.—*Toona ciliata*, Roem.

Leaves.—Mr. Gamble states that the leaves of the Toon tree are used to feed cattle in India.

Flowers.—The flowers of the Toon tree are dried, and are extensively used for the production of a red or yellow dye in India. Mr. Thomas Wardle, a well-known authority, says that the dye they produce for silk is "very good." On account of the competition of aniline dyes, Red Cedar flowers, and almost every other indigenous vegetable product of New South Wales, are of no commercial importance whatever to the dyer. They are considered emmenagogue (Dymock).

Fruit.—The fruit is an oval capsule, about 1 inch long, which soon opens and sheds its light, membranous seeds. Mr. Gamble says that those of the Indian tree run about 1,200 to the ounce. These seeds have always a remunerative value, but care should be taken to collect fully-ripe seeds from healthy, mature trees. The seeds should be kept dry, and preserved from insect pests, to which they are very

THE RED CEDAR (FRUITS).

(*Cedrela australis*, F.v.M.)

liable. The collection of seeds of useful and ornamental Australian plants is one of those minor industries which are usually neglected, and I will always assist collectors in making them true to name.

Bark.—The outer bark is scaly, and in drying falls off, leaving an almost perfectly smooth surface of reddish-brown colour. It is moderately fibrous, and will tear into layers if some force be used. The late Mr. C. Fawcett informed Baron von Mueller that the bark produces a purplish leather; and he also stated that it "contains a considerable quantity" of tannin. I examined some from Cambewarra, New South Wales. The inner bark alone gave 13·38 per cent. of tannin, and the outer and the inner combined 12·8 per cent., a result too low to give any encouragement to a hope that cedar bark might be of commercial value. The bark is not usually looked upon as a drug; but in India it is considered to be valuable in fevers, dysentery, &c. It has also been considered a reliable anti-periodic, and by Dr. Newton a good substitute for cinchona, according to Dr. Waring's official Pharmacopæia of India. I am not aware, however, that any alkaloid has been found in the bark, and am disinclined to look upon it seriously as a substitute for cinchona.

Timber.—But the value of a Red Cedar lies in its timber, for it is without doubt the most valuable timber produced in New South Wales, and it is in universal use. It is equal to mahogany, to which it bears a good deal of resemblance, except that it is much lighter in weight. The uses of the two timbers are much the same, *e.g.*, for tables, cabinets, and furniture in general, also for doors and fittings of buildings, where the cost does not stand in the way. When kept dry it is very durable. Pieces are now in existence which were taken from buildings erected in the very early days of the State, and are as sound as the first day they were used. Cedar often shows a beautiful figure, and it would be difficult to find any timber to surpass the beauty of picked specimens. Its colour is a pleasing red; it turns a deep rich colour with age. It is very rarely indeed attacked by white ants.

This is the first and foremost among colonial timbers for carriage building. Some grades of this, with clear, straight grain, dense and tough, make excellent framing for many parts of carriages—in fact, I have been informed that Sydney cabs of excellent quality have been built with cedar alone, except the shafts and wheels. The features that recommend it for the special use of the carriage builder are that it is light and easily worked. It bends well for panels when seasoned. If a log be cut through the centre, then quartered, and flitches cut from each of these quarters, the result will be that panels even a quarter of an inch thick will not split at the ends more than an inch or so—an important matter in a good and expensive timber. Mr. Samuel Lownds, late teacher of coachbuilding at the Sydney Technical College, informed me that he examined some samples which had been exposed to the sun and rain, and also to the drip of water from a galvanised-iron roof for a period of three and a half years. The outer surface was almost unrecognisable; but the ends of the board were neither split nor shaken. A board was planed up, and it had not deteriorated in the slightest, the colour and the grain remaining perfect. Comparing cedar with the best English ash, the former timber remains sound under treatment which would cause the latter to become rotten. Our Sydney timber merchants might be reminded that cedar which is left floating in Sydney Harbour deteriorates for the purpose of the carriagebuilder. The salt penetrates the timber, and in the best-grade work the painting and varnishing suffer accordingly.

Mr. B. P. Mitchell, of Gumeracha, South Australia, remarks that cedar saw-dust, when used for smoking ham, imparts a peculiarly nice flavour. Red cedar makes a luxurious fuel. Cigar boxes are, in this State, made of the softest cedar. Fresh uses are constantly being found for this valuable timber. The *Sydney Morning Herald*, of the 7th June, 1893, announced that the Railway Commissioners had accepted a tender for 200,000 cedar railway keys, at £4 15s. per thousand, it having been found that cedar keys are suitable for the work, and that they are a good deal less in cost than the imported article. The cost of cedar was about 1½d. per foot in A.D. 1800. It was at that time worked by the Government.

Professor Warren, of the Sydney University, has, in his work, "Australian Timbers," given the result of a number of carefully-conducted experiments on the strength of Red Cedar, but they are too technical and too lengthy for reproduction here, and the reader is referred to the book. I may mention that he gives the weight per cubic foot as 28·3 lb. Mr. F. S. Campbell, of Melbourne, gives 2,000 lb. to 3,000 lb. per square inch as the tensile strength of the timber, and the Victorian Tender Board of 1884 gives other determinations.

The well-known "Toon" tree of India is, as has already been stated, either identical with our Red Cedar or very closely related to it. The following notes in regard to it, taken from Gamble's "Manual of Indian Timbers" (1st edition), are interesting:—

Weight of cubic foot, about 35 lb. The wood is durable, and not eaten by white ants. It is highly valued, and universally used for furniture of all kinds, and also employed for door panels and carving. From Burmah it is exported under the name of "Moulmein Cedar," and as such is known in the English market. In north-west India it is used for furniture, carvings, and other purposes. In Bengal and Assam it is the chief wood for making tea-boxes, but it is getting scarce, on account of the heavy demand. The Bhutias use it for shingles and for wood-carving; they also hollow it out for rice pounders. It is, or rather used to be (for very large trees are now getting scarce), hollowed out for canoes in Bengal and Assam. It is one of the "Chittagong woods" of commerce.

The 2nd Edition states:—

Wood brick-red, soft, shining, even—but open-grained, fragrant, seasons readily, does not split or warp. *Annual rings* distinctly marked by a belt of large and numerous pores. *Pores* frequently double or subdivided, unequally distributed, scanty in the autumn wood, somewhat unequal in size, prominent on a vertical section; those in the spring wood larger. *Medullary rays* red, fine and moderately broad, uniform, bent round the pores, giving a marked silver grain.

Exudation.—The Red Cedar produces gum, but only very rarely, and in small quantity. An old cedar-getter says that trees well exposed to the sun [(?) in unsuitable situations] yield most gum. The specimens I have examined are pale yellow, almost colourless, and in thin tears about an inch long. Between the teeth it almost feels leathery. It swells up largely in cold water, but in the course of twenty-four hours it nearly wholly dissolves, forming a solution colourless and faintly cloudy, and leaving but little residue. It is one of the gums which form a connecting link between those which readily dissolve in water and those which merely swell up in that liquid. It forms a fair mucilage, and it would be a valuable commodity if obtainable in large quantities.*

Lauterer gives another analysis of this gum. The note on Toon Gum in *Pharmacographia Indica*, i. 339, 547, will be found of interest. It is worthy of note that a sticky aromatic resin exudes from cedar, *e.g.*, when a box or drawer is kept shut up, but only in small quantities.

Size.—A middle-sized to a very large tree, varying in height up to 200 feet, and with a trunk diameter up to 10 feet, though exceptional trees have exceeded these large dimensions. The size of the average trees now yielding cedar is about half the above.

"A tree cut down near Lismore, which measured 10 feet in diameter at the base, was calculated to yield 30,000 feet of saleable timber." (Moore.) In May, 1898, the steamer "Wodonga" brought from Barron Falls, Cairns, Queensland, a log weighing 8 tons.

Mr. A. R. Crawford, of Moona Plains, Walcha, gave me particulars of an even larger tree. He writes:—

> This half flitch of cedar was cut from a tree which grew on Mr. H. Sauer's selection in Mulla Mulla Creek, 45 miles from Kempsey, and was cut from the trunk 56 feet from the stump. This tree was measured, after being felled, by Messrs. O. O. Dangar and W. Nance, and found to contain 80,000 feet of sound cedar; the first limb grew 60 feet from the ground. The timber in this tree would be worth £800 in the flitch on the Kempsey Wharf. This flitch weighed 6 tons, and was drawn to Green Hills by Mr. Henry Davis, and exhibited by Mr. Robert Campbell, of Warneton.

Heinrich Sauer told me two years later that the top of the stump was about 10 feet from the ground, and that plenty of good cedar was cut from the branches, which were the size of fair-sized trees. It is said that the selection was chiefly taken up for the sake of this tree.

Habitat.—The best cedar is found from the Bellinger River, northwards to the Richmond River, and throughout Queensland, especially in the warmest and moistest districts. It is, however, found from the Illawarra northwards, in the Shoalhaven gullies, Bulli Mountain, Kowmung, and thence northwards in increasing abundance until the northern rivers are reached. In localities to the south of Sydney the cedar is practically cut out, the only remaining trees being in almost inaccessible situations.

Ulladulla, on the coast, 164 miles from Sydney, is the southern limit for cedar.

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* For analysis and further particulars of Red Cedar and Toon Gums, *see* Maiden, J. H., "On Cedar Gum."—*Proc. Linn. Soc., N.S.W.*, xiv., 1047 (1889).

An old log, cut thirty years ago at Otford, on the Illawarra Line (30 miles south of Sydney), and found a few years ago, was over 5 feet in diameter, and almost perfectly sound. This is an instance of the proximity of merchantable cedar to Sydney at one time. The Sydney market thus obtains its principal supply from the Richmond and Tweed River districts.

There is but little cedar on the Hawkesbury now; at one time it was plentiful. The following refers to this river:—

GOVERNMENT AND GENERAL ORDER, 2ND APRIL, 1802.

It has been represented to the Governor that some of the settlers at the Hawkesbury are making a traffic of the cedar growing on or about that river. He strictly forbids any cedar being cut down but by his particular permission to the officer commanding at that place. If any cedar logs are brought from any part of that river to any other settlement without the Governor's permission, such logs or planks will be seized for the purposes of Government, and the boats or carts containing them confiscated to the public use.—(*Historical Records of New South Wales*, iv., 736.)

It was the presence of this valuable timber on the Dorrigo which constituted the discovery of the Spaniard whose name the district and mountain bears, and which has largely caused the country to be opened up. There must have been enormous quantities of this timber on the Dorrigo Reserve at one time, but now very few mature trees remain standing, and I did not see one which was fit for cutting. I was told, however, that a few still remain dotted through the forest, but their existence is only known to timber-getters. Unfortunately, Dorrigo cedar is not of a high class, being pale and porous, and far inferior to the Bellinger or "River" cedar in quality. At the same time, it is still a valuable timber, and is so low in price that there is no doubt that there would be a much larger demand for it were this fact known to the general public. Glenfernie Forest Reserve once contained a large quantity of cedar, but it is now cut out, owing to its proximity to the Armidale-road. There are only a few small trees now. Some of the cedars in the Dorrigo and Glenfernie had great buttresses.

The following list of New South Wales Timber Reserves containing Red Cedar is furnished by the Forest Department:—

County.	Reserve.	Remarks.
Clarke	1,662	Matured and young cedar, mostly in gorges, in all stages of growth.
"	29,433	
Buller	4	Large quantities, matured and young.
" and Drake ...	1,120	Small quantities, in very rough places.
" and Clive ...	24,267	Scattered matured and young in the ravines.
"	33,219	Small quantity, young.
Dudley	158	A fairly large amount of matured cedar in patches in rough country; good growth of young timber.
"	3,753	
Drake	6,369	Moderate quantities of both matured and young cedar.
"	9,999	
"	11,452	
"	11,453	
"	22,413	
"	27,774	

County.	Reserve.	Remarks.
Fitzroy	354	On some of these reserves there is a fairly large amount of matured cedar in patches ; also, a large quantity of young growth, well distributed. In most instances the matured cedar is located in rough and broken gullies or gorges ; large quantities are now to be found in the watershed of the Macleay and Nambucca Rivers.
"	19,418	
"	20,667	
Gresham	1,608	
"	6,370	
"	6,479	
Gough	1,433	
Raleigh	14,641	
"	34,088	
"	34,089	
"	34,090	
"	34,091	
Rous	249 4,353	Contains matured and young cedar.
"	10,723	Contains matured and young cedar, in small quantities, in very rough localities.
"	31,841	
"	33,199	
Sandon	4,768	Scattered cedar, mostly young.

Propagation.—Red cedar grows most vigorously in the rich, moist, alluvial flats and sloping ground of our Northern Coast districts, particularly so on the banks of creeks on the eastern slopes of the ranges, where the greatest shelter from the prevailing winds and shade are obtainable. Young plants may be successfully transplanted* in such localities during the winter, at which season at least 90 per cent. of the trees planted will survive, and grow at a rate from 3 to 5 feet annually. The cedar flourishes best when planted in small open places in existing forests, where there is room for the trees to mature, and they obtain the most shade, and are better protected from the winds and the frosts than if planted in open ground. Too much air and light is fatal to them. The brush plants must be allowed to grow up with them, care being obviously taken that they do not smother the young cedar plants.

Seeds are rarely produced on cedar trees growing in dense forests ; but trees, if planted in rich and moderately moist soil in open places, will annually produce seed after they have attained the age of 6 to 8 years. If the seeds be fresh and sound they readily germinate, but they are very liable to deterioration, as has been already stated.

As an instance, however, of cedar seeds retaining their vitality for a considerable period, Mr. Forester Brown, of Port Macquarie, relates, on the authority of Mr. Donkin, that some land at Kimbriki, Manning River, was cleared. No cedar was then on it, no cedar trees near. There had been no floods for years previously, yet twelve months afterwards numbers of young cedars sprang up.

* Mr. Gamble says : "Seedlings are easily raised, but difficult to transplant. The roots are surface-feeders, so that it ought not to be grown on the edges of fields." These remarks refer to the Indian tree, but they mainly apply to our red cedar.

The young cedars in the State Forest Nursery at Gosford were a few years ago a good deal injured by the larvæ of a moth which burrowed into the main stems or leaders. The moth proved to be new, and was described by Mr. S. A. Olliff in the "Records of the Australian Museum" in 1890, under the name of *Epicrocis terebrans*.* The pest may be kept in check by the free use of the pruning knife, and it has been recommended to wash with a decoction of gum-leaves, though I doubt its efficacy.

It is one of the very few Australian deciduous trees, although in the warmest districts it is semi-deciduous, or even evergreen. It is a beautiful tree, and is well worthy of cultivation for that reason, apart from its value for timber.

The following particulars in regard to the cultivation and conservation of red cedar, and a list of forest reserves on which it is found, are of public interest. It is to be hoped that land-owners in suitable districts will see that it would be enlightened policy on their part to propagate such valuable timbers as red cedar. A few thousand well-planted and well-tended cedars would be a valuable legacy.

Spasmodic attempts have been made to reafforest the red cedar in this State. The Forest Department planted some on the Dorrigo, but the plantations were neglected. Greater success has attended the small plantations at Hogan's Brush, near Gosford.

Mr. Breckenridge, at Failford, near Cape Hawke, has the nucleus of a good cedar plantation. He has not gone to much expense in the matter; but has simply inexpensively fenced a part of the brush to keep cattle out. Here and there, in the rich soil, he has dug a small hole, and put in a seedling cedar. The young trees grow up with the rest of the vegetation, and most of them are doing well. About all that is now done is to see that the young cedars get fair play—that is (say) that they are not choked out of existence by some rampant growth. This very rarely happens, and practically all the attention given is to keep one's eye on them during an occasional walk in the brush. There are numbers of young seedlings at the head of Wollamba Creek, and it is Mr. Breckenridge's intention to add to his plantation from that source. This little cedar plantation is a valuable object lesson to the hundreds, and perhaps thousands, of selectors and others who have bits of brush land in the coast and coast mountain districts. An inexpensive fence, seedlings which can usually be obtained in the district, and which may be inexpensively planted about August, little labour and very little supervision, and we have a cedar plantation. The plants grow up under natural conditions; the

* In India the Toon tree also suffers considerably from an insect enemy, the "Toon twig-borer," a moth of the family of the *Phycilidæ*, the *Magiria robusta*, Moore, which bores along the pith of the leading shoots, which are consequently destroyed, this destruction seriously damaging the proper growth of the tree (see "Injurious Insects," by E. P. Stebbing, p. 122). The same borer attacks also the leading shoots of allied species, especially of mahogany (*Swietenia mahagoni* and *macrophylla*). No remedy for the damage has yet been suggested; but in young plants the best thing is to cut and burn the young shoots directly the presence of the larva is ascertained from the appearance of the usual gummy exudation (Gamble, *Manual of Indian Timbers*, 2nd Ed., p. 158). It will be noted that the symptoms are precisely those of affected red cedar trees in New South Wales.

brush land near creeks is often not utilised at all under existing circumstances, and the land is being utilised with the promise, in many cases, of yielding a fair interest for the outlay in (say) thirty or forty years. Planting for posterity, perhaps; but forest planting (as distinct from forest conservation) is usually planting for posterity. What militates against plantations, as ordinarily carried out, is the heavy initial expenditure—expensive fences, heavy, and worse than useless, clearing, and costly non-residential supervision. I hope my readers will think over the matter, and put in a small experimental patch next season.

Mr. Breckenridge's site is by no means perfectly favourable for the experiment, the soil being scarcely suitable, and the site too near the sea. On the Upper Paterson and Allen and Williams Rivers (Mr. Augustus Rudder tells me) there is ample scope on their banks where, with unused rich land, good results would attend moderate effort to produce a fine growth of cedar in considerable quantity, but it would require more than twenty or thirty years to mature it for market.

EXPLANATION OF PLATES.

PLATE 9.

Leaflets and Flowers.

A. Young flower.
B. Flower.
  a. Calyx.
  b. Petal.
  c. Stamen.
  d. Stigma.
  e. Ovary half immersed in disk.
  f. Pubescent disk.
C. Stamen, back and front view.

PLATE 10.

Leaf and Fruit.

D. Capsule opening in 5 valves, leaving the dissepiments attached to the persistent axis.
  a. Valve.
  b. Dissepiment.
  c. Seed.
E. Winged seeds.
F. Leaf (with usually 7 pairs of leaflets) much reduced in size.

No. 10.

Eucalyptus resinifera, Sm.

The Red Mahogany.

(Natural Order MYRTACEÆ.)

Botanical description.—Genus, *Eucalyptus,* L'Héritier. (*See* Part ii, page 33.)

Botanical description.—Species, *E. resinifera,* Smith in *White's Voyage* (1790), 231.

Following is the original description :—

"*Floribus pedunculatis, calyptrâ conicâ acutâ.*

"This is a very large and lofty tree, much exceeding the English Oak in size. The wood is extremely brittle, and, from the large quantity of resinous gum which it contains, is of little use but for firewood. Of the leaves Mr. White has given no account, nor sent any specimens. The flowers grow in little clusters, or rather umbels, about ten in each, and every flower has a proper partial footstalk, about a quarter of an inch in length, besides the general one. The general footstalk is remarkably compressed (anceps), and the partial ones are so in some degree. We have perceived nothing like bractea or floral leaves. The flowers appear to be yellowish, and are of a very singular structure. The calyx is hemispherical, perfectly entire in the margin, and afterwards becomes the capsule. On the top of the calyx, rather within the margin, stands a conical pointed calyptra, which is of the same colour as the calyx, and about as long as that and the footstalk taken together. This calyptra, which is the essential mark of the genus, and differs from that of the *Eucalyptus obliqua* of L'Heritier only in being conical and acute instead of hemispherical, is perfectly entire, and never splits or divides, though it is analogous to the corolla of other plants. When it is removed we perceive a great number of red stamina standing in a conical mass, which before the calyptra was taken off, were completely covered by it, and filled its inside. The antherae are small and red. In the centre of these stamina is a single style of pointal rising a little above them, and terminated by a blunt stigma. The stamina are very resinous and aromatic. They are inserted into the margin of the calyx, so that the genus is properly called by Mr. L'Heritier in the class Icosandria. These stamina and style being removed, and the germen cut across about the middle of the calyx, it appears to be divided into three cells, and no more, as far as we have examined, each containing the rudiments of one or more seeds, for the number cannot with certainty be determined. Whether the calyptra in this species falls off, as in that described by Mr. L'Heritier, or be permanent, we cannot tell. From one specimen sent by Mr. White, the latter should seem to be the case ; and that the calyx swells and rise around it nearly to the top, making a pear-shaped fruit, with the point of the calyptra sticking out at its apex ; but as this only appears in a single flower, and none of the others are at all advanced towards ripening seed, the flower in question may possibly be in the morbid state, owing to the attacks of some insect. (See fig. G.*) Future observations will determine this point. We have been the more diffuse in our description on account of the singularity of the genus, and the value of the plant. On making incisions in the trunk of this tree, large quantities of resinous juice are obtained, sometimes even more than 60 gallons from a single tree. When this juice is dried it becomes a very powerfully astringent gum-resin of a red colour, much resembling that in the shops known as "Kino," and, for all medical purposes, fully as efficacious. Mr. White administered it to a great number of patients in the dysentery which prevailed much soon after the landing of the convicts, and in no one instance found it to fail. This gum-resin dissolves almost entirely in spirits of wine, to which it gives a blood-red tincture. Water dissolves about one-fifth part only, and the watery solution is of a bright red. Both these solutions are powerfully astringent. The plate* represents a portion of the bark of the *Eucalyptus resinifera,* with the fructification annexed."

* Not reproduced.

THE RED MAHOGANY.

(*Eucalyptus resinifera*, Sm.)

This species is one of the most unsatisfactorily defined of the early species. The extreme brittleness of the wood, and the large quantity of "resinous gum," at once show that the tree now understood as *E. resinifera* is quite a different species.

The original figure of the bark, and the description of the wood and resinous exudation, apply exactly to *Angophora lanceolata.* The figures of the buds apply fairly well to the Red Mahogany, and doubtless assisted in causing Bentham to describe that tree under the name *Eucalyptus resinifera,* Smith. *Eucalyptus Stuartiana,* F.v.M., one of the Apple-trees, is another of our Eucalypts which were originally described from different material from that now understood as the species.

For a number of years *E. resinifera* was an unsatisfactory species, and Bentham re-defined it by describing the Red or Forest Mahogany under that name.

Following is Bentham's description :—

A tall tree with a rough persistent bark on the trunk, but more or less deciduous on the branches. (Woolls and others.)

Leaves.—Ovate-lanceolate to lanceolate, acuminate, straight or falcate, mostly 4 to 6 inches long, rather thick, with numerous fine close parallel and almost transverse veins, sometimes scarcely conspicuous, the intramarginal one close to the edge.

Peduncles.—Axillary or lateral, more or less flattened, each with about six to eight, or sometimes more, flowers on pedicels usually short, but sometimes longer than the calyx-tube.

Calyx-tube.—Broadly turbinate, $2\frac{1}{2}$ to 3, or rarely 4, lines in diameter.

Operculum.—Conical or acuminate, much longer than the calyx-tube, and often broader at the base, as in *E. tereticornis.*

Stamens.—4 to 6 lines long, raised above the calyx-border by the disk, inflected in the bud; anthers small, ovate, with parallel distinct cells.

Ovary.—Not much shorter than the calyx, conical in the centre.

Fruit.—Obconical, subglobose-truncate or almost hemispherical, not contracted at the orifice, the rim not broad, convex, or prominent, the capsule somewhat sunk, or nearly level with it, the valves protruding. (B.Fl. iii, 245.)

There are several forms of this species, viz. :—

(A.) Normal, or small-fruited form.

(B.) Large-fruited forms, including—

1. Var. *grandiflora,* Benth..
2. Var. *Kirtoniana,* Deane and Maiden.

B.—Large-fruited Forms.

Much more variation is undoubtedly presented by *E. resinifera* in its large-fruited than in its small-fruited forms.

1.—Variety *grandiflora,* Benth.; B.Fl. iii, 246.

This variety includes *E. pellita,* F.v.M., and *E. spectabilis,* F.v.M., and a series of closely allied forms bearing very near affinity to typical *E. resinifera.*

They are all known as Mahogany, and have the wood and bark of *E. resinifera*. Some of the forms are described in a little detail:—

(*a*) Buds ovoid to a "long beak and gradually tapering" (all connecting forms).

Fruit about 7 lines in diameter, with rather broad, raised rim and exserted valves.

This is the typical var. *grandiflora* referred to by Bentham, who points out its probable affinity to *E. pellita*, F.v.M., and Baron von Mueller has (Eucalyptographia) himself merged *E. pellita* in *E. resinifera*.

Besides Manly (the B.Fl. locality for this variety), it occurs as far south as Conjola, near Milton (W. Heron), and Currawang Creek (W. Bäuerlen), which are the most southerly localities hitherto recorded, while Springwood, Blue Mountains (J. H. Camfield), with narrower rim and valves less exserted, is the most westerly locality known to us.

(*b*) Buds not seen.

Very broad rim, round fruit. Fruits very large (10 lines diameter). Ordinary "Forest Mahogany" bark and timber.

"Mountain Mahogany" (Olney, F. R.), Cooranbong; also Wyong.

Charles Stuart's No. 486, Timbarra, near Tenterfield, has a fruit precisely similar to the preceding, though smaller. It bears Mueller's manuscript name "*E. resinifera*, Sm., var. *brachycorys*."

2.—Variety *Kirtoniana*, Deane and Maiden.

(Syn. *E. Kirtoniana*, F.v.M., in "Eucalyptographia," arts. *E. resinifera* and *E. robusta; E. patentinervis*, R. T. Baker.)

Buds all with a long beak and gradually tapering.

Fruits about 5 lines diameter. Valves usually *very* exserted. Tendency to conical shape (when dry), but also subcylindrical. Tendency to twinning in the fruits. Rather narrow rim.

Illawarra (Kirton); Concord, Parramatta River (Rev. Dr. Woolls); Cooranbong (J. Martin); Bungwall (A. Rudder); Port Macquarie (G. R. Brown); Ballina (W. Bäuerlen).

In 1879 Mueller wrote of this tree as follows ("Eucalyptographia," under *E. resinifera*):—

In the Illawarra district occurs a tree which attracted great attention in India.* . . . It was there considered to belong to *E. resinifera*. It differs, however, from that species in having the leaves of equal colour on both sides with more prominent veins, the intramarginal veins more distant from the edge; thus in venation, as also in odour of foliage and fruit, the tree in question approaches *E. robusta*, but its

* It is also cultivated in South Australia.

fruit is certainly similar to that of *E. resinifera*, wanting, however, the broadish outer ring around its orifice, characteristic of the typical *E. resinifera*, while the lateral veins of the leaves are not quite so transversely spreading as in either. If really specifically distinct, the tree might be named *E. Kirtoniana* in honour of its discoverer.

In 1889 the late Rev. Dr. Woolls first drew my attention to this plant,—a fine tree growing at Concord, near the Parramatta River. He looked upon it as a possible hybrid between *E. resinifera* and *E. robusta*. The fruits are subcylindrical and the valves not much exserted even when quite ripe, the likeness to those of *E. robusta* being thus evident. Its bark is harder than that of normal *resinifera*, and the venation precisely that of *E. Kirtoniana* and *patentinervis*.

The fruit rim, while often flat, is not always so, being sometimes domed, connecting it, in this respect, with other forms of *E. resinifera*.

Botanical Name.—*Eucalyptus*, already explained, p. 34. *Resinifera*, from two Latin words, signifying "resin-bearing," and given by the original describer owing to the circumstances described at p. 64. As a matter of fact the present species is by no means a free yielder of "resin" (kino). In the early days of New South Wales particulars of the properties of many of our trees could be obtained with difficulty. Particularly was this the case with a genus like Eucalyptus, which even now affords abundant difficulty. My view is that the reference to it "from this tree large quantities of resinous juice are obtained, sometimes even more than 60 gallons from a single tree" refers not to a Eucalyptus at all, but to an *Angophora* (*A. lanceolata*), which was abundant around the first settlement of Port Jackson.

Vernacular Names.—This is the timber called Mahogany, because it reminded the early settlers of the Central American wood, which is, however, of much less weight than our timber. Our timber-getters and saw-millers as often as not call it simply "Mahogany," but, in view of the better known Mahogany so largely used in the northern hemisphere, it would only lead to confusion if our timber were exported without some qualifying adjective. I would, therefore, express the hope that it would be consistently called, by way of distinction (at all events in the export trade), "Red Mahogany," a term which is, of course, very largely applied in the State to this timber. "Forest Mahogany" is a term often used. This timber is often simply known as Mahogany. A large-fruited form of the tree from the Olney Forest Reserve (Brisbane Water district) locally goes under the name of Mountain Mahogany. In Queensland it is often called "Jimmy Low," after the late Mr. James Low, of Maroochie River, a locality for some of the finest specimens in that State.

Aboriginal Names.—"Torumba" was the name in use by the Port Jackson natives, about 1807, according to Caley.

It was called "Booah" by the aborigines of the counties of Cumberland and Camden, according to the late Sir William Macarthur.

Synonyms.—

1. *E. longicornis*, Sm. According to specimens in Herb. Melb.
2. *E. hemilampra*, F.v.M. in *Journ. Linn. Soc.* iii, 85 (1859).
3. *E. pellita*, F.v.M. Fragm. iv, 159.
4. *E. spectabilis*, F.v.M. Fragm. v, 45.
5. *E. resinifera*, Sm., var. *brachycorys*.

(The first four synonyms represent large-fruited forms of the species,—var. *grandiflora*, Benth.)

6. *E. Kirtoniana*, F.v.M.
7. *E. patentinervis*, R. T. Baker.

(These are two synonyms of *E. resinifera*, Sm., var. *Kirtoniana*, Deane and Maiden.)

The name *resinifera* was used very loosely, almost in a generic sense by old writers; for example, the plate *E. resinifera* of a celebrated work (Hayne's *Arznei Gewachse*, Vol. x, Plate v, 1825) is a plate of *E. tereticornis*, Sm., with separate fruits of *E. corymbosa*, Sm.

Leaves.—There is a reference to oil being obtained from the leaves in the *Bericht*, April, 1893, of Schimmel & Co., of Leipsic, p. 38.

A bright yellow product, the odour of which strongly resembles the Australian oils of commerce. Rich in cineol (eucalyptol).

According to Gladstone,* the oil consists principally of a hydro-carbon smelling turpentine oil; Schimmel & Co., however, found in it much cineol. An oil, coming from Portugal and probably obtained from *E. resinifera*, had the sp. gr. 0·893, and the rotatory power $a_D = -17° 8'$. It was not soluble in 70 and 80 per cent. alcohol, and contained besides cineol (iodol reaction) also phellandrene.† ("The Volatile Oils," Gildemeister & Hoffman: trans. Kremers.)

In the oil of *Eucalyptus patentinervis* small quantities of citral were detected and identified by the production of citryl β naphto-cinchoninic acid. The same oil appears to contain also linalool or geraniol, partly as an ester. (Schimmel & Co.'s Report, April–May, 1901, page 34.)

Fruit.—The fruits vary much in size and to some extent in sculpture. This is brought out, to some extent, in the drawing.

Bark.—Of a flaky-fibrous character, intermediate between those barks known in Australia as Peppermint and Stringybark.

Timber.—Of a rich red colour. Very durable, and becoming very hard with age, even as hard or harder than Ironbark, and a nail cannot be driven into it without splitting it. Used for knees at Laurieton. No good for knees in sweaty situations (Mr. Kenny, Cundletown). Especially hard to cut with pit saw. Used for posts and rails. Yet Mr. Breckenridge, at Failford, says that the timber was not considered of much account in the Cape Hawke district until the demand for wood-blocks set in.

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* *Journ. Chem. Soc.*, 17, p. 1; *Jahresb. f. Chemie.*, 1863, p. 541.

† *Bericht von Schimmel & Co.*, October, 1898, p. 26.

Its principal uses are for general building purposes and for fencing, as it is a very durable timber. It is an excellent timber for wood-paving, but while not depreciating its value in this direction for a moment, I would point out there is just a little danger of our forgetting the merits of other valuable paving timbers. Red mahogany is often sold as jarrah, which it closely resembles, and for which I believe it is a perfect substitute. But there are fashions and fads in paving blocks, as in many other things, and European users of our hardwoods should be reminded that we have a number of other meritorious timbers to offer them. It is of a handsome colour, and works up well. It may be recommended for large turned work, and for heavy furniture. It is useful for weather-boards (very few are now made because of galvanised iron). It makes the best of shingles; it does not discolour paint, which remains intact until it peels off, and, as it does not affect the water, it should be used when slabbing for wells is required. It looks very well as skirting boards and banister rails, &c., and lasts well in the ground.

This is one of the most valuable hardwoods of the State. It is a grand furniture wood where its weight is not against it. Visiting furniture experts have been more taken with this timber, as a rule, than with any other Australian hardwood. There is a future before Red Mahogany. It is one of the most durable timbers we have, being greatly resistant to damp and the attacks of white ants. Mr. Hill, speaking of Queensland timber many years ago, states that it is used for piles, and it is said to resist the action of cobra. We want further evidence in the direction. It burns with difficulty, and is hence preferred for fencing. It is used for ship's knees, shingles, posts, and general building purposes. Rafters of this wood were removed in 1852 from St. John's Church, Parramatta (erected in 1798), and were found to be in perfect condition. It is an even grained timber, which works easily, and hence is one of the favourite hardwoods of carpenters. The notes on Ironbark tree (*E. resinifera*) in Laslett's work on timbers do not belong to *E. resinifera* at all, but probably to *E. siderophloia*. Professor Warren made determinations of the specific gravities of two specimens of this timber, which, in 1887, weighed 75·06 and 72·23 lb. per cubic foot respectively. Three years later hey weighed 62·21 and 62·23 lb. per cubic foot respectively.

In the very early days of settlement—that is to say, during the first decade of the nineteenth century—some red mahogany was cut from the bush, perhaps in the neighbourhood of Sydney itself, and along with three other logs, each some 15 feet or 18 feet in length, was shipped as a sample of New South Wales hardwood to England. The wood was put on board a vessel known as the "Boyd," which is believed to have been a brig of some 500 tons register. The "Boyd" sailed for New Zealand, where she purposed loading kauri gum for the Cape in the year 1809, having on board seventy white people and a number of Maoris, also a very valuable cargo. In Whangaroa harbour, however, a terrible fate awaited the ship and her crew. The "Boyd" fell into the hands of the Maoris, and the unfortunate white people on board, with the exception of four—two women and two children—were killed, cooked, and eaten. The vessel herself appears to have been run aground and burnt to the water's edge. The history of the unhappy voyage has since been embalmed amongst the most stirring events of seafaring life in Australian waters, and the charred remains of the ship have been traced with recurring interest as they have drifted from time to time about the harbour of Whangaroa, sometimes projecting above the surface, sometimes seen a few feet below, and occasionally completely lost for months together in the mud.

A log of this timber was presented by Mr. A. W. Farquahar to me in 1895, when Curator of the Technological Museum, and it seemed none the worse for its immersion of eighty-six years.

Exudation.—The specific gravity of this kino is about 1·416, and the percentage of tannin 65·57 (*sic.*) (Staiger).

Dr. Joseph Bancroft quotes another analysis by Mr. Staiger of this kino, in which he found 54 per cent. of kino-tannic acid, and "also a kind of gum-arabic, but in older samples the amount of kino-tannic acid is greater, and the gum less." I have no particulars of the above kino, so I am unable to say how far Mr. Staiger's analyses and my own are reconcilable.

A specimen received from the Government Botanist of Queensland (Mr. F. M. Bailey) is in smallish tears for the most part, showing firmly adherent wood or bark on one side, a clear-looking kino of a dark colour, showing a ruby colour by transmitted light. It has evidently been collected for a long time. It is inclined to be tough and horny, and is, therefore, rather difficult to powder; fracture, bright; colour of powder of a pure burnt-sienna.

Cold water forms a deep orange-coloured liquid, which thins out to a bright orange-brown colour. Colour of residue, Vandyke-brown.

With alcohol (so as to form a tincture of B.P. tinct., kino strength), the supernatant liquor is of a reddish-brown colour, and the granular residue of a reddish-brown colour likewise. It contains 39·62 per cent. of kino-tannic acid, 2 per cent. of insoluble phlobaphenes, and 32·1 per cent. of gum.

The name *Eucalyptus resinifera* is often given in old books (and regularly copied into later ones) as "Botany Bay Gum-tree," because it was imagined that the product of this tree first brought Australian kino into notice. Hence the name *resinifera*.

Size.—From 2 ft. to 4 ft. in diameter, with a height of 100 ft. and more.

Habitat.—The small and large fruited forms run into each other, but they may be separated to some extent. The range of the species has already been dealt with, but it may be said that, as far as this State is concerned, it is a tree of the North Coast districts. Nevertheless, it occurs sparingly as far south as Conjola, near Milton, and northerly as far as Northern Queensland.

It was formerly common around Sydney, and even now it is found in a number of suburbs, *e.g.*, Burwood, Homebush, Hornsby, Hurstville, Sutherland, George's River, &c. Westerly it occurs as far as the Kurrajong; also Springwood, on the Blue Mountains.

Northerly it will be found on the Hawkesbury River, Morriset, Bulladeelah, Port Macquarie, and so on to the Clarence and Tweed. In Queensland it is to be found at Eight-mile Plain and Maroochie.

The large-fruited form may be found at Conjola in the south, Currawang Creek (near Nelligen), Otford (near National Park), Manly (north of Sydney), Wyong, Bungwall, Timbarra (near Tenterfield), and other localities.

In Queensland, as far north as Rockingham Bay and the Barron River.

It is said that the tree prefers hard and gravelly ridges.

Propagation.—Writing to me from Oporto, Portugal, Mr. W. C. Tait says: "This tree grows very well in this country. It is a hardier tree than *E. globulus*, standing both drought and cold better when young. I have planted most of the New South Wales eucalypts; many of them, however, are too tender for this climate when young, 5 or 6 degrees of frost killing them off; *E. resinifera* is an exception."

EXPLANATION OF PLATE 11.

Twig with mature leaves, buds, and flowers.

A. Sucker leaves.
B. Anther, front and back view.
C. Normal or small fruits.
D. Large fruits (variety *grandiflora*).

No. 11.

Cryptocarya obovata, R.Br.

A She-Beech.

(Natural Order LAURACEÆ.)

Botanical description.—Genus, *Cryptocarya,* R.Br.

Flowers.—Hermaphrodite.

Perianth-segments.—Six, equal, or nearly so.

Stamens of the outer series 6, all perfect, with introrse anthers, alternating with three short staminodia.

Glands.—Six at the base of the inner perfect stamens, or almost as near to the outer opposed to them.

Anthers.—Two-celled.

Ovary.—Immersed in the perianth-tube, which, after flowering, closes over the ovary, and finally becomes more or less fleshy or succulent, completely enclosing, and usually consolidated with the fruit, the limb of the perianth deciduous, leaving a small scar at the apex, or rarely persistent.

Trees or small shrubs.

Flowers.—Small, in cymes arranged in axillary racemes or panicles, the upper ones often forming an apparently terminal panicle with the subtending leaves very small or deficient.

Fruiting perianths.—Globular ovoid or oblong, having the appearance of inferior fruits. (B. Fl., v, 295.)

Botanical description.—Species, *C. obovata,* R.Br., *Prod.,* 402.

A fine bushy-headed tree (Dallachy), the young young shoots and inflorescence minutely tomentose, and more or less ferruginous.

Leaves.—Oblong to obovate, very obtuse, and 2 to 4 inches long in the typical form, larger, broader, and sometimes shortly and obtusely acuminate in some northern specimens, rather thick, the margins often recurved, glabrous with the veins scarcely conspicuous above, often glaucous or even very minutely pubescent when young underneath, with the primary pinnate veins very prominent, the reticulations scarcely conspicuous.

Panicles.—Loosely thyrsoid, numerous and many-flowered, the upper ones forming a terminal panicle.

Flowers.—Rather larger than in *C. glaucescens.*

Perianth-segments.—As long as the oblong tube.

Glands.—Stipitate, appearing to belong as much to the outer as to the inner staminal series.

Staminodia.—Sessile, acuminate.

Fruiting perianth.—Globular, about half-inch diameter.—Meissn. in DC. Prod. xv, i, 73, 507. (B.Fl., v, 296.)

Mr. F. M. Bailey defines a Queensland form (*e.g.,* Rockingham Bay) with broader leaves than usual, under the name variety *tropica.*

A SHE BEECH.

(*Cryptocarya obovata*, R.Br.)

The relations of this species to *C. glaucescens* and *C. microneura* are shown by Mr. Baker and myself in *Proc. Linn. Soc., N.S.W.*, xx, 516 (1895).

The confusion of this species with *Litsæa* (*Tetranthera*) *reticulata* is best explained by the following note, published by me in the *Agric. Gazette* (N.S.W.) for 1894.

" Under the name of scaly or yellow beech, Mr. Forester G. R. Brown, of Port Macquarie, sent (in 1894) flowering specimens of *Litsæa* (*Tetranthera*) *reticulata*, Benth., which is an addition to the recorded plants of the Colony. Mr. Brown states that, like sassafras, the timber is used for lining-boards.

" Logs of this timber were shown by the late Sir William Macarthur at the Paris Exhibition of 1855. One log was numbered 24, and the following description given :—" *Cryptocarya obovata* (the shapes of the leaves of *Litsæa reticulata* and *Cryptocarya obovata* are not unlike, J.H.M.), beautiful small tree, wood tolerably close-grained but soft. Diameter, 18–30 inches. Height, 60–90 feet."

"The second log bore the number 192, and the following description :—" *Cryptocarya sp.*; aboriginal name Myndee, local name White Sycamore. A handsome tree (doubtful if not the same as No. 24), wood fine-grained and soft. Diameter, 12–54 inches. Height, 50–120 feet."

"Bentham, in the *Flora Australiensis* (v. 306), refers both these logs to *Tetranthera* (*Litsæa*) *reticulata*, and he had Sir William Macarthur's herbarium specimens before him.

" But in the *Flora Australiensis* the tree is referred to Queensland, Bentham remarking that the timbers above referred to probably came from Brisbane River (Queensland), whereas they came from Brisbane Water (New South Wales), 500 miles to the south. Owing to this typographical, or geographical, error, the species has continued to be recorded only as a Queensland tree to this very day. *Litsæa* belongs to the Laurel family (*Lauraceæ*)."

Botanical Name.—*Cryptocarya*, from two Greek words, *kryptos*, hidden, and *karya*, a nut, owing to the nut being concealed in the enlarged calyx tube; *obovata*, from the Latin *ovatus*, egg-shaped, or of an oval-figure, and *ob*, a Latin word indicating, in its botanical sense, a reversal, so that obovate means the reverse of ovate, *e.g.*, in the present case the leaves are reversely ovate, or broadest at the apex.

Vernacular Name.—This tree is one of the timbers known as She-Beech. There are several of them, and the name is applied somewhat at random. In New South Wales it means that the timber resembles Native Beech (*Gmelina Leichhardtii*) somewhat, but that it is inferior in durability, colour, and other useful properties. It is occasionally known as Sycamore, a name very loosely employed in New South Wales.

Aboriginal Name.—I know of no aboriginal name.

Synonym.—*C. hypospodia*, F.v.M. (Fragm., v. 170).

Leaves—Oil.—The leaves are slightly aromatic, but I have not heard that they have been distilled for oil. They are thickish, often obovate, and usually glaucous on the under side.

Timber.—This is one of the brush timbers whose use is not usually differentiated from that of other timbers. Yet it is often employed when a soft, easily obtained, easily worked timber is sufficient for rough purposes. It is pale-coloured, but it dries to a dirty colour, and is not very durable. At the same time very little is known about this timber, and one of the objects of this Forest Flora is to shed light upon it, and to endeavour to learn more about the numerous brush timbers of this class, so that we may be able to appraise them fairly. It is not my object to unduly praise or disparage a timber, and I shall endeavour to deal impartially with them all.

Bailey speaks of the Queensland timber as of a light colour, close-grained and tough, and a useful wood if not exposed to the weather.

Size.—Up to say 100 feet in height, with a trunk diameter of 2 or 3 feet.

Habitat.—It is found in the coastal brushes of New South Wales and Queensland, but its southern and northern (nor indeed its western) limits are not very precisely defined. Its southernmost limit known to me is the Port Stephens district; its most western that ofGlendon, near Singleton, where it was collected by Leichhardt.

As regards Queensland, if it has been collected farther north than Dallachy's old locality of Rockingham Bay, I am not aware of it.

EXPLANATION OF PLATE 12.

A. Flower bud.
B. Flower looked at from above.
 (*a*) Perianth segment.
 (*b*) Introrse anther.
 (*c*) Staminodium.
 (*d*) Extrorse anther.
 (*e*) Perianth.
 (*f*) Bract.
C. Pistil.
D. Anther dehiscing by two valves; front and back view.
E. Stipitate gland.
F. Fruit (fruiting perianth).
G. Seed.

Sydney: William Applegate Gullick, Government Printer.—1903.

INDEX OF TREES DESCRIBED.

PART I (ISSUED FEBRUARY, 1903).

PART II (ISSUED MARCH, 1903).

PART III (ISSUED MAY, 1903).

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OF

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Published by Authority of the

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PART IV.

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Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney.

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*14230 *PRICE, 1/- per Part, or 10/- per dozen Parts, payable in advance.*

BLUE OR FLOODED GUM.

(*Eucalyptus saligna*, Sm.)

No. 12.

Eucalyptus saligna, Sm.

The N.S.W. Blue or Flooded Gum.

(Natural Order MYRTACEÆ.)

Botanical description.—Genus, *Eucalyptus,* L' Héritier (see p. 33, Part ii).

Botanical description.—Species, *E. saligna,* Sm.

Following is the original description :—

Operculo conico acuto calyceque anguloso subancipiti, capitulis lateralibus solitariis, fructu turbinato, foliis lineari-lanceolatis.

The leaves are narrower and less coriaceous than in most of the species. The little heads of flowers grow on shortish flower stalks, one from the bosom of each leaf. The flowers are smaller than in any of the others, their covers acute, the length of the calyx. Fruit turbinate with a slightly curved margin, and crowned with the pyramidal permanent base of the style. (Smith in *Trans. Linn. Soc.*, III, 285, 1797.)

Following is the description by Bentham, taken from his "Flora Australiensis" :—

A tall tree with a smooth silver-grey shining bark, shedding in thin longitudinal strips (*Beckler*).

Leaves.—From ovate-lanceolate to long-lanceolate, but usually narrow, acuminate, 4 to 6 inches long, with very numerous, fine, close, transverse, parallel veins ; the intramarginal one close to the edge.

Peduncles.—Short, mostly flattened, each with 4 to 8 flowers.

Calyx-tube.—Narrow-turbinate, 2 to nearly 3 lines long, sessile or tapering into a short, thick pedicel ; the border of the calyx prominent in the bud, and the orifice usually expanding after flowering.

Operculum.—Conical, about as long as the calyx-tube.

Stamens.—Two to 3 lines long, inflected in the bud, anthers ovate, with distinct parallel cells.

Ovary.—Conical in the centre.

Fruit.—Subglobose-truncate, not contracted at the orifice ; the rim narrow, slightly raised above the calyx-border ; the capsule somewhat or scarcely sunk ; the valves more or less protruding.

Botanical Name.—*Eucalyptus* (explained formerly) ; *saligna,* Latin, signifying pertaining to a willow, in allusion to the leaves and habit of the tree, but the name is not a happy one, as the foliage is very seldom willow-like.

Vernacular Names.—"Sydney Blue Gum." This timber requires some distinctive designation to prevent its confusion with the pale-coloured Blue Gum of

Tasmania and Victoria. I have elsewhere called it New South Wales Blue Gum by way of distinction, but, as this is such a ponderous name, that of "Sydney Blue Gum" may be more acceptable; often also called "Flooded Gum." The question of "Blue and Flooded Gum" is referred to at page 79.

In the South Coast district sometimes it is called "Woolly Butt," because of its confusion with the true Woolly Butt, the two trees resembling each other a good deal in this particular district. I draw attention to the matter in this connection, because, in this district at least, our Blue Gum is inferior in durability to the true Woolly Butt (*E. longifolia*), so much so that it is there rarely used for posts and other underground work. In the same district it is also called "Redwood."

The variety *parviflora* has other names in addition to "Blue or Flooded Gum" (see p. 84).

Uniformity of Nomenclature.—I could hardly choose a better species of Eucalyptus than this to point out the great practical difficulty of securing a uniform nomenclature for some of the species. Here the same species is consistently called in different parts of New South Wales and Queensland "Blue Gum," "Flooded Gum," and "Redwood." I have said that all these belong to one species. How, then, can a man say, "Call each species by one common name, and one alone"? Let us see how that works out in practice :—

Blue Gum.—This name has already been appropriated by *Eucalyptus globulus*, the Tasmanian or Victorian Blue Gum, so that, beyond Australia, one must specify the State to be free from ambiguity. In other words, the term Blue Gum cannot be reserved for *E. saligna.* Suppose we ship home some paving blocks labelled "Blue Gum" (as we in New South Wales know Blue Gum). They are bought, we will say, by a London Vestry. They order some more, and this time they receive "Blue Gum" blocks as different as can be in colour and other properties. They have been supplied with *E. globulus* this time. The Surveyor of the Vestry says, "I will have no more of your Australian Blue Gum, which seems to me a very variable article, and upsets all my plans." The reply is, "Oh! but one is the Victorian sort, and the other is the New South Wales sort." Mr. Surveyor answers, "I never was taught anything about New South Wales and Victoria when I was at school, but I do know something about Australia, and, when I ordered Australian Blue Gum blocks, these people send me a red timber on one occasion and a white one on another. I will have no more to do with Australian timbers until Australians agree about the names." Is this a fanciful dialogue? I think not, or, rather, I am sure not, both from what I have read and from conversations I have had with Englishmen interested in Australian timbers. There is a great deal more in the nomenclature of our timbers than many people imagine, if we desire to develop an export trade in them. I hope the Parliaments will make an enactment rendering it compulsory to export our timbers (no matter from what Australian port) under unambiguous names (as per Schedule).

Flooded Gum.—This name would do very well as far as distinctiveness is concerned, but in Australia the term has, as a rule, got to be associated with an inferior grade of timber, and I am, therefore, afraid that it would never become sufficiently popular to supersede the term "Blue Gum," which is associated with timber of high quality.

Aboriginal Names.—According to the late Sir William Macarthur, the aborigines of the Illawarra used to call the Blue Gum "Couranga," while those of Brisbane Water called the Flooded Gum "Thurambai." The Flooded Gum of South Queensland is the "Toolur" of the aborigines, according to Mr. W. Pettigrew. It is the "Mungarie" of those of the Richmond River, New South Wales. By the Clarence River blacks it used to be called "Umbagga," according to Mr. Charles Moore; and "Warrimbarng" by those of the Hastings River, according to Mr. Forester Brown. Mr. Forester Allan gives its aboriginal name as "Mudione" in the Illawarra.

Leaves (Oil).—Messrs. Baker and Smith ("Research on the Eucalypts") give the following information in regard to the oil of this species:—Specific gravity, at 15° C., 0·886 to 0·8937; specific rotation, $(\alpha)_D = + 37{\cdot}14°$ to $39{\cdot}59°$ (first fraction); saponification number, 28·9 to 30·6; solubility in alcohol, 7 vols., 80 %, to 9 vols., 8 %; constituents found, pinene, eucalyptol, valeric acid ester, amyl eudesmate, free alcohols.

Fruit.—The shape of the fruit of the Blue Gum will, it is hoped, be clear from the drawing. As a guide it may be remarked that, as a very general rule, there is a narrow space between the valves and the rim of the fruit wide enough for one to insert the thickness of the finger-nail or a penknife blade. If this little point be grasped it will be found to be useful. The fruit with which that of the Blue Gum is most likely to be confused is the Bangalay or Bastard Mahogany (*Eucalyptus botryoides*), and I would suggest that persons interested gather the fruits of the two trees, and compare them for themselves.

I wrote what follows in 1896, and would like the remarks to be considered in connection with my observations on Blue and Flooded Gum below.

The fruits vary much in size and in the extent of protrusion (or the reverse) of the valves. They are sometimes angled, and, when not fully ripe, often with a rim. They are sometimes shiny, and sometimes covered with a bloom. This glaucousness seems to be only on northern forms.

I cannot detect any permanent difference between the fruits and foliage of Blue and Flooded Gum. Blue and Flooded Gum grown within a few feet of each other at Failford, near Forster, shows Flooded Gum in early fruit, while Blue Gum is only in bud (advanced); but perhaps this difference is only local and accidental.

"Blue Gum" and "Flooded Gum," Booral.—In specimens of the two trees sent from this district, the fruits of Blue Gum are subcylindrical, while those of Flooded Gum are more conical. At the same time, I do not consider these differences permanent.

"Flooded Gum," Port Macquarie.—Fruits conical; other "Flooded Gum" fruits from same place are large, of the same shape and size as Sydney forms, but covered with a bloom.

On the Richmond River there are two kinds of fruits in this species. They differ greatly in regard to size, but careful examination shows that they do not differ in any essential particular.

Small-fruited form:—Lismore and Ballina (also at Mullumbimby, on the Brunswick River).

Large-fruited form:—Lismore.

Bark.—The Blue Gum is a smooth-barked tree, but it has more or less fibrous bark near the butt. Sometimes the fibrous bark is almost as absent as in the case of a White Gum, while in the case of some South Coast trees it extends so far up the trunk as to make the confusion between this species and *Eucalyptus longifolia* (the Woolly Butt) excusable. "Some trees smooth and whitish, others are rough-barked for a considerable height, occasionally to 40 feet." (A. R. Crawford, New England.)

Timber.—One of the best hardwoods of the State, usually of a pale red colour, straight in the grain, comparatively easy to work, and, therefore, a favourite with carpenters. The timber is of a lower specific gravity than that of most Eucalypts, being not very close-grained. It is largely used by shipwrights and wheelwrights, and is a very useful hardwood. It is extensively used for building purposes, ships' planks, &c., and is the most widely used of our timbers for felloes of wheels. Although this timber varies a good deal in quality, much of it, and particularly that found in the northern parts of the State, is very durable, and has been used for wood blocks with much success. I confidently recommend sound, mature, Sydney Blue Gum for this important purpose.

The late Rev. Dr. Woolls informed me that a coffin made of it was found to be in a sound state after fifty years.

In the Nelligen (Clyde River) district, where it is known as Redwood, it is used by wheelwrights chiefly for felloes, and the local saw-millers often go long distances for it. It is a favourable timber for inside work. On the South Coast this tree strongly resembles the Woolly Butt in the trunk, and the trees are hence often confused, local residents calling both *Eucalyptus saligna* and *longifolia* "Woolly Butt" with delightful impartiality; but Woolly Butt for *E. saligna* is wrong, and is, I repeat, the result of confusion. On the South Coast the Redwood (of course not to be confused with Californian Redwood, so extensively used in this State), is not much used for posts or underground work, as it is not considered at all durable.

Timber hard, not heavy, colour red, that from the smooth trees straighter in the grain than that from the rough-butted tree, whose timber is darker, curled, and interlocked, resembling the wood *Euc. tereticornis.* If it were not for its weight it would be a handsome furniture wood. Above ground it will last a lifetime, but as posts it can only be depended on for from ten to fifteen years. I have found both dry rot and white ants in it. The dwelling-house at my place, 4 miles distant from here, is built chiefly of this timber, and I find that many of the boards and some of the rafters are quite riddled by a minute borer. (A. R. Crawford, referring to New England timber).

Blue and Flooded Gum.—Following are some statements which refer chiefly to Flooded Gum.

Flooded Gum.—An excellent timber for shipbuilding, weatherboards, and general carpentry, but inferior to Blue Gum. Mr. Charles Moore wrote of Clarence River Flooded Gum in 1862:—"This timber is extensively used for building purposes, such as scantling, battens, flooring-boards, and for posts and rails, ships' planks, &c." I have no doubt that this tree is the same as the Flooded Gum of Queensland, to be alluded to presently. With respect to the value of the Queensland timber for fencing, a Byron Bay correspondent (Mr. H. A. Hall) informs me that there is a difference of opinion locally as to its value for rails. He informs me that on a selection in Queensland, posts of it were sound after twenty-three years.

In the catalogue of the "Timbers of Queensland," prepared by Mr. Walter Mill, for the London Exhibition of 1862, he refers to a tree which he calls *Eucalyptus grandis.* No description of the species was ever made, so that the name has no standing in science; but I have no doubt that the tree is *Eucalyptus saligna.* He describes it as "Flooded Gum"—diameter, 4 to 5 feet; height, 90 to 140 feet. A majestic tree, inhabiting the rich alluvial flats upon the banks of the rivers, and on such has a pillar-like trunk, clear of branches for three-fourths of its entire height. The timber is in high repute for strength, lightness (floats in water when dry), and durability, and it can be had in great quantities. Mr. Pettigrew, writing about this timber in 1877, says:—"It is the lightest of all the gums hereabout, floating in water soon after being cut. It is easily cut by the saw, but shrinks very much in drying. It is used for weather-boards and sometimes for making parts of drays and carts; also used for masts, spars, and planks of vessels."

Following are notes on "Flooded Gum" by different writers:—

Flooded Gum.—An excellent timber for shipbuilding, weather-boards, and general carpentry; grows from 100 to 180 feet high, and diameter 3 to 4 feet, on the margin of the brush forests north and south. (J. Duff.)

Flooded Gum.—A hardwood growing in the same districts as Blue Gum; largely used in shipbuilding work. (J. Duff.)

The Blue Gum is found throughout the northern and southern rivers as well as inland for miles, while the Flooded Gum seems to flourish best on the northern rivers only, particularly in the vicinity of Cape Hawke.

The Flooded Gum is much lighter in weight than the Blue Gum, and floats in water in small sizes just beneath the surface, hence the name "Floating Gum" which is sometimes given to it. I am of opinion that in furniture-making Flooded Gum will be found an excellent substitute for Red Cedar, and also for verandah posts, table legs, and similar work. I look upon it as a matter of great importance to the architect that he should guard against using Flooded Gum in general building work, particularly in positions where it is called upon to take any strain whatever. (J. V. de Coque.)

Flooded Gum is a large tree, often up to 7 or 8 feet in diameter, with smooth deciduous bark of a silvery grey or white in colour, excepting near the butt, where it is usually for some distance up from the ground, rough, of dark colour, and persistent. This tree is generally found growing on the alluvial banks of rivers and creeks, or in dense scrubby mountain dells. The timber in the young trees especially is often soft, spongy, and brittle near the heart, and in such case, it is next to worthless, but in old and mature trees, in which the centre heart wood has rotted away, leaving them hollow, their timber, especially that of the butt logs, is tough and strong, and becomes very hard when dry, and is suitable for ships' planking and for building purposes generally, also for fence rails, &c., but for bridge work it is not, taken altogether, very reliable. (A. Rudder.)

Blue Gum is very similar, in general appearance, to the above, and is often found with it, but the trees are not usually so large, and their bark has a bluish colour, and is somewhat blotchy in appearance, and is rarely rough and persistent at the butt, and the wood is usually redder. The timber of this tree differs a good deal in character and quality from very tough and inlocked to soft, brittle, and fissile (leaving a doubt in my mind whether there are not several kinds). This is often a good timber for building purposes generally, but in some places the trees are pipy, and the wood is subject to grub-holes, and is not lasting in the ground, and should not be used in any bridges where better timbers for the purpose are obtainable. Blue Gum is frequently met with on open country, on the mountains east of the Dividing Range, and is very plentiful on the Upper Patterson, Allen, and Williams Rivers, &c. (A. Rudder.)

Worried with such statements as these, I made special inquiry in the northern districts, and particularly about Cape Hawke, as to the differences between Blue and Flooded Gum.

Following is a report of my inquiries :—

Blue Gum is found on the slopes and smaller ridges; Flooded Gum usually on the flats, particularly those liable to inundation. Sometimes, however, the two trees may be found quite close to each other, under conditions apparently identical.

One of the objects of my trip was to see if I could obtain evidence as to permanent and specific differences between Blue and Flooded Gum, but I found none. Trees were felled for me, and I could see no difference in their fruits; the Flooded Gum was more advanced than Blue Gum (the latter was in bud and the former in early fruit), but that was all.

The smooth bark of the Blue Gum is, as a rule, of a bluer cast than that of the Flooded Gum, which is white.

Blue Gum has the rough bark not so far up the stem as Flooded Gum. The rough bark of Flooded Gum is like that of rough-barked apple-tree.

I found plenty of both Blue and Flooded Gum throughout the coast districts, and made both examination of the timbers on the spot, and also took evidence. Following are excerpts :—

Plenty of both in the Kempsey district. Excellent for wheelwrights' purposes; good for wood-blocks. Flooded Gum lighter in colour and weight when seasoned than Blue Gum. (Mr. Forester Macdonald.)

Flooded Gum far inferior to Blue Gum. A valuable timber for inside work, but of very low durability for outside work. Valueless for wood-blocks, posts, &c., while Blue Gum is valuable for such purposes. (Mr. Sydney Verge, Kempsey.)

Flooded Gum in small sizes twists and warps. Very tough, yet not hard. Excellent for ships' timbers. (Mr. Mackay, Laurieton.)

So far we have what is the usually accepted estimate of the comparative value of the two timbers. Now we come to what we saw and heard at Failford. Here we had the advantage of the testimony of Mr. J. Breckenridge, a gentleman of many years' experience of colonial timber, and a resident of the district for nearly forty years. He stated :—"Flooded Gum is tougher to fell than Blue Gum. Both the rough-barked portion and the smooth-barked upper portion of Flooded Gum are tougher than the corresponding parts of Blue Gum." My companion, Mr. de Coque, felled both Blue and Flooded Gums on the spot, and confirmed this testimony. The timber covered by the rough part of the bark of Flooded Gum is remarkably tough.

"Flooded Gum does not readily split, while Blue Gum does." We tested this as far as we could, and confirmed the observation.

Mr. Breckenridge then proceeded to state :—"Flooded Gum is the most durable and wearable timber in the district. It wears better than Ironbark. It is more durable and less brittle than mahogany. It is used for carriage-building, oars, and the masts of ketches. Blue Gum is straight in the grain, and used for splitting. It is not tough enough for spars, a purpose to which Flooded Gum is put."

Here we have one of the most experienced timber men in the country speaking, and I could not shake his evidence. He showed me some remarkable specimens, illustrative of the toughness of Flooded Gum, and produced other specimens bearing out other of his statements. I wondered at first if (and I can believe anything with Australian timber names) the Failford Flooded Gum was the Blue Gum of other parts, but no, and we examined both standing trees and sawn stuff.

There is but one conclusion (and it is a disquieting one for the student who likes plain sailing with Australian timbers), and that is that in the Failford district, through local conditions, the quality of the Flooded Gum is superior to what it is in other parts of the State—so superior, in fact, that it is of better quality than that of the Blue Gum, with which it is associated.

Messrs. Baker and Smith ("Research on the Eucalypts," p. 32) settle the Blue and Flooded Gum difficulty in the following words:—

Eucalyptus saligna var. *pallidivalvis*, Nobis.

It has been customary in the past to include under the species (*E. saligna*) two trees known vernacularly as "Blue" and "Flooded" Gum, respectively, but in this work the two are separated, the latter being placed as a variety of the former under the varietal name of *pallidivalvis*. The timbers of the two are quite distinct, and are so sold in the trade. The fruits of the variety are very constant throughout the area of distribution, the exserted white valves and glaucous calyx being very characteristic, and it is against our better judgment, perhaps, that this Eucalyptus is not raised to specific rank.

The localities of Blue Gum in the above work are given "mostly in or at the head of gullies in the coastal district of New South Wales; Queensland." The localities of Flooded Gum are given from Gosford northward; with the isolated southern locality of Barber's Creek, near Goulburn.

I have spent much time in the field for many years in trying to arrive at botanical differences between Blue and Flooded Gum. I have long been aware of the glaucous appearance the fruits *E. saligna* sometimes take on, but have not been able to associate it definitely with any special kind of tree. Messrs. Baker and Smith appear to have been more fortunate, and I can only commend the matter to consideration of my readers.

Exudation.—I have very rarely seen kino of this species, and it would appear to be very scarce; in fact, settlers will tell you it yields none. I have only collected it in small quantities, and an old bushman "never knew it had any gum," although he often cut it up for felloes. Mr. A. R. Crawford writes, "except in the one instance mentioned in my first letter, I have never met with traces of exudation on this Eucalypt." As seen by me, it is of a dullish colour, of all tints of garnet. It is of a horny texture for the most part; it readily dissolves in cold water, forming a quite clear liquid of a dark orange-brown colour, with a small amount of residue of a Vandyke-brown colour. Alcohol dissolves a portion of it, producing a tincture of an orange-brown colour. Analysis of a specimen procured near Sydney showed it to contain 35·56 per cent. of kino tannin, 4·6 per cent. of insoluble phlobaphenes, and 31·3 per cent. of gum. It is one of comparatively few Eucalyptus kinos which contain gum, and I have placed it in one of the three great groups into which I have divided Eucalyptus kinos, viz., the Gummy group.

Size.—Up to 150 feet high and more, and a diameter of 3 or 4 feet, though exceptionally attaining a much greater size.

The following note, originally written for the Paris Exhibition of 1855, is interesting :—

Plentiful on the Clarence. This timber is extensively used for building purposes, such as scantling, battens, flooring-boards, and for posts and rails, ships' planks, &c., it is often 7 feet in diameter, with a stem without knot or flaw of from 70 to 80 feet in length. Many trees yielded from 6,000 to 8,000 feet of timber, which is worth at the present time 18s. per 100 feet. (C. Moore.)

Not far from the *Euc. globulus* Reserve I saw a tree of the species about 3 feet in diameter and height probably of 100 feet to first limb. I measured a short-stemmed tree at Cumbueri (my place) 27 feet in circumference. (A. R. Crawford, New England.)

Habitat.—Confined to New South Wales and Queensland, and essentially a coastal and coastal-ranges tree. It does not extend further south, at least in workable sizes, than Currawang, a few miles south of Nelligen, on the Clyde River. I should be glad to hear from correspondents as to its extreme southern limit. North of this it is extensively diffused throughout the coastal districts of New South Wales, while it is fairly plentiful in Southern Queensland.

The following data in regard to the distribution of the various woods ranked under *Eucalyptus saligna* has been supplied by the Forest Department :—

Eucalyptus saligna—Blue or Flooded Gum.

No. of F.R.	County.	Area in acres.	Class.	Size of Trees.	How distributed.		Royalty per 100 superficial ft.	Quality.	Remarks.
					Number of Trees.	Over area.			
				girth. ft. in.		acres.	pence.		Locally called—
225	Argyle	6,340	A	3 6	over	6,340	...	Good ...	Blue gum.
8,559	Auckland ...	2,027	A	8 0	5 ,,	1,300	...	,, ...	,,
14,150	Buller	15,750	A	......	......	......	...	,, ...	,,
14,162	Camden	10,120	C	......	......	......	6	,, ...	,,
242	Clarence	11,100	C	6 0	3 over	100	6	,, ...	Flooded gum.
1,612	Clarke	43,620	C	6 0	7 ,,	6,000	12	,, ...	Blue gum.
8,928	Clive	11,000	A	......	......	......	...	,, ...	,,
9,056	Cumberland ...	6,000	A	......	......	......	...	,, ...	,,
6,264	Drake	9,005	A	8 0	5 over	9,005	...	,, ...	,,
112	Dudley	2,453	A	6 0	1 ,,	200	...	,, ...	Blue and Flooded gums.
158	,, ...	79,680	C	10 0	3 ,,	28,000	...	,, ...	Flooded gum.
3,753	,, ...	16,000	C	10 6	1 ,,	500	...	,, ...	Blue and Flooded gums.
14,537	,, ...	47,205	C	9 0	......	200	...	,, ...	,, ,,
202	Durham	48,000	C	......	......	......	...	Very good	Blue gum.
136	Fitzroy	12,440	A	8 0	1 over	1,000	...	Good ...	Blue and Flooded gums.
49A	Gloucester ...	26,700	A	8 0	1 ,,	2,500	...	,, ...	Blue gum.
1,608	Gresham	24,960	A	6 0	20 ,,	......	...	,, ...	,,
1,293	Hawes and Vernon	38,800	A	7 0	3 ,,	10,000	...	Very good	,,
144	Macquarie ...	12,262	A	8 0	......	......	...	Good ...	Blue and Flooded gums.
70	Northumberland...	33,186	C	6 0	5 over	16,000	...	,, ...	Blue gum.
13,736	Raleigh	4,000	A	......	......	......	...	,, ...	Blue and Flooded gums.
246A	Richmond.. ...	18,600	A	......	......	......	...	,, ...	Blue gum.
249	Rous	16,661	C	11 0	1	7,000	...	,, ...	Flooded gum.
10,616	St. Vincent ...	49,250	C	6 0	4	5,000	6	,, ...	Blue gum.
13,457	Vernon	7,800	A	......	......	......	...	,, ...	,,

It is the tree which gives the name to so many New South Wales localities which rejoice in the name of Blue Gum Flat—an indication of the alluvial soil it prefers.

Mr. A. R. Crawford, of Moona Plains, wrote to me as follows in February, 1896, in regard to its distribution in New England :—

This species is found in heads of creeks on the eastern slopes, usually smooth and white in appearance, like the Flooded Gum of the low country. I have never seen the wood of trees grown there. On the table-lands it is found in the gullies, running into ranges, and also on ridgy ground.

Variety *parviflora*, Deane and Maiden.

This interesting small-flowered variety was described and figured in the *Proceedings of the Linnean Society, N.S.W., for* 1899.

It was originally described from Northern New England (Bluff River, near Tenterfield; also near Red-soil Creek, Mount Spiraby, east of the Dividing Range), where it bears the local name of " Silky Gum," owing to the sheen of its bark. It was also called by some people " White Gum " and " Blue Gum."

It is a very large tree, with smooth and sometimes almost glaucous bark, a little ribbony at the butt. Some of the trees resemble Blue or Flooded Gum (*E. saligna*) a good deal. In other cases it forms a gnarled tree up to 7 or 8 feet in diameter as seen; the scrambling branches in some cases actually touching the ground. Some trees remind one of *Angophora lanceolata*.

The gnarled trees have buttresses spreading over a large area of land, and have thin, scaly, or ribbony bark extending a good distance up the trunk; in others the roughish bark extends but a short distance. The trunk and branches show patches of bluish, purplish, or reddish colour. The twigs are often red, so are the young suckers—twigs, midribs, and margins.

The tree is what bushmen recognise as a broad-leaved Gum in comparison with other species. The young foliage is especially broad, shining, particularly on the upper surface, and bears some superficial resemblance to pear foliage.

Apparently rich in oil, which has a peculiar and somewhat penetrating odour, as tested by the crushed leaves.

The buds are clavate; the fruits are much smaller than those of the normal species; the valves are not exserted. The timber also appears to be different to that of the normal species.

Recently specimens of this tree, under the name of Brown Gum, were sent by Mr. District-Forester Stopford, of Armidale, from Glen Innes, with the following report:—

Known locally in the Glen Innes and Tenterfield part of this district as " Brown Gum."

I do not know this tree in the Armidale portion of the district; the timber is being used at the Bald Nob Saw-mill, on the Grafton-road; and it is also growing in the Tenterfield district, near the falls from the New England table-land to the coastal district, to which part it appears confined.

Later on he reported :—

The timber known as Brown Gum is a useful hardwood, but it is decidedly inferior to "Sydney Blue Gum" (*Eucalyptus saligna*).

It is used for building purposes, but not for such as flooring or weather-boarding, on account of its shrinking and warping propensites. It is best suited to such sizes as 9 x 4, 6 x 3, and 4 x 2.

It is accepted by the Railway Commissioners for railway sleepers, and is an excellent hardwood to stand in the ground. Brown Gum has been known to have been in the ground for twenty years, and at the end of that time it has been in a good state of preservation.

As a rule, Brown Gum grows exceedingly straight, and is free from bumps and knocks, which is very much in its favour.

There appears to be a difference of opinion amongst builders as to the qualities of this timber, some readily accepting it, whilst others do not seem to care for it. This, in my opinion, is accounted for to a great extent by the fact of there being an absence of a proper system of seasoning timber before being used in buildings ; but this, I think, will be rectified before long by the public refusing to accept timber unless properly seasoned.

The above notes, of course, extend its northern range very considerably.

Last year I received it from Woy Woy, near Gosford, from Mr. A. Murphy, with the following note :—

This timber grows near Ourimbah, and it is called by the timber-getters "Round-leaved Blue Gum." The tree is very similar to *E. saligna*, only of much larger growth. Plenty of these trees reach 10 to 12 feet in diameter. The timber is good.

Mr. J. L. Boorman also collected it at Jilliby Jilliby, in the same district.

The same tree occurs in the Blue Mountains (*e.g.*, the Valley, Springwood), and also Jamieson Valley, Wentworth Falls (found in the latter place by Mr. W. Forsyth) ; Mr. Jesse Gregson has sent it from Mount Wilson.

Mr. R. H. Cambage has sent it from several southern localities with the following note :—

It is a round-leaved Gum. There is a fine large tree at Burragorang, where it is known as Flooded Gum. It is the Blue Gum of Blue Gum Creek, Picton Lakes. It has thin-leaved broad suckers, green above, pale underneath.

This paleness of the under-leaf is often seen in young leaves of normal *saligna*. Mr. Cambage's and the Jilliby Jilliby specimens have fruits rather more urceolate than those originally figured in 1899.

It would appear that this variety of *E. saligna*, variously known as "Silky Gum," "Round-leaved Blue Gum," "Blue Gum," "Flooded Gum," "Brown Gum," &c., is not very well known, at all events, nothing like so well known as normal Blue or Flooded Gum. It is a valuable timber, though apparently somewhat inferior to normal Blue Gum, and I draw attention to it, for it appears to me to be well worthy of more extended use.

EXPLANATION OF PLATE.

A. Twig of young foliage.

B. Twig in flower.

C. Front and back view of anthers.

D. Twig bearing fruits.

No. 13.

Podocarpus elata, R.Br.

The Brown or She Pine.*

(Natural Order CONIFERÆ.)

Botanical description.—Genus, *Podocarpus*, L' Hér.

Flowers.—Diœcious or rarely monœcious.

Male amenta.—Cylindrical.

Stamens.—Numerous, slightly contracted at the base, the scale-like apices closely imbricate; anther cells two.

Female amenta.—Of two to four bracts or scales, more or less succulent, and united with the rhachis in an oblong receptacle, unequally two or four toothed at the apex.

Ovules.—One or two, exserted, reversed, and adnate to an erect stipe from within the larger teeth or bracts of the receptacle.

Seeds.—Drupaceous, the nucleus enclosed in a double integument, the outer one succulent, the inner one long.

Embryo.—With two short cotyledons and an inferior radicle.

Trees or shrubs.

Leaves.—Alternate or rarely opposite, usually distichous and flat, with a prominent midrib.

Buds.—Scaly.

Amenta.—Axillary or terminal, solitary or several together, sessile or shortly racemose.

Botanical description.—Species, *P. elata*, R.Br.; Mirb. in *Mem. Mus. Par.* XIII, 75.

A tree of 50 to 100 feet.

Leaves.—Oblong linear or broadly linear-lanceolate, very variable in size, on some specimens with young flowers 1½ to 2 inches long and ¼ inch wide and quite straight; in the ordinary form 3 to 6 inches long and 4 to 6 lines broad, straight or slightly falcate, acute or rather obtuse, the midrib prominent, the petiole very short.

Male amenta.—Clustered two or three together, sessile, 1 to 1½ inches long, surrounded by several short scales or bracts.

Female peduncles.—Two to 3 lines long, solitary in the axils of the lower leaves or more frequently of small bracts at the base of the year's branches.

Fruiting receptacle.—Oblong, 4 to 6 lines long, with usually only one seed, ovoid or globular, 4 to 6 lines diameter. (B. Fl. vi, 247.)

Botanical Name.—*Podocarpus,* from two Greek words—*pous, podos,* a foot, and *karpos,* a fruit, referring to the thick, fleshy fruit-stalk of these plants; *elata,* Latin, lofty, referring to the tallness of the tree.

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* White or She Pine on Plate.

WHITE or SHE PINE.

(*Podocarpus elata*, R.Br.)

Vernacular Names.—In a general way the name Pine is given to that group of plants known to botanists as Conifers. The exceptions are rare, but a few brush trees in Australia go by that name. Our tree is known as "Pine," "She Pine," and "Brown Pine," and, to a less extent, "White Pine," but the last designation had better be left for *Araucaria Cunninghamii*, the "Hoop Pine." Called also "Plum Pine" and "Berry Pine," in allusion to the fruits; and also "Brush Pine," because of the situation in which it grows. It is also known as "Native Deal."

Aboriginal Names.—"Dyrren-dyrren," of the aborigines of Illawarra, New South Wales, and "Goongum," of those of northern New South Wales; "Kidney Wallum," of some of Queensland. "Mooloolah" is another Queensland aboriginal name, according to the Hon. W. Pettigrew; and it is the "Daalgaal" of the aborigines of the Barron River, according to Mr. Cowley.

Synonyms.—*P. ensifolia*, R.Br.; *P. falcata*, A. Cunn.; *Nageia elata*, F.v.M.; *Nageia elata* in Muell. Cens., p. 109.

Fruit.—The fruits are called by Sydney boys "plums," "damsons," or "cherries." The fruit, which ripens in autumn, consists of an astringent, aromatic, resinous drupe, egg-shaped, and something like a sloe, sitting upon a fleshy substance of a purplish or damson colour, which is the "damson." I have measured them up to $\frac{15}{16}$ inch long (they are depressed) and $\frac{7}{8}$ inch in diameter, and they are probably larger. The "sloe" cannot be eaten, but aborigines and small boys are fond of the "damsons," which have no stones, and consist of a pleasant but rather insipid mucilaginous substance, the thin skin being slightly astringent. They rank among the best of the indigenous fruits. When ripe they stain the mouth and fingers like black cherries do.

Timber.—The timber is used for miscellaneous purposes, like "Colonial Pine" (*Araucaria Cunninghamii*), but its most valuable property is its resistance to white ants and *Teredo*. Round piles of this timber with the bark on are all but proof against the attacks of *Teredo* (cobra) even in brackish water; in fact, some saw-millers say that its power of resistance to marine borers is absolute, but I doubt this, although it is rarely touched. It used to be employed in the Port Macquarie district for staves for tallow casks, and was then called "Stave-wood." In the Gloucester district it has the reputation of shrinking a good deal and being knotty. Locally, it is used for flooring and ceiling boards and dray bottoms.

Another report says:—"Timber light and durable when used for any inside work; it takes a fine polish." We know but little of the uses of this timber, except for piles. Mr. F. M. Bailey says that it is excellent for the spars and masts of vessels.

The genus *Podocarpus* is far more developed in New Zealand than it is in Australia, and the uses and properties of the better known New Zealand timber trees will suggest uses and properties probably possessed, in a greater or less degree, by their Australian congeners. The Totara stands in the very first rank of New Zealand trees; it is one of the best timbers in the world to withstand marine borers; in fact, some comparative tests between this timber and the Western Australian Jarrah, made a few years ago by the Engineer to the Auckland Harbour Board, tend to show that Totara possesses greater resistant power than Jarrah. Other *Podocarpus* timbers of note from the sister Colony are the Matai (*P. spicata*) which is practically imperishable, the Miro or Black Pine (*P. ferruginea*), all the above being grand timbers. There is still another New Zealand *Podocarpus* (*P. dacrydioides*), the White Pine or Kahikatea, which by no means bears so good a name for durability as those already mentioned. It is, however, largely used in the manufacture of butter-boxes, for which it is very suitable.

The genus to which our Brown Pine belongs is even more developed in Asia (chiefly in the tropics) than it is in Australasia. A few species are found in tropical America and in the West Indies, in mountainous districts. It also follows the Andes south into Chili and Peru for a considerable distance. It is also found in South Africa.

Two species of *Podocarpus* are found in the warmer parts of Japan, and are frequently planted in the vicinity of temples. Although not largely used for timber, being chiefly utilised for ornamental purposes, *e.g.*, green hedges and specimen trees, their timber is well-known, and it is considered to be more durable in water than in the air, confirming Australasian experience of allied timber trees.

A Burmese species yields timber which is held in high regard by the natives, and they call it by a name which signifies the Prince of Wood and of trees. It is used by carpenters for various purposes, and the natives of Burma have a superstition that the beams of balances should be made of it. A writer states that it is used to avert evil by driving a peg of it into a house post or boat. Apart from the sentimental and superstitious considerations which influence the use of this timber, there is no doubt that it is really valuable, and a distinguished Indian botanist has suggested that it may prove a valuable substitute for box.

Exudation.—While this is a very common tree with us, I have found no resin upon it; but should be looked for for scientific reasons. The following references are interesting:—*Podocarpus ferruginea* yields a dark red-coloured gum resin. (G. Bennett, *Wanderings of a Naturalist*, p. 415.)

See also "Podocarpic Acid" (*Watts Dict.*, VII [2], 1657.)

Amongst the natural products collected by Dr. T. E. de Vrij, during his stay in the Isle of Java, was a crystalline resin produced from *Podocarpus cupressina* or *P. imbricata*, a tree common in the forests of Java, and known locally by its Malay name of Djamoudjou. This resin, when treated with alcohol, yields a white crystalline acid substance, which has been called Podocarpic acid. The last number of the *Journal für praktische Chimie* contains a long paper by Herr A. C. Oudeman, junr., in which he describes the results of his studies of this acid, and of several of its salts and derivatives. (*Jour. Soc. Arts*, XXII, 864.)

Size.—It grows to a height of 90 or 100 feet, with a diameter of 2 or 3 feet.

Habitat.—It extends from the Illawarra to Northern Queensland, being confined to the coast districts. It usually occurs in brushes or good soil, and often on the banks of water-courses.

Following are specimen reports of its occurrence in a few localities:—"In New South Wales it is fairly plentiful in the Tweed district." "There is abundance of Brown Pine on the north shore of Port Macquarie, say 25 to 30 feet high, and from 15 to 18 inches in diameter." On the Gloucester River I observed some fine trees of *Podocarpus elata*, which I was informed is very common on this and other rivers and creeks in the district.

EXPLANATION OF PLATE.

A. Branch with male (staminiferous) flowers.

B. Amentum, partly magnified, showing the scales at the base.

C. Staminiferous flower shedding pollen.

D. Pistilliferous (female) flower.

E. Branch with ripe fruits, showing drupaceous seed and the fleshy receptacle.

F. Seed.

G. Vertical section of seed.

H. Horizontal section of seed.

No. 14.

Melaleuca leucadendron, Linn.

The Broad-leaved Tea-tree.

(Natural Order MYRTACEÆ.)

Botanical description.—Genus, *Melaleuca*, Linn.

Calyx-tube.—Campanulate or urceolate, adnate to the ovary at the base, the free part erect, contracted or scarcely dilated; lobes five, imbricate or open, herbaceous or more or less scarious, and then occasionally irregularly confluent.

Petals.—Five, orbicular, spreading.

Stamens.—Indefinite, much longer than the petals, united in five distinct bundles opposite the petals; the united part or claw usually flattened, from very short and broad to long and linear; the filaments (or free parts) filiform, either pinnately arranged along the margin of the claw or clustered or digitate at the end, or covering also the inner face.

Anthers.—Versatile, the cells parallel, opening longitudinally.

Ovary.—Enclosed in the calyx-tube, inferior or semi-inferior, the convex summit villous (except in *M. calycina*) with a central depression round the style; three-celled, with indefinite ovules in each cell, either numerous and closely packed on the outer surface of a peltate placenta, or few and ascending on a short peltate or two-fid placenta.

Style.—Filiform, with a peltate capitate, or frequently very small stigma.

Capsule.—Enclosed in the enlarged and hardened calyx, crowned by the cup-shaped or annular free part of the tube, the lobes rarely persistent, opening loculicidally at the top in three valves, and occasionally separable from the calyx into three cocci.

Seeds.—More or less cuneate, the perfect ones usually few, testa thin.

Embryo.—Straight or scarcely curved.

Cotyledons.—Flat, plano-convex or folded, and embracing each other, longer than the radicle. Shrubs or trees.

Leaves.—Alternate, or in a few species opposite, entire, usually coriaceous, flat, concave, or semiterete, 1–3 or several nerved, very rarely thinner with recurved margins.

Flowers.—Red, white, or yellow, closely sessile and solitary within each bract or floral leaf, in heads or spikes, or rarely solitary and scattered, the axis of the spike usually growing out during or after the flowering.

Fruiting spike.—Forming the base of the new branch.

Bracts.—Usually scale-like, and often imbricate in the young spike, but usually deciduous long before flowering.

Bracteoles.—Usually small and deciduous, or sometimes none.

Botanical description.—Species, *M. Leucadendron*, Linn, Mant., 105.

A tree often attaining a considerable size, with a thick, often spongy bark, peeling off in layers; the branches slender and often pendulous, but in some situations remaining a small tree or shrub with rigid erect branches.

BROAD-LEAVED TEA-TREE.

(*Melaleuca leucadendron*, Linn.)

Leaves.—Alternate, often vertical, elliptical or lanceolate, straight, oblique or falcate, acuminate, acute or obtuse; when broad, very rigid, and 2 to 4 inches long; when narrow, sometimes 6 to 8 inches long; narrowed into a petiole, 3 to 7 nerved with anastomosing veins.

Flower-spikes.—Elongated, more or less interrupted, solitary or two or three together, from under 2 to 6 inches long, at first terminal, but the axis growing out after flowering into a leafy branch; the rhachis and calyces glabrous, pubescent, tomentose, or woolly.

Calyx-tube.—Ovoid, usually about 1½ lines long; lobes short, orbicular, often scarious on the margin.

Petals.—1 to 1½ lines diameter. Staminal bundles under ½ inch long, the claws sometimes exceedingly short, sometimes exceeding the petals, each with five to eight filaments at the end.

Ovules.—Numerous, ascending on an oblong placenta.

Fruiting-calyx.—Usually about 2 lines diameter, varying from globular to almost hemispherical.

Seed.—Obovoid or cuneate.

Cotyledons.—Obovate, thick, much longer than the radicle. (B.Fl., iii, 143.)

Varieties.—Var. (?) *parvifolia.* Leaves mostly ½ to 1 inch long. Flowers small, and only very slightly pentadelphous, *M. lanceolata*, R.Br., Herb.; *Callistemon nervosus*, Lindl., in Mitch. Trop. Austr., 335; *Leptospermum speciosum*, Schau., in Walp. Rep. ii, 923 (described from Cunningham's specimen in bud only); behind the Government House, Sydney, *R. Brown*; rocks, Balmy Creek, in the interior of Queensland, *Mitchell*; Moreton Bay, *A. Cunningham.* This may prove to be a distinct species, but I can find no character to distinguish it from the small-leaved specimens of *M. leucadendron* (B.Fl., iii, 143).

I have not seen Bentham's var. *parvifolia*, but I do not doubt that the "Government House, Sydney," locality plant is that afterwards described by Mueller (*Proc. Linn. Soc.*, N.S.W., xi, 1106, 1886) as *Melaleuca Deanei.* See also "Synonyms."

Mr. F. M. Bailey (*Queensland Flora*) recognises three varieties in Queensland.

1. Var. *lancifolia*,* Bail.—A large tree, common in the south.
2. Var. *saligna*,† Bail.—A drooping tree from tropical localities.
3. Var. *Cunninghamii*, Bail.—A small tree, also from tropical localities; has dark-red flowers. (A Queensland form with "dark-coloured stamens" was collected by R. Brown and Dallachy. See B.Fl., iii, 143.)

The tropical forms (of which there are many) should be compared with the tropical varieties *Cajeputi* and *minor*, and perhaps others. It would be desirable for a monographer to re-examine all the forms of this variable species.

Botanical name.—*Melaleuca.*—From two Greek words *melas*, black, and *leukos*, white, because the trunk of the first tree described was black and the branches white. The explanation probably is that trunk and branches were alike papery and white, but that the trunk (as is often the case) was charred by a fire, giving it a blackish appearance. *Leucadendron*, also from two Greek words, *leukos*, white, and *dendron*, a tree, hence "White tree" from its general appearance. In fact, we in Australia sometimes call it "White Tea-tree."

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* This name would appear to be pre-occupied unless it is *M. lancifolia*, Turcz., which is a form of *M. leucadendron*, as Bentham has pointed out.

† I do not know whether this is *M. saligna*, Schauer, from the Endeavour River.

Vernacular names.—Like so many Australian Myrtaceous trees and shrubs it is known as "Tea-tree." Because of the broadness of its leaves it is usually known by the name "Broad-leaved Tea-tree." It is known also as "Swamp Tea-tree" because (with other species of the genus) it grows in swamps. Because of the foliaceous character of its bark, which gives the trunk a whitish appearance, it is known as "Paper-bark tree" and "White Tea-tree." Baron Mueller calls it the "Tropical Paper-bark tree." I have heard that it is called "Milkwood" in the Northern Territory.

Aboriginal names.—"Numbah" of the aborigines of the southern part of New South Wales, according to the late Sir William Macarthur. I would suggest that this is the origin of the name of the township of Numba, near the mouth of the Shoalhaven River. It is "Belbowrie," of the county of Gloucester, as far as Kempsey at least, hence the place-name Belbowrie, near Krambach, New South Wales.

It bears a number of aboriginal names in Queensland. They are quoted by Mr. Bailey as follows:—"Mor-ngi," Palmer River (Roth); "Kyenbooree," Mackay (Nugent); "Bichuma," Forest Hill (Macartney); "Atchoourgoo," Mitchell River (Palmer); "Oodgeroo," Stradbroke Island (Watkins), to which may be added "Bethar," Port Curtis (Hedley).

Synonyms.—*M. minor*, Sm.; *M. Cajeputi*, Roxb.; *M. viridifolia*, Gaertn.; *M. saligna*, Blume, Mus. Bot. i, 66, with the several synonyms quoted by De Candolle, Prod. iii, 212, and Blume; *Metrosideros albida*, Sieb. Pl. Exs., referred in Spreng Syst. Cur. Post 194 to *M. coriacea* (attributed by mistake to Labill. instead of Salisb. Prod., 352).

Bentham says:—

This species varies exceedingly in the size, shape, and texture of the leaves—in the young shoots very silky or the spikes silky-villous or woolly or the whole quite glabrous; in the short and dense or long and interrupted spikes; in the size of the flowers, in the greenish-yellow, whitish, pink, or purple stamens, &c., and at first sight it is difficult to believe that they all can be forms of one species, but on examination, none of these variations are sufficiently constant or so combined as to allow of the definition of distinct races. In general the name of *M. leucadendron* is given to the glabrous forms, and *M. minor* to the silky or villous-flowered ones, but the indumentum is here the most uncertain of all characters. *M. lancifolia*, Turcz., in Bull. Mosc., 1847, I, 164, and *M. Cumingiana*, Turcz., l.c., from the Philippine Islands, belong to one of the common Archipelago forms with rather thin leaves and small flowers, and I cannot find the auricles of the staminal bundles mentioned as characterising the former. *M. Cunninghami*, Schau., in Walp. Rep., ii, 927, is a large silky form with broad thick leaves and large flowers. *M. saligna*, Schau., l.c., from Endeavour River, is more glabrous, with long acuminate leaves and long glabrous interrupted spikes. *M. mimosoides*, A. Cunn., Schau., l.c., is very little different from the last. Some specimens from Rockingham Bay, *Dallachy*, and from Endeavour River, *R. Brown*, are remarkable for their dark-coloured stamens.

Leaves—Oil.—The young leaves are bruised in water and the liquid drunk for headaches and colds, and general sickness; the bark is also used for bedding, &c., on the Mitchell River, Queensland (E. Palmer). But by far the most important use of this tree is for the oil the leaves contain; this is the well-known "Cajeput oil" of commerce.

Origin and History.—Oil of Cajeput is distilled from the fresh leaves and twigs of various forms of *Melaleuca*, especially *Melaleuca leucadendron*, L., and the variety known as *M. minor*, Smith (*M. Cajeputi*, Roxb., *M. viridifolia*, Gaertn.).

Oil of Cajeput appears not to have been brought to Europe until the beginning of the seventeenth century when the Dutch took possession of the Moluccas. The first accurate account of the source of the oil was made known by the missionary Valentyn and the merchant George Eberhard Rumpf (Rumphius) of Hanau, both living in Amboina. The latter was an enthusiastic plant collector, and author of the first flora of Amboina. According to Rumpf's statement, the Malays and Javanese were acquainted with the oil of Cajeput long before the Moluccas, the Banda, and Sunda Islands were taken possession of, and used it as a diaphoretic. In Europe the oil at first appears to have found no application. The first notice of such is by a physician Lochner in Nürnberg, and the apothecary Link in Leipzig. The former mentioned the oil in 1717, the latter had brought the oil about the same time as a novelty from the physician of a ship which had just returned from the East Indies. From this time on Cajeput oil was used medicinally in Germany, and was introduced into the apothecary shops, and mentioned in price ordinances and in medical works. It remained, however, for some time rare and expensive, and not until 1730 did larger quantities of the oil come into the European market through Amsterdam. In Germany it was at once called *Oleum Wittnebianum*, after a merchant E. H. Wittneben of Wolfenbüttel, who lived several years in Batavia, and had recommended the oil as a valuable remedial agent in German writings. In France and in England oil of Cajeput was not used until the beginning of the nineteenth century.

The first detailed account of the simple method of distillation of Cajeput oil used on the Moluccas was given by the French traveller Labillardière, who visited the island of Buru in 1792. The use of copper stills and condensers gave rise to a green colour due to a small amount of copper in the oil. When perfectly pure the oil is colourless. The cause of the colouration was first detected by the apothecaries Hellwig in Stralsund, in 1786, Westrumb in Hameln, in 1788, and Trommsdorff in Erfurt, in 1795.

Preparation, Production, and Trade.—Oil of Cajeput is obtained in a primitive manner by the natives of some of the Molucca Islands. According to Reinwardt the oil was prepared formerly only on Buru. In 1821 there were only three distilling apparatus on this island; in 1855 there were fifty. Recently the distillation is also carried on in Ceram. Martin, who in 1891-92 visited Ceram and Buru, described the method of preparation, illustrated in the accompanying figure,* as follows :—

Above a crudely-mortared fireplace stands a barrel (*a*) 1 meter in height, which serves as a distilling vessel; into this are pressed the leaves of the *Melaleuca*, and the container is half filled with water. A metallic helm (*b*), which is obtained from Ambon or Java, is mounted on top, and its elongated tube passed through a second somewhat larger barrel (*c*), serving as a condenser. Water is conducted into the latter from the top by means of a bamboo tube (*d*) from some small channel on the side of a hill. The volatile oil of the plant passes over with the water vapour and separates again after condensation. Water and oil flow into a vessel made of a cocoanut shell, which in turn is connected by means of a short tube with a bottle. Usually one sees a four-cornered brandy-flask, as they are frequently seen in India, used for this purpose. This flask is provided at the bottom with a small opening, and stands in a small trough (*e*) filled with water, so that it is likewise filled with water at the beginning. The distillation product gradually replaces the water in the flask, and the water which has passed over with the oil likewise flows through the opening into the trough, until finally the entire flask is filled with oil, and can be removed by putting a finger on the opening while under water. The yield of oil as obtained with such an arrangement amounts to about $1\frac{1}{2}$ litres per day. As is well known, the light bluish-green liquid is valued in Europe as a stimulant; in Buru it is used as a domestic remedy for all imaginable ills.

The oil is filled into empty wine and beer bottles. Twenty-five bottles are packed at a time into a box made of the stems of the leaves of the sago palm† (*Metroxylon*); the exhausted Cajeput leaves serve as packing material. Macassar, in Celebes, is the principal commercial centre for oil of Cajeput.

Properties.—Crude oil of Cajeput is a green to bluish-green liquid, due to the presence of copper, while the rectified oil is colourless or yellowish. It has the pleasant camphor-like odour of cineol, and an aromatic—somewhat burning—later cooling taste. Sp. gr. 0·920 — 0·930 ; $\alpha D = -0° 10'$ to $-2°$. The oil dissolves in one part of 80 per cent. alcohol, but often gives clear solutions even with 3–5 parts of 70 per cent. alcohol.

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* Not reproduced.

† An illustration of such a case is to be found in Tschirch's *Indische Heil-und Nutzpflanzen*, plate 75 and p. 127.

On strongly cooling with liquid carbonic acid and ether, it solidifies to a crystalline mass. The copper can be removed from the oil by shaking with a concentrated solution of tartaric acid. As can be seen from its spectroscopic behaviour, chlorophyllan,* oxidized chlorophyll, is contained also with the copper in the crude oil.

Composition.—The first chemical investigations dealt almost exclusively with the principal constituent of Cajeput oil, the elementary composition of which, $C_{10}H_{18}O$, was correctly recognised as early as 1833 by Blanchet.† The identity of this body, which was called cajeputene hydrate by Schmidt,§ cajeputol by Gladstone,‡ also by Wright and Lambert,|| with cineol was shown by Wallach¶ in 1884. He prepared the halogen and hydrohalogen compounds. A further proof was finished by Wallach and Gildemeister** by the oxidation of the fraction in question to cineolic acid $C_{10}H_{16}O_5$, melting at 196–197°.

Another important constituent of Cajeput oil, which in regard to the amount present takes second place, is the solid terpineol,†† $C_{10}H_{18}O$, discovered by Voiry,‡‡ which is present in the free state, as well as in the form of its acetic acid ester.

Terpenes are present in the oil to only a small extent; the lævogyrate fraction boiling at 155–165° gives with hydrochloric acid a solid lævogyrate monohydrochloride $C_{10}H_{16}HCl$ ‡‡ melting at 126–128°. 1 – pinene is therefore present.

Several aldehydes are present in the first fraction. Voiry obtained by separation with sodium bisulphite a liquid of the properties of valeric aldehyde. The second aldehyde, smelling like oil of bitter almonds, is probably benzaldehyde.—"The Volatile Oils" (Gildemeister and Hoffmann, Kremer's translation, pp. 518-22).

I will give a few more notes on Cajeput oil, but I am a little uncertain as to whether the particular variety of *Melaleuca* which produces it is actually indigenous in Australia. But whether it is actually indigenous or not, the oil yielded by the various species of *Melaleuca* possesses a greater or less family likeness, and as the oil of the present species has been most worked at, the notes will be useful as a guide.

Rumphius says that the leaves are gathered on a warm day and placed in a sack, where they become hot and damp. They are then macerated in water, and left to ferment for a night, and afterwards submitted to distillation. Two sacksful of the leaves yielded only about three fluid drachms of the oil. Lesson's account is also given in Bentley and Trimen's *Medicinal Plants*. This is probably a proper and convenient way of treating the leaves of many of our myrtaceous trees with the view of extracting the oil they contain.

Cajuput, or Cajeput oil, is much used in India as an external application for rheumatism. It is a powerful anti-spasmodic diffusable stimulant and sudorific. It is coming more into use in European practice. It varies in colour from yellowish-green to bluish-green; it is a transparent mobile fluid, with an agreeable camphoraceous odour and bitter aromatic taste, sp. gr. 0·926; it remains liquid at 13° C., and deviates the ray of polarised light to the left. (The author has noticed the oil of every shade of brown, but when exposed to the light it in a few days turns to a greenish colour.) . . . When the oil is

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* *Pharm. Zeitschr.* f. *Russl.*, 27, p. 548; *Jahresb.* f. *Pharm.*, 1883, p. 317.
† Liebig's *Annalen*, 7, p. 161.
‡ *Journ. Chem. Soc.*, 14, p. 163; *Journ.* f. *prakt Chem.*, 82, p. 189.
§ *Journ. Chem. Soc.*, 25, p. 1; *Pharm. Journ.*, iii, 2, p. 746; *Jahresb.* f. *Chemie*, 1872, p. 815
|| *Berichte*, 7, p. 598; *Pharm. Journ.*, iii, 5, p. 234.
¶ Liebig's *Annalen*, 225, p. 315.
** Liebig's *Annalen*, 246, p. 276.
†† *Berichte von Schimmel & Co.*, April, 1892, p. 7.
‡‡ *Compt. rend.*, 106, p. 1538; *Bull. Soc. Chim.*, ii, 50, p. 108; *Journ. de Pharm*, v, 18, p 149

rectified it is obtained colourless, but it readily becomes green if in contact for a short time with metallic copper. Guibourt, has, however, proved by experiment that the volatile oil obtained by the distillation of the leaves of several species of *Melaleuca*, *Metrosideros*, and *Eucalyptus*, has naturally a fine green hue. It is not improbable that this hue is transient, and that the contamination with copper is intentional in order to obtain a permanent green. (*Materia Medica of Western India*, Dymock.)

M. Jules Poisson states that in the new edition of the Swedish Pharmacopœia cineol (from Eucalyptus oil, probably) replaces Cajeput oil.

Oil of variety lancifolia, Bailey.—The fresh leaves of this Australian variety yield ·895 per cent. of a slightly acid essential oil, of specific gravity ·917 (Staiger).

Schimmel & Co.* give the specific gravity of a specimen as 0·955; $a_D = -3° 38'$, and states that it consists principally of cineol.

Dr. Bancroft considers "this oil to be more agreeable than that of Cajeput oil, which it closely resembles." He finds that small insects imprisoned in its vapour are intoxicated. He has found it of value as an antiseptic inhalation in phthisis, for which purpose he considers it more pleasant than Eucalyptus oil. A sample of Queensland oil, however, examined at the Colonial and Indian Exhibition by an expert, was described as having a distinctly disagreeable odour, not resembling Cajeput, but reminding one of rotten fruit, so that probably the variety yielding it is somewhat removed from the typical form yielding the Cajeput oil of commerce. In Bentley and Trimen's *Medicinal Plants*, 108, the name *Melaleuca minor* is retained as the species name for the Cajeput oil plant; "as, however, it appears that this is the form only from which the oil is obtained, we have maintained the specific name without intending thereby to express any opinion as to its distinctness from the common Australian 'Tea-tree' (*M. leucadendron*)."

Oil of variety viridiflora (Oil of Niaouli).

Oil of niaouli, the distillate obtained from *Melaleuca viridifolia*, Brongn. et Gris, called *Niaouli* in New Caledonia, is very similar to oil of Cajeput in its properties and composition. The oil is called *Gomenol* on account of its preparation in the neighbourhood of Gomen. Sp. gr. 0·908 – 0·922 at 12°. Optically it is either inactive or slightly dextro or laevogyrate.

Composition.†—In place of the l – pinene in Cajeput oil, niaouli oil contains d – pinene, of which a dextrogyrate solid monohydrochloride $C_{10}H_{16}HCl$. was obtained. Cineol is the principal constituent (about 66 p.c.) and is accompanied by a lævogyrate compound of the same boiling-point (l – limonene). Crystallised terpineol, $C_{10}H_{18}O$, and its valerianic acid ester are present to the extent of about 30 p.c.; there are also present traces of acetic and butyric acid esters.‡ Bertrand separated by means of bisulphite two aldehydes from the oil, of which the one had the odour of valeric aldehyde, the other that of bitter almond oil, and boiled at 180° (benzaldehyde?). The unpleasant odour of the crude oil is due to sulphur compounds.—"The Volatile Oils" (Gildemeister and Hoffmann), pp. 522–3.

See also abstracts of investigations on this oil in *Pharm. Journ.* [3] xxiii, 989; *Chemist and Druggist*, 27th May, 1893, p. 737.

* *Bericht*, April, 1892, p. 41.

† Bertrand, *Bull. Soc. Chim.* iii, 9, p. 432; *Compt. rend.*, 116, p. 1070; *Journ. Chem. Soc.*, lxiv, 523, 727; Voiry, "Contribution à l'étude chemique des huiles essentielles de quelques Myrtacées." *Thése de l'Ecole de Pharmacie de Paris*, 1888.

‡ *Bericht von Schimmel & Co.*, April, 1892, p. 41.

Bark.—Several species of *Melaleuca* have a thin papery bark which tears off in several layers. It is used, amongst other purposes, by the aboriginal women to wrap their children in.

Backhouse (*Narrative*, p. 58) mentions that the natives of Tasmania used to cross the mouth of a harbour on floats, in the form of a boat, made of bundles of the paper-like bark of the Swamp Tea-tree, lashed side by side by means of tough grass. On these, three or four persons were placed, and one would swim at each side, holding it with one hand.

Mr. W. Soutter, of Brisbane, has used the ground paper bark of this tree for packing fruit for export. (See *Queensland Agricultural Journal*, also *Cape Agricultural Journal*, 11th and 25th January, 1894.)

Timber.—Exceedingly hard and cross-grained, almost imperishable in moist places, but otherwise not of special merit, greatly used for ship timbers, boat knees and posts; wood much resembling that of the *Melaleucas* generally, very apt to crack and fly open on drying.

Speaking of the Indian-grown timber, Gamble says:—

Wood reddish brown, hard; pores moderate-sized, scanty, producing wavy lines on a vertical section. Medullary rays very fine, extremely numerous.

Size.—Up to 40 or 50 feet, and a diameter of 1 or 2 feet in central and coastal New South Wales, but attaining a large size as Queensland is approached. Mueller says it is the largest and straightest tree in the Northern Territory.

Habitat.—From the Shoalhaven River, New South Wales (I do not know its furthest southern locality), north right along the coast, in moist sandy localities, to Northern Queensland and the Northern Territory. Found also in Western Australia (its precise range I do not know), in New Caledonia, the whole Malayan Archipelago, and Burma.

EXPLANATION OF PLATE.

A. Outside view of the flower opened out.
 a. Calyx.
 b. Petals.
 c. Stamens.

B. Inside view of the flower opened out.
 d. Pistil.

C. One staminal bundle with a petal.

D. Stamens.

E. Pistil.

F. Ovary, showing convex summit.

G. Vertical section of ovary.

H. Horizontal section of ovary.

I. Fruiting spike.

QUANDONG.

(*Fusanus acuminatus*, R.Br.)

No. 15.

Fusanus acuminatus, R.Br.

The Quandong.

(Natural Order SANTALACEÆ.)

Botanical description.—Genus, *Fusanus,* Linn.

Flowers.—Hermaphrodite.

Perianth-tube.—Adnate, turbinate, shortly produced beyond the ovary into a broad open free portion, lined by the sinuately four-lobed disk, the margin of which is continuously free inside the stamens; the perianth lobes four, with a tuft of hairs behind each stamen.

Filaments.—Short, inflected over the notches of the disk.

Anthers.—Short, with two parallel cells opening longitudinally.

Ovary.—Inferior, with an erect rather thick placenta, scarcely acuminate at the top, the two or three adnate ovules distinct only at the base, and the whole difficult to separate from the fleshy ovary before fecundation..

Style.—Very short and conical, or scarcely any, with two, or rarely three, distinct seminal stigmas.

Fruit.—A globular drupe, crowned by the persistent perianth lobes, or rarely by the scar only of the fallen lobes; the epicarp more or less fleshy or succulent; the endocarp hard, and usually rugose or pitted.

Trees or *shrubs.*—With the habit, foliage, and inflorescence of *Santalum,* but with smaller flowers.

Bracts.—Small, and very deciduous, so as to be rarely seen.

Botanical description.—Species, *F. acuminatus,* R.Br., Prod. 355.

A tall *shrub* or a *tree* of 20 to 30 feet.

Leaves.—Opposite, lanceolate, acute, or sometimes, when young, with a short hooked point, mostly 2 or 3 inches long, and tapering into a petiole of 2 or 3 lines, but very variable in size and breadth, coriaceous, with the lateral veins often prominent when old.

Flowers.—Rather numerous, in a terminal pyramidal panicle, scarcely longer than the leaves, but in some of the western specimens much reduced.

Perianth.—Spreading to about 2½ lines diameter, the lobes somewhat concave, even when open. Free margin of the disk very prominent, broadly rounded between the stamens, which curve over the notches.

Anthers.—Very short.

Style.—Exceedingly short and conical, or scarcely any, with a deeply two or three-lobed stigma.

Fruit.—Globular, ½ to ¾ inch diameter, with a succulent epicarp, and a hard, bony, much pitted endocarp; the perianth lobes persisting on the top till the fruit is nearly or quite ripe. (B.Fl., vi, 215.)

Var. (?) *angustifolia*, Benth. :—

Leaves.—Narrow.

Flowers.—Rather larger and fewer.

Fruit.—Not seen.—*Santalum angustifolium*, A.DC., Prod., xiv, 685. Western Australia—Drummond, n. 430, and, perhaps, also n. 218.

The leaves of the specimen figured approach the narrow-leaved form. I have some specimens from Byrock, New South Wales, much shorter and broader; but I have not a specimen of Robert Brown's type for figuring.

Botanical Name.—*Fusanus*, from the French *fusain*, "a spindle-tree" (*Euonymus*), on account of the resemblance of the leaves and fruit to those of a Cape species (*F. compressus*) ; *acuminatus*, Latin, "pointed or sharp" (in botany, acuminate), in allusion to the shape of the leaves.

Vernacular Names.—"Quandong," is its commonest name, and sometimes it is called "Native Peach."

Aboriginal Names.—Used to be called "Kelango" by the blacks of Moorunde (on the Murray River, S.A.)—Eyre. "Gutchu" of the aborigines of the Lake Hindmarsh Station (Victoria).

Synonyms.—*Santalum acuminatum*, A.DC.; *S. Preissianum*, Miq.; *S. cognatum*, Miq.; *Santalum acuminatum*, in Muell. Cens., p. 64.

Bentham in the "Flora Australiensis" keeps *Fusanus* and *Santalum* apart; they are similarly dealt with in the *Pflanzenfamilien*. Mueller separates them.

Fruit.—The fleshy epicarp which envelops the seed known as the "Quandong" makes an excellent sub-acid preserve and jelly; it is somewhat of the same flavour as the black guava. By simply extracting the stones and drying the fruit in the sun, it may be used when convenient, just like preserved apples. The kernel is also edible, being very palatable; it is quite spherical.

Miss M. A. Clements has been good enough to send me a parcel of this dried fruit, and she also favoured me with the following directions:—"They require to be soaked in water for a few hours, and then gently stewed with a good deal of sugar, as they are very acid, when they may be put in a tart or eaten with cream." When treated in this way they form a very pleasant dish of good colour, but not equal to our garden fruits. It would be interesting to see what cultivation could do for this pleasant native fruit. It is a favourite food of emus.

The nuts (Quandongs) are used for necklaces, bracelets, and other ornaments, The kernels of the nuts are not only palatable and nutritious, but they are so full of oil that if speared on a stick or reed they will burn entirely away with a clear light, much in the same way as candle-nuts (*Aleurites triloba*) do.

Timber.—Timber hard and close-grained, and emitting a very pleasant fragrance when freshly cut or re-worked, sap-wood of a creamy-pink, heart-wood flesh coloured. It works splendidly, and is excellent for cabinet work. It takes a fine polish ; specific gravity, ·828.

It is durable, not liable to warp according to some people; and Mr. John Duff says of it, "I believe no indigenous wood yet tested is better adapted for wood-engraving."

For an account of a microscopical examination of the wood, with drawings, see *Pharm. Journ.* [3], XVI, 759.

The timber was used by the natives of the Lachlan River, Western New South Wales, for obtaining fire by friction. "Two pegs are driven firmly into the ground about a foot apart, a slotted piece of Quandong wood is then placed against these pegs, a small wedge is tapped lightly into the groove to keep it open, and some finely-rubbed dry grass or bark fibre is placed in the groove or slot; the native then sits down on the ground, and placing his heels against the grooved piece opposite the pegs, holds it firmly in position, and with a piece of Quandong wood shaped like a paper-knife, rubs quickly and heavily across the groove where the grass, &c., has been placed. The friction soon produces combustion of the grass; the wedge is then tapped in order to open the groove wider, the smouldering grass is shaken out into a ball of dry grass ready for the purpose, and the whole waved backwards and forwards for a minute or two until the flame is produced." (K. H. Bennett, in a letter to the author.)

Oil.—The timber is used to some extent for the distillation of an oil, as the following passage will show. *Santalum Preissianum* is, of course, a synonym of *Fuscanus acuminatus*.

SOUTH AUSTRALIAN SANDALWOOD OIL.

Santalum Preissianum, Miq., known as "Quandong" in Australia, bears edible fruits known as native peaches. The wood is dark-brown, of very dense and tough texture and unusually hard and heavy. It contains 5 p.c. of a viscid, cherry-red oil, sp. gr. 1·022. The odor is pleasantly balsamic, reminding one somewhat of roses. Upon standing the oil separates crystals, which by recrystallisation are obtained in prisms melting at 105–105°.*

Composition.—The crystalline constituent of the oil has been examined by Berkenheim† (1892). He found the melting point 101–103°, and assigned to it the formula $C_{15}H_{24}O_2$. The substance is an alcohol, the acetic ester of which crystallises in hexagonal plates, melting at 68·5 to 69·5°. With phosphorus trichloride it yields a chloride, $C_{15}H_{23}OCl$., m.p. 119–120·5°; phosphorous pentachloride does not act on the alcohol. The methyl ether obtained by means of the sodium compound of the alcohol is liquid Potassium permanganate oxidizes it to a liquid acid $C_7H_{14}O_2$.—"The Volatile Oils," Gildemeister and Hoffmann (Kremer's trans.), p. 344.

I will deal with the oil of allied species of *Fusanus* and *Santalum* at page 100.

* *Bericht von Schimmel & Co.*, Apr., 1891, p. 49 ; and Oct., 1891, p. 33.
† *Zeitschr. d. Russ Phys. Chem. Ges*, 24, p. 688; Abstr. *Chem. Centralbl.*, 1893, I, p. 986.

Size.—A small ornamental tree, usually attaining a height of 10 or 12 feet, but under favourable conditions 20 or 30 feet, with a stem diameter of 6 to 8 inches.

It forms a useful fodder-bush, protected from the operation of timber licenses.

Habitat.—It is found plentifully in places in the Lachlan district and on the Murray and Darling Rivers, and other parts of the interior of New South Wales; also in various dry parts of Queensland, Victoria, South Australia, and Western Australia.

It exists in moderately large quantities in the districts where found, but I cannot estimate the approximate quantity.

Sandalwood Oil.

The principal species yielding the sandalwood oil of commerce is *Santalum album*, Linn., whose timber has been used because of its perfume, and for distillation of its oil, from remote antiquity. A full account of this oil, its manufacture, composition,* uses, &c., will be found in "The Volatile Oils,"† and also in Sawers,‡ and in many other works. For a figure of the plant, see *Bot. Mag.*, t. 3235.

Australian Sandalwood.—The Australian species of *Fusanus* and *Santalum* are more or less known as "Sandalwood" in Australia, and following is a brief account of them, with particular reference to their use for oil distillation, as far as I am aware of it.

Fusanus.

1. *Fusanus persicarius*, F.v.M.—Found in all the States except Tasmania.
2. *Fusanus spicatus*, R.Br. (*Santalum cygnorum*, Miq.).—Western Australia.
3. *Fusanus crassifolius*, R.Br.—New South Wales.

1. *Fusanus persicarius*, F.v.M. (Syn. *Santalum persicarium*, F.v.M.) "Native Sandalwood."

The root-bark is used as food by the aborigines. (Mueller, *2nd General Report*, 1854.) Also mentioned by Wilhelmi as used by the natives of the Murray, near Swan Hill; he describes it as tasteless but nutritious, and it is prepared in the same way as other roots—viz., by roasting in hot ashes.

Miquel (*Ned. Kruidk. Arch.*, iv, 1856) speaks (from Mueller's notes) of the seed being of the size and taste of a filbert.

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* See Cripps, *Pharm. Journ.* [3], XXIII, 461, Dec., 1892.
† By E. Gildemeister and Fr. Hoffmann (auspices of Schimmel & Co., Leipzig); Milwaukie, U.S.A., 1900.
‡ "Odorographia," p. 315; also, 2nd series, p. 405.

It is a small shrub or small tree, yielding a kind of sandalwood. Specific gravity, ·749, according to one experiment by Mr. Osborne.

Possibly this species is referred to in the following note:—

A shipment of 88 tons of sandalwood left Rockhampton recently for Singapore. The wood was obtained in the west, and was shipped to test the Eastern market. Large quantities of this wood are obtained in the interior of Queensland.—*Building and Engineering Journal*, Sydney, July 2, 1892.

2. *Fusanus spicatus*, R.Br. (Syn. *Santalum spicatum*, A.DC.; *S. cygnorum*, Miq.), described in Muell. Cens., p. 64, as *Santalum cygnorum*. "Fragrant Sandalwood."

In 1849, 1,204 tons of sandalwood, valued at £10,711, were shipped from Western Australia. The merchants bought it for shipment at £6 to £6 10s. per ton.

At the London International Exhibition of 1862, a fine log of sandalwood, weighing 4½ cwt., was shown from the Blackwood River, Western Australia; and another, 3 feet 6 inches long by 11 inches diameter, from York.

Now, the sandalwood trees of any size, within a radius of 150 miles of Perth, have been cut down, and little can be obtained, except at a great distance. In 1876, 7,000 tons were exported, of the estimated value of £70,000. The amount exported in 1879 (chiefly to China and Singapore) was 4,700 tons, valued at £47,000.

The amount exported in 1884 was valued at £29,960, of which this wood formed a considerable portion. China is the chief market for it. Some of it is used for burning in joss-houses.

Schimmel & Co.'s Report of October, 1890, contains the following statement:—

The considerable quantity of 4,470 tons, worth £33,525, of the resinous-smelling Australian sandalwood, from the Swan River (quite unsuitable to European requirements), was exported in 1899 to Singapore and China.

The *Sydney Morning Herald*, of 11th September, 1890, contained the telegram from its Perth correspondent: "The newly-established Distillery Company, a short distance from Albany, shipped the first instalment of twenty cases of sandalwood oil to England."

Extract from the *Chemist and Druggist*, dated 28th March, 1891:—

" . . . For several years the wood has been exported in large quantities from Western Australia, but only recently has the Western Australian Distillery Company (Limited), with headquarters at Albany, undertaken the distillation of the essential oil on an extensive scale. Several consignments have already reached London and been disposed of, and last week ten cases of the oil were offered at the public sales.

"We have had the opportunity of examining a small sample of this oil, and have carefully compared it with a sample of the genuine Madras oil. The Australian oil is of much more fragrant odour than the Madras kind; it rather resembles the Fiji oil (distilled from *Santalum yasi*) in this respect, and also in colour, which is a pale straw. The most notable point of difference between this oil and the official kind is in specific gravity, which is 0·963. This is above the B.P. figure, but the experience of distillers of East Indian wood goes to show that oil from that source has a specific gravity of at least 0·970, and that figure is, we believe, generally taken by wholesale houses. That being so, it is obvious that the Australian oil might be looked upon with suspicion, especially as it is not so soluble as East Indian oil in a mixture of one part of proof spirit and three parts of rectified spirit; the latter dissolves in its own volume, while 1 volume of Australian oil requires at least $1\frac{1}{4}$ volume of the spirit. Both differences are, we have assured ourselves, due to the oil containing a larger proportion of lower boiling constituents, and not to admixture of cedarwood oil. So far as the physical characteristics indicate, the oil may be regarded as equal to official sandalwood oil, but it would be advantageous to have a hospital trial made of it."

Extract from the *Chemist and Druggist*, dated 4th April, 1891:—

. . . . In your issue of the 28th ultimo you published an article under the head of "Australian Sandalwood Oil," in which you say, "The most notable point of difference between this oil and the official kind is in specific gravity, which is 0·963;" but the "experience of distillers of East Indian wood goes to show that oil from that source has a specific gravity of at least 0·970." I beg to say that, in practice, we have found a difference of from 3 to 5 points between the specific gravities of the oils from young and full-grown wood. We have tried a series of experiments, and all our last shipments are of the specific gravity of 0·965 to 0·969.

You conclude by saying, "It would be advantageous to have a hospital trial made of it." I beg to assure you that it has been thoroughly tested, both in hospitals and by private medical men, in the Australian Colonies. The oil passed through its experimental stages, and was highly approved of years ago, or it would not have been introduced here. I enclose testimonials from Mr. Joseph Bosisto, Melbourne (1st October, 1885); the Industrial and Technological Museum, Melbourne; and others, bearing out this assertion.

A further article on West Australian Sandalwood will be found in the *Chemist and Druggist* for 2nd January, 1897, p. 17.

A valuable paper* by Mr. E. J. Parry on "Western Australian Sandalwood Oil" will be found in the same journal for 29th October, 1898, p. 708.

Following is the latest report on the oil, taken from Gildemeister and Hoffmann's work already quoted:—

WEST AUSTRALIAN SANDALWOOD OIL.

The wood of *Santalum cygnorum*, Miq. (*Fusanus spicatus*, R.Br.), is exported from Fremantle, West Australia, and is known in the Singapore market as Swan River Sandalwood. In India and China it is used as substitute for the Indian Sandalwood from *Santalum album*. The wood contains 2 per cent. of oil, having an unpleasant resinous odour; sp. gr., 0·953†–0·965 (Parry‡); $a_D = +5° 20'$.

West Australian Sandalwood oil, therefore, has very different properties from those of the East Indian oil, and cannot be used as a substitute for the latter. The oil was distilled as early as 1875 by Schimmel & Co. Recently the distillation of the oil has been taken up in Fremantle.§

Parry‡ found the saponification numbers 1·1–1·6. After acetylisation he obtained saponification numbers which seemed to indicate an apparent santalol content of 75 per cent. Whether the alcohol of this oil is identical with that of *S. album* has not yet been established.—"The Volatile Oils," p. 345.

3. *Fusanus crassifolius*, R.Br.—A rare species, confined to this State, and of no economic importance at present.

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* See also "Odorographia," already referred to, quoting a valuable paper by Mr. Cripps.

† *Bericht von Schimmel & Co.*, October, 1888, p. 36, and April, 1891, p. 43.

‡ Notes on Santal Wood Oil, p. 9; *Chem. and Drugg.*, 53, p. 708.

§ *Bericht von Schimmel & Co.*, October, 1898, p. 45.

Santalum.

4. *Santalum lanceolatum,* R.Br.—All the States, except Victoria and Tasmania.

5. *Santalum ovatum,* R.Br.—Northern Australia.

6. *Santalum obtusifolium,* R.Br.—Victoria and New South Wales.

4. *Santalum lanceolatum,* R.Br.—"Sandalwood," known as "Black Currant Tree" in parts of South Australia. The "Tharrah-gibberah" of the aborigines of the Cloncurry River (North Queensland); "Bolan" of those of the Palmer River (Roth). This tree produces a small purple fruit of very agreeable taste (Leichhardt's *Overland Journey to Port Essington,* p. 95). Otherwise described by E. Palmer as a brown or black drupe, oblong, of a sweet taste, and the size of a small plum.

Blacks eat the fruits in South Australia. A friend of mine asserts that on a hot summer's day, accompanied by a black boy, he was driving a flock of sheep, and met a tree loaded with ripe fruit. Both ate a large quantity of it, and fell asleep. Awaking, they drove the sheep further on, and met with another tree, ate some more fruit, with the same result. My friend is of opinion that the berries contain narcotic properties.—(Max Koch, in a letter to the writer.)

The wood is close-grained, and takes a good polish. It is firm, yellowish in colour, and useful for cabinet work. Diameter, 3 to 6 inches; height, 15 to 25 feet.

It is found in the drier parts of New South Wales (in addition to the other States). I am not aware whether it is found in large or small quantities, nor of the approximate quantity of timber obtainable.

Mr. F. M. Bailey ("Queensland Flora") quotes Dr. Roth as stating that the leaves are burnt in the fire to withstand mosquitos in Queensland.

He also describes a variety *venosum* from Somerset, Northern Queensland, and adds that Mr. Frank L. Jardine reports that "the wood is fragrant, and is being exported to China, where it fetches a good price."

5. *Santalum ovatum,* R.Br.—Northern Territory. I have no information in regard to the uses of this species, which is very closely related to No. 6.

6. *Santalum obtusifolium,* R.Br.—A shrub found in the Sydney district, and also in the coast districts, extending to Queensland. I know nothing of its economic value, except that stock eat the leaves of this and other species.

South Sea Island Sandalwoods.

The best account of the South Sea Island Sandalwood, including a figure and description of *S. yasi*, Seem., is to be found in Seemann's *Flora Vitiensi*, pp. 209–215, with tab. lv. There are also some notes in Horne's *A Year in Fiji.*

a. **Fiji Sandalwood.**—The wood of *Santalum yasi*, Seem.,* from the Fiji Islands, was exhibited at the Colonial Exhibition at South Kensington in 1886. Upon distillation it yielded $6\frac{1}{2}$ per cent. of a volatile oil, with a faint but not very delicate odour, thus rendering it unfit for perfumery.† Sp. gr., 0·9768; $a_D = -25{\cdot}5°$ (MacEwan, 1888)‡ ("The Volatile Oils," p. 345).

Mr. John MacGillivray§ read an interesting paper, entitled "Some remarks on the Sandalwood of the South Sea Islands," many years ago, before the Horticultural Improvement Society of New South Wales.

b. **New Caledonia Sandalwood.**—*Santalum austro-caledonicum*, Vieill., the *tibo* of the natives, formerly very abundant, has become very scarce, because the trees, on account of the fine aromatic yellow wood, have been felled to such an extent, that now only the stumps and roots left from former times can be utilised.‖

c. **New Zealand Sandalwood.**—This is *Fusanus Cunninghamii*, Benth. and Hook., f. (*Santalum Cunninghamii*, Hook., f.), one of the trees known as "Maire" in New Zealand. It possesses an agreeable perfume, and is used for small articles of turnery.

Parasitism of Sandalwood trees and other Santalaceæ.

The difficulty which attends the cultivation of Sandalwood trees which, of course, are very valuable, is notorious, and the key to the problem of cultivation probably lies in the fact that its roots are parasitic on the roots of other plants. The notes I give show that the matter is engaging the attention of Indian botanists and others, and it is of especial importance to them because of the magnitude of the Sandalwood industry in that country. We in Australia should also give attention to the subject. We have not only species of Sandalwood, but ornamental trees, such as the Native Cherry (*Exocarpus cupressiformis*), which we know from experience is very difficult to transplant.

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* *Pharm. Jour.*, iii, 16, pp. 757 and 820.

† *Bericht von Schimmel & Co.*, Apr., 1888, p. 39.

‡ *Pharm. Journ.*, ii, 18, p. 661.

§ *Sydney Magazine of Science and Art*, ii, 196 (1859).

‖ *Journ. de Pharm. et de Chim.*, March, 1870, p. 242. (*Pharm. Journ.* [3], ii, 403.

Mr. C. A. Barber, Government Botanist, Madras, has made the interesting statement * that the roots of this tree are parasitic in character, and puts forward a plea for a closer study of the natural history of the tree.

It appears to me, he writes, sufficient attention has not been given in past attempts at artificial reproduction, and a careful study of the liking of the Sandalwood for its different hosts is sure to be reproductive of useful results.

The late Professor T. Kirk † had previously stated, speaking of *Fusanus Cunninghamii*—

There is reason to believe that this plant is parasitic on the roots of other plants in the young state.

In an appreciative notice of Mr. Barber's paper, Sir Dietrich Brandis ‡ points out that the parasitism of the Sandalwood tree of India is undoubted, and I make the following extracts from his paper :—

That this tree is a root parasite was established in 1871 by the late John Scott, then Curator of the Royal Botanical Garden, Calcutta, in a most important paper on *Loranthaceæ* and other parasites (*Journal of the Agricultural and Horticultural Society*, Calcutta, vol. ii, p. 287). This paper has not received the attention in England which it deserved. Mr. Barber himself apparently had not seen it when he wrote. In other countries, however, it has been fully appreciated. Count Solms Laubach, who in 1867 had published his researches on *Thesium* and *Osyris*, both root parasites of the Order *Santalaceæ*, § gave in the *Botanische Zeitung* for 1874 (pp. 128 and 144) a full account of Scott's paper, including a translation of that portion which relates to *Santalum*. The microscopic examination by Count Solms Laubach of Sandal haustoria sent him by Mr. Scott, whereby its roots attach themselves to the roots of other plants, showed a structure in all essential points identical with that of the haustoria of *Thesium*. In Engler und Prantl's Natürliche Pflanzenfamilien (*Santalaceæ*) iii, 1, 204, and in the article on *Santalum album* of Köhler's Medizinalpflanzen (vol. iii), a detailed review of Scott's researches will be found. In 1872 and 1873, when I was working at Kew on the Forest Flora of North-West and Central India, Scott's paper of 1871 was not known to me, and the reviews mentioned above appeared much later.

Scott established the root connection between *Saccharum album* and species of *Saccharum*, *Bambusa*, as well as a number of palms. To palms he paid special attention, because he had noticed Sandal-trees growing with unusual vigour in the vicinity of *Arenga*. Among Dicotyledons he examined the root connection with two species of *Heptapleurum* and *Inga dulcis*.

In regard to *Heptapleurum*, the following extract from Mr. Scott's paper is worth quoting here :—

With the *Araliaceæ* I had most demonstrative evidence ; *first* in a vigorous old tree of Sandalwood growing in the vicinity of a large specimen of *Heptapleurum umbraculiferum*, which I had occasion to cut out. A few months after this I was surprised to find the tree nearly destitute of leaves and altogether in a most unhealthy state, though for some time, after the ivy-wort had been removed, no changes have been observed. This, however, was probably due to the strong vitality of the ivy-wort's roots, which may have remained fresh for weeks after the stems had been cut out. The tree has since made poor and weak growths, though always yielding an abundance of flowers ; and now—the fourth year—it seems to be acquiring fresh vigour, probably from having formed new root attachments. The *second* case was of a young tree, 15 feet in height, and growing from the midst of a bush of *Heptapleurum venulosum*. The latter having been cut out, the young sandalwood tree shortly after lost the whole of its foliage, and was for fully two years afterwards in a most unhealthy state.

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* *The Indian Forester*, September, 1902.

† *The Forest Flora of New Zealand*, p. 138 (1889).

‡ *The Indian Forester*, January, 1903.

§ Hermann Graf zu Solms Laubach, Bau und Entiwicklung parasitischer Phanerogamen, in Pringsheim *Jahrbücher für wissenschaftliche Botanik*, vi, 539.

If I correctly understand Mr. Barber, he has established the root connection of *Santalum* with *Casuarina* and *Lantana*. Hence it is evident that the sandal-tree lives and thrives while its roots are in intimate connection with the roots of many other plants belonging to different orders and having different structure and organisation. Foresters in Mysore and Coorg have long known by actual experience that the tree thrives well when growing in company with *Casuarina* and *Lantana*. But they have also known that it flourishes when growing in hedges and among shrubs where no *Casuarina* or *Lantana* is near.

The sandal-tree, most probably, takes up a large proportion of those mineral substances which it requires, not directly from the soil, but through its haustoria from the roots of those plants with which it lives. It is well known that plants do not take up indiscriminately all substances which are offered to their roots in a soluble state; they have the power of selecting those substances which suit them best. The majority of trees and shrubs, for instance, leave soda salts alone and take up instead potassium salts from the soil. The coffee-bush takes up a large proportion of magnesia, the bamboos take up enormous quantities of silica, and tobacco extracts lithium from soil in which this element is present in the most minute quantities. Doubtless therefore, there are only certain species which are capable of furnishing those mineral salts which sandalwood requires. But we have seen that these species are very numerous, and that they belong to a large number of different natural families.

* * * * * * *

On the present occasion I would mention two questions of great practical importance:—(1) Has the tree effective root hairs, and is it capable of taking up directly from the soil a portion of the food it requires? (2) Which species are the most useful companions of the sandalwood?

It is interesting that at the present time also a Japanese botanist has made the discovery of parasitism in another Santalaceous genus.

An addition to our knowledge of semi-parasitic plants is made by Mr. S. Kusano, who contributes the result of his studies on *Buckleya quadriala*, a genus of the Santalaceæ, to the *Journal of the College of Science*, Tokio. The plant was found growing naturally on several hosts, some Dicotyledons, and some Gymnosperms, but a decided preference and better development was displayed on the roots of *Abies* and *Cryptomeria*. The haustoria arise laterally in the young stage, but eventually appear to originate from the apex, or in reality in close proximity to the apex. A feature which has only been suggested for allied genera, *e.g.*, secondary growth due to cambium, is in *Buckleya* so marked that the contour of the vascular strand is entirely changed, and definite medullary layers become differentiated. Since the cambiums are adjacent and develop tissue to the same degree, the sucker keeps pace with the growth of the host root.*

* *Nature*, January 15, 1903, p. 253.

EXPLANATION OF PLATE.

A. Inflorescence.

B. Flower seen from above, showing disk, stamens, and short style.

C. Side view of flower.

D. Vertical section of flower.

E. Anther.

F. Disk.

G. Side view of disk.

H. Drupe crowned by the persistent corolla-lobes (perianth-lobes).

I. Drupe opened showing—
- *a*. Fleshy epicarp.
- *b*. Hard endocarp (Quandong) much pitted.

Sydney: William Applegate Gullick, Government Printer.—1903.

INDEX OF TREES DESCRIBED.

PART I (ISSUED FEBRUARY, 1903).

PART II (ISSUED MARCH, 1903).

PART III (ISSUED MAY, 1903).

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OF

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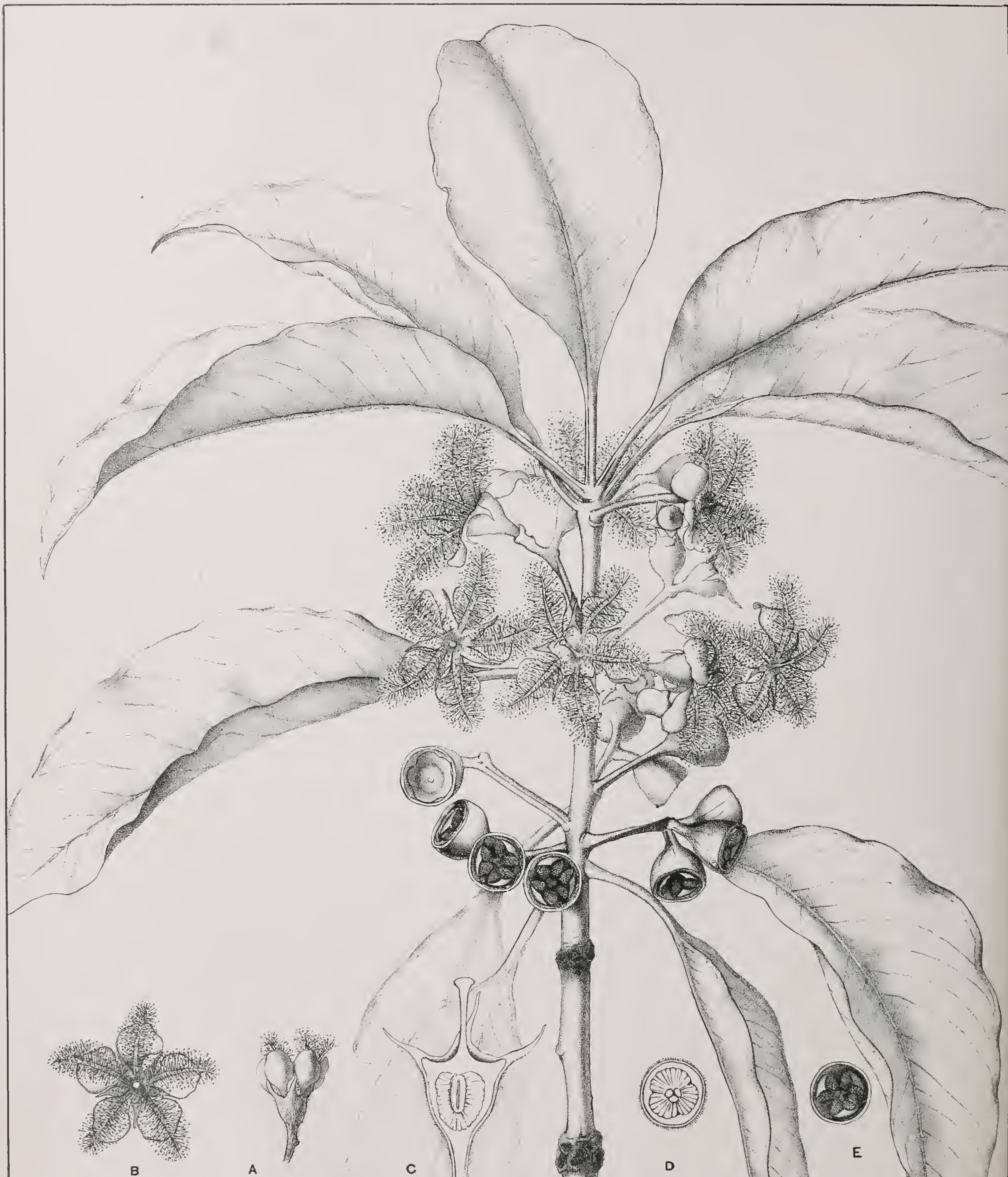

BRUSH BOX.

(*Tristania conferta*, R. Br.)

No. 16.

Tristania conferta, R.Br.

The Brush Box.

(Natural Order MYRTACEÆ.)

Botanical description.—Genus, *Tristania,* R.Br.

Calyx-tube turbinate-campanulate or open, adnate to the ovary at the base, the free part broad; lobes 5, short.

Petals.—Five, broad, much imbricate.

Stamens.—Indefinite, more or less united in bundles opposite the petals, the filaments or free parts filiform, inflected or rarely erect.

Anthers.—Versatile, the cells parallel, opening longitudinally.

Ovary.—Inferior, half superior or free except the broad base, but included in the calyx-tube, flat or convex on the top and very rarely depressed in the centre round the style, 3-celled, with several horizontal or recurved ovules in each cell.

Style.—Filiform, with a more or less capitate stigma.

Capsule.—Adnate or almost free, enclosed in or protruding from the persistent calyx, opening loculicidally in 3 valves.

Perfect seeds.—Where known, few in each cell, linear-cuneate or expanded at the end into a flat wing; testa thin, embryo straight; cotyledons broad and folded over each other, as long as or longer than the radicle.

Tall shrubs or trees.

Leaves.—Alternate or irregularly verticillate at the ends of the branches, or in one species opposite, penniveined.

Flowers.—Small, yellow or white, in pedunculate axillary cymes.

Bracts.—Very deciduous or entirely wanting. (B. Fl. iii, 261.)

Botanical description.—Species, *T. conferta,* R.Br. in Ait., *Hort. Kew.*, ed. 2, IV, 417.

A tall tree with a smooth brown deciduous bark and dense foliage, the young shoots often clothed with spreading hairs, otherwise glabrous except the inflorescence, the buds of the succeeding year covered with large imbricate coloured scales.

Leaves.—Alternate, crowded at the ends of the branches so as to appear verticillate, petiolate, ovate or ovate-lanceolate, acuminate or rarely almost obtuse, usually 3 to 6 inches long, penniveined and minutely reticulate underneath.

Flowers.—In cymes of 3 to 7, usually on the young wood below the cluster of leaves, the floral leaves mostly abortive, the peduncle flattened, $\frac{1}{4}$ to $\frac{1}{2}$ inch long, or rarely elongated.

Calyx-tube.—More or less pubescent or hirsute, turbinate, 1½ to near 3 lines long; lobes narrow, acute, nearly as long as the tube.

Petals. Undulate, often 3 lines diameter.

Staminal bundles.—Often ½ inch long, inflexed, the claws long and linear, with numerous short slender filaments nearly along their whole length.

Anthers.—Very small.

Ovary.—Wholly adnate, flat-topped, without any central depression.

Ovules.—Exceedingly numerous in each cell, covering an oblong reflexed placenta.

Fruiting-calyx.—Three to 4 lines diameter, hemispherical or cup-shaped, truncate, smooth, the capsule level with the orifice or shortly exceeding it.

Seeds.—Linear-cuneate, not winged.

Cotyledons.—Folded. (B. Fl. iii, 263.)

Bailey (*Queensland Flora*, 636) distinguishes a variety *fibrosa*:—

This variety forms a handsome compact tree, and differs from the usual form in its bark being fibrous on both trunk and branches, and in its inflorescence being more slender and usually longer, the calyx only slightly hairy, the flowers smaller. Pimpana, Queensland.

Botanical Name.—*Tristania*, after M. Tristan, a French botanist. Don (probably following Sir J. E. Smith) has a fanciful derivation from the Greek, *treis*, *stao*, signifying to stand in threes, in allusion to a supposed disposition of the flowers and leaves.

I may, however, mention, as a warning to etymologists, that Sir James E. Smith* is entirely mistaken in his derivation of the name of *Tristania* from the Greek, and in supposing it to allude to the ternate disposition of the flowers and their stalks, a derivation recently adopted by Professor Lindley.† M. Jules de Tristan published, in the early part of the present (19th) century, in the *Journal de Physique*, and in the *Annales du Muséum d' Histoire Naturelle*, memoirs on the development of buds, on the genus *Pinus*, and on the affinities of the genus *Reseda*. (J. J. Bennett in Horsfield's *Plantæ Javanicæ Rariores*, p. 128.)

Conferta, from the Latin, denoting "close together," the leaves being crowded together on the twigs.

Vernacular Names.—Usually known as "Box" of one sort or another—"Brush Box," "Scrub Box," "White Box," "Bastard Box," "Brisbane Box," "Red Box." It must not be confused with any of the species of Eucalyptus known as "Box," owing to the timber being tough and inlocked; "Brush," because it is essentially a brush (an Australian word for luxuriant vegetation—jungle in fact) timber. The name "Brush Box" distinguishes it especially from "Forest" or "Grey" Box (*Eucalyptus hemiphloia*). The name "Woollybutt" is in use in the Port Stephens district as well as on the Manning. It must not be confused with the true "Woollybutt" (*Eucalyptus longifolia*); see Part II. In Aiton's work, where the species was described, it was called "*Pittosporum-leaved Tristania.*"

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* *Encyclopædia Britannica*, in voce *Tristania*.
† *Botanical Register*, xxii (1839).

Aboriginal Names.—" Giaboriga " is the name formerly used by the Bellinger aborigines, according to Forest Ranger Mecham. " Geria " is also an aboriginal name (*Cat. London Exh.*, 1862). At Double Island Point, Queensland, its native name is " Weerabi," according to the Hon. W. Pettigrew, M.L.C. " Tubbilpulla " is also a Queensland aboriginal name.

Synonyms.—*T. subverticillata*, Wendl.; *T. macrophylla*, A. Cunn. in *Bot. Reg.* xxii, 1839; F. Muell., *Fragm.* i, 82; *Lophostemon arborescens*, Schott. in *Wien. Zeitschr* iii (1830), 772.

Strange to say the name *Lophostemon* (usually *L. australis*)* has stuck to this plant, particularly amongst nurserymen. It has no priority, and its use should be discouraged. The origin of the name is explained in the following paragraph:—

An attempt has been made by Mr. Schott† to distinguish two of the species confounded in gardens under the name of *Tristania* from *T. neriifolia*, for which latter he has retained the original generic name, applying to the species separated that of *Lophostemon*; but his knowledge of these plants . . . was too limited. (Bennett in *Pl. Javan. Rarior.*, p. 128.)

Timber.—Its characteristics are toughness, strength, and durable qualities. It has a more than usual tendency to warp and twist, which could be largely counteracted by felling at the proper season, and by giving some attention to seasoning. The timber wants a little humouring, but it is so promising as regards durability and resistance to wear, that it is worthy of pains being taken to give it fair play. With the knowledge that we possess of Myrtaceous timbers, to cut Brush Box when in full growth, and then to expose it to the rays of the sun as we often feel them in New South Wales, is *not* to give it fair play.

It is one of the timbers most obnoxious to white ants. It is pale-coloured, usually brownish to pinkish, and turning greyish on exposure. It dulls the saws. This is the timber perhaps universally used in the northern districts for tram-rails for haulage of the logs from the forest to the saw-mill. It is not cut by the iron wheels, but becomes polished by the traction, while it is eminently durable. Much used for bullock-yokes. I am of opinion that if proper attention were paid to the time of felling, and if it were moderately seasoned, it would be a useful timber for paving-blocks. I also am of opinion that the question of its suitability for bridge-decking should form the subject of careful inquiry. I have seen inch boards of this timber exposed to the atmosphere for months without warping; at the same time, that it warps a good deal if cut all through the year, and never seasoned, is notorious. Owing to its toughness, it is used locally for mallets, chisel-handles, planes, jaws of hand-screws, etc.

It is extensively used in the North Coast districts for wheelwrights' work.

Following are specific reports upon it:—

One of the most valuable timbers in the Colony on account of its durability; it is averred on credible authority that instances are known of this timber remaining perfectly sound after being nearly thirty years worked up as ribs of vessels. . . . . Used for scantling, flooring-boards, etc. (*N.S.W. Catal., London Exh.*, 1862.)

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* It would appear that *T. suaveolens* is known in cultivation in Europe under the name *L. australe* (*Kew hand-list of tender dicotyledons*, 1900, p. 417).

† *Wiener Zeitschr., fur Kunst., &c.*, 1830, vol. iii, p. 772, as quoted in *Linnea* 1831, *Literatur-bericht*, p. 54.

I would suggest it as worth trying for large wood type-making and similar purposes, as it does not crack. It is excellent for bullock-yokes. It is generally said to twist very much when in boards, but at Coopernook saw-mill I saw last week (June) boards of it 1 inch thick, which had been exposed for months and had not warped; also rails of it laid down as a tramway for bringing logs to the saw-mill, in moist ground (and for months swampy), in use for four years, and now perfectly sound, and has worn well. It is excellent for paving blocks. White ants will not touch it, whether it is alive or dead. The sap which runs out of a nob or swelling in a living tree, when cut with an axe, is said to taste strongly of salt. (Mr. Forester Brown, Port Macquarie.)

He also states (*Agric. Gazette*, 1896, page, 557):—

I find that, besides the many valuable uses to which Brush Box is put, the following may be added, gleaned from Mr. A. Jennings, Port Macquarie:—"A countershaft, which drives from the main countershaft, also drives a planing machine, hand-saw, and two gulleting machines, is 15 feet long. The centre bearing is of Brush Box, end on. It has been in use twelve months, and shows no perceptible wear, whilst the bearing at one end of brass has been renewed in nine months, and now shows $\frac{1}{8}$ inch wear. The other bearing of cast-iron, which has been renewed twice in twelve months, also shows $\frac{1}{8}$ inch wear."

Scrub Box has lately come much into use, and is considered a very useful and durable timber, free from pipes and very sound. (Mr. Forester Green, Casino.)

Timber of a brownish colour, sometimes yellowish, turing grey on exposure, or generally so when dry; hard, heavy, and interlocked; used for ribs and planking of ships; very hard when dry. Considered to be very lasting (as I have observed), but said, however, by some not to be very reliable when used for the decking of bridges. Shrinks irregularly; when cut into thin stuff is liable to twist and warp. Unequalled when subject to friction; makes the best hardwood rails to carry trucks, and is excellent also for bullock-yokes. The tree, as a rule, is sound; but some of them are liable to heart shakes in the falling. As the cutting of this timber soon dulls the saws, it is not a favourite with the mill-owners. (Mr. Forester Rudder, Booral.)

A further report by Mr. Rudder, published in the *Agric. Gazette*, says:—

I can recollect this timber in the earlier days, over fifty years ago, as the chosen of all others by a firm of shipbuilders of the names of Malcome, Newton, and Ferrier, who used it for ships' planking. It becomes pale when dry, and in texture is fine and close in the grain, and is usually inlocked, and, when seasoned, stands more friction than any other timber I know of, not excepting the best ironbark, and for this reason is used for tramway rails, also for bullock-yokes and planes, as it works very smooth. I have seen it used in decking for bridges, of which there is now an example in a bridge at Gooloogolook, in this district, where it has been placed for experiment side by side with tallow-wood, with the result, so far, after four and a half years, with the exception of two planks, one of which seems to be in part sapwood and the other too near to the heart, that it is wearing well, even better as regards friction than the other timber. Unfortunately, it shrinks unevenly, and in thin stuff is given to warp; but perhaps by soakage in water these defects might be remedied. In the house in which I am now writing, one of the floors is of this wood, which has been down for twenty-seven years, and is still in excellent order. I believe this timber will be found of value for carving and for engraving purposes. More attention should be given to it.

The timber is generally considered to be absolutely useless for any purpose except for firewood, for which it is admirably suited. (Mr. Forester Pope, Murwillumbah.)

Timber more inlocked than that of any of the Eucalypts, being too short in the texture to split well, though sometimes will burst freely on the sap. It makes good mauls, being heavy and dense. As a mine timber (for props, etc.), it can scarcely be surpassed. It takes a fair polish, and is very durable, and forms splendid fuel. (Mr. Forester, Deverell, Glen Innes.)

Useful for ships' planking and decking of bridges, etc., etc. It is one of our best hardwoods, although not liked by sawyers and mill proprietors. (Mr. Forester MacDonald, Kempsey.)

The Hon. W. Pettigrew, of Brisbane, wrote to me (August, 1891):—

Some of this timber was cut into sleepers for a railway near Double Island Point, Queensland, in 1878, and a few months ago they were examined and found sound—no white ants at all about them. The railway was abandoned over ten years ago.

Mr. Pettigrew's opinion (written in 1877) is, however, not favourable as to this timber.

This timber is of no account for sawing, as it twists and gets uneven in drying.

It would appear that this timber obtains its best development in New South Wales, say, from the Manning to the Richmond Rivers.

Bark.—The tree has brown deciduous sub-fibrous bark on the butt, with smooth branches. It has been stated that this bark is occasionally used for tanning, but it does not appear to promise much in that direction.

Habitat.—It is confined to Eastern and Northern Australia, chiefly to northern New South Wales and southern Queensland, in the coast districts. The most southern locality known to me is Port Stephens. It is found generally in mountain brushes near watercourses, and in gullies near and on the coast and eastern slopes of the Darling Range; occasionally in the open forest.

It thrives in and about the edges of brushes, along creeks and shady hollows, but not to any great extent, and is not found in belts in this district. (Mr. Forester Brown, Port Macquarie.)

Plentiful in places in this district, Macleay, Nambucca, Bellinger, and Clarence to the Tweed River. Generally in mountain brushes near water-courses, and in gullies near and on the coast, and eastern slopes of the Dividing Range, occasionally in the open forest. (Mr. Forester Rudder, Booral.)

Found to a large extent growing on the crests of forest ridges, its presence generally indicating poorness of soil and rough country. (Mr. Forester Pope, Murwillumbah.)

This is one of the most plentiful timbers we have in the brush forests here. (Mr. Forester MacDonald, Kempsey.)

Queensland.—Sandy Cape and Keppel Bay, mouths of the Burdekin River, Rockhampton, Edgecumbe Bay to the Brisbane River, Moreton Bay, etc. (B.Fl.). It is plentiful on the ridges near Brisbane, but is of no great size. It grows in the scrubs near Double Island Point, and in similar places up Moggill Creek, and in these places it is a tall straight solid tree. (Hon. W. Pettigrew.)

North Australia.—Port Essington.

Size.—Up to 150 feet, with diameter of 5 feet. (Mr. Forester Brown, Port Macquarie.)

Forty to 50 feet. (Mr. Forester Green, Casino.)

Generally about 3 to 4 feet in diameter, exceptionally up to 7 or 8 feet; height up to 120 or 130 feet. (Mr. Forester Rudder, Booral.)

On another occasion Mr. Rudder stated:—"This tree is of large size, not unfrequently up to 17 and 18 feet in circumference. Of eighteen I measured, their average girth was 17 feet 4 inches."

"The trees grow to an average height of 120 feet, with an average diameter of 2 feet 6 inches." (Mr. Forester Pope, Murwillumbah.)

"Height 150 feet, diameter 3 feet." (Mr. Forester MacDonald, Kempsey.) I saw trees of this size also in the Bellinger River District.

Propagation.—From seed. It is one of the best shade-trees of New South Wales, is evergreen, with rich glossy leaves, white feathery-looking flowers, and fruits looking very much like those of gum-trees. It is to be seen in thousands of Sydney gardens, planted for shade and ornament, the tree being shapely as well as possessing handsome foliage. It is one of the best trees for street planting in the Sydney climate, and has been largely adopted by the Municipality of Strathfield in boulevarding the streets of Strathfield and Homebush. Other municipalities have used it less extensively. It is well worthy of being planted in the play-grounds of schools where there is a fair depth of soil, and the climate is warm and not too dry.

EXPLANATION OF PLATE 17.

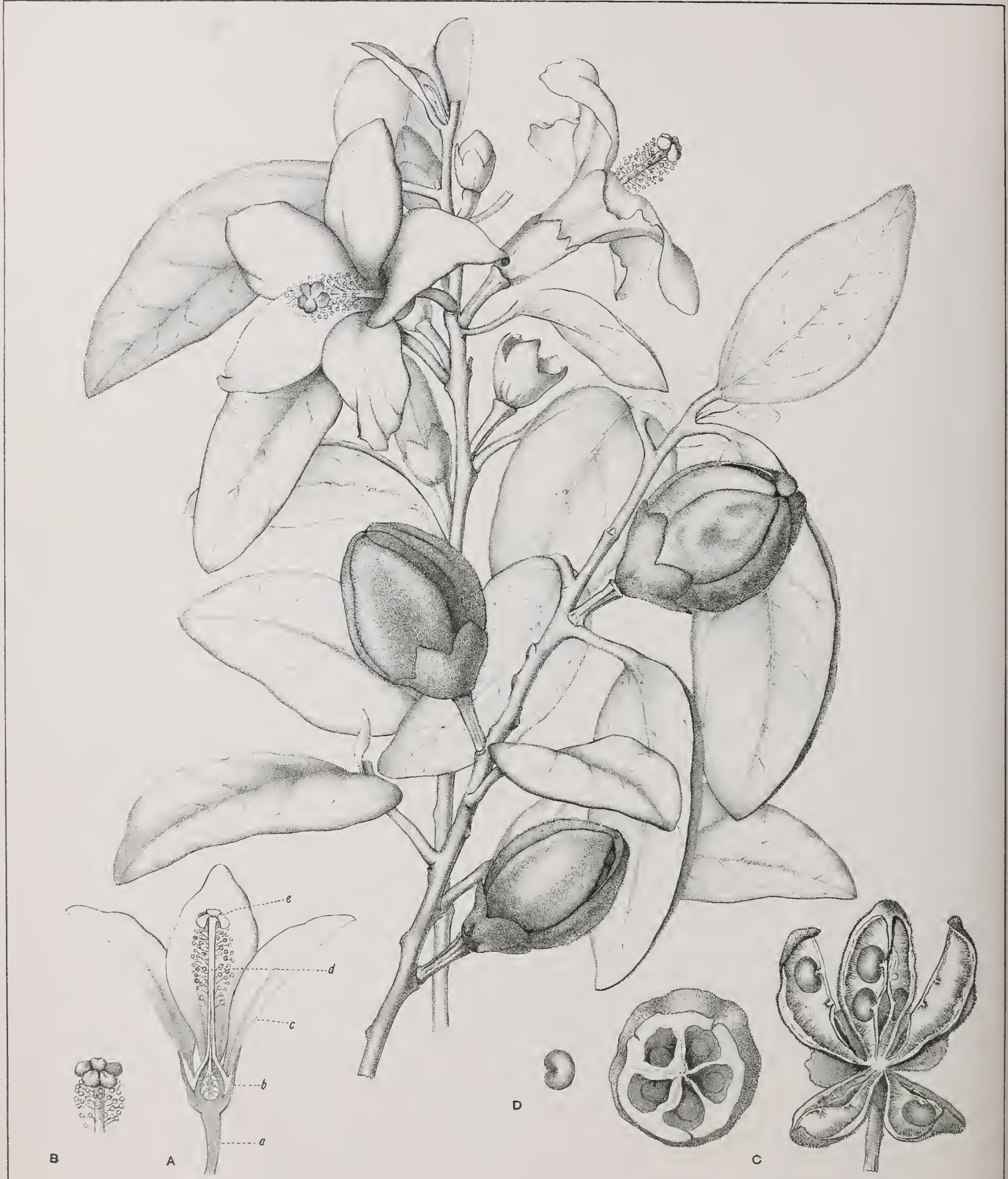
A. Expanding bud.

B. Front view of fully expanded flower, showing staminal bundles.

C. Vertical section of ovary, with style and stigma (petals removed).

D. Transverse section of ovary.

E. Top view of fruit.



WHITE OAK.

(*Lagunaria Patersoni*, Don.)

No. 17.

*Lagunaria Patersonii,** D. Don.

A White Oak.

(Natural Order MALVACEÆ.)

Botanical description.—Genus, *Lagunaria*, G. Don.

Bracteoles.—Three or four, broad and united at the base, often very deciduous. Calyx very shortly five-lobed.

Staminal column.—Bearing numerous filaments on the outside, below the five-crenate summit.

Ovary.—Five-celled, with several ovules in each cell.

Style.—Clavate at the top, with five distinct ovate radiating stigmas.

Capsule.—Loculicidally five-valved, the endocarp villous inside, and separating from the pericarp.

Seeds.—Reniform, thick, glabrous.

Leaves.—Entire; sprinkled or curved, with scurfy scales.

Flowers.—Large, axillary, on short thick pedicels. (B. Fl. i, 218.)

Botanical description.—Species, *L. Patersonii*, Don., *Gen. Syst.*, i, 485.

A tree, the young parts and inflorescence more or less covered with minute scurfy scales, but otherwise glabrous.

Leaves.—Petiolate, oblong or broadly lanceolate, rarely ovate-oblong, 3 to 4 inches long, entire, somewhat coriaceous; white underneath when young, glabrous and pale green on both sides when full grown, the scales of the under surface almost disappearing.

Pedicels.—Very short and angular.

Bracteoles.—Three to five, very obtuse, united in a broad, shortly-lobed cup, usually persistent at the time of flowering in the Australian variety, but sometimes even these falling off early.

Calyx.—Four to 5 lines long.

Petals.—Narrow, above $1\frac{1}{2}$ in. long, slightly tomentose outside. (B. Fl. i, 218.)

Botanical Name.—*Lagunaria*, "A name given to this genus from its similarity to *Lagunæa*" (D. Don, *op. cit.*). The name *Lagunæa* was given to a genus of tropical plants belonging to the same Natural Order, and now merged in Hibiscus, in honour of Andreas Laguna, a Spanish physician and botanist of the sixteenth century, who translated Dioscorides into his native tongue. *Patersonii*,

* Not *Patersoni*, as on the Plate.

after Colonel Paterson, Lieutenant-Governor of New South Wales. "The *Lagunæa Patersonia* is a native of Norfolk Island, from whence the seeds were brought to England by Colonel Paterson" (*Bot. Mag.*, t. 769) in 1792 (according to Endlicher, *Prod. Norf.*, p. 75).

Vernacular Names.—I have heard it called by the name of "Tulip-tree"—rather a far-fetched reference to its flowers. It is more commonly known as "White Wood." On Norfolk Island it is known as "White Oak," which name I suggest as the least objectionable of those in use.

Aboriginal Names.—I know of none.

Synonyms.—*Hibiscus Patersonii*, Ait.; *Hibiscus Patersonius*, Andrews; *Lagunæa Patersonia*, Sims, *Bot. Mag.*, t. 769; *Lagunæa squamea*, Vent.; *Solandra squamea*, Poir.; *Lagunaria Patersonia*, Endl.

Flowers.—It has very large handsome flowers, of a deep pink; those in Norfolk Island are larger and more ornamental than those of the same species on the mainland. Backhouse speaks of them as "the size of a wineglass"; in New South Wales they are much smaller.

Fruit.—The inside of the fruit is lined with short, barbed hairs, which attach themselves to the skin (like the hairs of "Cowitch," from the pods of *Mucuna pruriens*), and are sometimes very irritating.

Timber.—It is a soft wood, valueless for economic purposes except as an inferior firewood; it is one of the few woods of Norfolk Island little used for that or any other purpose. I have not been able to learn of its use on the mainland either.

Bark.—A fibre is prepared by maceration of the bark. It is very beautiful.

Habitat.—"Scattered on the grassy hills of Norfolk Island, it forms a spreading tree of 40 feet in height. It is perhaps the largest plant known to exist, belonging to the Mallow tribe. In a thick wood I met with it 80 feet high, and with a trunk 16½ feet round." (Backhouse, p. 258.)

Trees 5 feet in diameter are common.

It is found in coastal Queensland, but I doubt if it has been found to naturally occur on the mainland of New South Wales. Still it is marked N.S.W. in Mueller's *Census* and some other lists, doubtless because of the political relation of Norfolk Island to N.S.W., and has been included in this Flora as a matter of convenience.

Propagation.—From seed. The tree is very shapely and ornamental in appearance, and is worthy of being planted far more extensively than it is. Any Sydney nurseryman can supply it. It should do well in all our sea-coast suburbs, such as Waverley, Randwick, and the Illawarra suburbs. The Manly Municipal Council has one or two in the Reserve near the jetty, but I cannot call to mind many about Sydney. In Adelaide I noticed a large number planted by the sides of the road, on the North Terrace. They were planted alternately with other trees, and were healthy-looking and ornamental. I have not at all a doubt they would do even better for street-planting in Sydney, for we have a more humid climate and a more saline atmosphere than has that beautiful city of our sister State.

EXPLANATION OF PLATE 18.

A. Flower in vertical section. *a*, Peduncle; *b*, Sepal; *c*, Petal; *d*, Monadelphous stamens; *e*, Five-rayed stigma.

B. Portion of staminal column, showing five-rayed stigma.

C. Five-valved capsule, opening loculicidally.

D. Seed.

No. 18.

Eucalyptus goniocalyx, F.v.M.

The Mountain Gum.

(Natural Order MYRTACEÆ.)

Botanical description.—Genus, *Eucalyptus*, L. Héritier (see part ii, p. 33).

Botanical description.—Species, *E. goniocalyx*, F.v.M.

Following is the original description of the species in Miquel's *Stirp., Nov. Holl.*, in *Ned. Kruidk., Arch.* iv, 134 (1856) :—

23. *Eucalyptus goniocalyx*, Ferd. Muell., herb. ramulis gracilibus angulatis, foliis longiuscule petiolatis lanceolatis rectiusculis vel falcato-inaequilateris sursum attenuatis, basi acutis, crasse coriaceis, venis adscendentibus tenere reticulatis ante marginem nervo submarginali unitis, pedunculis axillaribus et lateralibus crassis brevibus ancipitibus 4–6-floris, floribus sessilibus, calycis tubo cylindrico-trigono ; facie dorsali convexâ, 2 interioribus planis, operculo breviconico quam tubus breviore. Buffalo Range, Novæ Holl., Austr., M. Martio (F.M.)

Ramuli adultiores teretiusculi pallide viriduli vel fusculi, juniores angulati, hic illic compressi. Petioli pollicares vel breviores, semiteretes leviter torti. Folia 3–5½–7 poll. longa, 6–8 lin. lata, costa venulisque in sicco supra etiam distinctis. Pedunculi 3–4 lin. longi ; calycis tubus 2–2½ lin. æquans, operculum 1½ lin.

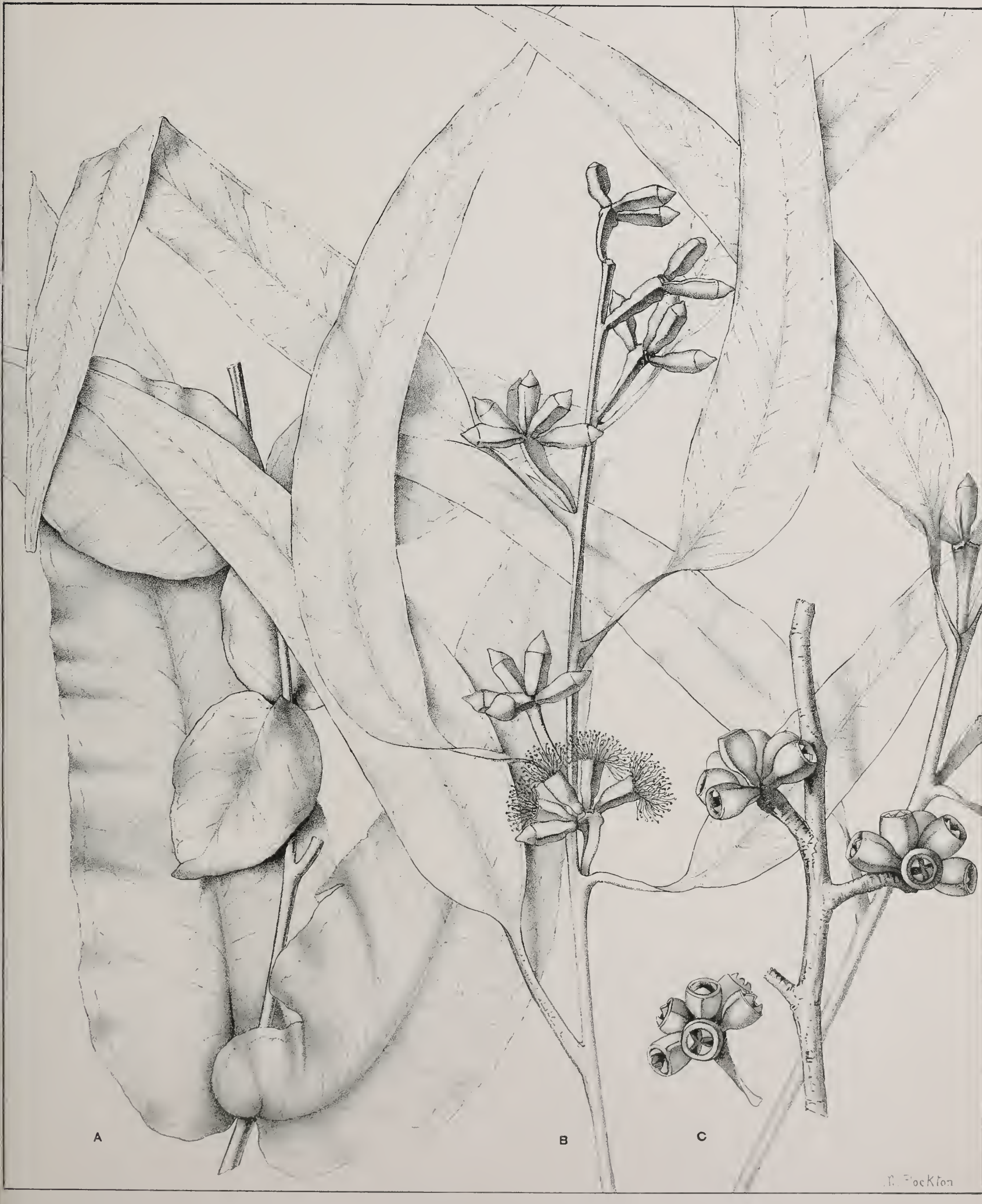
The original specimens thus came from the Buffalo Range, in North-eastern Victoria.

A few years later, Mueller, in *Fragm.*, ii, 48, expanded the description, as follows :—

Arborea, foliis elongatis alternis angusto-v. falcato-rarius subovato-lanceolatis tenui-coriaceis concoloribus longiuscule petiolatis patulo et prominulo-penniveniis reticulari-venulosis imperforatis, vena peripherica a margine remotiuscula, umbellis capituliformibus axillaribus solitariis 4–7-floris, pedunculis subcuneatis ancipitibus longitudine alabastra æquantibus v. paulo superantibus, pedicellis perbrevibus v. obliteratis, tubo calycis angulato ovato-v. obconico-cylindraceo 2–4 costato longitudinem operculi conico-hemisphaerici acutiusculi ferme duplo excedente, antheris subovatis, fructibus semi-v. truncato-ovatis 3–4-locularibus exangulatis, valvis infra marginem tenuem orificii insertis brevibus inclusis, seminibus apteris.

In montibus Buffalo Range, Mount Buller, ad sinum Loutitt Bay, ad fontes fluminum Yarra et Barwon, ad flumen Mitchell.

Arbor mediocris v. alta, passim "Spotted Gum-tree" vocata. Cortex rugosus, secedens. Folia 3–8″ longa, ½–1″ lata, raro latiora, dilute viridia, nitidula, exsiccatione pallescentia et opaca. Pedunculi ⅓–⅔″ longi, superne 1½–2‴ lati, sæpius ancipites quam compresso-teretes. Calycis tubus subvirens, 3–4‴ longus. Operculum 1½–2½‴ altum, junius interdum tenui-conicum. Filamenta longiora circiter 3‴ longa, exsiccatione dilute fulvida.



MOUNTAIN GUM.

(*Eucalyptus goniocalyx*, F.v.M.)

Antheræ ochroleucæ, pæne ⅓‴ longæ. Stylus circa 2‴ longus. Fructus 3–4‴ longi, sessiles v. pedicello brevi anguloso prædití.

Valvæ breves, si fructus magis apertus est, sæpe orificium tangentes; si ille magis ore contractus evadit, perfecte inclusæ. Semina sterilia fusca, saltem ex parte angulato-clavata; fertilia ovata, nigrescentia, compressa, opaca, circiter 1‴ metientia.

Following is Mueller's description, in English, of his species, taken from the *Eucalyptographia* :—

The Spotted Gum-tree of Victoria. Finally very tall; leaves scattered, elongate, or sickle-shaped lanceolar, rarely verging into a more oval form, of equal colour on both sides, rather opaque or not strongly shining; oil-pores much concealed or transparent; veins thin, moderately spreading, the intra-marginal vein somewhat removed from the edge; flower-stalks broadly compressed, axillary, solitary, exceptionally panicled, bearing 4–7, seldom fewer, flowers, calyces without or on very short stalklets, conspicuously angular; lid pyramidal or conical-hemispheric, about half as long as the obconical or oval-cylindrical tube, or rarely the lid fully as long as the tube, or occasionally even three times shorter; stamens all fertile, inflexed while unexpanded; anthers almost oval, upwards slightly dilated, and at the summit truncated, opening with longitudinal slits; stigma not broader than the apex of the style; fruits truncate, or semi-ovate, three or less frequently four celled, lined by 2–4 more or less prominent angles; valves deltoid, inserted very near the narrow margin of the orifice, enclosed or less often semi-exserted seeds without any appendage, the sterile mostly narrower than the fertile seeds.

Botanical Name.—*Eucalyptus* already explained, see p. 34, part ii. *Goniocalyx*, from two Greek words—*gōnio*, an angle, and *karpos*, a fruit, in reference to the raised ridge on the fruit.

Vernacular Names.—This is the common "Spotted Gum" of Victoria (the common "Spotted Gum" of New South Wales is *E. maculata*), and the "Mountain Gum" of New South Wales.

Other vernacular names are "Giant Gum," "Silver Top," "White Ash," "Ribbon Gum," and are referred to below under "Habitat," which I hope will be a convenient arrangement. With reference to Messrs. Baker and Smith's statement (*Research on the Eucalypts*, p. 89), that "the Yellow Gum of Berrima is also given by Deane and Maiden, *Proc. Linn. Soc.* of N.S.W., 1899, p. 463, as identical with *E. goniocalyx;* we show this to be distinct under the name of *E. paludosa*, R.T.B.," &c.,—I desire to say that I adhere to the correctness of the statement made by Messrs. Deane and myself. Messrs. Baker and Smith are confusing two distinct trees, both known as Yellow Gum in the Berrima district. One is *E. goniocalyx*, and the other is *E. Gunnii*, var. *acervula*, to which latter tree Mr. Baker has given the name *paludosa*. It is dangerous to assume anything in regard to the vernacular names of Eucalypts in New South Wales. People in different parts of the State give the same name to different species, and different names to the same species, in a most exasperating manner.

Aboriginal Names.—I know of none.

Synonyms.—*E. elata*, Dehnh; *E. elaeophora*, F.v.M.; *E. goniocalyx*, F.v.M., var. *acuminata*, Benth.; *E. pallens*, F.v.M., non DC.; *E. albens*, F.v.M., non. Miq. (these two are synonyms of var. *pallens*, Benth.). *E. Stuartiana*, F.v.M., var. *longifolia*, Benth.

Varieties.—*a*, Var. *nitens*, Deane and Maiden.
b, Var. *pallens*, Benth. (Syn. *E. pallens*, F.v.M., non DC; *E. albens*, F.v.M., non. Miq.)

The present is not a suitable opportunity for discussing at length the complicated synonymy of this species; I will take another opportunity of going into the matter, and will content myself with saying that I have had access to all the types concerned.

Leaves.—Messrs. Baker and Smith (*Research on the Eucalypts*) give the following particulars in regard to this oil.

Specific gravity at 15° C = 0·9117 to 0·9125. Specific rotation, $[a]_D$ + 4·77° to + 7·89°, Saponification number, 13·3. Solubility in alcohol, $1\frac{1}{4}$ to $1\frac{1}{2}$ vols., 70 per cent. Constituents found—Eucalyptol, pinene, eudesmol, valeric acid ester, acetic acid ester.

Messrs. Gildemeister and Hoffmann (*The Volatile Oils*, Kremers' translation) say:—

Yield from the leaves, 0·9 per cent. The light yellow oil has a penetrating, quite unpleasant odour, and obnoxious taste. Sp. gr., 0·918–0·920; $[a]_D$ = 4·3°[1]; boiling temperature, 152–175°.[2] According to Smith [3] the oil contains eudesmol.

The manager of the Dunolly Scent Farm, Victoria, reported a yield of 7 oz. of oil per 100 lb. of leaves.

Fruit.—The angularity—to which it owes its specific name—may be observed. It is more evident on some trees than on others.

Timber.—Mueller describes the wood as—

Hard and tough, usually free from kino veins. It varies from a pale yellowish to a brownish colour, is exceedingly durable, and lasts longer underground, not warping, and on account of the interwoven woody fibres is almost as difficult to split as *E. rostrata*. It is much esteemed by wheelwrights, particularly for spokes, for ship and boat building, for railway sleepers, and when not used for better purposes, it is sought for fuel. According to Mr. Boyle, the rough-barked variety* from low, dry, and stony ranges, supplies a timber which wheelwrights consider equal to ironbark, with the advantage of its not being so weighty; the taller mountain variety, with smoother bark, is more used for planks, piles, and general building purposes—the timber also in this instance being more durable than that from wet forest valleys. This wood resembles, in many respects, that of *E. globulus*.

The above refers to the Victorian timber. Further notes in regard to timber from the same State will be found at p. 119, and in regard to timber from New South Wales at p. 120, which I hope will be a convenient arrangement in the present case.

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[1] *Proc. Royal Soc. of Victoria*, 1893, p. 198. [2] Maiden, "*The useful native plants of Australia*," p. 268. [3] *Journ. and Proc. Royal Soc. N.S.W.*, 33, p. 86; Bericht von Schimmel and Co., April, 1900, p. 24.

* Perhaps *E. Cambagei*, Deane and Maiden.

Exudation.—The kino of this species belongs to my "Turbid" group of Eucalyptus kinos, since it produces a turbid solution in cold water. See *Proc. Linn. Soc., N.S.W.*, vol. vi (2nd series), p. 408.

The analysis of a specimen from Bonang, near Delegate, is given in that paper.

Habitat.—

South Australia.—Although *E. goniocalyx* has been recorded from South Australia, the specimens I have seen so far belong to *E. Cambagei*, Deane and Maiden.

Victoria.—*E. goniocalyx* has a wide range in Gippsland, especially in the western parts.

It grows well in the deep shady gullies of the southern slopes of the mountains, where it reaches some 200 feet to 250 feet in height, with a tall massive bole. In its typical form it occurs in the valley of the Thompson River, on the Upper Wellington, near Grant, on the southern slopes of Fainting Range, at Gelantipy, and elsewhere, up to 4,000 feet above sea level in favourable localities. It is very commonly termed " Blue Gum," and as such, has, to my knowledge, been cut by saw-millers. At Walhalla it is used in preference to *E. Sieberiana* or *E. capitellata*, as being the best procurable in the district for props in the mines, and, so far as my experience goes, may be placed after *E. globulus* as a useful timber tree for work that is not placed in or on the ground—as framing or planking.

The typical form of *E. goniocalyx* seems not to be able to cross from the cool southern slopes to the warmer and drier northern sides, but there is found in such places a peculiar divergent form.*—(Howitt, *Trans. R. S. Vict.*, 1890, 102).

A few years later (1895) Mr. A. W. Howitt, in an official report, states:—

The Spotted Gum (*E. goniocalyx*) occurs in two botanically different varieties, which in practice cannot be mistaken for each other. The one distinguished in my list as variety (*a*) is confined to Gippsland, but possibly may also grow in the Otway Ranges. It has been found suitable for rails, decking, for mine timber, but is not very durable under ground. The tree grows commonly together with Messmate (*E. obliqua*), and less commonly with Blue Gum (*E. globulus*).

Mr. Howitt's variety (*b*) is *E. Cambagei.*

The late Mr. G. S. Perrin, Conservator of Forests, Victoria, reported as follows in 1895 on *E. goniocalyx* in Victoria (Mr. Howitt's and Mr. Perrin's reports have not been previously published, as far as I am aware):—

Spotted or Blue (?) Gum, No. 5, *Euc. goniocalyx*—Spotted Gum or False Blue Gum. This tree has been used on our own and on other constructive works very often under the name of Bluegum—*i.e.*, *E. globulus.* In the bush it is known as " Bastard " Blue Gum, and in other places as Spotted Gum. It is a fine timber tree, not quite as good as the true Blue Gum (*globulus*), but, nevertheless, most valuable. For street paving this wood will be found of great value, as it is strong, durable, and very sound.

Its chief habitat is in Gippsland, and in the mountain ranges and gullies of south-eastern Victoria the tree assumes large growth, trees running up to 200 feet in height, and in favourable localities vies with the Blue Gum and Mountain Ash (*E. regnans*) for pride of place as regards height and girth. This tree is very generally distributed, with slight variations of growth, all over the State, being found in most of the mountain ranges around Macedon, Wombat, Ballarat, Clunes, Maryborough, Dunolly, Bealiba, Kara Kara, St. Arnaud, the Upper and Lower Mitta, and Upper Murray, the Western District, Chiltern, Bright, and all over Gippsland.

The timber is highly suitable for decking, railway sleepers, beams, and bridge works, where heavy and durable timbers are required, and also for wood-paving.

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* *E. Cambagei*, Deane and Maiden

Specimens from the following Victorian localities are in the National Herbarium, Sydney. Owing to the difficulty of discriminating between *E. goniocalyx* and *E. Cambagei* with imperfect material, it is possible that one or two of these specimens may be *E. Cambagei*:—Beechworth (Falck) and Pyrenees (both specimens glaucous); Fainting Range, Walhalla, Bairnsdale (A. W. Howitt); Warrandyte, "smooth-barked variety" (C. Walter); Goulburn River, near Bunyip River, Blacks' Spur, and Darlimurla (H. Deane); Upper Barwon, Mount Macedon (J. H. Maiden); "Grey Box," Lilydale (A. W. Howitt); Healesville (C. Walter); Fern-tree Gully (R. H. Cambage); Dandenong (J. H. Maiden).

New South Wales.—With us, *E. goniocalyx* is usually known as Mountain Gum; I have also heard it called Blue Gum, Ribbon Gum, and other names. It is usually found in gullies—bottoms or sides,—and prefers good soil. It attains a diameter of 6 feet, and with 80 or 90 feet of barrel. Its timber has been passed both for Tallow-wood (*E. microcorys*) and Box (*E. hemphloia*), but it more closely resembles the former. It is very hard when dry, and nails do not readily drive in it; hence it is not so well liked for building purposes as some softer but inferior timbers. It stands well in the ground.

While not of equal merit to Ironbark, Tallow-wood, and other first-class timbers of the State, it is undoubtedly of considerable value, and deserves an honourable place amongst the timbers of the second-class.

In New South Wales it is sometimes known as "Yellow Gum," owing to the yellowish cast of the foliage (especially when young), of the bark, and of the timber (particularly when fresh). There are several so-called "Yellow Gums" in New South Wales, but they must not be confused with the "Yellow Box" or "Yellow Jacket" (*E. melliodora*).

In New South Wales it occurs in the South Coast districts, and also in the Coast and Main Range, and its spurs at least as far north and west as the Blue Mountains. We require further investigation to determine its northern boundary. Following are some localities in this State represented in the National Herbarium, Sydney:—

SOUTH.

"Mountain Gum."—Cathcart and Tantawanglo Mountain (H. Deane and J. H. Maiden).

"Ribbon Gum."—Candelo (A. Rudder); Cooma District (W. Hutchinson); Twofold Bay (Lockhart Morton).

"Grey Gum."—Benandra (J. S. Allan); West Dapto (R. H. Cambage); Braidwood (J. S. Allan).

"Yellow Gum."—Wingello (A. Murphy, J. H. Maiden, J. L. Boorman); Hill Top, a few miles north of Mittagong (J. H. Maiden).

Following is a note on this timber, written by Mr. Forester J. S. Allan in 1892:—

The timber referred to is locally called "Mountain Gum," or, in some instances, "Grey Gum"; the botanical name is *Eucalyptus goniocalyx*. It is found growing along the Coast Range, on the eastern and western fall of the Irish Corner and Sugar Loaf Mountains, within forest reserve No. 166, County of St. Vincent. The timber is the best procurable in the Braidwood district, and is used locally for bridge-planking, girders, dray-shafts, poles, and for house-building; grows on high elevations in open forest country, usually sound.

When the heart-wood is cut out it is a durable timber, fine grained, and free from gum-veins. I know several culverts that have been decked with the above timber over nine years, and the planks that were free from heart I find are sound yet. The timber is equal to the "Spotted Gum" of the coast districts. But there is an easily worked timber known as Ribbon Gum (*Eucalyptus Gunnii*), the timber of which is worthless. It resembles the other in colour, and has been very often substituted for "Mountain Gum." The true Mountain Gum, *E. goniocalyx*, is well suited for bridge building, but requires care to prevent the worthless timber, referred to above, from being substituted in its place. For bridge work the trees should be felled when the sap is down; it will last many years longer.

I reported as follows on a piece of timber sent by Mr. Baeuerlen:—"Mountain Gum," from Sugar Loaf Mountain, Braidwood, where it attains a height of 100–130 feet, and a diameter of 2–3 feet, has a very hard and tough timber, bad to dress, and of a greyish or brownish grey colour. It is apparently suitable for fencing, joists, and wheelwrights' work. In Woolls' *Contribution to the Flora of Australia*, p. 230, he speaks of *E. Stuartiana*, var. *longifolia*, as the "Yellow Gum of Wingeecarribbee and other parts of the interior" (*sic*). . . . . This gum bears some resemblance to the Grey Gum and Hickory of the County of Cumberland." The former was called by Sir William Macarthur "Yellow Gum of Berrima"* and is *E. goniocalyx*.

The Grey Gum or Hickory is *E. punctata*, DC., as has already been pointed out by Mueller in the Eucalyptographia. It will be observed that both trees are placed by Bentham (B. Fl. iii, 244) under a variety *longifolia* of *E. Stuartiana*, which variety name should be dropped. In the Wingello district, *E. goniocalyx* is known as Yellow Gum, and following are some notes that Mr. Crawford of that place obligingly gave me:—

Six feet in diameter, up to 80 or 90 feet of barrel. Found also at Bundanoon; usually occurs in gullies—bottoms or on sides. Fond of good soil. The timber has been passed for Tallow-wood and Box, but it is more like Tallow-wood. It is very hard when dry.

Yellow Gum as posts has lasted over thirty years. Mr. Crawford has re-used some which have been in the ground for this long period. It dries rather hard, and nails do not readily drive in it; hence it is not so well-liked for building as the local White Mahogany (*E. pilularis*, var. *Muelleriana*) and White Stringybark (*E. eugenioides*).

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* No. 34, N.S.W. Exhibits, London Exhibition, 1862; No. 264, Paris Exhibition, 1855, with the note: "Diameter 4–40 inches; height, 40–80 feet. Said to be a good timber."

WEST.

Head of Valley of Waters, Wentworth Falls (W. Forsyth); Mount Victoria, also Kanimbla Valley, Lowther, and Hassan's Walls (J. H. Maiden); Mount Wilson (Jesse Gregson). The fruits smaller than usual, with almost spreading orifice; the valves well exserted; long footstalk. Jenolan Caves (J. H. Maiden and W. F. Blakeley).

The specimen from Mount Bulaway, Warrumbungle Range, referred to in *Proc. Linn. Soc., N.S.W.*, is *E. Cambagei.*

NORTH.

The record *E. goniocalyx*, Tia, New England (W. Forsyth). *Proc. Linn. Soc., N.S.W.*, p. 126, 1901, is probably *E. Cambagei.*

Propagation.—From seed.

EXPLANATION OF PLATE 19.

A. Sucker leaves.

B. Flowering twig.

C. Fruits, showing angularity.
(From Blue Mts.)

A CUPANIA.

(*Cupania anacardioides*, A. Rich.)

No. 19.

Cupania anacardioides, A.Rich.

A Cupania.

(Natural Order SAPINDACEÆ.)

Botanical description.—Genus, *Cupania*, Linn.

Flowers.—Regular, polygamous.

Sepals.—Four or 5, imbricate in the bud.

Petals.—Either as many as sepals, small, with or without scales inside, or none.

Disk.—Usually annular.

Stamens.—Usually 8 to 10, inserted inside the disk; filaments short, rarely as long as the calyx.

Ovary.—Two- or 3-celled, rarely 4-celled, with 1 ovule in cach cell.

Capsule.—Obovoid or rarely globular, coriaceous or hard, 2- or 3-, rarely 4-celled, often angled or lobed, opening loculicidally in as many valves as cells.

Seeds.—Usually more or less covered by an arillus; testa crustaceous or coriaceous; embryo curved; cotyledons plano-convex.

Trees.—Or rarely tall shrubs.

Leaves.—Alternate, pinnate; leaflets alternate or opposite, with or without a terminal one.

Flowers.—Small, in small axillary or terminal panicles, sometimes almost reduced to simple racemes.

Petals.—Rarely as long as the sepals.

Botanical description.—Species, *C. anacardioides*, A. Rich, *Sert.*, *Astrol.*, 33, t. 13.

A slender tree.—Quite glabrous or with a minute hoariness on the inflorescence.

Leaflets.—Six to 10, usually 8, from broadly ovate or obovate to elliptical-oblong, very obtuse, $2\frac{1}{2}$ in. to 4 in. long, rounded at the base and shortly petiolulate, quite entire, coriaceous.

Flowers.—Rather large for the genus, in pedunculate cymes along the branches of loose panicles.

Sepals.—Orbicular, the inner ones 2 lines broad, slightly ciliate.

Petals.—Small, orbicular, with two very short obovate hirsute scales at the base.

Stamens.—Ten; filaments short, hirsute; anthers oblong.

Ovary.—Villous.

Capsule.—Glabrous, coriaceous, acutely and divaricately 3-lobed, 6 to 8 lines broad, very shortly attenuate at the base. (B.Fl. i, 458.)

The type specimen was in fruit, and was communicated by Mr. Chas. Fraser, first Superintendent of the Botanic Gardens, Sydney, who obtained it at Moreton Bay (Brisbane).

Bailey (*Queensland Flora*) describes a variety *parvifolia* in the following words :—

A small tree, minutely hoary. Leaflets 3 to 6, opposite or subopposite, $1\frac{1}{2}$ to $3\frac{1}{2}$ inches long, $\frac{1}{2}$ inch to 1 inch broad ; oblong, with sometimes a cuneate base, the apex emarginate ; petiolules about 3 or 4 lines, margins entire. Panicles seldom more than 3 or 4 inches long, and broad. Capsule about 4 or 5 lines broad, shortly stipitate, angular, rugose outside, densely hairy inside with short rusty hairs. Seeds black, nearly enclosed in the arillus. Hab.—Main Range and several other localities in southern Queensland ; also Mt. Perry (J. Keys). Wood light-coloured, close-grained, very tough.

Botanical Name.—*Cupania*, in memory of Francesco Cupani, an Italian monk and botanical author, who died in 1710. An account of his works will be found in Pritzel's *Thesaurus Literaturæ Botanicæ*, edition of 1872, p. 73; *anacardiodes*, Anacardium-like—the foliage being deemed to resemble that of a species of *Anacardium*.

Vernacular Names.—" Brush Deal " is a name said to have been given to this tree in Queensland. I have heard the name " Carrot Wood " given to it in the northern part of New South Wales.

Aboriginal Names.—"Yowarro" is a name formerly given by the Illawarra blacks to this tree, according to the late Sir William Macarthur. " Tuckeroo " is a Queensland aboriginal name.

Synonym.—*Cupaniopsis anacardioides*, Radlkofer, in *Sitzungber., K. Bayer., Acad.*, ix, 512, 585 (1879)

Radlkofer divides the tribe *Cupanieæ* into two sub-tribes—

(*a*) *Cupanieæ lomatorrhizæ.* Radicle of the embryo appressed to the margins of the cotyledons.

(*b*) *Cupanieæ notorrhizæ.* Radicle of the embryo appressed to the back of one of the cotyledons.

Cupania belongs to sub-tribe (*a*), and *Cupaniopsis* to sub-tribe (*b*). It would appear that there are no other important differences between the genera.

According to Radlkofer, *Cupania* is confined to " tropical and sub-tropical America," and *Cupaniopsis* to " Australia and the Pacific Islands."

Timber.—Occasionally used for house building purposes, but not generally valued (Moore). It is of a light pinkish colour, close-grained, and tough. It dresses well, and is not an ill-looking timber, but it cannot be called handsome. A slab in the Technological Museum, which has been seasoned over twenty-five years (having been exhibited at the London International Exhibition of 1862), has a weight which corresponds to 47 lb. per cubic foot. It is one of the numerous brush timbers that are found in our forests, and whose special uses have not yet been discovered.

Habitat.—In brushes, and often growing near salt water. The late Mr. Critchett Walker was fond of pointing out the association of this tree with the Port Jackson Fig (*Ficus rubiginosa*). Certainly a pair of trees of the two species were often found together, with no other trees quite near.

It occurs from the neighbourhood of Sydney north all round the continent, at least as far as Port Essington, North Australia. It is found in the National Park, a few miles south of Sydney; I do not know its precise southern range. I have collected it on the Brushy Mountain, between Gloucester and Krambach; this is the most westerly locality known to me.

It is stated by Mueller (*Fragm.*, ix, 91) that the species occurs on Lord Howe Island; but in *Proc. Linn. Soc., N.S.W.*, 1898, 126, I have shown that the statement was made under a misapprehension.

Size.—It attains a height of 70 or 80 feet in good situations, and 18 inches to 2 feet in diameter.

Propagation.—From seed. It is a very handsome tree for park-planting or for large gardens. It is shapely and very umbrageous, and visitors to the Botanic Gardens can form an opinion as to its merits in this respect.

EXPLANATION OF PLATE 20.

A. Flower bud.

B. Expanded flower—
 (*a*) Sepal.
 (*b*) Petal, with two obovate hirsute scales at base.

C. Flowers, with petals and stamens removed—
 (*c*) Disk.
 (*d*) Ovary.

C[1]. Side view of C.

D. Three-celled ovary (transverse section).

E. Stamens.

F. Part of the style, showing stigma.

G. Fruit.

H. The same—a divaricately three-lobed capsule, dehisced.

I. Seed, showing aril.

Sydney: William Applegate Gullick, Government Printer.—1903.

INDEX OF TREES DESCRIBED.

PART I (ISSUED FEBRUARY, 1903).

PART II (ISSUED MARCH, 1903).

PART III (ISSUED MAY, 1903).

PART IV (ISSUED JULY, 1903).

THE FOREST FLORA

OF

New South Wales.

J. H. MAIDEN.

Published by Authority of the

GOVERNMENT OF THE STATE OF NEW SOUTH WALES.

PART VI.

Sydney: William Applegate Gullick, Government Printer.—1904.

THE FOREST FLORA

OF

NEW SOUTH WALES

J. H. MAIDEN,
Government Botanist of New South Wales and Director of the
Botanic Gardens, Sydney

PART VI.

Published by the Forest Department of New South Wales, under authority of
The Honourable the Secretary for Lands.

Published by Authority of
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Sydney:
WILLIAM APPLEGATE GULLICK, GOVERNMENT PRINTER.

1904.

PRICE, 1/- per Part, or 10/- per dozen Parts, payable in advance.

*30596 a

No. 20.

Ceratopetalum apetalum, D. Don.

The Coach Wood.

(Natural Order SAXIFRAGEÆ.)

Botanical description.—Genus, *Ceropetalum*, Sm. *Bot. Nov. Holl.* (1793).

Calyx-tube.—Short, adnate to the base of the ovary; lobes 5, valvate, persistent and enlarged after flowering.

Petals.—Small and laciniate or none.

Stamens.—Ten, inserted on a perigynous disc.

Anthers.—Small, the connective produced into a recurved appendage.

Ovary.—Short, half-inferior, 2-celled, with 4 collateral ascending ovules in each cell, tapering into 2 more or less united styles, free and recurved at the top; stigmas terminal.

Fruit.—Small, hard and indehiscent, surrounded by the 5 wing-like horizontally spreading enlarged calyx-lobes.

Seed.—Solitary, slightly curved; *embryo* green, curved, in the axis of a fleshy albumen.

Trees or shrubs, glabrous and resinous.

Leaves.—Opposite, with 1 or 3 digitate leaflets articulate on the petiole.

Stipules.—Very small.

Flowers.—Small, in terminal trichotomous cymes or corymbose panicles. (B. Fl., ii, 442.)

Botanical description.—Species, *C. apetalum*, D. Don., Cunon. II, in *Edinb. New Phil. Journ.*, April to June, 1830.

A beautiful tree of 50 to 100 feet, with a smooth bark.

Leaflets.—Usually solitary, occasionally 3 on luxuriant shoots or perhaps young trees, from ovate-lanceolate to narrow-lanceolate, 3 to 5 in. long, or nearly twice that size on luxuriant barren branches, obtusely serrate, coriaceous, shining, narrowed at the base, articulate on a petiole of $\frac{1}{2}$ to 1 in.

Flowers.—Numerous in rather dense corymbose cymes, usually shorter than the last leaves, sometimes slightly pubescent.

Calyx-lobes.—Acute, above 1 line long in flower, scarcely above $\frac{1}{4}$ in. in fruit.

Petals.—None.

Appendage of the connective of the anthers smaller and straighter than in *C. gummiferum*. (B. Fl., ii, 442.)

Botanical Name.—*Ceratopetalum*, from two Greek words, *keras*, a horn, and *petalon*, a petal, the petals being jagged, reminding one of a stag's horn, in the species (*C. gummiferum*) on which the genus was founded.

Apetalum, without petals, this character being distinctive of the species.

A

Vernacular Names.—Its commonest name is "Coach Wood," so called because of the use of its timber in coach-building. It is also called "Leather Jacket" because of its tough, fibrous, closely adherent bark. "Light Wood" is a common name for it (perhaps nearly as much in use as "Coach Wood," but an undesirable name as we have so many other light woods). It is so called because it is very light when properly seasoned, in fact about 40 lb. per cubic foot would be a fair average.

Aboriginal Names.—"Boola" of the Illawarra blacks, and "Ngnaa rewing" of those of Brisbane Water, according to the late Sir William Macarthur.

Synonym.—*C. montanum*, D. Don. was established on narrow-leaved specimens which do not otherwise differ from the common form. (B. Fl. ii, 412).

Flowers.—The flowers are white and not very conspicuous, but as growth proceeds, the calyx very largely increases in size, takes on a crimson or purple colour, and becomes very conspicuous, forming what is known to most people as the "flower."

Bark.—If the bark be wounded, it gives off a perfume; its smell is like that of Tonka beans or new mown hay, and is owing to the presence of a substance called "Coumarin." I have known a small slab of it to be useful for scenting linen-presses. I first drew attention to the presence of Coumarin in this bark, which is also referred to in Schimmel & Co.'s *Bericht*, April, 1890, p. 51, and *Pharm. Journ.* [3], xx, 856.

Timber.—The one great value of this tree is for its timber, and it would be far more used than it is were it not for the frequently inaccessible gullies in which much of the best timber is found. It is tough and is used for tool handles and for boat and coach building. It possesses a faint but pleasant odour. It is said to be peculiarly well adapted for sounding boards, for musical instruments, for stethoscopes, and such purposes. Its uses in that direction have, however, been little more than tentative.

Planks of Coach Wood, both wide and thick, may be procured from the larger timber yards in Sydney, so that enterprising people can have no difficulty in testing it for special requirements. Much of what supplies the Sydney market comes from Gosford.

Its value as a coach-builder's timber is sufficiently great to be insisted upon.

It is a useful timber to the coach-builder for placing in clean, dry situations. Under such circumstances it is equal to English ash. Its weakness is its liability to rot when left in damp or dirty places near the bottoms of carriages which are neglected and not kept clean. For very many years this timber has been in request

THE COACHWOOD.

(*Ceratopetalum apetalum*, D. Don.)

for coach-building. An eminent coach-builder informed me that "it is the grandest Australian timber for coach-building." It is undoubtedly excellent for bodies, and a good all-round timber.

Exudations.—When the bark of a Coach Wood is wounded there exudes from it a small quantity of a tough, red, astringent gum, which has a powerful odour, from the large percentage of Coumarin it contains, which is far higher than in the bark; but it is too small in quantity to be of commercial importance. Observations are going forward to see if the Coumarin contained in the tree is sufficiently abundant to make it valuable to the manufacturer of fine chemicals.

Size.—It commonly attains a height of 60 or 70 feet and even more, and a diameter of 2 or 3 feet.

Habitat.—This tree is confined to New South Wales. It is a gully tree, and common as it is, I believe I have never seen it out of such situations. It may be found in most of the Blue Mountain gullies, and also a considerable distance north and south of Sydney. The furthest southern locality I know for this tree is Conjola, near Milton; the furthest western, Mount Wilson; and the furthest northern, near Stroud, but I feel sure that observations will considerably extend its range to the northward.

Propagation.—It is readily propagated from seed. The tree is well-shaped, bears handsome, bright foliage, always green, and it bears a profusion of inflorescence, rendering it altogether one of the most desirable of our native plants. As far as my observation goes, it is very little cultivated, but so beautiful and useful a plant is well worthy of a fair trial. Its natural habitats show that it requires fairly rich soil, not too much sun, and plenty of water, a trio of requirements not always obtainable in Sydney gardens; but as plants frequently show capability of adapting themselves to changed circumstances in a remarkable degree, it would be interesting to know what liberties could be taken with the present species.

EXPLANATION OF PLATE 21.

The small twig at the right hand of the plate shows the normal flowers.

The large twig, filling most of the plate, shows the enlarged calyx-lobes, forming the "flowers."

A. Flower.

B. Flower in a more advanced stage.
- (*a*) Lobe of calyx.
- (*b*) Stamen.
- (*c*) Perigynous disc.

C. Flower, further advanced with calyx removed.
- (*d*) Half inferior ovary.
- (*e*) Recurved styles.

D. Stamen, front and back view of anther appendage.

No. 21.

Eucalyptus hemiphloia, F.v.M.

The White or Grey Box.

(Natural Order MYRTACEÆ.)

Botanical description.—Genus, *Eucalyptus*, L. Heritier (see part ii, p. 33).

Botanical description.—Species, *E. hemiphloia*, F.v.M., *Fragm.*, ii, 63.

The following description is by Mueller himself, and is taken from the Eucalyptographia. As a matter of uniformity and convenience, I prefer to adopt, where there is no objection, the classic descriptions of Bentham, as contained in the *Flora Australiensis*, but in the present case Bentham separates *E. hemiphloia* from *E. albens*, which I have no hesitation in saying has been proved most amply to be an erroneous view, although extreme forms, without their innumerable gradations, present some diversity in general appearance. (J.H.M.)

Leaves.—Scattered, elongate or oval lanceolar, of firm consistence, of equal colour on both sides, only slightly or sometimes moderately curved, not very shining, the *lateral veins* diverging at a very acute angle, the *circumferential vein* very evidently removed from the edge of the leaf.

Oil-dots.—Usually obliterated or much concealed.

Umbels.—In lateral or terminal short panicles or some solitary, on angular stalks, with from four to ten flowers.

Calyces.—Somewhat angular.

Stalklets.—Comparatively thick, of the length of the tube or shorter.

Operculum.—Broadish-conical, rather acute or even pointed, seldom semiovate, about as long as the tube or somewhat shorter.

Stamens.—All fertile, inflected before expansion.

Anthers.—Very minute, globular, opening laterally, by pore-like apertures.

Stigma.—Slightly or not broader than the style.

Fruits.—Truncated-ovate or hemiellipsoid, three- to five-celled, the rim narrow-compressed, prominent, valves quite enclosed, short.

Seeds.—Without any appendage, the fertile much larger than the short sterile seeds.

Botanical Name.—*Eucalyptus*, already explained (see p. 34, part ii); *hemiphloia*, from two Greek words—*hemi*, half, and *phloia*, bark—half-barked.

Vernacular Names.—It is called Grey Box because of its tough, inlocked character, which reminded the early settlers of Turkey Box. Here, however, the resemblance ceases, as our box is a coarser-grained, duller-looking timber, while in Australia it often goes by the name of "Box," the adjectives "Grey" or "White" being used to distinguish it from Red Box, Brush Box, &c.

Aboriginal Names.—A short time ago I came across some specimens collected by George Caley in New South Wales in the first decade of the Nineteenth Century. They were labelled with almost the first aboriginal names attributed to Eucalyptus, and I reproduce them. Caley's specimens, which I identified as belonging to this species, are three, and it is interesting to note that he spelt what is evidently the same name in three different ways. This is partly owing, doubtless, to the lack of an orthographic standard in those early days, and to the variants adopted by different blacks belonging to tribes now long extinct.

1. "Box, Barilgora" (Caley's label).
2. "Berigora Box" (Caley).
3. "Berijora. More luxuriant" (Caley). This is a coarse-foliaged specimen, probably from a young tree.

Many years afterwards the late Sir William Macarthur, who did good service in collecting the aboriginal names for our vegetation, gave the name "Barroul Gourrah" to the "True or Yellow Box of Camden." The similarity of this name to those of Caley's is evident. Recently when in England I examined the original specimen, which I have referred to in the following passage:—"No. 135. Sydney Woods. W. Macarthur, 1854, Paris Exhibition, is represented in Herb., Kew, by foliage only. I have no doubt in my own mind that this is *E. hemiphloia*, F.v.M."

Sir William Macarthur's catalogue notice is "Names in Cumberland and Camden, Bastard Box and Barroul Gourrah (aboriginal). An excellent timber; the tree of most unsightly appearance, and almost invariably hollow or decayed at heart before attaining full stature. The wood greatly prized for plough beams, poles, and shafts of drays and carts, spokes of wheels, &c."

E. hemiphloia is also stated to have been known as "Narulgun" by the aborigines of sub-tropical Eastern Australia.

Synonym.—Some of the synonyms of this species are referred to below. I recognise three varieties, viz.:—

1. var. *albens*, F.v.M. The large fruited glaucous (whitish) form. *E. albens*, Miq. The name of *E. albens* arose only from a misprint of *E. pallens*, and was first promulgated without any diagnosis (Eucalytographia under *E. hemiphloia*). *E. pallens*, F.v.M., non DC., is a synonym.

2. var. *microcarpa*, Maiden. The small fruited form common in the drier parts of the State.

3. var. *purpurascens*, Maiden. *Trans. R. S., S.A.*, 1902, p. 12. The purple-flowered form found in South Australia. It is *E. purpurascens*, F.v.M., by Bentham thought to be a variety of *E. Behriana*, F.v.M., but its affinity would appear to be with *E. hemiphloia*. It has a pale-coloured timber, like *E. hemiphloia*, while that of *E. Behriana* is red.

Leaves (oil).—The reddish-brown oil contains cineol and large amounts of cuminic aldehyde.*

* Bericht von Schimmel & Co., Leipzig, April, 1892, p. 28.

The following analyses of oils yielded by the normal species, and of the variety *albens*, are taken from Messrs. Baker and Smith's "Research on the Eucalypts," and form an instructive illustration of variation in the composition of Eucalyptus oils belonging to the same species :—

Specific Gravity at 15° C.	Specific Rotation. $[\alpha]_D$	Sponification Number.	Solubility in Alcohol.	Constituents found.
0·9117	—7·46° (First fraction.)	5·78	2 vols. 70%.	Pinene, Eucalyptol, Aromadendral.
0·9044	—7·2° (First fraction.)	8·55	1 vol. 80%.	Pinene, Eucalyptol, Aromadendral.

Flowers.—This species is one of the most profuse flowerers of the Eucalypts. The *Agricultural Gazette* for February, 1893, contains a useful paper on "Plants visited by Bees." It is very condensed, and the native plants are not separated from the introduced ones. Botanical names are not given, and it would be desirable to compile a list of our native plants stated by responsible bee-keepers to be useful bee-plants. The above-quoted paper says :—"It is worthy of remark that the flora of Australia possesses honey-producing trees shrubs, and plants of a high standard of excellence, the honey produced by bees in the near neighbourhood of the forest being of the finest quality, and having few (if any) faults." The value of the Box-tree (*Eucalyptus hemiphloia*) for honey has passed into a proverb.

It having been reported that a boy at Burragorang had been poisoned through eating honey, many years ago, the late Rev. Dr. Woolls wrote a paper, entitled "Poisonous Honey," in "A Contribution to the Flora of Australia," p. 28. It refers, however, to exotic plants for the most part.

In the *Agricultural Gazette* for January, 1902, I compiled some notes, from Foresters' Reports, on the value of various Eucalyptus trees to bee-keepers. Following are the reports on this species :—

Months of Flowering.	Reports from—
*January	Forester Siddins, Armidale.
September to December ...	,, Rotton, Picton.
May, June, and July ...	,, Postlethwaite, Grenfell.
March to May	,, Smith, Dubbo.
February	,, Payten, Corowa.
February and March ...	,, Stopford, Penrith.
October and November ...	,, Mecham, Bellingen.
February and March ...	,, Rudder, Booral.
*March and April	Inspect. Forester Manton, Moama.
November to March... ...	Forester Brown, Port Macquarie.
February to August... ...	,, Harris, Gunnedah.
September	,, Allan, Milton.
March	,, Crowley, Casino.

* Sometimes twice a year.

Yields the best honey (Forester Marriott). A good honey-plant, nice and clear, of good flavour, but rather thin (Forester Rotton). One of the best Eucalypts for honey (Forester Smith). Blooms triennially if the season be normal (Forester Marriott). The best honey-plant in this district; it yields 50 per cent. more honey than any other tree (Forester Harris). I do not think that these trees are of any great value as honey-plants (Insp. Forester Manton). A favourite with bees (Forester Brown). Best for honey in the fall of the year (Forester Crowley).

Fruit.—In Eucalyptus the fruit is of considerable importance for purposes of diagnosis. In *E. hemiphloia* the fruit varies considerably in size; but it is always subcylindrical, smooth, and never has the valves exserted.

Bark.—This species obtains its name from its bark, although this is a character that can only be employed with caution. This trunk is more or less covered with a matted, sub-fibrous bark that is generally known as "box" bark. The branches are smooth, with a little ribbony bark at the junction of the fibrous and smooth portion.

Timber.—Its characteristics are its toughness, hardness, cross-grained, non-fissile character, and its great strength. It is a pale hardwood, of a very pale brown. It is used for the naves of wheels and heavy framing, and for the cogs of wheels, large screws, mauls, handles, shafts, poles of drays, &c., which require a tough wood for their manufacture. In Victoria it is in high repute for railway sleepers, and in that State and our own for piles, girders, &c. It can be recommended with confidence to railway-carriage builders and others who require a strong durable timber for framing, &c. While usually sound in the coast districts, in the interior a great drawback to this tree is its tendency to become hollow at a comparatively early age. It is certainly a valuable timber, one of the best of our hardwoods. It forms an excellent fuel.

Exudations.—The kino of this species is of a specially interesting character. It is of a reddish-brown colour, which breaks down to a fine powder. It forms a turbid solution in water, and hence belongs to my Turbid group of kinos. This turbidity of kinos is owing to more than one substance, and a new crystallised organic body, Eudesmin, is chiefly responsible for the turbidity of this particular kino. It is a very interesting substance; but a technical description of it would be out of place here, and I therefore refer my readers to a paper* by Mr. H. G. Smith and myself. Later on Mr. Smith made the very interesting discovery of a second substance causing turbidity in this† (and other) kinos. It is a colourless, transparent substance, to which the name Aromadendrin has been given, and my readers are referred to the original paper for a full account of it.

* "A Contribution to the Chemistry of Australian Myrtaceous Kinos." *Proc. Roy. Soc. N.S.W.*, 1895, pp. 30–40.

† *Op cit.*, 1896, pp. 135–143. "On Aromadendrin or Aromadendric Acid from the Turbid Group of Eucalyptus Kinos."

Size.—It varies a good deal in size. I have seen it 60 to 80 feet in height, and even higher, with a stem-diameter of 3 or 4 feet, but it is not one of our largest Eucalypts.

Habitat.—In one form or another it is found over a large area of this State, from the coast-line away into the dry west. It also occurs in Queensland, Victoria, and South Australia. In the two last States the predominating form is variety *albens*. The variety *albens*, the White Box *par excellence*, is in New South Wales mainly developed in a longitudinal strip of country on the western slope of the Dividing Range. Roughly, the eastern boundary would run through Corowa, Wagga Wagga, Temora, Parkes, Dubbo, and thence northerly to the Queensland Border. Its eastern boundary would run through, say, Tumut, Burrowa, Cowra, Orange; then easterly to Rylstone, Singleton, Muswellbrook, and then northerly. The typical form is found east of this.

Propagation.—From seed, which is readily obtained. It seems a pity that this valuable timber-tree is not oftener propagated. As a general rule, the more worthless the species the greater abundance of seed produced, and that is the explanation why so many rubbishy Eucalyptus trees have been cultivated both in Australia and other countries.

EXPLANATION OF PLATE 22.

A. Twig of fruits of the typical form.

B. Section of fruit of variety *albens*.

THE WHITE OR GREY BOX.
(*Eucalyptus hemiphloia*, F.v.M.)

No. 22.

Stenocarpus salignus, R.Br.

A Beef-Wood.

(Natural Order PROTEACEÆ.)

Botanical description.—Genus, *Stenocarpus,* R.Br. *Prod.*

Flowers.—Hermaphrodite.

Perianth.—Slightly irregular, the tube opening along the lower side, the limb nearly globular and recurved, the segments at length separating.

Anthers.—Broad, sessile within the concave laminæ, the connective not produced beyond the cells.

Hypogynous glands.—United in a short semi-annular disc or cup or almost obsolete.

Ovary.—Stipitate, tapering into a long style dilated at the top into a flat oblique disc, stigmatic in the centre.

Ovules.—Several, laterally attached at or near the top, imbricate downwards in two rows.

Fruit.—A follicle, usually narrow coriaceous.

Seeds.—Produced at the lower end into a membranous wing Trees.

Leaves.—Alternate or scattered, entire or deeply pinnatifid with few lobes.

Peduncles.—Terminal or in the upper axils, sometimes several in an umbel or short raceme, each bearing an umbel of pedicellate red or yellow flowers.

Bracts.—None, or falling off at a very early stage. (B.Fl. v, 539.)

Botanical description.—Species, *S. salignus,* R.Br., in *Trans. Linn. Soc.* X, 202, *Prod.* 391.

A moderate-sized tree, glabrous or the inflorescence minutely pubescent.

Leaves.—In the typical form, ovate-lanceolate or elliptical; acute acuminate or rarely obtuse, tapering into a short petiole, 2 to 4 in. long, varying from penniveined or triplinerved (the lower primary veins scarcely longer or much longer and thicker than the others); but the veins usually indistinct, slightly prominent or almost immersed; a few leaves on young trees or barren branches larger and pinnatifid.

Peduncles.—Slender, terminal or in the upper axils, usually shorter than the leaves, bearing a single umbel of ten to twenty flowers, or, in luxuriant specimens, as many as thirty flowers.

Pedicels.—$\frac{1}{4}$ to $\frac{1}{2}$ in. long, irregularly crowded on the summit of the peduncles.

Perianth.—Usually under $\frac{1}{2}$ in. long.

Ovary.—Slightly silky-pubescent or nearly glabrous.

Ovules.—Six to eight, not so closely imbricate or not so narrow and compressed as in *S. sinuatus,* (B.Fl. v, 539).

B

There are two varieties, viz. :—var. *Moorei*, Benth. *Leaves* broader and usually more distinctly triple or quintuplinerved, the *ovary* minutely pubescent. (*S. Moorei*, F.v.M., *Fragm.* i, 134; v. 154), Rockingham Bay, Queensland, *Dallachy*; Mount Lindsay, New South Wales, *W. Hill*. Var. *concolor*, Benth. *Leaves* more prominently triple or rarely quintuplinerved, the reticulations also more distinct. *Flowers* rather larger; *ovary* glabrous or rarely so. (*S. concolor*, F.v.M., *Fragm.*, iii, 147; v. 154), Broadsound, and near Maryborough, Queensland, *E. Bowman*.

Botanical Name.—*Stenocarpus*, from two Greek words, *stenos*, narrow, and *karpos*, a fruit, in reference to the narrowness of the fruit (follicle); *salignus*, Latin, willow-like, but hardly an appropriate name, as a general rule, yet descriptive of some specimens.

Vernacular Names.—This is often called "Silky Oak," and this term is very widely in use. In some districts in which *Grevillea robusta* and *Orites excelsa* also occur, our tree goes by the name of "Red Silky Oak" in order to distinguish it. Further allusion to the redness of its timber is in the name "Beef-wood," which is in very frequent use, the appearance of the fresh wood being remarkably like raw beef in colour.

Aboriginal Names.—I only know of one name, that of "Melyn," which was in use by the Illawarra blacks, according to the late Sir William Macarthur.

Synonyms.—Meissn. in DC., *Prod.* xiv, 451; *Bot. Reg.* t. 441. *Embothrium rubricaule*, Giord, Obs. 1837; according to Meissner, in his monograph of the Proteaceæ in DC., *Prod.*, Vol. xiv.

Leaves.—The shape of them has been referred to above. The varieties show that the leaves present some variation.

Flowers.—White or greenish-white, small and inconspicuous in comparison with those of *S. sinuatus*. They are somewhat fragrant.

Timber.—A reddish, fissile timber, used locally for furniture, veneers, staves, gun-stocks, walking-sticks, picture-frames, &c. This timber is an efficient substitute for the northern silky oaks (*Grevillea* and *Orites*); in fact, it has long been used by the Illawarra dairy-farmers for such purposes as butter-kegs. In the old days it was used to a limited extent for shingles. Mr. Forester Brown told me it had been used for gun-stocks at Taree.

"A slab of this timber is of extreme beauty for the uniformity of the pale, red-brown, mottled colour, with an undulating figure perfectly uniform, of hard texture, easily worked. Altogether one of the most beautiful woods in the Exhibition, and of the highest merit." (*Jurors' Reports, London International Exhibition of* 1862). As it ages it sobers down to a reddish-brown colour, with a tendency to uniformity of colour throughout. Proteaceous timbers are very characteristic in appearance, and this is no exception. A slab which has been seasoned for many years (having been exhibited at the London International Exhibition of 1862), has a weight which corresponds to 44 lb. 4 oz. per cubic foot.

A BEEF-WOOD.

(*Stenocarpus salignus*, R Br.)

A drawback to fissile timbers such as this is their fissility, and they sometimes tear when in use.

As to the beauty of this timber there can be no difference of opinion: I would like to see it more frequently utilised for furniture, as it is a really handsome furniture wood.

Exudations.—Small quantities of gum have been seen on bruised trees of this species several times. I look upon gum as being usually a pathological product, and hence most likely to be found on sickly and injured trees.

(*Stenocarpus sinuatus*, Endl., "Yiel Yiel," Fire-tree. I have seen a small quantity of a reddish gum (?) from this tree.)

Size.—Usually 40 or 50 feet, with a stem-diameter of 1 or 2 feet; but I have seen trees twice as large or larger.

Habitat.—New South Wales and Queensland, extending from the Illawarra to Southern Queensland. The precise southern range of the species is unknown to me, and I should be glad of information on the subject.

Propagation.—From seed.

EXPLANATION OF PLATE 23.

A. Flower before expansion.

B. Expanded flower.

C. Flower, petals (perianth), with stamens removed.
- *a.* Hypogynous disc.
- *b.* Stipitate ovary.
- *c.* Stigmatic disc.

D. Petal (perianth segment), with sessile anther.

E. Stigmatic disc.

F. Fruits (follicles).

G. Seeds, showing the thin lamellæ separating them.

No. 23.

Panax elegans, F.v.M.

The Black Pencil Cedar.

(Natural Order ARALIACEÆ.)

Botanical description.—Genus, *Panax*, Linn. (*Nothopanax*, Miq.)

Calyx-border.—Usually slightly prominent, truncate or shortly 5-toothed.

Petals.—Five, valvate, often cohering at the tips, especially in female flowers.

Stamens.—Five.

Disk.—Broad and not thick, the margin sometimes prominent.

Ovary.—Two or rarely 3-celled.

Styles.—Two, rarely 3, at first erect and sometimes cohering, afterwards distinct and recurved.

Fruit.—Flattened, the endocarp hardened into 2 distinct pyrenes not furrowed, sometimes 2-ribbed on the dorsal edge, the exocarp more or less succulent.

Albumen.—Even.

Trees or shrubs.

Leaves.—Pinnately or digitately compound or rarely a few on the same tree or bush undivided.

Flowers.—Often polygamous, articulate on the pedicels, in umbels or rarely in heads or racemes, the umbels or racemes paniculate or rarely solitary. (B.Fl. iii, 380.)

Botanical description.—Species, *P. elegans,* F. Muell. in *Trans. Phil. Inst. Vict.* II, 63.

A large and handsome tree, glabrous, except the inflorescence.

Leaves.—Large, simply or doubly pinnate, the rhachis articulate.

Leaflets.—Petiolate, opposite, ovate, acuminate, entire, coriaceous, shining, often 3 or 4 in. long.

Flowers.—Singly pedicellate in little racemes, which are very numerous, and arranged in a large terminal divaricately-branched panicle, the rhachis minutely hoary pubescent.

Calyx-border.—Shortly prominent, entire.

Petals and styles of the genus.

Disk.—Not prominent.

Fruits.—About 3 lines broad, the endocarp or pyrenes hard. (B.Fl. iii, 383.)

Botanical Name.—*Panax*, from two Greek words—*Pan*, all, and *akos*, a remedy—in allusion to the miraculous virtues attributed to the Ginseng (*Panax quinquefolia*). Panacea (Greek, *panakeia*), a universal remedy, has the same meaning.

Elegans, Latin, handsome, in allusion to the beauty of the tree.

Vernacular Names.—"Black Pencil Cedar." It was difficult to understand why this species (and the allied *P. Murrayi*) is called by the name of Pencil Cedar since the wood does not resemble that of cedar. Many years ago Mr. W. Bäuerlen gave me the following explanation:—"When the trees are of a fair size, the bark looks somewhat rough and scaly, resembling young cedar (*Cedrela australis*) a little, in fact a log I cut was to-day, after the ends had been painted, by several people taken to be young cedar. The centre of the wood is dark-coloured, which may have given the name of Black Pencil Cedar to this species. However, the bark of young trees of saplings often looks somewhat blackish I am told, and the large log (No. 165) of *Panax Murrayi* goes far to prove that *Panax Murrayi* never has a dark centre, while *Panax elegans* always has one."

It is called "Celery tree" in parts of Queensland, owing to the smell of the leaves, according to Seemann, who points out that most of the genus smell of aniseed or celery. Another Queensland name is "Mowbowlan Whitewood" and "Laurel," "White Sycamore" and "Light Sycamore," and other names stated to be in use in Northern New South Wales. Mr. Bailey gives the name "Greyanger" in use in the Bunya Mountains, Queensland.

Aboriginal Names.—At one time called "Merring-arra" by the aborigines of Illawarra, New South Wales, according to the late Sir William Macarthur. According to Mr. Charles Moore, "Undambie" of the aborigines of Northern New South Wales. "Greyangee" of those of the Bunya Mountains, Queensland.

Synonym.—*Nothopanax elegans*, Seem. *Fl. Vit.*, 114.

In a Queensland Exhibition Catalogue the late Mr. W. Hill has the reference "*Aralia elegans*, Cunn., height 30–40 ft., diameter 12–16 inches. Elegant small tree, with large pinnate leaves; wood soft, white, and spongy."

Leaves.—Large pinnate or doubly pinnate leaves, which are the glory of the tree.

The leaves of *Panax Edgerleyi*, Hook., f., of New Zealand, are used by the Maoris as a perfume.

Timber.—Wood soft, light, and of very little durability. "It splits well, might suit for cricket bats, and would form excellent lining boards; it will possibly prove a most useful wood to the musical instrument makers." (Bailey in *Cat. Queensland Woods, Col. and Ind. Exh.*, 1886.) It cleans well, and if cut for effect it will show a neat and pretty grain, but it is apt to get dirty-looking with age. It warps and cracks unless very carefully treated. Two slabs in the Technological Museum, which had been seasoned over 25 years (having been exhibited at the London International Exhibition of 1862), had weights which corresponded to 30 lb. 14 oz. and 31 lb. 8 oz. per cubic foot respectively. The tree is really of very little value for timber purposes.

Exudations.—Following is a paper I wrote some years ago on *Panax* gum:—

Panax is a genus of the Araliaceæ, several species of which order are more or less acrid or aromatic. But the recorded instances of gum or resin being found in any of them are extremely few, and in no case, so far as I am aware, has the composition of the exudation been dealt with, much less an analysis given.

In the common English ivy (*Hedera helix*), there is stated to be contained "the gum-resin called 'Hederine,' used by varnish-makers, and said to be depilatory and emmenagogue." (Lindley, *Medical and Œconomical Botany.*)

"An aromatic gum-resin comes from *Aralia racemosa, spinosa,* and *hispida.*" (Lindley, *Vegetable Kingdom.*)

Meryta Sinclairii, Seem., of New Zealand, "is charged with a peculiar resin in all its parts." (Kirk's *Forest Flora of New Zealand.*)*

All the above quotations refer to resins or gum-resins.

We now come to *gums* in the Araliaceæ, and the two references I give are all I can find of gums in this Natural Order, and they both refer to *Panax,* the genus to which all the gums I have been able to obtain up to the present also belong.

"*Panax Colensoi* exudes a gum very similar to gum arabic, and occasionally used for adhesive purposes." (*Report New Zealand Exhibition,* 1865.)

"*Panax sambucifolius* in Novam Angliam extendit. Truncus cum ramis gummifluus." (Mueller, *Fragm.,* vii, 95.) It would appear therefore that the Araliaceæ exude both gums and resins. It is a fact not generally known that the same Natural Order, the same genus, and even the same species may exude both a gum and a resin, and some writers have even doubted the exactness of their own observations when they have found both a gum and a resin in closely related plants. I hope to show in another place, chiefly by citing Australian instances, which have come under my notice, that the occurrence of both a resin and a gum in the same genus and even species, is by no means uncommon.

Returning to *P. sambucifolius,* I have not yet obtained gum from the normal species, but from a variety, viz., *P. sambucifolius,* var. *angusta,* or, according to Baron von Mueller's nomenclature, *P. dendroides,* var. *angusta.*

This plant is found on the banks of the Snowy River, amongst boulders of rock, attaining a height of about 8 feet, with a diameter of 2 inches when grown in tree shape; mostly, however, the plant is shrubby, with a number of thin stems.

The gum was obtained from old sickly plants. When obtained fresh it has a peculiar sweetish odour, and when placed in the mouth it has a pleasant flavour, reminding one strongly of a rose jujube. It dissolves wholly in the mouth in a few minutes, and except for the perfume already alluded to, it might readily be taken for one of the readily soluble wattle gums.

---

* Since the above was written I have received from Mr. W. W. Froggatt a quantity of a gum-resin from *Astrotriche floccosa,* DC., belonging to this Natural Order. It has a very pleasant perfume, and appears to be an interesting substance. It exuded from sickly shrubs whose stems had been wounded by a small *Curculio.*

Nevertheless when I first received it I was informed that in a local family it had the reputation of being injurious, and even poisonous. The gum is credited with having caused vomiting and serious symptoms which lasted three or four days in a young man who had eaten the gum as freely as one would wattle gum.

Nothing in my analysis shows any poisonous substance in the gum, and as this is the only instance which has come under my notice of alleged poisoning by *Panax* gum, the sufferer may have been under a misapprehension. At the same time it must be borne in mind that vegetable substances of an injurious nature (*e.g.*, the poisonous principle in *Macrozamia* seeds) are sometimes not capable of detection by ordinary chemical processes.

My sample has the appearance of an inferior gum arabic; it breaks with a dull conchoidal fracture; the colour varies from amber to colourless.

After twenty-four hours in cold water a portion of the gum remained undissolved, and had swollen a good deal. After separating the solution, this insoluble substance was treated with very dilute potash; it readily dissolved, and on acidifying with acetic acid and adding alcohol, arabin was precipitated, showing the insoluble portion to have been metarabin. The gum soluble in cold water has proved to be arabin. The composition of this sample of gum is:—

Arabin	68·8	
Metarabin	2·0	(by difference).
Ash	2·0	
Water	13·1	
	100·0	

I have received (also from Mr. William Bäuerlen, collector of the Technological Museum) a sample of gum from *Panax Murrayi*, obtained from Lindendale, Lismore, where it is known locally as "Pencil Cedar," and where it attains a height of 40–60 feet, and a stem diameter of 9 to 24 inches. It was collected in January, 1892, and was analysed a month later.

This gum is brittle, like that of *P. sambucifolius*, var. *angusta*, and not viscous like that of *P. elegans*. Its taste is not pleasant; it has not much odour, not resembling *P. elegans* in this respect. It is fairly light in colour, although portions are as dark as ordinary glue. In cold water it wholly dissolves to a clear transparent liquid, not opalescent like that of *P. sambucifolius* var. The aqueous solution has an odour different from that of the others, and not so pleasant. It is difficult to describe.

On the addition of alcohol of specific gravity, ·834, the gum is precipitated as an opaque white substance, and is arabin. The composition of the gum is:—

Arabin	85·1
Ash	2·3
Water	12·6
	100·0

Two specimens of gum from *Panax elegans* may now be described separately:—

1. Found at Lismore. Diam., 1 foot. Height, 50–60 feet. Gum gathered April, 1891, and analysed the following February.

Both gums are rather dark in colour, and resemble wattle gum. They are in irregular lumps of about half an inch in thickness. Both are plastic after months of keeping. Both are mainly soluble in water, the insoluble portion largely swelling up in that liquid. The odour of the aqueous solution of No. 1 sample of *P. elegans* resembles that of carrots in a remarkable degree. This is noteworthy, and reminds one of the close affinity of the Araliaceæ and Umbelliferæ.

2. *Panax elegans.* Sample from Ballina, N.S.W. This specimen has been partly described under No. 1. In aqueous solution it has an aroma which reminds one of hops.

The following analysis gives a good idea of the composition of both gums of *P. elegans*:—

Arabin	70·2	
Metarabin	9·8	(by difference).
Ash	3·3	
Water	16·7	
	100·0	

Conclusions.—Panax gums closely resemble Acacia gums in composition. They both contain gums wholly soluble in cold water, and consisting entirely of arabin, and gums partially soluble in water, though containing varying proportions of metarabin, which substance causes them to swell in cold water. The gum of *P. Murrayi* would form a valuable substitute for gum arabic, and it would be a valuable minor industry for this country if it were procurable in large quantities.

All the gums possess some odour, obtained from the barks, and isolation of the odoriferous bodies could best be carried out by analysis of the bark. This odoriferous principle in the Araliaceæ, and reminding one of the Umbelliferæ, has long been known. "Most of the species have a very strong smell of aniseed and celery, hence the name "Celery tree" is given to *Panax* (*Nothopanax*) *elegans* by the Queensland colonists." (Seemann, *Flora vitiensis,* 114).

The ash of *Panax* gums principally consists (in my samples) of lime, magnesium, and potassium, with a trace of iron, and although the bases were present principally as carbonates, both sulphuric and phosphoric acids were found. Quantitative determinations of the different constituents of the ash were not made, with the exception of phosphoric pentoxide; the percentage of P_2O_5 in the ash of *P. elegans* being ·969.

THE BLACK PENCIL CEDAR.

(*Panax elegans*, F.v.M.)

The gums may therefore be considered as principally the calcium, magnesium, and potassium salts of arabic acid.

[*From Vol. VII (Series 2nd) of the "Proceedings of the Linnean Society of New South Wales" (January 27th, 1892).*]

Size.—Up to 50 or 60 feet, and a trunk diameter of up to 2 feet.

Habitat.—This tree is confined to coastal New South Wales and Queensland, in rich brushes. It occurs as far south as the Illawarra, and northerly into Queensland to Rockingham Bay, Rockhampton, and Edgecombe Bay. Particulars as to its southernmost limit are desirable.

I bring this tree under notice because of its high horticultural value, which seems much neglected. Growing in the rich soil of its native brushes, and surrounded by other vegetation, it overtops its immediate neighbours, exhibiting a graceful palm-like trunk, surmounted by a graceful plume of large handsome pinnate foliage. It is a scenic plant of great beauty, and in large gardens it would sometimes supply a pleasing variation to palms which, if not varied as regards kinds, may possibly be monotonous.

Propagation.—The fruits germinate readily.

EXPLANATION OF PLATE 24.

A. Flower buds in two stages.

B. Plan of flower—

(*a*) Petal.
(*b*) Stamen.
(*c*) Margin of disc.

C. Flower in vertical section; stamens removed—

(*a*) Petal.
(*b*) Styles.
(*c*) Two-celled ovary.
(*d*) Pendulous ovules.

D. Front and back view of stamens.

E. Fruit.

F. Vertical section of fruit, showing the two pyrenes (nutlets).

G. Horizontal section of fruit. Pyrene.

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PART II (ISSUED MARCH, 1903).

PART III (ISSUED MAY, 1903).

PART IV (ISSUED JULY, 1903).

PART V (ISSUED NOVEMBER, 1903).

THE FOREST FLORA OF New South Wales.

J. H. MAIDEN.

Published by Authority of the
GOVERNMENT OF THE STATE OF NEW SOUTH WALES.

PART VII.

Sydney : William Applegate Gullick, Government Printer.—1904.

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NEW SOUTH WALES

J. H. MAIDEN,
Government Botanist of New South Wales and Director of the
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No. 24.

Castanospermum australe, A. Cunn.

The Black Bean.

(Natural Order LEGUMINOSÆ.)

Botanical description.—Genus, *Castanospermum*, A. Cunn.

Calyx-teeth.—Very short and broad.

Standard.—Obovate-orbicular, recurved, narrowed into a claw; wings and keel-petals shorter than the standard, all free and nearly similar, erect, oblong.

Stamens.—Ten, all free; anthers linear, versatile.

Ovary.—On a long stipes, with several ovules, tapering into an incurved style.

Stigma.—Small, terminal.

Pod.—Large, coriaceous, almost woody, turgid, two-valved, spongy inside.

Seeds.—Large, nearly globular; cotyledons thick; radicle scarcely prominent, straight.

Tree:

Leaves.—Large, unequally pinnate.

Flowers.—Large, yellow to orange, and even red; in loose axillary or lateral racemes.

Bracts small; bracteoles none.

Botanical description.—Species, *C. australe*, A. Cunn. in Hook. *Bot. Misc.*, i. 241, tt. 51, 52.

A tall glabrous tree.

Leaves.—One to 1½ feet long; leaflets 11 to 15, ovate-elliptical or broadly oblong, shortly acuminate, 3 to 5 inches long, shortly petiolulate.

Racemes.—Under 6 inches long, either in the axils of the older leaves or on the leafless older wood; pedicels nearly 1 inch long.

Calyx.—About 8 lines long, including the turbinate base.

Standard.—Above 1 inch diameter.

Pod—8 or 9 inches long, about 2 inches broad, slightly falcate, almost terete, the valves hard and thick, the spongy substance inside dividing it into 3 to 5 cells, each containing a large chestnut-like seed. (B.Fl. ii. 275).

Var. *brevivexillum*, Bailey.

This variety differs from the normal form in that its flowers are smaller and of a canary yellow, and the standard shorter than the wings and keel-petals, of nearly the form of these, and but slightly recurved. Stamens nearly straight. (*Queensland Agric. Journ. Vol.* 1, where an illustrative plate is given).

Botanical Name.—*Castanospermum*, from the Latin *castanea*, a chestnut, and *spermum*, a seed. The tree is confined to Australia, and in non-Australian descriptions of it the name is usually explained on the ground that "the seeds are roasted like chestnuts." This matter is alluded to later on. *Australe*, Latin Southern, and hence Australian.

Vernacular Names.—Because of the seeds, which are very large beans, this tree goes under the name of Bean Tree; and because of the dark colour of the wood, and partly by way of distinction from the Red Bean (*Dysoxylon Muelleri*), it is usually known by timber merchants as Black Bean. Moreton Bay Chestnut is an old name for the tree, because it was first found in the Moreton Bay district (Queensland).

This tree was discovered by Mr. Charles Fraser, Colonial Botanist, and Mr. Allan Cunningham, a botanist then attached to the Royal Gardens at Kew, and who afterwards succeeded Mr. Fraser at the Sydney Botanic Gardens.

The plant is figured and described in Hooker's *Botanical Miscellany*, vol. i (1830), which contains an account of a botanical trip made by those gentlemen in the neighbourhood of Moreton Bay. A forest, "near Brisbane Town," contains "a most interesting new plant, producing fruit larger than a Spanish chestnut, by which name it is here known."

Aboriginal Names.—"Irtalie" is the name given to this tree by the aborigines of the Richmond and Clarence Rivers, New South Wales (C. Moore); "Bogum" was an aboriginal name in the northern parts of the same State; "Kongo" of the natives of the Russell River, Queensland (F. M. Bailey); "Wung-ah," of Herbert River (Q.) blacks (J. A. Boyd).

Leaves.—Mr. F. M. Bailey points out that the micro-fungi, *Asterina platystoma*, Cooke and Massee, and *Myriocephalum castanospermi*, Cooke and Massee, often injure the leaflets of this tree.

Flowers.—The flowers are borne on the last year's wood, bear a general resemblance to pea-flowers, though more solid and fleshy, and in colour vary from yellow, through all stages of orange, to coral red. They are very handsome, though not available for cut flowers. There are two forms, as has already been pointed out.

Fruits.—Mr. C. Fraser, Superintendent of the Botanic Gardens, Sydney, "being directed to establish a public garden in Brisbane Town," carried out this task in 1828, and was accompanied by Allan Cunningham. They discovered this tree, and Fraser says—

By the natives the fruit is eaten on all occasions; it has, when roasted, the flavour of a Spanish chestnut, and I have been assured by Europeans who have subsisted on it exclusively for two days, that no other unpleasant effect was the result than a slight pain in the bowels, and that only when it was eaten raw.

Sir William Hooker adds a note :

Although the large and handsome seeds are eaten by the natives of Brisbane River, and by the convicts in that part of our colony, as substitutes for our Spanish chestnuts, I have found them hard, bitter, and their flavour not unlike that of an acorn.

Extended experience shows that very few stomachs can tolerate them.

The principal food of our natives is the Queensland chestnut; the beans are cut into strips, soaked in water, and then either cooked as they are, or kneaded into cakes. (J. A. Boyd, Herbert River, Q., in a letter to the author.)

The aborigines usually scrape it, by means of jagged mussel shells, into a vermicelli-like substance, prior to soaking it in water.

The beans are used as food by the aborigines, who prepare them by first steeping them in water from eight to ten days; they are then taken out, dried in the sun, roasted upon hot stones, pounded into a coarse meal, in which state they may be kept for an indefinite period. When required for use, the meal is simply mixed with water, made into a thin cake, and baked in the usual manner. In taste, cakes prepared in this way resemble a coarse ship biscuit. (C. Moore.)

A sample of starch from these beans was exhibited by Mr. Moore at the Intercolonial Exhibition of Melbourne, 1866.

The starch or flour is neither better nor worse than many of the food starches at present consumed for food. As an experiment, a chemist at Lismore once made 40 lb. of starch from the beans, which he sold at 4d. per lb.

Dr. T. L. Bancroft, of Brisbane, has examined the beans, and is very emphatic in regard to their deleterious properties as far as man is concerned. He states that if a small piece of the bean be eaten it causes severe diarrhœa, with intense griping, and he says it does this whether it was previously soaked in water or even roasted. He states that no poisonous principle is removed by water, and no part of the plant is bitter.

Having considered these seeds as food for human beings, let us consider them as food for domestic animals.

Stock-owners have long waged war against this tree, owing to the fact that cattle and horses are poisoned through eating the seeds. They are not, however, a poison in the strict sense of the term, since no alkaloid or poisonous principle was for a long period found in them. All the same, the beans kill the stock owing to their highly indigestible character, the indigestible portion in time forming a ball in the stomach. The leaves also are found to be injurious, and animals which take to eating them become very fond of them, and when taken away return long distances to these trees, and according to some accounts become affected similarly to animals which eat the Darling pea, and, if not carefully looked after, they will pine away and die. Following are some interesting notes in regard to bean poisoning on the Richmond River :—

1883 was a dry season, and grass scarce. ——— informed me that he had lost over 100 head of cattle by bean-poisoning. Next day my attention was drawn to a few cattle in the stockyard said to be poisoned by eating beans. I inquired of the stockman if he had any proof that they had eaten beans, when he pointed to a beast that had died the day before, and beans had been taken from its stomach. In reply to my question he said he expected some of the cattle in the yard to recover. They appeared much purged, discharging thin watery fæcal matter. Cattle seem to be attracted by the bright green appearance of the beans as they lie upon the ground. Many cattle and horses on the Richmond have been lost from bean-poisoning. ——— lost a valuable entire horse and cattle in this way, and many others have similar experience. It appears to affect horses in a different way from cattle. ——— informed me that while removing horses from a paddock in which the bean-tree was growing two of them died without previously showing any symptoms of poisoning.

The seeds are also rapidly fatal to pigs in some cases, probably when devoured on an empty stomach. Opossums are stated to be fond of them.

Knowledge was in this state when Mr. J. C. Brunnich, chemist of the Queensland Department of Agriculture, took the matter up. Following is his report, taken from the *Queensland Agric. Journ.*, Oct., 1901, p. 422:—

For the analysis, I prepared the beans by shredding them roughly into thin slices, and determining the moisture in a fresh sample of these slices. The bulk of the sliced seeds was left exposed to the air to dry spontaneously. This air-dried sample was ground into a fairly fine flour (all passing through a sieve with thirty meshes to the inch), and this prepared flour was used for the exhaustive analysis, calculating the composition of the fresh seeds from the analysis of the air-dried flour.

The tabulated result of this analysis is as follows :—

	Air-dried Flour. per cent.	Fresh Bean. per cent.
Water	10·68	55·76
Fat	1·06	0·52
Chlorophyll	0·39	0·17
Albuminoids, soluble in water	5·41	2·68
" " " coagulated when boiling ...	1·18	0·59
" insoluble, Legumin	4·44	2·20
Glucoside, Saponin	14·58	7·23
Starch	37·54	18·59
Mucilaginous substances...	3·18	1·57
Dextrin	4·98	2·47
Glucose	0·64	0·32
Woody fibre	7·99	3·96
Crude ash...	2·21	1·09
Undetermined extra matter, colouring matter, organic acids, pectin, &c., by difference	5·72	2·83

Analysis of the Crude Ash.

	per cent.
Soluble in water	73·05
Insoluble in water, soluble in HCl	19·70
Unburnt carbon	7·25
Phosphoric acid	26·17
Chlorine	2·48
Potash	29·81
Soda	3·44
Lime	6·16
Magnesia	6·88
Unburnt carbon	7·25
Carbonic acid by difference	17·81

The result of the analysis was obtained as follows, most operations being carried out in duplicate :—

	per cent.	per cent.
Extract by petroleum spirit (boiling under 45 degrees C.) ...	1·02	1·10
Extract by ether (water free) chlorophyll	0·40	0·39
Extract by absolute alcohol, principally glucose, with a trace of tannin ; no alkaloids	0·73	Lost.
Extract by cold water	27·04	...

As the previous treatment with ether and absolute alcohol made some of the albuminoids insoluble, a fresh watery extract of the flour was prepared.

	per cent.	per cent.
Extract by cold water of air-dried flour	28·48	27·96
This watery extract contained :—		
Ash	1·65	1·60
Total nitrogen	1·054	1·055
Soluble albuminoids calculated from nitrogen	6·59	6·59
Soluble albuminoids coagulated when boiling the watery extract, vegetable casein	1·18	
Precipitated by absolute alcohol :—		
1st. Mucilaginous substances	3·22	3·14
2nd. Dextrin	4·98	6·70

When treating the watery extract with 4 vols. of absolute alcohol, there is a danger that part of the saponin is also precipitated with the dextrin, if the filtering is not done very quickly. As the second sample filtered very slowly, the dextrin contained a large amount of saponin, by giving the characteristic test, when treated with sulphuric acid.

	per cent.
Not precipated by absolute alcohol, glucose	0·64

For comparison with the usual method of extraction, extracts with benzol and 80 per cent. boiling alcohol were also made :—

	per cent.
Extract by benzol (C_6H_6) boiling at 81° C.	1·43
Extract by 80 per cent. alcohol (Sp. Gr. ·8483 at 15°)	19·88
Of this extract was :—	
Soluble in abs. alcohol	2·50
Insoluble in absolute alcohol, but soluble in water, and precipitated by sub-acetate of lead	17·16

The saponin was determined in accordance with the method recommended by Christophson and Otten (Dragendorff's *Plant Analysis*, p. 68), by extracting with boiling 80 per cent. alcohol, filtering when hot, boiling off the alcohol of this extract, and precipitating the saponin with concentrated baryta water. For the quantitative determination, the residue of the flour, after having been treated and extracted with petroleum ether, ether and absolute alcohol were used, and gave in an average of several determinations—14·58 per cent. saponin. Larger quantities of the glucoside were prepared from fresh samples of the flour. The purest saponin was obtained on cooling of the alcoholic solution, in the form of a white curdy precipitate. I also separated the saponin by evaporating the alcoholic solution, precipitating with baryta water, and decomposing the baryta saponin with carbonic acid, and separating the saponin by shaking the watery solution with chloroform.

The yellowish amorphous powder obtained had a peculiar sweetish taste, was easily soluble in water, chloroform, and in hot dilute alcohol. From the solution, it was precipitated with subacetate of lead, baryta water, and also, to a slight extent, by acetate of lead, but gave no reaction with Mayer's solution. By moistening a trace of the dry saponin with strong sulphuric acid, or, better, with fuming sulphuric acid, a beautiful red colour is slowly formed, turning purple and becoming darker on standing. This colour keeps for days. A small quantity of the saponin dissolved in water forms a strong froth on shaking the solution.

Both these reactions may be shown with slices of the fresh or dried seeds, as when moistening the surface with sulphuric acid, very shortly bright red spots and streaks are formed ; again, when putting a few slices of the seeds in water and shaking the mixture, a froth is formed as if soap were present.

A peculiar reaction, which I have not seen mentioned in any of the works at my disposal, is that the sample of saponin prepared from the beans, on the addition of ammonia, dissolves in the cold with a beautiful carmine colour, which appears only gradually, and gets more brilliant as exposed to the air. After a while the colour begins to fade, and remains yellow; when heating the red colour disappears rapidly. The saponin itself is not changed, as, on evaporation of the ammoniacal solution with sulphuric acid again, the characteristic glucoside reaction is obtained. Weak caustic potash dissolves a trace of the saponin with a brick red colour, also changed into yellow on standing or heating. I don't know if this peculiar reaction is due to the impurity in my samples of saponin or not. The air-dried sample of the bean was also tested for alkaloids, but no trace of a bitter principle can be found in alcoholic extract or acidulated alcoholic extracts. That the substance obtained from the hot alcoholic soluble extract is really a true saponin, is further proved by the fact that a solution of it does not reduce Fehling's copper solution. When heating a solution with dilute acids for some time, the saponin is decomposed into glucose, and into a substance, saponogin, sparingly soluble in water. The inverted saponin solution, due to the presence of glucose, acts at once on Fehling's solution. The saponogin is soluble in hot alcohol, and forms, on evaporation, a crystalline residue.

I consider the presence of a saponin in the beans undoubtedly proved, and the toxic effects of the bean are due to this glucoside.

As saponin is very soluble in water, it also shows that by soaking the crushed beans for a few days in water, as practised by our aboriginals before using the seeds as food, the poisonous principle is removed, leaving a rather valuable nutritious food.

Bark.—The bark is smooth, dirty gray externally, pale brown or yellowish internally. A tree 2 feet in diameter has a bark, say, ½ inch thick. It is not astringent, and therefore not to be thought of by the tanner. It is, however, bitter to the taste, and probably contains saponin, though I have not chemically examined it.

I wrote the above words concerning the bark in the *Agricultural Gazette*, N.S.W., Jan., 1894, p. 3, and it is interesting to find that, in 1901, Mr. Brunnich found a saponin in the seeds.

On the bark may be observed numbers of lenticels. These are organs (usually slightly raised) frequently found in the periderm of both stems and roots. They correspond to the stomata of the epidermis (commonly that of the leaf), and serve, like them, to admit air to the living internal tissues.

Timber.—It is easiest described by stating it strongly resembles walnut. I have always endeavoured to urge moderation in advocating the claims of colonial timbers, feeling sure that our timbers have received a good deal of harm from indiscriminate praise; but, having kept black bean under observation for a number of years, and having caused large quantities of it to be worked up into various articles, I think very highly of it. I look upon it as scarcely inferior to walnut. People sometimes complain of it that it warps and splits a little, but it does not do this if it receives the seasoning that cabinet woods receive in the northern hemisphere. Let black bean be felled when the sap is down, and given a reasonable amount of seasoning, and I do not hesitate to say that it may be pitted against walnut without disgrace. Black bean is easier to dress than even cedar; in fact, it is almost perfection as regards the ease with which a surface can be got on it. It polishes readily, but the grain is inclined to rise under polish. This timber often shows a beautiful figure; planks which have the figure in bands, like the marking of an agate, are really gorgeous.

Mr. Allen Ransome tested some specimens sent to the Colonial and Indian Exhibition. He thus reports:

A beautifully figured brown wood. The sample sent, being very wet, was tried under somewhat unfavourable circumstances. A baluster was turned from it, and some boards and panels planed; the work from both lathe and planing machine being excellent. The wood should prove valuable for cabinet-makers, but should be thoroughly seasoned before being used, as it shrinks very much in drying.

I have already alluded to seasoning in connection with this timber, but Mr. Ransome's specimen, "being very wet," is hardly a fair one from which to draw conclusions. In the building of the Austral Banking Company, in Phillip-street, Sydney, I have seen black bean used for framing twelve months after felling, and it was standing splendidly two years afterwards. A piece of black bean, bone dry, having been seasoned over 25 years, has a weight which corresponds to 39 lb. 8 oz. per cubic foot; but as a rule the timber is heavier than this. Although the great use and value of this timber is for cabinet work, yet it has been used for rougher work. I am informed that on the Tweed River it has been used for culverts, and when free from sap it lasts well underground. Mr. Forester Pope, of Murwillumbah, also reports:

Very durable; will last any number of years under the ground.

This is more satisfactory, as for many years it was not considered to be a durable timber. It is also used for staves. The sapwood is white and thick, and of all the hundreds of New South Wales timbers with which I am acquainted, I know of no other sapwood, other than that of Spotted Gum, so readily attacked and so promptly destroyed by borers as this one. Insects speedily reduce it to a flour-like substance.

Exudations.—A gum from this tree was shown in the New South Wales Court at the Paris Exhibition, 1867, but I cannot find any account of it, and it does not appear to have been examined. The bark of this tree is often glazed in patches with a gummy exudation, but I have not been able to get a quantity approximately pure. It is not likely to have commercial value as it does not appear to be soluble, but the samples seen may have been those from which the soluble portion had been washed away by the rain, leaving the insoluble, or metarabic portion.

Dr. Lauterer (see p. 167) gives a note on it.

Size.—A fair average height for the bean tree would be 60 feet or 70 feet, with a trunk diameter of 2 feet or 3 feet. At the same time it frequently attains a height of nearly double this, with a diameter of 5 feet or 6 feet.

Habitat.—It is usually found growing in brush land of the very richest soil, usually near the banks of rivers in the Clarence, Richmond, and Tweed River districts, but frequently in the scrub, a considerable distance from creeks and rivers. It comes as far south as the well-known Don Dorrigo Forest Reserve, in the Bellinger River district. It is also found in Queensland, extending a considerable distance along the coast districts, right into the tropics.

Propagation.—The tree is propagated from seed, the large "beans," and can be supplied by every nurseryman. The leaves are pinnate, as shown in the drawing, and in a mass are of more than ordinarily handsome appearance. The foliage is dark and the whole tree shapely, quite justifying Cunningham's laudatory remarks in regard to it. Those who are not familiar with the tree in its native habitat may see some magnificent specimens in the Sydney Botanic Gardens. It is one of our most beautiful native trees, always admired, and it should be more freely planted.

EXPLANATION OF PLATE 25 (FLOWER).

A. Calyx with stipitate ovarium.
  (*a*) Stipe.
  (*b*) Ovarium.
  (*c*) Curved style.

B. Standard.

C. Wing and keel petals.

D. Stamens (enlarged).

PLATE 26 (FRUIT).

A. Legumen (pod).

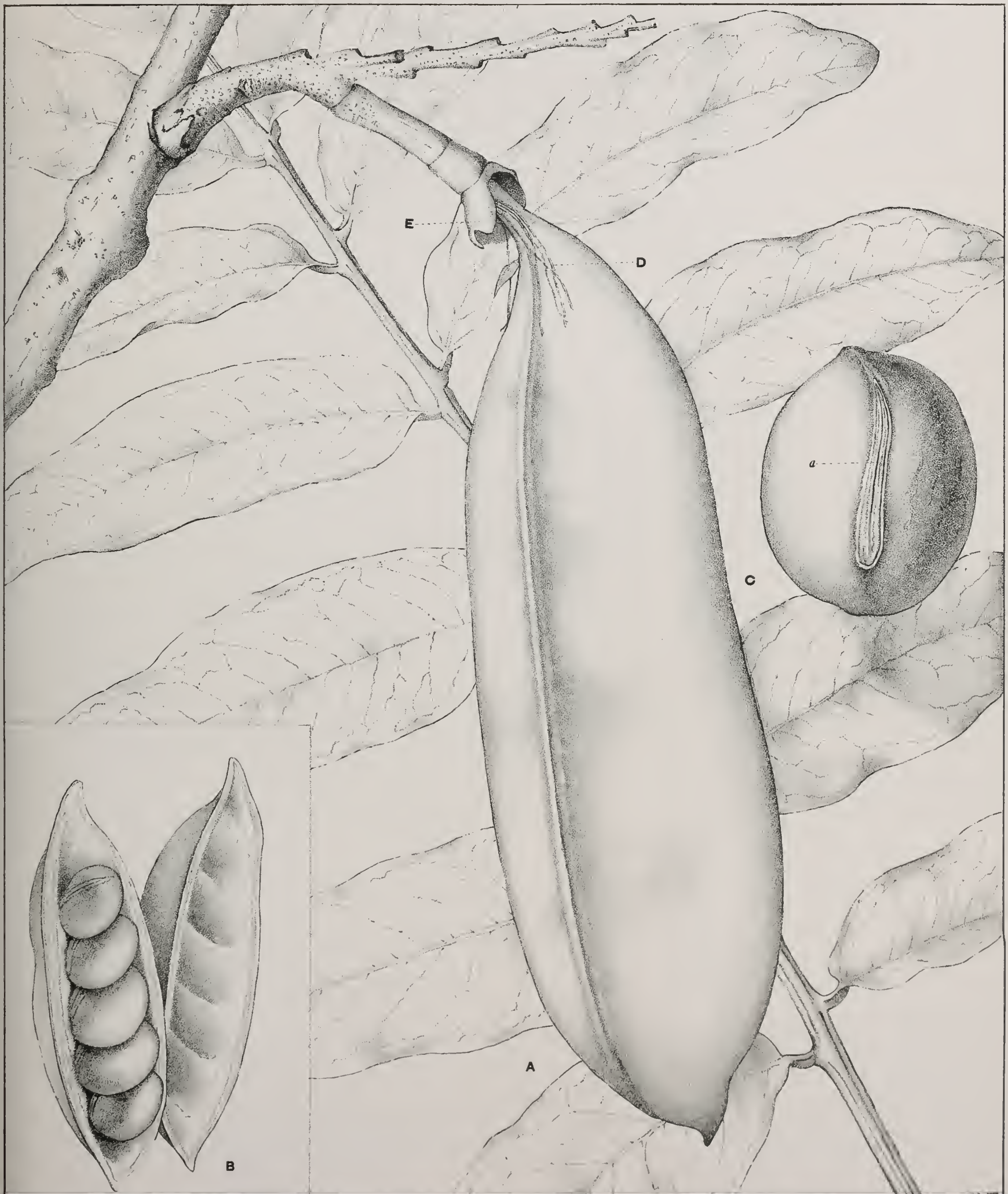
B. The same, after dehiscence by both dorsal and ventral sutures.

C. Bean (seed).
  (*a*) Hilum.

D. Remains of stamens.

E. Persistent calyx.

THE BLACK BEAN (FLOWERS).
(*Castanospermum australe*, A. Cunn.)



THE BLACK BEAN (FRUITS).
(*Castanospermum australe*, A. Cunn.)

No. 25.

Eucalyptus maculata, Hook.

The Spotted Gum.

(Natural Order MYRTACEÆ.)

Botanical description.—Genus, *Eucalyptus* (see Part II, page 33).

Botanical description.—Species, *E. maculata*, Hook., *Ic. Pl.*, t. 619.

Following is the original description, which will be useful for reference :—

Arbor excelsa, trunco maculato foliis alternis petiolatis lanceolatis longe acuminatis pellucido-punctatis purpureo-marginatis, nervis copiosis distinctis oblique patentibus, paniculis axillaribus terminalibusque parce ramosis folia brevioribus, operculo duplici, ext. conico-hemisphærico mucronato cupula subangulata breviore, int. (corolla) hemisphærico membranaceo nitido.

Eucalyptus sp. Spotted Gum, mss., n. 37.

Habitat.—Interior of N. Holland (Fraser) ; Maitland, Liverpool, and Newcastle (Backhouse).

A large tree, Mr. Backhouse observes, of which the bark falls off in patches, giving it a spotted appearance.

The timber is nearly equal to oak, but the sap or outer layers decay rapidly. The lid or operculum is double ; inner one membraneous. This inner one has justly been considered by Mr. Brown as the corolla, and it here forms an exactly hemisphærical glossy membraneous cup, which often continues to adhere after the outer one has fallen away. The gum from the tree contains benzoic acid. (Backhouse.)

Fig. 1.—Cupula and style, magnified.

Following is the description by Bentham, taken from his *Flora Australiensis* :—

A lofty tree with a smooth bark, falling off in patches, so as to give the trunk a spotted appearance.

Leaves.—Ovate lanceolate or lanceolate, straight or falcate, acuminate, mostly 4 to 6 inches long or even more, with numerous parallel but rather oblique veins, not so close as in *E. pyrophora*, Benth., and rather coarse, the intramarginal one close to the edge.

Umbels.—Three-flowered, usually several together, on short leafless branches, forming a panicle or corymb.

Peduncles and pedicels.—Short and thick, scarcely angular.

Calyx-tube.—In the young bud shortly cylindrical, when open broadly turbinate, 3 to 4 lines diameter.

Operculum.—Hemispherical, much shorter than the calyx-tube, the outer one much thicker and more persistent than in most species where it has been observed, and usually umbonate or shortly acuminate, the inner one (corresponding to the single one of most species) thin, obtuse, smooth, and shining.

Stamens.—Attaining 4 or 5 lines; anthers ovate, with parallel distinct cells opening longitudinally.

Ovary.—Flat-topped.

Fruit.—Ovoid urceolate, usually about ½ inch long, and nearly as much in diameter, the rim narrow, the capsule deep sunk (B.Fl. iii, 258).

A variety of the Spotted Gum, found in Queensland, has leaves of a citron or lemon scent, and is hence called Citron or Lemon-scented Gum. It was formerly called *E. citriodora*, Hooker; its name is now *var. citriodora*, F.v.M.

Mueller (Eucalyptographia, under *E. maculata*), thus speaks of it:

E. citriodora can only be considered a variety of *E. maculata*, differing merely in the exquisite lemon-scent of its leaves, and holding as a variety precisely the same position to *E. maculata* as *Boronia citriodora* to *B. pinnata*, or *Thymus citriodorus* to *T. Serpyllum*. Mr. Bailey, who had opportunities to compare the two trees promiscuously growing, confirms their specific identity.

Some writers prefer to retain *citriodora* as a species, just as nurserymen do, because of the perfume of the oil. It has been pointed out, over and over again, that an adaptive character, like oil, cannot be used for specific determination. In the present instance, however, I pointed out some years ago (and since then have, over and over again, repeated the observation), that the young foliage of *E. maculata* very commonly exhibits the *citriodora* odour when crushed in the warm hand. In fact, species and variety run into each other.

Botanical Name.—Eucalyptus, see Part II, page 34; *maculata*, Latin, "spotted," in allusion to the bark.

Vernacular Name.—Its almost universal name is "Spotted Gum." Occasionally one hears the name "Mottled Gum," which has the same meaning. The variety *citriodora* goes by the name "Lemon-scented" or "Citron-scented Gum."

Aboriginal Names.—"Yah-ruigne" was the name of the aborigines of the Illawarra, and "Booangie" of those of Cumberland and Camden, N.S.W., according to the late Sir William Macarthur. Mr. Forester Allan tells me that "Thurraney" was the name used by the South Coast blacks. "Urar" is a Brisbane name, according to T. Petrie. "Kangar" is a name employed by Queensland aborigines to denote the variety *citriodora*.

Leaves.—*Elastic threads in Eucalyptus.*

I was so much interested with the nature and behaviour of a leaf of *Eucalyptus citriodora*, which I picked yesterday, that I send you the specimen I dealt with, which I have mounted on the paper. When I broke the leaf, which was about 3 inches long, across the midrib, I found that there was an attachment, as of a thread or filament, at each of the outside edges of the leaf. On drawing apart the two broken pieces of the leaf these two threads still held on, and I slowly drew them out, when, besides stretching out like a thread of india-rubber, they gradually separated or unravelled from the edges of the leaf, both at the stalk end and at the tip of the leaf. The threads were so elastic that I drew them out to the length of 6¼ and 7¼ inches respectively before they broke, and they then curled up like a piece of india-rubber cord when the strain is taken off, and they now, after twenty-four hours, retain their elasticity. (*Gardeners' Chronicle*, February 7, 1903, p. 92.)

To which I replied :—

There is a small quantity of Caoutchouc in the leaves of (at least) the members of the Corymbosæ section of the genus. It is particularly observable in the widely-distributed *E. corymbosa*, Sm. (Bloodwood). It is a common thing to see small boys pull apart the young leaves of that species, and a thin membrane, mainly consisting of Caoutchouc, is at once obtained. (23/5/03.)

The quantity of caoutchouc in Eucalyptus leaves has not been ascertained, so far as I am aware, but it is not likely ever to be a commercial source of that article.

The leaves of the Lemon-scented Gum are used to a limited extent for perfumery purposes when dry; they are, however, of far greater importance as yielders of essential oil. As regards ordinary Spotted Gum, I am not aware that the leaves are distilled for commercial purposes. Following are some references to the oils of the Spotted Gum and its variety, emanating from the laboratory of the leading essential oil firm of the world, Messrs. E. Schimmel & Co., Miltitz, Saxony :—

Oil of Eucalyptus maculata.—The Spotted Gum-tree (*Eucalyptus maculata*) closely related to *E. citriodora*, Hook., grows in New South Wales and Queensland, but has also been transplanted to Ceylon and Algiers. The oil, of citronellal-like odour,* has the sp. gr. 0·900, boils from 210–220°, and cannot be distinguished from the following oil (*E. citriodora.*).†

Oil of Eucalyptus citriodora.—Eucalyptus citriodora, Hook., is probably only a variety of *E. maculata*, Hook., and is for this reason sometimes designated as *E. maculata*, Hook., var. *citriodora*. The tree grows best in strong ground. It is indigenous to Queensland, and has also been planted with succcess in India, in Zanzibar, and on the Magdalene River.‡ The fresh leaves are distilled in Gladstone (Queensland) and give, in the fresh state, 1–1·5 per cent.; in the dried state, 3–4 per cent. of oil.

The oil, distinguished through its pleasant citronellal-like odour, is much used as a perfume for soap. Sp. gr. 0·870–0·905. It is inactive or slightly dextrogyrate (a_D up to + 2°), and is soluble in 4 or 5 parts of 70 per cent. alcohol.

It consists to the extent of 80–90 per cent. of citronellal, $C_{10} H_{18} O$. The remainder of the oil, judging from the odour, consists of geraniol and citronellal. Cineol is not contained in it § (The above extract is also taken from Gildemeister and Hoffman's work, p. 537.)

An oil of *Eucalyptus citriodora*, recently obtained by us, *via* London, showed properties which differed somewhat from those observed in other cases, viz., specific gravity 0·865; $a_D = -15° 52'$ at 19°. Soluble in 7 and more parts of 70 per cent. alcohol. The aldehyde-content, found by Tiemann-Parry's cyanacetic-acid method, was 87 per cent. The determination can be made with this oil without difficulty, as it is free from slimy and wax-like substances, which, as in the case of oil of lemon, make it difficult or totally impossible to read the scale correctly.

Some oils previously examined in our laboratory had specific gravities from 0·870 to 0·905, were either inactive or slightly dextrogyre, and formed already clear solutions with 5 parts of 20 per cent. alcohol. (Schimmel & Co., April-May, 1901, p. 35.)

The Chemist and Druggist, of Australasia, 1890, in noticing a sample of oil of the Lemon-scented Gum, received from Mr. A. J. Timbury, of Gladstone, Q., says :—

The odour strongly recalls that of citronella, so that in its commercial career the oil will have to face the competition of one of the lowest priced of essential oils. For external medicinal use this resemblance

* Bericht von S. & Co., April, 1888, p. 19.

† "The Volatile Oils" (Gildemeister and Hoffmann, p. 536).

‡ v. Mueller, Select Extra-Tropical Plants, 1, 9th ed., p. 187.

§ Bericht von Schimmel & Co., Apr., 1888, p. 20; October, 1890, pp. 16 and 20; April, 1891, p. 19; April, 1893, page 27; October, 1893, page 17.

is rather against it, from the inevitable association with cheap hair-oil. . . . . . The oil is beautifully white, and the odour is very penetrating and endurable, so that there is every likelihood that it may find use in the manufacture of soap. . . . . . From the moderately dry leaves the yield is about 520 oz. to the ton, from fresh leaves 270 oz.

Following are some other references to literature of the oil of var. *citriodora* :—

Thoms (Dr.)—Oil of *Eucalyptus maculata*, var. *citriodora*. *Pharm. Centralh.*, 13th August, 1891, p. 469; *Pharm. Journ.* [3], xxii, p. 165. Expresses the opinion that the oil possesses no therapeutic properties not equally shared by citronella oil.

Kremers (E.)—On Citronellone; an unsaturated fatty aldehyde. *Am. Chem. Journ.* 14, p. 203; *Journ. Soc. Chem. Ind.*, xi., p. 935, November, 1892.

Semmler (F.W.)—Citronellal (Citronellone) Ber. 26, 2254 (1893). *Journ Soc. Chem. Ind.* xii, p. 1054, Dec. 1893.

See also a paper on oil of *Euc. citriodora*. (*Pharm. Journ.*, 5th September, 1896, p. 200.)

Messrs. Baker and Smith (Research on the Eucalypts) give the following particulars in regard to the oils of *E. maculata* and *E. citriodora* respectively. They should be compared with the analyses of Messrs. Schimmel & Co. quoted above :—

Sp. gravity at 159° C.	Sp. rotation $[a]_D$.	Saponification number.	Solub. in Alcohol.	Constituents found.
0·8959 to 0·9201	+ 5·7° to + 18·37°,.	6·47 to 9·56..	1 vol. 80 % to 4 vols. 80 %.	Pinene, eucalyptol, sesquiterpene.
0·864	— 1·15°	7·5	$1\frac{1}{2}$ vols. 70 % ...	Citronellal, esters.

Sucker Leaves (Use of the term "Sucker" in Australia).—The sucker leaves of the Spotted Gum (*see* figure) are more broadly lanceolate than the mature foliage.

In referring to an Australian work, two writers, penning a joint letter, criticise the use of the term "sucker" as used in Australia.

I largely use the term in the Australian sense, and propose to inquire into the correctness of such use.

Following is the passage :—

A minor fault . . . . is the use of the word "sucker." By "sucker" is properly understood shoots from the roots, such as one sees in poplars, elms, and willows. (1) Eucalypts do not sucker (2) (except rarely and accidentally), and the authors use the word in the sense of "coppice shoot." (3) No doubt "sucker" is an Australian colloquialism, but, naturally, the use of slang expressions (4) is to be avoided in a scientific work. To be accurate, the authors should uso the term early or first foliage (5) or its equivalent, since this important diagnostic feature is seen in the first foliage of Eucalypt seedlings equally with coppice shoots.*

The numbers are my own, and will be convenient for reference. I suppose there is no greater English-speaking authority on forestry than Schlich,† and I propose to quote him :—

(1) *Sucker*, or *Rootsucker*, means a shoot which has sprung up from a root. (Schlich i. 7.)

* "Nature," August 6th, 1903, p. 231.

† A Manual of Forestry, W. Schlich (in 5 volumes), London, 1896.

This is the theoretical British definition. The Australian definition of a sucker is young growth (usually of Eucalyptus), whether springing from root or stem.

(2) It is amusing for an Australian to be told this of Eucalypts. How happy would pastoralists and others be if such were the case! It may be largely true of a Eucalyptus plantation in a foreign land.

The definition of Coppice is :—

Coppice Forest or Copse.—The trees consists of stool-shoots or root-suckers, which are cut over periodically, either close to the ground or at some distance from it, every succeeding crop being created in the same way. (Schlich i. 10.)

Turning to a definition of "stool" we have :—

Stool means that part which remains in the ground after a tree has been felled close to the ground. It comprises the whole of the root system and the lower end of the stem up to the point where it emerges from the ground, or a short distance (generally a few inches) above the surface. (Schlich i. 7.)

In other words, a coppice shoot is a shoot from a root or from a stem—*i.e.*, a short stocky stem, the remains of a greater portion which has been already cut off. So that, to find fault with the use of the term "sucker" because it is stated to belong to the root exclusively, and at the same time to recommend the use of the term "coppice shoot," which is really a stem shoot, lands the authors on the horns of a dilemma.

(4) I object to the word "slang" as applied to the Australian term "sucker." This word is one of many which in English-speaking countries, such as America and Australia, are departing, more or less, from the meaning of the same word in the mother-land. I have shown that the use of the term is not incorrect. It is certainly not slang, and it is in universal use over hundreds of thousands of square miles.

(5) I see no advantage in the use of a clumsy and vague term, such as "early or first foliage." The earliest or first foliage is that of cotyledon leaves. These are succeeded by that foliage which may be termed "seedling leaves," and which are, morphologically, precisely similar to sucker leaves, while both seedling and sucker foliage develop into the mature leaves.

To the use of the term "sucker foliage," alike for the young leaves of root suckers and of growths from the stem, I can see no objection. Because the seedling foliage is, as has been indicated, morphologically similiar, Australians, botanists, and others, often in practice use the term "sucker foliage" for this also to save the trouble of endeavouring to ascertain the origin of the shoot, whether from a seed or from a root. The term "seedling foliage" is, of course, the correct expression in the former case.

Fruit.—Note the shape of the fruit, which is often like a small form of the Bloodwood (*E. corymbosa*). Note the tubercular prominences which are often seen on the fruit.

Timber.—Following is the main portion of a Report on Spotted Gum, drawn up by Messrs. G. S. Cowdery, J. V. de Coque, and the author, a Committee appointed by the Minister for Mines and Agriculture to investigate it. The full report will be found in the *Agricultural Gazette* for April, 1896.

The importance of a decision as to the merits of this timber, not only for wood-blocking purposes, but also as to its general utility in works of all descriptions, is apparent when we consider the large interests involved. This State is capable of supplying both the Sydney market and the markets of the world with an immense quantity of Spotted Gum timber for wood-paving and other purposes.

Notwithstanding the fact that we have individually had considerable experience as regards the durability and general value of Spotted Gum, we have secured information as to the experience of many gentlemen—engineers in the Department of Public Works, as well as saw-millers, and others. These reports, we need hardly state, are highly valuable.

Spotted Gum is a timber in regard to whose merits or demerits there exists very strongly-formed opinions, which are, in some cases, we are afraid, rather the result of tradition than of personal observation and experience.

That Spotted Gum timber has been used in the past to a considerable extent in paving the streets of Sydney is beyond doubt. We have taken the precaution to secure and carefully examine a considerable number of blocks from various parts of the city, not only of Spotted Gum, but also (for purposes of comparison as regards durability) other hardwoods used for a similar purpose. We have devoted a considerable amount of time to the diagnosis of these different timbers, which has helped us considerably in arriving at a unanimous opinion. We recognise that there are conflicting interests involved in the Spotted Gum question. But the fact must be borne in mind that if the export trade of hardwoods, particularly for wood-blocking purposes, shall acquire, and continue to maintain, the dimensions we believe to be in store for it, we shall require all our suitable hardwoods for shipment, and we think that there will not only be lucrative employment for existing saw-mills, but also for fresh ones in new forests in different parts of the State.

It is hardly within the scope of our present inquiry for us to draw comparisons between each class of hardwoods as regards their merits for wood-blocks; but we have no hesitation in stating that Spotted Gum, subject to certain conditions which we shall enumerate, compares favourably with the other timbers we have examined, and we recommend its use for wood-blocking in Sydney, as well as for export, but subject to strict supervision as regards quality.

Timbers mistaken for Spotted Gum.

To add to the inherent difficulty of the subject, some of our correspondents are under the impression that the Spotted Gum of New South Wales (and Queensland) is identical with that of Victoria. The Spotted Gum of New South Wales (*Eucalyptus maculata*) does not extend to Victoria, and the Victorian Spotted Gum, whose botanical name is *Eucalyptus goniocalyx* is an inferior timber to it.

Another correspondent alludes to a bastard Spotted Gum at Orange, which is a most inferior timber; we know of others in the Mudgee and Queanbeyan districts, both nearly worthless timbers, and any impression that they were varieties of the true Spotted Gum would be injurious to the reputation of that timber.

Mr. Forester MacDonald has seen the Smooth-barked Apple (*Angophora lanceolata*), which somewhat resembles the Spotted Gum in bark, cut up for Spotted Gum. *Angophora* timber is very inferior, and, if passed as Spotted Gum, would undoubtedly prejudicially affect opinion in regard to the merits of that timber. A certain amount of discrepancy in regard to reports is also to be accounted for by wrong diagnosis of timbers. Blackbutt, Stringybark, and even White Gum, of coarse, wavy grain, have all been sent to us as Spotted Gum, to which they bear a superficial resemblance more or less strong.

Specific Uses to which Spotted Gum has been put.

Our correspondents have used Spotted Gum for railway fencing, hammer and axe handles, way-levers, shipbuilding, paving-blocks, sleepers, decking and deck guards for bridges and wharfs, girders in bridge and flood openings, house carpentry, door-frames, sills and joists, buggy and dray shafts, and other portions of the bodies of vehicles, wheelwrighting, farm implements, boat timbers, tip waggons, railway buildings, railway and other bridges (laminated arches of railway bridges, sheeting, wings, wales and decking, hand-railing, braces, ballast guards, walings, girders).

Spotted Gum is largely replacing American Hickory in the coach factories along the coast for waggons, buggies, sulkies, &c., and large orders are being filled for coach factories in Sydney and elsewhere, care being taken to cut the timber free from sap, heart, and gum-veins.

Uses for which Spotted Gum is recommended by our Correspondents.

There is no difference of opinion as to its value for inside work for coachbuilders' purposes, and for such purposes as levers and handles, and rods for artesian bores, where great strength and elasticity are required.

In coachbuilding in this State, Spotted Gum has largely superseded Hickory, as already stated, and although not quite so elastic and strong as the best Hickory, is a very good substitute and cheaper.

Providing timber is matured and free from sap, no more suitable timber can be used for railway timber can be used for railway waggon building in Europe. Its strength and elasticity make it excellent for the purpose, particularly as railway engineers at home object to Ironbark owing to its excessive weight. They constantly ask for suitable hardwoods of less weight. The objection to the use of Blackbutt for the purpose is the presence of concentric gum-veins and its more fissile nature generally. The Hawkesbury and Singleton Spotted Gum are excellent as regards freedom from gum-veins. We have also seen Spotted Gum from the South Coast comparatively free from the same.

As regards outside work, its value for fence-rails is indisputable, while it bears a good reputation for deck-planking, as already spoken of in allusion to its durability.

Spotted Gum particularly considered with respect to its fitness or otherwise for Paving.

Hardly any situation affords so severe a test of the durability of a timber as paving. A wood pavement is constantly watered and in contact with decaying vegetable matter. It is, therefore, desirable that the blocks should be as well-seasoned as practicable, in order to reduce the liability of fungus growths to attack the tissues of the wood. On the other hand, we must guard against over-seasoning, which would result in the blocks absorbing an inordinate proportion of water, which would cause them to swell, to the destruction of the pavement, and perhaps the causing of injuries to buildings, tram-lines, &c.

Spotted Gum (like other hardwoods) is, when cut at the mills, immediately loaded into vessels. When landed in Sydney, the lengths are cut at once into blocks, and if at once placed in the streets, are as free to decay through the sap being unable to escape as are all other hardwoods.

The balance of evidence is strongly in favour of the use of Spotted Gum for planking and decking, but as regards paving-blocks we have very little information in these replies.

Mr. Gustave Fischer, Mr. R. W. Richards, and Mr. Moir, who have used it in the Sydney streets, are not in favour of it. Mr. Richards, in a Report* to the Forest Department, under date 31st October, 1893, states, page 2:—"The wearing surfaces of the blocks of Spotted Gum from King-street were thickly impregnated with gravel and extraneous matter, causing an irregularity of surface, the sides of the block in section showing a quick intention to split, the top edges of wearing surfaces were frayed over on each side for about one quarter of an inch in plan and section. Spotted Gum is a treacherous timber to deal with, inasmuch as if the tree is not fully matured, the blocks therefrom, painted with tar, laid in the work, enclosed air-tight, prevent the sap from escaping, and its fermentation sets up 'dry-rot.' This has occurred in many instances, and as one block is attacked dry-rot spreads throughout those adjacent. A sample block showing this decay is forwarded herewith." Again, page 10:—"My experience of Spotted Gum leads me to advise that the use of this wood be discontinued."

The same gentleman has also courteously replied to our schedule of questions (Appendix A.†), in which he still holds to his adverse opinion. So strong a condemnation, coming from such an important source, requires our careful consideration. We find, however, after examining over 200 wood-blocks, which were recently removed from various streets in Sydney, about 150 of which were presented (labelled as to class) to the Department of Forests, by the City Surveyor, that the names given on the labels are in some instances incorrect.

* "Wood Pavements in Sydney, 1880–1893." Fcap., Sydney, n.d. (1894). † Not reproduced.

In some instances we find a badly-worn block labelled "Spotted Gum," which on examination proves to be some other timber; and, again, some blocks which have worn well are Spotted Gum, although labelled otherwise. In other words, a general statement, whether of praise or condemnation, founded on data such as this, must be unreliable.

We further observe that in an official report by the City Surveyor to the Under Secretary for Mines and Agriculture, the rate of wear per annum, in the Sydney streets, of Spotted Gum and other timbers is calculated to very small fractions of an inch, and certain conclusions are based upon or left to be inferred from figures thus obtained. We are of opinion that, owing to the conditions under which the city paving-blocks were laid, the tests are of little value. To begin with, it is almost impossible to obtain blocks exactly 6 inches deep. This is recognised from the fact that it is usual to allow contractors a variation of $\frac{1}{16}$ of an inch when cutting, allowance being made for the set of teeth of the saw, and other circumstances it would be difficult to control. After the blocks are laid, the wear for some time will depend on the merits of the top-dressing (which varies under climatic conditions), and the position of the blocks in the carriage-way, whether they are near the centre of the roadway where the traffic is heaviest, or near the kerbs where it is likely to be less.

We are, therefore, of opinion that tests which do not fulfil accurately all and similar conditions are of little value.

The Advantages and Disadvantages to the Use of Spotted Gum considered.

(a) *Advantages.*

The advantages stated by several persons are—

1. Durability.
2. Strength, toughness, and elasticity.
3. Capacity for bending.
4. Lightness.
5. Easy working.
6. Evenness of quality.
7. Large sizes readily obtainable.
8. Comparative freedom from pipe.

1. Durability.

It has a life of over thirty years in the Singleton Railway bridge A similar life is stated for slabs in barns and slab-houses on the Berry Estate.

For bridge decking the life is given variously up to thirteen, fifteen, and sixteen years. Another correspondent states its life as six and ten years in "bridge and culvert work."

The life of joists is given at twenty years, and of girders at twenty-five years. We were informed of a girder twenty-six years in a bridge, and still quite sound. (Dingo Creek, Belbowrie, near Wingham.) The life of rails of a chock-and-log fence is given at thirty-five years. Several witnesses give the life of rails at twenty years, others thirty years, other "fences" (? rails) at forty and more. One correspondent gives the lives of "posts" at forty years.

Shingles are stated to last thirty years. Turning to shipbuilding, the planking, beams, &c., of a pilot steamer, after nineteen years' wear, were stated to be "as sound as ever." At the London Exhibition of 1862 a piece of timber was shown from the hull of the steamer "William the Fourth," and properly certified. With the exception of some slight charring on the mere surface of the timber in the immediate vicinity of the boilers, the entire fabric of this vessel is as substantial and sound as when she was built in the year 1830 (thirty-one years' wear). If the above statements as to the life of Spotted Gum be examined (and reference to the evidence will show that other instances of long life of the timber can be quoted), no doubt can remain that, under the circumstances alluded to, Spotted Gum is a very durable timber, in fact, that it is one of the most durable of our timbers for the purposes stated.

2. Strength, Toughness, and Elasticity.

We have already dealt with this in speaking of the fitness of Spotted Gum for coachbuilders' purposes, &c.

3. Capacity for Bending.

This is readily admitted, and advantage is taken of this property, which Spotted Gum possesses in a high degree, by the coachbuilder.

4. Lightness.

This is also a great advantage for light vehicles. Throughout the western district the coachbuilders purchase, at great expense, for cartage and railway freight, Spotted Gum for buggy and waggon building, no other available timber having the same elasticity and toughness.

5. Easy Working.

It gives a clean face, takes paint readily, and when at all seasoned before putting in work does not warp or twist, particulary in buggy shafts and poles.

6. Evenness of Quality.

This is an important question, all timber showing large gum-veins (or discoloured in appearance), or carrying any sap whatever, should be rejected. Timber must be cut from fully-matured trees, absolutely free from heart or heart-shakes and sap. Shipments should be uniform in colour, from one district if possible, and as free from veins as possible. For home railway waggon sizes, it should be specially selected. We feel confident if this is done it will at once command the attention of English engineers.

7. Large Sizes readily obtainable.

This is borne out by the heights and girths given by various correspondents in reply to question 19.

8. Comparative freedom from pipe.

This is more particularly applicable to southern Spotted Gum, and we do not know that it can be altogether considered to be an advantage. Freedom from pipe means presence of heart, inferior timber in regard to which special care is, or should be, taken to remove.

We do not recommend it for square girders, as it shells in square sizes under sun exposure.

(b) Disadvantages (as stated by various correspondents).

1. Liability to warp and twist.
2. Inclination to split.
3. Liability to attack by White Ants.
4. Great thickness of worthless sapwood.
5. Presence of Gum-veins.

1. Liability to Warp and Twist (irregular shrinking).

If the timber is cut when the sap is down, and allowed to season without exposure to the sun, it shrinks evenly, but if exposed to sun, and cut full of sap in small sizes, free of heart it twists from the heart out,—that is to say, it curves, with the heart side on the circumference.

Opinions are nearly equally divided, but the balance of opinion is in favour of Spotted Gum not shrinking more than colonial hardwoods usually do.

2. Inclination to split.

It does not split any more than Blackbutt, and not as much as Sydney Blue Gum (*E. saligna*). We think that increased attention should be given to the proper period for felling Spotted Gum, *i.e.*, it should be cut when the sap is up.

3. Liability to attack by White Ants.

Diversity of opinion exists in regard to this, but we are of opinion the durability of Spotted Gum is equal to that of the average colonial timbers as regards white ants, and superior to that of Ironbark and Blackbutt, to which they are very partial.

4. Great thickness of worthless Sapwood.

The sapwood of Spotted Gum decays most rapidly of all the sapwoods of the best timbers, and perhaps even of those of all hardwoods whatsoever. It is utterly worthless, and has contributed a good deal to the prejudice which exists in some quarters in regard to Spotted Gum. The sapwood should be removed with the greatest care. The sapwood readily crumble to a fine powder through the operations of the larvæ of a small beetle *(Lyctus brunneus)*, but these insects confine their attention to the sapwood. Because of the similarity of the sap to the other part of the timber, and because of the worthlessness of the former, the inspection of Spotted Gum demands especial care on the part of the inspector of timber.

We consider that it is especially unsuited for telegraph poles and piles, inasmuch as saplings of the size required for such purposes carry an inordinate proportion of sapwood, which is of a peculiarly perishable nature.

Spotted Gum should be cut from mature trees, and should be free from sap and heart-wood. It also should be well seasoned.

5. Presence of Gum-veins.

The timbers is often deteriorated by the presence of gum-veins, and we recommend the timber to be "as free of gum-veins as can be procured."

Minimum Girth for Felling.

The regulations of the Forest Department preclude the cutting of Spotted Gum trees less than 6 feet in girth, measured 5 feet from the ground.

In our opinion this regulation concerning minimum girth should be strictly enforced, and, if possible, should be extended to 7 feet 6 inches.

Exudations.—I am only aware of the existence of two previous analyses of this kino, but they differ exceedingly; and in the absence of the fullest details of the kinos, one cannot institute comparisons between them.

According to Mr. Staiger (quoted in Dr. J. Bancroft's "Contributions to Pharmacy from Queensland"):—

This kino is entirely soluble in boiling water to the extent of 60 per cent. It contains benzoic acid in an impure state, and catechin. The gum, insoluble in water, is of a sticky nature. When dissolved in alcohol, and the solution evaporated in the air without artificial aid, a sticky, clear, reddish brown, tasteless gum remained. If this is treated with ether, the sticky part of the gum goes into solution, and a dry, clear, reddish, tasteless gum remains possessing the qualities of shellac."

Mr. F. N. Grimwade (*Pharm. Journ.* [3], xvi, 1102) says of a sample:—

Soluble in rectified spirit to the extent of 80·85 per cent.; cold water dissolved 18·9 per cent. Warm water extracted "a slightly higher percentage." The amount of volatile constituents was determined to be about 7·07 per cent., and consisted almost entirely of water, with the merest trace of a volatile oil, to which the peculiar aromatic odour, strongly resembling styrol, possessed by the gum, is due. By steam distilling, two or three drops of this oil were obtained from about three-quarters of a pound of gum. I found no trace of either benzoic or cinnamic acids in the gum.

The tannic acid was found to be nearly allied to, if not identical with querco-tannic acid, giving the blue-black precipitate with ferric chloride, which is readily distinguished from the dirty-green precipitate produced by kino-tannic acid, the variety existing in the B.P. kino. Percentage of tannic acid, 10 per cent.

Dr. Wiesner says:—

E. citriodora, Hook., easily soluble in water; solution faintly acid, smells like Bordeaux wine; yellow colour, turbid on cooling. Porous lumps with greenish lustre, like Socrotine aloes; mixed with bark.

E. maculata, Hook. Exactly like the last.

This is one of the kinos mentioned as quite suitable for replacing the official kino in *Spon's Encyc. of Industrial Arts.* It is, however, an unfortunate statement as regards this species, chiefly on account of its colour.

"The kino from Cambewarra has quite a strong odour, something like decomposing apples or pears, or perhaps like a not perfectly sweet wine cask. But while the smell is hard to describe it is easily recognised, and it appears to be characteristic.

"That from New England has a smell similar to that which common resin gives out when held in the warm hand; while the other two samples have very faint aromatic odour. They all can be crushed between the fingers into a fine powder.

"No. 67. Kino from Cambewarra, collected August, 1886; height, 100-120 feet; diameter, 3-4 feet. Distinctly the darkest and most opaque-looking of all the samples of this kino examined, with the exception of some fragments of No. 70. It is exceedingly brittle, even when in compact masses. The fracture is fairly bright, and shows a great lustre. Colour, olive-brown to reddish-brown; forms a dull-looking powder of an olive-brown colour.

"In cold water it forms a yellow solution of the tint of fresh and pure olive oil, leaving a resinoid catechin residue of a dirty-brownish colour, very like soft toffee in appearance, and with the odour already referred to. On long continued digestion with water it loses its resinoid texture and almost entirely dissolves.

"Water at 100° C. (1 grm. to 1 litre) yields a browner solution than No. 68, and very turbid. Alcohol (to form tincture B.P. strength) yields an olive-brown solution, with a dark olive-brown, muddy residue, consisting largely of ligneous matter, and accompanied by a sticky substance. In ether a small percentage dissolves, and a lemon-yellow liquid is formed. The substance which gives the kino its odour is entirely taken up by the ether.

Following is an analysis, made October, 1888, of this kino:—

Catechin and tannic acid	84·25
Ligneous matter, &c....	1·95
Moisture	12· 9
Ash	·9
	100·00

Tannic acid determination (Löwenthal), 46·222 per cent."

The above is an extract from a paper* by me, but a full analysis of the kino is a desideratum.

Size.—The Spotted Gum is not usually more than 60 to 100 feet high, and with a stem diameter of more than 4 feet. Larger trees are, however, not phenomenal.

Mr. M. Ryan, of Little Mill, Cullendulla, writes to the *Evening News*, 18th June, 1895:—

About 1½ miles from my residence there stands, in Casey's Gully, an enormous Spotted Gum, said to be the largest on the South Coast. Those who have compared it with one on Mr. Higgins's selection, 14 miles distant, give the palm to that in Casey's Gully. Its circumference at the base is 44 ft. 1 in.; about 5 feet from the ground it measures 40 ft. 3 in. It scarcely tapers from that to the first limb, which projects at a height of 75 feet. The tree is about 100 feet high.

* The Examination of Kinos as an aid in the diagnosis of Eucalypts. Part iii.—The Turbid Group. (*Proc. Linn. Soc., N.S.W.*, 1891, p. 418.)

Another South Coast tree (Bateman's Bay) was examined by Mr. Forester Allan. It was 90 to 100 feet to the first limb, girth at 5 feet, 25 feet, and even up to 18 feet at first limb. The average was 21 feet for whole barrel.

Habitat.—Until a few years ago the Spotted Gum was believed to be confined to New South Wales and Queensland. Mr. A. W. Howitt* has received a specimen from Mr. J. H. King, showing that it occurs on the eastern slope of a spur from the Tarra Mountain, on the track from Buchan to Orbost, Gippsland, Victoria, and about 15 miles from the former place, where it forms a small compact colony of a few acres in extent.

In New South Wales it is found along the coast and coastal ranges. The most western locality known to me is Poggy, a wild district a few miles from Merriwa. There is also some on the Mudgee-Cassilis road. It prefers ridges and poor country, and is commonly found with Ironbark. It extends into Queensland, and is common in the south, but its northern limit is not defined. It probably merges into the lemon-scented form, which, according to Bailey, is found about Gladstone, Rockhampton, Springsure, Herberton, and Port Denison. The late Rev. J. E. Tenison-Woods says it is found right up to the waters of the Gulf of Carpentaria.

Propagation.—By seed.

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* *Victorian Naturalist*, xiii, p. 150 (1897).

EXPLANATION OF PLATE 27.

A. Sucker or juvenile foliage.

B. Twig, bearing flowers.

C. Fruits.

THE SPOTTED GUM.
(*Eucalyptus maculata*, Hk.)

No. 26.

Baloghia lucida, Endl.

The Brush Bloodwood.

(Natural Order EUPHORBIACÆ.)

Botanical description.—Genus *Baloghia*, Endl.

Flowers.—Diœcious or monœcious, in unisexual short terminal racemes.

Male flower—

Calyx.—Four or 5-lobed, the lobes imbricate in the bud or very short.

Petals.—As many as calyx lobes.

Disc.—With a thick raised undulate or irregularly-lobed border.

Stamens.—Indefinite, the filaments shortly united or inserted on a raised or conical central receptacle or column without any rudimentary ovary; anthers dorsally attached, with two distinct parallel cells opening outwards and longitudinally in two valves.

Female flower—

Calyx, *Petals*, and *Disc* as in the males.

Ovary.—Three-celled, with one ovule in each cell.

Styles.—Three, distinct or shortly united at the base, spreading, deeply divided into two branches (at least in the Australian species).

Fruit.—Globular, the exocarp often fleshy or succulent, the endocarp rather hard, separating into three 2-valved cocci.

Seeds.—Oblong, with a small caruncula; albumen copious, cotyledons flat, longer than and at least twice as broad as the radicle.

Tree or shrubs, glabrous except sometimes the flowers.

Leaves.—Opposite or alternate, coriaceous, finely veined.

Flowers.—Few, not small, the racemes sometimes almost reduced to umbels.

Bracts.—Very deciduous, with one flower within each.

Botanical description.—Species, *B. lucida*, Endl., *Prod. Fl. Norf.* 84, and *Iconogr.*, t. 122, 123.

A tall shrub or small tree, perfectly glabrous.

Leaves.—Opposite, very shortly petiolate, oblong, obovate-oblong or elliptical, obtuse or obtusely acuminate, rigidly coriaceous and shining, the primary veins numerous, fine but prominent, transverse and anastomosing.

Flowers.—Few together in short loose sessile terminal racemes, the males and females usually separate branches, but sometimes the one or two pair female and the upper two or three pair males : the pedicels opposite, ¼ or ½ inch long, solitary in the axils of very small bracts.

Calyx.—Deeply divided into five lanceolate lobes, varying to four only in the males, or rarely to 6 inches in the females, 2 to 2½ lines long.

Petals.—Oblong or lanceolate, nearly twice as long.

Disc.—In both sexes, with a thick irregularly-lobed undulate margin.

Stamens.—Numerous, the filaments very shortly united in a conical or oblong column or receptacle.

Styles.—Divided almost to the base into two branches.

Capsule.—Hard, globular, ½ to ¾ inch in diameter, somewhat tridymous, with a furrow bordered by two narrow ridges on the back of each coccus. (B.Fl., vi, 148.)

In the "Catalogue of the . . . Products of New South Wales," intended for the London Exhibition of 1862, and shown in Sydney, October, 1861, we have at p. 57, No. xe, 11—

Baloghia lucida, var. *Australiana*, F. Mueller. Brushes on the Clarence, abundant. A tree of general occurrence, and occasionally of considerable size. Timber not used.

I cannot find any description of this so-ealled variety, and probably it was dropped.

This tree, in Norfolk Island, is remarkably infested with the Mistletoe (*Viscum articulatum*, Burm.). Not only is the parasite very abundant, but the Brush Bloodwood is almost the only tree attaeked.

Botanical Name.—*Baloghia*, in honour of Joseph Balog, author of a work on Transylvanian Plants, published at Leyden in 1779; *lucida*, Latin, "bright or shining," in allusion to the foliage.

Vernacular Name.—It is commonly called Brush Bloodwood or (less eorrectly) Scrub Bloodwood. It grows in brushes, and is distinguished by the adjective from the eommon Bloodwood (*Eucalyptus corymbosa*). The late Sir William Maearthur, in his catalogue of southern (N.S.W.) timbers, called it "Roger Gough," but I know nothing of the individual thus eommemorated.

Aboriginal Names.—Sir William Maearthur gave "Nulliera" as the name given by the Illawarra blaeks, and Mr. Charles Moore "Nun Naia" by those of the Clarence River. "Dooragan" is another name attributed to the natives of northern New South Wales.

Synonym.—*Codiæum lucidum*, Muell., Arg. in DC. *Prod.*, xv, ii, 1116. In old writings eoneerning Norfolk Island it is often ealled *Croton sanguisflua* (allusion to the blood-red sap, of course), but I cannot traee the name otherwise.

Leaves.—At Mount Dromedary this species has the reputation of being greedily eaten by cattle. A farmer cut the limbs of this tree down for his cattle, and they would always eat the leaves of it before anything else that was given to them. (W. Baeuerlen.)

Timber.—Wood fine and close-grained. It is impregnated with a resinous substance, and burns readily in a green state. It is of a buff or even light reddish-brown colour (sometimes it is nearly white), apparently evinces little tendency to split, and is probably a useful timber. Some specimens of it are rather pretty when polished, although it has but little figure. It is fairly good to work. Two slabs of this wood, which were seasoned over twenty-five years (having been exhibited at the London International Exhibition of 1862), have weights which correspond to 44 lbs. and 45 lbs. 4 oz. per cubic feet respectively.

Exudations.—A blood-red sap oozes from the trunk when cut, and was obtained in the following manner in Norfolk Island:—

> A knife, similar to a farrier's, is used, but stronger, fixed upon a handle 4 to 5 feet long, which enables the workman to reach high up the trunk of the tree. A perpendicular incision is made through the bark, an inch wide at the surface, but tapering to a point near the wood, and from 8 to 10 feet long, forming the main channel through which the sap flows to the base of the tree, where a vessel is placed for its reception; branch channels are cut on each side of the main one, leading obliquely into it, 6 or 8 inches apart, and extending nearly two-thirds round the trunk. The sap generally flows from the channels for about twelve hours, when it is collected. The quantity produced by each tree varies; sometimes about a pint, but on an average about half that quantity. The sap forms an indelible paint, and was formerly used in the island for marking bags, blankets, and other articles. (Shepherd.)

Although very little used now, I was informed on the island that the red juice was formerly used as a stain for furniture made of Norfolk Island Pine (*Araucaria excelsa*).

I have seen the inspissated juice collected from New South Wales trees. Lauterer* gives an analysis of this substance.

Size.—Its height may be estimated at 40 to 60 feet, and its diameter 1-2 feet.

Habitat.—Coastal brushes of New South Wales and Queensland. Its precise southern and northern limits are not known: in the former State it is found in the Illawarra, and in the latter as far as Rockhampton and Rockingham Bay. It also occurs in Lord Howe's Island and Norfolk Island.

Propagation.—By seed. Its handsome dark green foliage and umbrageous habit renders it a pleasing object under cultivation in the shrubbery or arboretum.

---

* Gums and resins exuded by Queensland plants chemically and technologically described. From pages 35 to 80 of F. M. Bailey's Botany Bulletin, No. xiii (April, 1896).—Contributions to the Queensland Flora.

EXPLANATION OF PLATE 28.

A. Staminate flower.

a. Sepal.

b. Petal.

c. Lobed margin of the disc.

B. Vertical section of staminate flower, showing the stamens inserted on the sub-conical central receptacle.

C. Pistillate flower.

D. Anthers, front and back view.

E. Fruits.

F. Fruit separating into 3 cocci.

G. Transverse section of fruit, showing the 3 two-valved cocci.

e. Succulent exocarp.

f. Hard endocarp.

g. Seed.

H. Seed.

Sydney: William Applegate Gullick, Government Printer.—1904.

THE BRUSH BLOODWOOD.

(*Baloghia lucida*, Endl.)

INDEX OF TREES DESCRIBED.

THE FOREST FLORA

OF

New South Wales.

J. H. MAIDEN.

Published by Authority of the

GOVERNMENT OF THE STATE OF NEW SOUTH WALES.

PART VIII.

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THE FOREST FLORA

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J. H. MAIDEN,

Government Botanist of New South Wales and Director of the
Botanic Gardens, Sydney.

PART VIII.

*Published by the Forest Department of New South Wales, under authority of
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NO. 27.

Banksia integrifolia, Linn. f.

White Honeysuckle.

(Natural Order PROTEACEÆ.)

Botanical description.—Genus, *Banksia,* Linn. f.

Flowers.—Hermaphrodite.

Perianth.—Regular, or nearly so, straight or curved, the slender tube opening equally or along the lower side only; the limb ovoid, oblong, or linear; the laminæ remaining long coherent, or rarely separating as the tube opens.

Anthers.—Narrow, sessile in the concave laminæ, the connective thick, usually very shortly produced beyond the cells.

Hypogynous scales.—Four, very thin and membranous (rarely deficient).

Ovary.—Very small and sessile; style usually longer than the perianth, rigid, curved, and protruding from the slit in the perianth-tube until the end is set free by the separation of the laminæ, and then either straightened or remaining hooked or curved, rarely straight from the first and not exceeding the perianth; the stigmatic end on a level with the anthers, of a different texture but smooth, or striate and furrowed, continuous with the style or with a prominent rim at the base, the real stigma small and terminal; ovules 2, collaterally attached about the middle.

Fruit.—A compressed capsule, opening at the broad end (or rather outer margin, for the scar of the style is lateral) in two hard (often woody) horizontal valves.

Seeds.—Usually 2, compressed, with a terminal membranous wing broad and rounded like the valves, the seeds separated by a plate of the same shape (the consolidated outer integuments of the inner side of the two seeds) free from the ripe seeds, simple (completely consolidated) between the nuclei, double (remaining distinct) between the wings.

Trees or shrubs.

Leaves.—Alternate, or rarely verticillate, or nearly so; usually narrow, entire, toothed, pinnatifid or pinnate, with numerous (rarely few) short teeth lobes or segments, the primary veins numerous and transverse, rarely inconspicuous or irregular and the minute reticulations numerous on the under surface, with a minute tomentum rarely wanting in the areolæ, and sometimes white and covering the whole under surface, the upper surface almost always glabrous and smooth.

Flowers.—Sessile in pairs, in dense terminal cylindrical, oblong, or globular spikes, either terminal and sessile above the last leaves or rarely lateral or on short lateral branches, each pair of flowers subtended by one bract and two lateral rather smaller bracteoles, both bracts and bracteoles densely woolly, villous on the sides, the tips glabrous tomentose or villous, either clavate and obtuse or truncate, or shortly acuminate, always densely imbricate in parallel, spiral, or rarely vertical lines.

Perianth tube.—Very slender and entire within the bracts, ultimately splitting beyond them.

In fruit the bracts and bracteoles become consolidated with the rhachis into a thick woody cone, either covered with the withered remains of the perianths, amongst which the capsules are entirely concealed, or, where the flowers are wholly deciduous, the valves of the capsules protrude more or less beyond the bracts, the lower indehiscent portion containing the nuclei of the seeds remaining imbedded among the bracts. The proportion of perfect capsules is usually very small in relation to the number of flowers, of which there are often from 500 to above 1,000 in the same spike. (B.Fl., v, 541.)

Botanical description.—Species, *B. integrifolia*, Linn., f., Suppl., 127.

A tree attaining sometimes a considerable size, the young branches closely tomentose.

Leaves.—Scattered, sometimes irregularly verticillate, oblong cuneate, or lanceolate, quite entire or irregularly toothed, tapering into a short petiole, 3 to 4 in. long in some specimens, twice that length in others, especially the northern ones, ½ to near 1 in. broad, white underneath, with numerous transverse veins and reticulations not very prominent; the young shoots are also sometimes tomentose or villous, with richly coloured fulvous, almost woolly, hairs persisting on the under side till the leaves are nearly full grown.

Spikes.—Oblong or cylindrical, 3 to 6 in. long.

Bracts.—Tomentose at the end.

Perianth.—Usually about 1 in. long, silky; style straightening after the perianth-laminæ have separated, and usually very spreading or reflexed, as in *B. marginata.*

Fruiting-cone.—Oblong, cylindrical, the capsules prominent and not thick as in that species.—R.Br. in *Trans. Linn. Soc.*, x, 206; Prod., 393; Meissn., in *DC. Prod.*, xiv, 456; Cav. Ic. VI, t. 546; *Bot. Mag.*, t. 2770. (B.Fl., v, 554.)

Bentham (B.Fl. v, 554) has a var. *paludosa* of *B. integrifolia.* He says:—

Flowers scarcely larger than in *B. marginata*, the perianth 7 to 8 lines long, but the leaves of one of the common, short-leaved forms of *B. integrifolia*,

and gives the synonymy "*B. paludosa*, R.Br., *Trans. Linn. Soc.* x 207; *Prod.* 394; *DC. Prod.* xiv, 457; *Bot. Reg.* t. 697; *Lodd. Bot. Cat.* t. 392."

This is a dwarf, much-branched shrub found in the coast districts and coastal tablelands from south to north of this State. Mr. Camfield and I (*Proc. Linn. Soc., N.S.W.*, 1898, pp. 267–270) have shown that *B. paludosa*, R.Br., is a good species, and that it is certainly not a form of *B. integrifolia.* The paper is too long to print here, but it may be referred to in view of the confusion that has so long existed between the species. The cones, as described by Meissner (DC. *Prod.* xiv, 457) are referable to a form of *B. latifolia.*

Botanical Name.—*Banksia*, in honour of Sir Joseph Banks, long the President of the Royal Society of London, and deeply associated for a number of years with the welfare of the infant colony of Australia; *integrifolia*, Latin, *integer-gra*, entire or whole; *folium*, a leaf, referring to the margin of the leaf.

Vernacular Name.—The origin of the name Honeysuckle will be dealt with under "Flowers." This particular species is commonly known as "White Honeysuckle," primarily to distinguish it from *B. serrata* (Red Honeysuckle) whose timber is far redder than that of the species now under consideration. Often it is called "Coast Honeysuckle," from the situations it frequents.

Aboriginal Names.—"Curridjah" of the aborigines of the counties of Cumberland and Camden, New South Wales, according to the late Sir William Macarthur. Said to be the "Pomera" of some Queensland aborigines.

Synonyms.—*B. spicata*, Gaertn., Fr. i, 221, t. 48; *B. oleifolia, Cav. Anal. Hist. Nat.* i, 228, t. 14, Ic. xi, 30, t. 545; *B. macrophylla*, Link., *Enum. Hort. Berol.* 1, 116; *B. compar*, R.Br. in *Trans. Linn. Soc.* x, 207, *Prod.* 393; Meissn. in DC. *Prod.* xiv, 457.

Leaves.—There is considerable variety in the shapes of leaves of this species. This is indicated to some extent in the figure. As a rule, however, the specific name describes the shapê very well.

Bentham (B.Fl. v, 554), speaking of Queensland specimens, says:—

> The greater number of these northern specimens have remarkably long leaves, sometimes 8 to 10 in. long and ¾ in. wide, and constitute the *B. compar*, Br. They have also usually rather larger flowers, but neither character is at all constant, and R. Brown had himself at first referred his specimens to *B. integrifolia*.

Flowers.—In this connection, a valuable paper by Bentham* may be referred to, as it contains some notes on the fertilisation of this genus.

Speaking of the Natural Order as a whole, Kerner and Oliver (ii, p. 94) remark:—

> The pollen is deposited, whilst the flower is still in bud, upon the summit of the stigma, without, however, coming into contact with the receptive spot; the stigma in this case serves, at the commencement of flowering, as a temporary depôt for the pollen.

Coming back to *Banksia*, Bentham (*loc. cit.*, p. 59) says:—

> One thing appears certain, that there is no genus in the order where the stigma is longer kept smothered in a bed of pollen, whilst there is none where effective fecundation is proportionally more rare. In a cone of about a thousand flowers we often find not more than two or three dozen, and sometimes not one dozen, fully formed fruits.

This is one of the plants used by the aborigines for the honey or nectar they contain.

> The natives used also to compound liquors—perhaps after a slight fermentation to some extent intoxicating—from various flowers, from honey, from gums, and from a kind of manna. The liquor was usually prepared in the large wooden bowls (*tarnucks*) which were to be seen at every encampment. In the flowers of a dwarf species of *Banksia* (*B. ornata*) there is a good deal of honey, and this was got out of the flowers by immersing them in water. The water thus sweetened was greedily swallowed by the natives. The drink was named *Beal* by the natives of the west of Victoria, and was much esteemed.—(*Aboriginals of Australia*, R. Brough Smyth, i, 210).

Sir Thomas Mitchell (*Three Expeditions*, ii, 288), speaking of an "Ironbark" near Port Phillip (Melbourne), says:—

> The flowers are gathered, and by steeping them a night in water the natives made a sweet beverage, called "bool."

(Evidently the same name as that in the preceding paragraph).

---

* "Notes on the styles of Australian Proteaceæ." (Proc. Linn. Soc. xiii, 58.)

Other melliferous plants are and were used for the same purpose. Proteaceous plants are, as a rule, rich in honey.

The name "honeysuckle" was applied to the genus *Banksia* by the early settlers, from the fact that the flowers, when in full bloom, contain, in a greater or lesser quantity, a sweet honey-like fluid, which is secreted in considerable quantities, especially after a dewy night, and is eagerly sucked out by the aborigines.

It is so abundant in *B. ericifolia* and *B. collina* that when in flower the ground underneath large cultivated plants is in a complete state of puddle; bees and wasps become intoxicated, and many lose their lives in it.—(*Smith: Dictionary of Useful Plants.*)

This may possibly be true of a particular *Banksia,* cultivated under exceptional conditions. I have, however, never heard of such a case. It certainly does not apply, except in a very modified degree, to the case of any *Banksia* I have noticed, and since I observed the above statement I have taken the trouble to look at hundreds of individuals of various species with the view to testing its accuracy. I also requested Mr. Bäuerlen (a collector for the Technological Museum) to make similar observations, and he wrote:—

I have never heard from anyone having observed the liquid exuding so abundantly as mentioned by Smith. I have found the flowers pretty rich in the honey-like liquid, and when travelling over dry, waterless areas I have sometimes sucked the liquid from the flowers to quench my thirst, but always endeavour not to do so, as it invariably gives me a headache and a feeling of nausea afterwards.

Drummond (*Hooker's Journ. Botany,* ii) states that the natives of the Swan River district lived for five or six weeks principally upon the honey which they suck from the flowers of a species of *Banksia* (near *grandis*).

Fruit.—The only use to which these cones have been put, so far as I am aware, is contained in the following paragraph:—

The smaller and barren cones, being porous, were used with fat by the bushman in the early days of the colony as night lights.—(Melville.)

Timber.—We have two principal species of Honeysuckle, but although the wood of both is esteemed locally for various purposes, neither appears to be much in demand outside Australia. White Honeysuckle is a pinkish timber, showing a neat grain. It is, however, but little used as an ornamental timber, being chiefly employed for ribs and knees in boat-building, bullock yokes, &c. Minor uses are wood screws, bow-saw frames, walking-sticks, and clean turnery generally. Red Honeysuckle (*B. serrata,* Linn., f.) is a coarser, redder timber. It is largely used for boat knees. It is a much inferior timber to the preceding. A thoroughly well-seasoned piece of timber gave a weight of 39 lb. per cubic foot.

A drawback to this and other *Banksia* timbers is its liability for the living tree to be attacked by beetles.

Size.—Up to 40 or 50 feet high, and with a trunk diameter up to 1 feet.

WHITE HONEYSUCKLE.

(*Banksia integrifolia*, Linn., f.)

Habitat.—This tree extends from Victoria to Queensland. In the former State it is found in the southern and eastern portions. In New South Wales, it extends from south to north, chiefly in the coastal strip, but extending to the table-lands. In New England, for example, it attains a large size. In Queensland it extends a considerable distance along the coast, but its northern locality is not yet defined.

Propagation.—From seed. Bake the cone in an oven at a temperature of about 120° F., and the seeds will drop out. Sow them a quarter of an inch deep in a mixture of leaf-soil and sand.

An excellent tree for sandy sea-coast lands, and inasmuch as the vegetation suited to such localities is limited, and the tree is ornamental, it should be encouraged. Mr. J. H. Carruthers, M.L.A., has, from his own experience, advocated the planting of this tree for many years.

EXPLANATION OF PLATE 29.

A. Inflorescence (cylindrical spike).

B. Flower.
- (*a*) Four-lobed corolla.
- (*b*) Ovary.
- (*c*) Style.
- (*d*) Stigma.

C. Style (larger than shown in B).

D. Corolla lobe.
- (*e*) Back view.
- (*f*) Showing stamen.

E. Fruiting spike, showing the prominent capsules (*g*).

F. Winged seeds.

G. Portion of leaf, enlarged to show venation.

H. Showing the toothed margin of the leaf, often seen in this species.

No. 28.

Eucalyptus paniculata, Sm.

White or Grey Ironbark.

(Natural Order MYRTACEÆ.)

Botanical description.—Genus, *Eucalyptus.* See p. 33, part ii.

Botanical description.—Species, *paniculata,* Sm. Following is the original description :—

> Operculo hemisphaerico submutico, calyce angulosa, umbellis subpaniculatis terminalibus. This differs from the last in its angular calyx and less pointed operculum, as well as being smaller in all its parts. The umbels do not form so considerable a compound cluster of corymbs, but are collected about the top of the branches into a small panicle, the lowermost of them being axillary.
>
> My specimens were gathered at Port Jackson by Mr. David Burton, and I received them from Sir Joseph Banks' Herbarium.
>
> Of all these twelve species of *Eucalyptus,* I am not certain of any more being in the gardens than the *corymbosa, obliqua,* and *piperita.* The latter is very common and may be known by its smell, resembling that of peppermint. There are, however, several New Holland shrubs in the collections about London, which I suspect belong to the same genus; but having never seen their fructification I cannot ascertain them.—(Smith, in *Trans. Linn. Soc.* iii, 287, 1797.)

A full botanical description will be found in Bentham's *Flora Australiensis,* and also in Mueller's *Eucalyptographia.*

Botanical Name.—*Eucalyptus,* already explained, part ii, p. 34; *paniculata,* Latin, the inflorescence being paniculate.

Vernacular Name.—This is usually called "White Ironbark," by reason of the pale colour of its timber in comparison with others. For a similar reason it is often called "She Ironbark." The term "She" in this connection does not imply inferiority of strength (as the term "She" does, as a rule in Australia, as applied to timbers), since this is the strongest timber of the ironbarks. It is also called "Grey Ironbark." On the South Coast I have known it to be called "Red Ironbark," because of its pale red colour. The fact is that Eucalypts vary in the colour of their timber just as they do in every other character. Variation is a law of nature, applying impartially to timber, fruits, oils—everything. It would conduce to a sounder knowledge of these protean trees if their marvellous variation could ever be borne in mind.

Aboriginal Name.—"Parragilga," of the aborigines of the Bellinger River, according to Mr. Forester Mecham; "Thattinebark," of those of the Hastings, according to Mr. Forester Brown, "bark" being the name for tree.

Synonym.—*E. terminalis*, Sieb. (*E. fasciculosa*, F.v.M., found in South Australia and also in the far west of New South Wales, is a White Gum, with reddish timber. Its flowers and fruits, however, resemble those of *E. paniculata* a good deal, and it was for a number of years erroneously looked upon as a variety of that species.)

Leaves.—This species is not an abundant yielder of oil, so that the ironbarks felled for timber are not likely to have their leafy tops utilised for distillation.

Messrs. Baker and Smith ("Research on the Eucalypts") report thus on the oil:—

Species.	Specific Gravity at 15° C.	Specific Rotation. $[\alpha]_D$	Saponification Number.	Solubility in Alcohol.	Constituents found.
E. paniculata ..	0·901	+ 8·65°	7·11	1 vol. 80%	Pinene, Eucalyptol, Alcohols, Sesquiterpene.

In many Eucalypts the young growth of leaves (whether a young plant, or what is universally known in Australia as "sucker" growth) differs a good deal in appearance from the mature foliage. For example, to take perhaps the best known species, the young leaves of *E. globulus* are markedly different from the mature ones. This species may accordingly be termed dimorphic as regards its foliage. The term is only comparative, as all species present more or less dimorphism as regards those organs.

In *E. paniculata*, however, the dimorphism is not particularly marked—that is to say, there is not much difference between young and old foliage, the young foliage being more broadly lanceolate than the old. It would appear that those species with very dimorphic foliage are more archaic forms than the others. These forms have, in the course of ages, undergone much variation, as the result of environment, hybridism, and other causes. In other words, *E. paniculata* may, as compared with *E. globulus*, be a recent species, though I at once admit that the element of time is uncertain, since the forces which determine variation may re-act irregularly to form different species. In other words, one form, theoretically of archaic type, may be a shorter period in the making than one less archaic in appearance.

Fruit.—In referring to the plate, I have drawn attention to the fact that the fruit of this species varies in size.

Timber.—The Ironbarks form such a natural group that I think it will be best to give a preliminary account of them, and then a few notes on the species under present consideration.

We have four ironbarks, three of them of especial value. Timbers of this class are so important that it will be interesting to discriminate them. There is a good deal of confusion in regard to the local names given to ironbarks, and the names I suggest for the four species seem to me the least objectionable. At the same time, the name "Narrow-leaved Ironbark" and "Broad-leaved Ironbark" are too cumbersome for ordinary use, and certainly for persons outside the State. It is probable that ironbark for the export trade will go forward under two names only, viz., Grey Ironbark and Red Ironbark, the first being the White or Grey Ironbark, and the second including both the Narrow and Broad leaved Ironbarks, the timbers of which closely resemble each other. The fourth ironbark, whose botanical name is *Eucalyptus sideroxylon*, is mainly an interior species, and will seldom, if ever, be exported. Perhaps timber will go forward under the single generic name of ironbark; if so, I wish to impress on friends at a distance that our various species of ironbark vary a good deal in colour, as a consignee may readily be confused if an ironbark be sent to him different in appearance to that to which he has been accustomed.

Table of Ironbarks.—The following table brings out the principal points in ironbark trees and ironbark timbers, and may help to elucidate them:—

	White or She Ironbark (*paniculata*).	Narrow-leaved Ironbark (*crebra*).	Broad-leaved Ironbark (*siderophloia*).	Red Ironbark (*sideroxylon*).
Colour (darkens with age).	Very pale; pink when fresh.	Medium	Medium; a little darker than preceding.	Very dark.
Strength of timber	Best	Good	Good	Inferior.
Bark	Often pale-coloured, even grey. Furrows often anastomosing.	Very deeply furrowed, inferior in depth only (if at all) to *sideroxylon*.	Often of a flaky character.	Dark; deepest furrowed.
Leaves	Narrow and medium	Very narrow ...	Very broad ..	Medium; foliage often sparse.
Flowers	White	White	White	Crimson; sometimes creamy.
Fruits	Small	Very small ...	Rather large ...	Large.

How to tell Ironbark.—It is not very easy, in a few words, to give a definition of Ironbark. Of course, if the bark is available the thing is simple enough, for most of the barks are characteristically furrowed and rugged. To describe it we must take note of a variety of circumstances. It is heavy (almost the heaviest of our hardwoods). It is hard, as may be readily seen if it be touched with a plane, or a nail be driven (or attempted to be driven) into it. Its most characteristic property, however, is a certain "gumminess" in working, which is well brought out under the plane, and its horny texture. The result is that when planed ironbark shows the appearance of more or less parallel striæ, or lines of close textured wood, strongly resembling horn, while between these the wood has a more open grain, showing narrow pits which may be seen, even by the naked eye, to be filled by a substance of a resinous texture. In some specimens it is not easy, however, to make out these lines of horny-textured wood, but the resin-pits appear to be always present. Ironbark is more or less curly in the grain, consequently it often gives trouble to plane to a perfectly smooth surface. If a blunt tool be used the ironbark tears in fairly regular blotches, while to get a perfectly smooth surface the wood often requires to be traversed with the plane, or even to be gone over with the steel scraper. Its hardness and weight often preclude it from use, perhaps an advantage, as otherwise the consumption of this timber would be inordinate.

Principal uses.—Ironbark is the king of New South Wales hardwoods, in fact it is not excelled in any part of the continent for combined strength and durability. It is extensively used in bridge construction, for railway sleepers, for posts, for naves, spokes, shafts, and framing, by the waggon and carriage builder; for large beams in buildings, particularly in stores for heavy goods; in a word, wherever great strength is required. For such purposes as railway-sleepers, it will last an indefinite period, and in many cases has to be taken up, not because it shows signs of decay from exposure on the permanent-way, or disintegration, because of the vibration to which it has been subjected, but because holes have been made in the sleeper by the renewal of bolts and spikes. I have specimens of sleepers which have borne the heaviest traffic of the main line, near Sydney, for twenty-five years, and which are as sound as the day they were laid.

E. paniculata is the ironbark usually called White or Grey Ironbark in the coast districts. It is, however, also called Red Ironbark in the Moruya and Wagonga districts and other places.

The best white ironbark is very pale, the hardest of ironbarks, and cuts almost like horn; some of the same species from the Moruya district is of a medium red colour, not unlike Sydney blue gum in tint. It is to white ironbark of good quality that all the encomiums which have been passed on ironbark may be attributed. At the same time, timber but little inferior may be produced by some of the other ironbarks.

Size.—Usually a tree of medium size, say 60 or 70 feet in height, with a diameter of 2 to 4 feet; it exceptionally attains a greater size.

Mr. A. R. Crawford, a man of considerable knowledge of our timber trees, wrote me in 1896:—

On my recent visit to the Macleay I was informed by a gentleman there that an ironbark tree had not long before been measured by the mining manager of Baker's Creek Co., Hill, 125 feet to the first limb. The deeply furrowed hard barked species, which I think is *Eucalyptus paniculata*, is the kind meant.

Habitat.—It is chiefly found in New South Wales, extending practically along the whole of the coastal strip. I have obtained it almost from the Victorian border. Mueller records it from north-western Victoria, under the name of "Box Ironbark." It extends to southern Queensland.

It prefers ridges, often ironstone ridges, growing on dry, poor land, of very little use for any other purpose. Just as hard struggles in one's younger days bring out what is best in a man—his grit and quality—so we find, as a rule scarcely admitting of exception, that timber grown under "hard" conditions is better than timber growing more luxuriously as regards soil and moisture.

Propagation.—From seed; and it is a species that should be cultivated at every opportunity.

EXPLANATION OF PLATE 30.

A. Twig, showing buds, flowers, and fruits. The foliage is often pendulous.

B. Cluster of fruits of the size often seen.

C. Fruits of the smaller kind, by no means rare.

WHITE OR GREY IRONBARK.
(*Eucalyptus paniculata*, Sm.)

No. 29.

Barklya syringifolia, F.v.M.

(Natural Order LEGUMINOSÆ.)

Botanical description.—Genus, *Barklya*, F. Muell.

Calyx-teeth.—Very short and obtuse.

Petals.—All free, obovate, erect, similar, and nearly equal, on long claws, the upper outer one, or standard, rather broader than the others.

Stamens.—Ten, all free, longer than the petals; anthers sagittate.

Ovary.—Stipitate, with several ovules, tapering into a short style with a minute terminal stigma.

Pod.—Stipitate, flat, the valves thin and scarcely separating.

Seeds.—Flat, albuminous; cotyledons obovate, flat; radicle inflexed.

Tree.

Leaves.—Simple (unifoliolate), petiolate.

Flowers.—Small, yellow, in dense racemes.

Bracts.—Very small; bracteoles, none. (B.Fl. ii, 275.)

Botanical description.—Species, *B. syringifolia*, F. Muell. in *Journ. Linn. Soc.* III, 158, and *Fragm.* i, 109, t. 3.

A handsome tree, attaining from 20 to 60 ft., glabrous or the young shoots, and inflorescence rusty-tomentose.

Leaves.—Very broadly cordate, shortly acuminate, 2, 3, or even 4 in. long, and often as broad as long, entire, 5 to 7 nerved, on a petiole of 1 to 2 in., slightly thickened at the base and the top. Stipules small, ovate, deciduous.

Flowers.—Of a bright golden yellow, in dense racemes of 6 to 9 in., forming handsome terminal panicles.

Pedicels.—Short.

Calyx.—About 2 lines long.

Petal-claws.—Rather longer than the calyx, the lamina about as long.

Ovary.—Glabrous, with 3 or 4 ovules.

Pod.—Oblong-lanceolate, oblique or slightly falcate, $1\frac{1}{2}$ in. to 2 in. long, and about $\frac{1}{2}$ in. broad, narrowed at the base, with 1 or 2 seeds. (B.Fl. ii, 275.)

Mr. F. M. Bailey mentions a cultivated form with a tortuous habit of growth to which he gives the name var. *tortuosa* :—

A stunted form with zigzag branches, reminding of *Robinia Pseud-acacia*, var. *tortuosa*. It was raised from seed by Mr. A. J. Hocking. (*The Queensland Flora*, p. 449.)

Botanical Name.—*Barklya*—in honour of the late Sir Henry Barkly, Governor of Victoria at the time of recognition of the plant—*syringifolia*, from *Syringa*, the botanical name of the common Lilac, and *folium* a leaf, the leaves of the two trees being somewhat similar.

Vernacular Name.—If this tree has any vernacular or aboriginal name, I should like to know it.

Flowers.—The large dense racemes of small yellow flowers are the glory of the tree. They are borne in great profusion.

Timber.—The wood is hard, close-grained, and of a blackish-grey colour, considered to be possibly suitable for tool handles. It is but a small tree, not very abundant, and considering its beauty from a horticultural point of view, it would appear wicked to cut it down for use as timber, which is really inferior, having no special merit to recommend it.

Size.—Up to a height of 40 or 50 feet, with a stem-diameter of 12 to 15 inches.

Habitat.—This tree is confined to New South Wales and Queensland. In the former State it does not appear to occur further south than the Richmond River. In Queensland it has been recorded as far north as Rockhampton; but its precise southern and northern localities remain to be defined. It grows in rich brush land.

Propagation.—From seed. This is one of the most beautiful trees of medium size that Australia produces. It is of little or no economic value; but as a handsome plant it should be widely cultivated wherever moisture, warmth, and fairly good soil are available. There is a fine specimen in the Sydney Botanic Garden, and its rich dark exuberant foliage, surmounted by a golden crown of flowers every January, is worth a long journey to see.

EXPLANATION OF PLATE 31.

A. Flower bud.

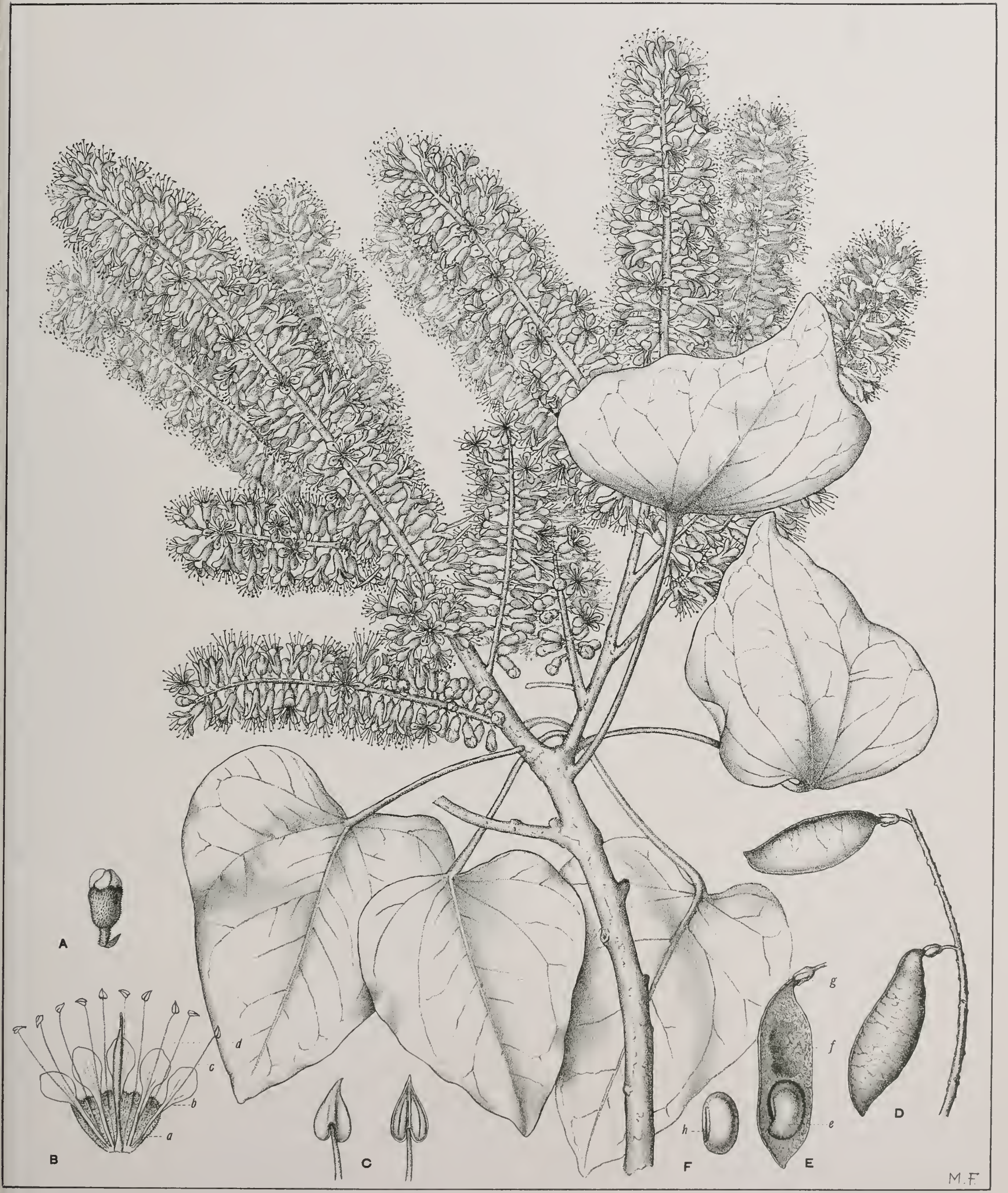
B. Flower examined vertically.
- (*a*) Calyx.
- (*b*) Petal.
- (*c*) Stamen.
- (*d*) Ovary (stipitate)

C. Anthers, front and back view.

D. Pod (stipitate).

E. Pod, valve removed, showing—
- (*e*) Seed
- (*f*) Seed-cavity.

F. Seed.
- (*h*) Hilum.



Barklya syringifolia, F.v.M.

No. 30.

Rhodosphæra rhodanthema, Engler.

A Yellow Wood.

(Natural Order ANACARDIACEÆ.)

Botanical description.—Genus, *Rhodosphæra*, Engler, in *Bot. Jahrb.* i, 423.

(Following is a translation from A. et C. De Candolle, *Monographiæ Phanerogamarum*, Vol. iv, p. 234–5 : Anacardiaceæ by Engler.)

Flowers.—Polygamo-dioecious.

Calyx-segments.—5, imbricate.

Petals.—5, erect, imbricate.

Stamens.—10 (in the female flowers shorter), filaments subulate ; anther obtuse on both ends, longitudinally dehiscent, of equal length.

Disc.—Short, cup-shaped, slightly 10-crenate.

Ovarium.—Sessile, nearly globular ; ovules solitary, suspended from a shortly ascending basal funicule.

Styles,—3, free, spreading, stigma capitate, provided with a blunt point.

Drupe.—Globose, the epicarp chartaceous, very smooth, the mesocarp thick and woody, the endocarp thinner and long, compressed.

Seed.—Ovoid, compressed, the testa thin, membranous.

Embryo.—Without albumen ; cotyledons flat, the radicle short, superior.

Leaves.—Impari-pinnate, subcoriaceous, slightly puberulous above ; leaflets shortly petiolulate.

Flowers.—Small, red, numerous, densely crowded in axillary and terminal pyramidal panicles.

Botanical description.—Species, *R. rhodanthema*, Engler. in *Bot. Jahrb.* i, 423.

Tree, 20-25 metres high.

Leaves.—About 2 dm. long, with 3 to 4 pairs of leaflets, the space between the leaflets 2 cm. long, the petiole of the leaflets 2-3 mm. long, oblong, shortly acuminate, obtuse, 6 to 7 cm. long, 5 to 2½ cm. broad, the upper half somewhat broader than the lower half, the lateral nerves underneath prominent, nearly parallel.

Panicle.—Pyramidal, densely flowered, minutely puberulous, up to 1 dm. long, secondary branches horizontally spreading, the lowest 3½ to 4 cm. long, the pedicels scarcely 1 mm. long.

Calyx-segments.—1 mm. long.

Petals.—2 mm. long, 1 mm. broad, reddish.

Stamens.—Scarcely 1 mm. long.

Drupe.—Cherry-shaped, globular, reddish-brown, shining, 1½ cm. in diameter, the endocarp 1 cm. in the thickest diameter. (Translated, *op. cit*)

Following is the original description by Mueller of his *Rhus rhodanthemum.* It is contained in an exceedingly rare serial,* and I am indebted to Mr. H. H. Shillinglaw, Secretary, Pharmaceutical Society of Victoria, for a copy :—

Dioecious, thornless; branches imperfectly tubercled; leaves evergreen, with two to five pairs of leaflets, which are flat, subcoriaceous, ovate, or ovate-lanceolate, bluntly acuminate, somewhat repand, above shining, below opaque, and in the axils of the veins and the midrib bearded; racemes red, forming a large panicle; peduncles and pedicels slightly downy; stigmas capitate; styles distinct; drupe dry, shining, brown, smooth, nearly globose; putamen slightly streaked. In the forest valleys and along the wooded banks of rivers around Moreton Bay.

A middle-sized tree, doubtless hardy in this State, and desirable, therefore, to be introduced, both for the sake of its umbrageous foliage and its showy panicles; leaflets generally between 1½ and 2½ inches long; petals hardly exceeding one line; drupes scarcely half an inch long, with a thin fragile pericarp.

Systematically to be consociated with *Rhus succedanea* from Japan, and *Rhus acuminata* from Nepaul.

Botanical name.—*Rhodosphæra* from the Greek *rhodon*, a rose (in allusion to the colour of the fruit, not happily described by such a name), and *sphæra*, a sphere, in reference to the shape of the fruit; *rhodanthema*, *rhodon*, a rose (in reference to the colour of the flowers, the name is appropriate in this instance); *anthemon*, a flower.

Vernacular name.—Yellow-wood; called also "Light Yellow Wood." See remarks under "Timber"; sometimes it goes by the name of "Yellow Cedar."

Aboriginal name.—"Jango-Jango" of some Queensland aborigines.

Synonyms.—*Rhus rhodanthema*, F.v.M. in *Journ. Pharm. Soc. Vict.* 43 (1858), with a plate; B.Fl. i, 489. *Rhus elegans*, Hill, in the list of woods contained in the *Cat. of the Natural and Industrial Products of Queensland* (London Int. Exh. 1862).

Flowers.—The flowers are pink or crimson in colour.

Timber.—It has a brownish or yellowish-bronze colour, with a silky lustre. When fresh, the colour is lighter than when the wood is older; but it is always inclined to a brown, and, therefore, the name "Light Yellow-wood" is very inappropriate, and should only be used for *Flindersia Oxleyana*. A slab in the Technological Museum, which has been seasoned over twenty-five years (having been exhibited at the London International Exhibition of 1862), has a weight which corresponds to 47 lb. 1 oz. per cubic foot.

The wood is soft, fine-grained, and beautifully marked; it is much esteemed for cabinet-work, as it is one of the handsomest of timbers. It is sound and durable, and will take an excellent polish.

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* *Transactions of the Pharmaceutical Society of Victoria*, Vol. i, No. 2, April, 1858. (With plate.)

As regards its combustibility, Mr. A. R. Crawford writes to me:—"It is difficult to burn, as it contains an acid. I had a fine sample at the Sydney International Exhibition of 1879; the judges' note said it burned freely; they had in mistake tried *Olea paniculata*, which burns like Pitch Pine."

In the following quotation* we have the first full account of this wood as a dye-wood, and also a useful note on the use of the term Yellow-wood as applied to *Oxleya xanthoxyla* (*Flindersia Oxleyana*). I cannot find, in spite of its name, that the *Flindersia* wood is used as a dye-wood, although its yellowish colour is evident.

In this instance little is known with certainty, either scientifically or technically, of the wood in question, beyond the fact that a tree, which furnishes an exquisite yellow dye, exists in the virgin forests around Moreton Bay. Although we are indebted to the late Allan Cunningham for a botanical account of a tree yielding a kind of yellow-wood at the eastern sub-tropical coasts of Australia, which plant, in honor of the discoverer of the Brisbane river, generically, and in consideration of the properties of its wood specifically, he named *Oxleya xanthoxyla*, it seems that doubts still exist whether really that tree alone, or some other species with similar evergreen pinnate foliage, of which the almost Indian vegetation of the East Coast is so rich, produces the only or the preferable dye.

Not having enjoyed, during a short stay at Moreton Bay, the opportunity to institute direct inquiries about this wood, I met hitherto with only vague and contradictory accounts; but it seems, according to the best authenticated statements, very probable that the specimen of Australian Yellow-wood, which attracted considerable attention at the Great Exhibition in Paris, originated, not from *Oxleya xanthoxyla*, but from an undescribed species of *Rhus*, a genus previously not found by botanists, represented in Australia, although amply developed in many other parts of the globe.

Probably the most important use of Yellow-wood will be as a dye, as a substitute for young fustic belonging to the allied genus *Rhus* (*R. Cotinus*). It has engaged the attention of A. G. Perkin in an important paper.†

Perkin states that the colouring matter of the wood is *fisetin*. The glucoside of the Yellow-wood is probably not fustin, as the only known glucoside of fisetin is.

Dyeing properties.—These experiments† were carried out in the usual manner, employing woollen cloth mordanted with aluminium, chromium, tin, and iron. The shades given by the Yellow Cedar are slightly weaker and differ considerably from those given by *Rhus Cotinus* (Young fustic) although both contain the same colouring matter.

	Chromium.	Aluminium.	Tin.	Iron.
Young fustic ...	Reddish-brown ...	Orange	Orange yellow ...	Brown-olive.
Yellow cedar ...	Yellowish-brown ...	Brownish-yellow ...	Golden-yellow ...	Olive-yellow.

Size.—Up to 60 or 70 feet in height, and with a stem-diameter of 18 to 24 inches.

Habitat.—It grows in the rich brushes of the Northern Rivers of New South Wales and of coastal Queensland. In the former State I have no record of

* Mueller, *op. cit.*

† Yellow colouring matters obtained from *Rhus rhodanthema*, *Berberis aetnensis*, and *Rumex obtusifolius*—*Journ. Chem. Soc. LXXI*, 1194 (1897).

its occurrence south of the Clarence River, but it should be looked for at least as far south as the Macleay. In Queensland it has only been recorded from the Brisbane River and Moreton Bay, but probably extends further north.

Hill, speaking of it as *Rhus elegans*, remarks :—

> A picturesque tree of very general occurrence in the scrubs on the banks of rivers. The trunk is of moderate size, covered with a rough, scaly, grey bark ; the branches are small, tortuous, and numerous ; the leaves are pinnate, the flowers terminal, and of a pinkish colour.

Propagation.—From seed. This is a beautiful tree, well worthy of propagation for purely ornamental purposes. Like other "brush" trees it requires good soil, moisture, and shelter. It is a handsome foliage tree, whose habit and general appearance under cultivation may be seen from a fine specimen in the Botanic Gardens, Sydney, near the aviary.

EXPLANATION OF PLATE 32.

A. Flower, seen from above.
  (*a*) Sepal.
  (*b*) Petal.

B. Back view of flower.
  (*a*) Sepal.
  (*b*) Petal.

C. Flower, with calyx and corolla removed.
  (*c*) Stamen.
  (*d*) Disc.
  (*e*) One of the three styles.

D. Fruit.

E. Drupe, showing the striate, woody putamen.

F. Longitudinal section through the fruit (and seed).

G. Transverse section through the fruit (and seed).

Sydney : William Applegate Gullick, Government Printer.—1904.

A YELLOW WOOD.

(*Rhodosphæra rhodanthema*, Engler.)

INDEX OF TREES DESCRIBED.

THE FOREST FLORA

OF

New South Wales.

J. H. MAIDEN.

Published by Authority of the

GOVERNMENT OF THE STATE OF NEW SOUTH WALES.

PART IX.

Sydney : William Applegate Gullick, Government Printer.—1904.

THE FOREST FLORA

OF

NEW SOUTH WALES.

J. H. MAIDEN,

Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney.

PART IX.

Published by the Forest Department of New South Wales, under authority of The Honourable the Secretary for Lands.

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No. 31.

Gmelina Leichhardtii, F.v.M.

The White Beech.

(Natural Order VERBENACEÆ.)

Botanical description.—Genus, *Gmelina,* Linn.

Calyx.—Four or 5-toothed or sinuate-lobed.

Corolla-tube.—Much dilated upwards, or almost campanulate; limb oblique, with 4 or 5 spreading lobes, the two upper ones sometimes united in an upper lip.

Stamens.—Four, in pairs, shorter than the corolla.

Ovary.—Four-celled, with 1 ovule in each cell laterally attached at or above the middle; style filiform, unequally 2-lobed at the top.

Fruit.—A succulent drupe, the putamen hard or bony, 4-celled or rarely 2-celled.

Seeds.—Solitary in each cell, without albumen.

Trees or tall shrubs.

Leaves.—Opposite, undivided.

Flowers.—Often rather large, pale purplish pink or blue, or in species not Australian yellow, in cymes arranged in irregular terminal panicles, sometimes almost reduced to simple racemes.

Bracts small.

Botanical description.—Species, *G. Leichhardtii,* F.v.M., in B.Fl. v, 66.

A fine timber tree, attaining a great height, the young branches and inflorescence tomentose.

Leaves.—Ovate, scarcely acuminate but rather acute, rounded or cuneate at the base, 3 to 6 inches long, somewhat coriaceous, quite glabrous, and almost rugose on the upper side, much reticulate, with raised veins and densely and softly tomentose underneath, the petiole often above 1 inch long.

Flowers.—"White, with purple markings," numerous in opposite pedunculate cymes forming loose ovoid or shortly pyramidal terminal panicles.

Calyx.—Broadly turbinate-campanulate, truncate, tomentose, and not 2 lines long at the time of flowering, enlarged and spreading under the fruit.

Corolla.—Villous outside, the tube very broad and dilated upwards, twice as long as the calyx, the lobes ovate, above 2 lines long, the two upper ones rather larger and shortly united in an upper lip.

Stamens.—Incurved, the longer pair about as long as the upper lip; anther-cells diverging.

Fruits.—In the specimens seen all deformed by insects, the calyx opening out horizontally to a diameter of 6 to 8 lines and obscurely sinuate-toothed. (B.Fl. v, 66.) See p. 186.

Botanical Name.—*Gmelina,* in honour of George Gmelin, a German naturalist and traveller (Georg Friedrich), author of a botanical work published at Tübingen in 1699. *Leichhardtii* is also in honour of a German naturalist and traveller, an Australian explorer whose name is ever before the people of New South Wales and Queensland.

Vernacular Names.—This tree is favoured by being universally known as Beech, or White Beech, and by no other names; but it should be borne in mind that hardly any term is more loosely known in New South Wales than that of Beech. We have a true Beech (the Negro-head, *Fagus Moorei*), and in addition She Beech, Blue Beech, Brown Beech, Bully Beech, and many other beeches, most of which only resemble each other in all being totally dissimilar to the beech of Europe.

Sometimes, in the Illawarra, it goes by the name of "Long Jack," owing to its size.

Aboriginal Names.—"Coo-in-new" of the Illawarra, according to the late Sir William Macarthur; "Binburra" of those of northern New South Wales. Mr. W. Baeuerlen informed me that an old timber-getter, of Lismore, told him that the aboriginal name was "Binna Burra." There is a station on the Lismore-Tweed railway line called Binna Burra, and his informant told him that this used to be the chief locality where they formerly obtained the White Beech, he himself having taken many and many a thousand feet of it from the locality. "Cullonen" was in use by some tribes in Queensland.

Synonyms.—*Vitex Leichhardtii*, F.v.M., Fragm. iii, 58, *Tectona grandis*, Hill, in *Cat. Queensland Woods*, London Exhibition, 1862, p. 20, where he speaks of it as follows:—

> This very useful tree has a lofty cylindrical stem; the bark ash-coloured; the leaves are obovate, downy underneath, from 4 to 6 inches long and from 2 to 3 inches broad. The flowers are in panicles, large, purple; the seeds in four-celled drupes. The wood has, by experience, been found to be useful; it is easily worked, and at the same time it is both strong and durable. It does not expand by damp and contract by dry weather. The river steamers of Queensland use it principally for the floats of their wheels. It is found in small quantities in the scrubs bordering the rivers.

Flowers.—They are very handsome, white with purple markings, as stated by Bentham, and sometimes almost entirely purple.

Fruits.—Fruit described by Maiden and Betche* in the following words:—

> This is the first time that we have noticed ripe fruits on the tree in the Gardens, and as the fruits are not described in the "Flora Australiensis" we give a short description of them:—Fruits of a dull mauve, almost blue colour, somewhat depressed globular, nearly 1 inch in diameter; always provided with the persistent, flattened out, and enlarged calyx.

Leaves.—The leaves are rather large, and show handsome venation, particularly on the underside. Like many other verbenaceous plants, they readily fall off in drying.

Timber.—A very useful timber, strong, durable, and easily worked. It does not expand in damp or contract in dry weather if moderately seasoned, hence

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* *Proc. Linn. Soc.*, 1902, p. 125.

it is much prized for the decks of vessels and the flooring of verandahs. Speaking of this timber, Mr. Baeuerlen wrote to me :—

> I have just seen a staircase, and eleven months ago the tree from which the wood was taken was growing in the forest. It was cut at once, green as it was, and up to the present no sign of shrinking or cracking can be seen.

It warps neither in plank nor in log. It is excellent for picture-frames, and is a wood frequently chosen where it would not be safe to trust a wood of which there might be doubts as to whether it would shrink or warp. It is used for the floats of mill-wheels, the jambs of windows, and for innumerable other purposes. It would be almost impossible to misplace it for ordinary indoor carpentry work. If I were asked to name the three most valuable timbers of New South Wales I would say, Grey Ironbark, Cedar, and Beech.

One drawback to this valuable timber is that where it is used for flooring which is exposed to the weather, around every nail there becomes a hole in the course of a few years. This is usually explained by ascribing to Beech some property which eats or rusts away the nails. For the same reason, wine-casks of Beech can never be hooped with black iron. So far as I am aware, no chemist has ever examined Beech to see if it contains a trace of free acid or some salt which would explain the corrosion above referred to.

Beech is largely used for the manufacture of vats for wine, and I believe it is an admirable wood for the purpose. It is too short in the grain to split, so that split staves cannot be made of it.

As regards its use by coach-builders, Mr. S. Lownds, Teacher in Coach-building at the Technical College, informed me—

> This is a very useful timber for panels and thin boards It is pretty durable, but rather soft, but its softness is, in some instances, an advantage. Where extreme heat or moisture has to be considered, as in bakers' carts, Beech will be found to withstand such influences better than most timbers. It paints and polishes well, is very easily worked, and does not readily split.

It is pale-coloured, white with a tinge of brown. As a very general rule, it is plain, but occasionally it shows a neat grain, which is ornamental. It is rather close-grained and excellent to work. If it be glued with Russian glue, mixed with sour milk, it will hold like solid wood when made into furniture. It is very extensively used for ships' blocks.

Up till a few years ago it was remarkable that no engineering tests had been made of such an universally-appreciated timber. Professor Warren has rectified the omission in his work on Australian timbers, published for the Chicago Exhibition. The timber referred to as White Beech is the one under discussion, the other beech (Negro-head) is a *Fagus*. Professor Warren gives the weight of some beech he tested as 49·1 lb. per cubic foot. I examined some which was bone-dry, having been seasoned over a quarter of a century ; its weight was 36 lb. per cubic foot. On the average (as found in the market), its weight is between 40 and 50 lb. per cubic foot.

Size.—From 80 to 120 feet high, and a diameter of 2 to 4 feet. The *Sydney Morning Herald*, of 16th August, 1898, says:—

An Enormous Beech Tree.—Mr. Nicholl's steamer, "Excelsior," which yesterday arrived in port, brought, as part cargo, an enormous beech tree from the Byron Bay district. The tree was cut into logs 9 feet in length, and averaged about 17 feet in girth. Only the main barrel of the giant was brought to Sydney, and this comprises 10,000 feet of timber, which filled one-half of the vessel's hold.

Distribution.—The north bank of the Shoalhaven is its southernmost limit in New South Wales; thence it extends along the coast, in brushes, to Southern Queensland. It is found in the Shoalhaven district and the Illawarra, but is not plentiful. It used to be found in Jasper's Brush, but not on the Cambewarra Mountain. Proceeding north, a few trees may be found in the brushes about Otford, Lilydale, &c., but I have not seen any. It skips the Sydney district and reappears in the Brisbane Water district, being cut at the present time, though to a small extent (as good trees are in almost inaccessible localities), about Wyong Creek, Cooranbong, &c. Then it is found here and there along the coast, but nowhere very plentifully. There is a good deal back from the Bellinger and Coff's Harbour. It occurs all through the Big Scrub, on the Richmond and Brunswick, and also in isolated patches of scrub on the Tweed. It is not a plentiful tree; it nowhere appears to be gregarious, but in isolated trees, far apart.

Following are a few specific notes:—

Never plentiful in my district; only a few trees left in very rugged places.—(Forester Martin, Gosford.)

One or two saplings only in my district.—(Forester A. Rudder, Bowral.)

It is found on Tallowak Mountain (back of Failford), also at John's River, and at Pappinbarra Creek, 40 miles back from Port Macquarie. This timber is getting so scarce that notes of localities from which it is obtained at the present time are interesting. Lattice-laths of beech were being cut at Laurieton.—(J.H.M.)

Sparsely distributed throughout the brush portion of my district. Large quantities have been removed from this district years ago, particularly from the Allgomera Forests and the Upper Nambucca; but not much remains in easily accessible districts. Probably from 20,000 to 40,000 feet might be readily obtained at an advanced price.—(Forester MacDonald, Kempsey.)

Very little in my immediate locality.—(G. M. McKeown, Wollongbar.)

A few trees are to be found on Reserves 4,353 and 10,723, county Rous; 14,150, county Buller, 1,120, counties Rous and Buller; on Crown lands, Haystack and Watershed between Koreela and Beaury Creeks, county Buller.—(Forester Crowley, Casino.)

Propagation.—From the fruits (beech-nuts). Unfortunately, however, they are usually attacked by an insect as they approach maturity, and this, combined with the natural hardness of the seed, renders propagation of the Beech usually a difficult matter. This is to be regretted, as one sees so few seedlings and saplings of the White Beech coming forward in the brushes. The tree, therefore, is within measurable distance of extermination in readily accessible localities. It would be nothing less than a national calamity if this valuable tree were to practically die out. In most cases our trees propagate themselves readily, and what is chiefly

THE BEECH OR WHITE BEECH.
(*Gmelina Leichhardtii*, F.v.M.)

required is to conserve the young growth, not to make artificial plantings; but in the case of the White Beech, I think an exception should be made, and artificial propagation resorted to in suitable localities. Indian Teak seeds are very similar to White Beech seeds, and indeed the two trees are closely allied, botanically. Both seeds take a long time to germinate under ordinary circumstances. The method of preparing Teak seeds for germination in India is to bury heaps of them in a shallow earthen pit which is covered over with soil and kept moist. When the seeds begin to germinate they are opened out and carefully planted.

Allies.—We have two other *Gmelinas* in Australia, but they are Queensland trees and do not extend to New South Wales. Their timber resembles that of our beech a good deal. There are five or six other species, confined to India, the Malay Archipelago, and the regions between.

Of the three Indian species of *Gmelina*, of which *G. arborea* is the most important, Gamble, in his *Manual of Indian Timbers*, says:—

> The wood is easily worked and readily takes paint or varnish; it is very durable under water. It is highly esteemed for planking, furniture, door-panels, carriages, well-work, boats, toys, packing-cases, and all ornamental work. It would probably be a valuable wood for tea-boxes. It is the chief furniture wood of Chittagong, and is in some demand in Calcutta.

He quotes Captain Baker as stating that it is—

> Well calculated for light planking, panelling, blinds, and venetians, and of much estimation for picture-frames, organ-pipes, sounding-boards, and such other work where shrinkage has to be avoided.

It is noticeable that this property of comparative absence of shrinkage is a characteristic of both the Indian and the New South Wales Beech.

EXPLANATION OF PLATE 33.

A. Corolla, opened out, showing didynamous stamens.

B. Exterior of corolla.

C. Gynæceum, showing unequally 2-lobed stigma.

D. Stamen, with diverging anther-cells.

E. Stamen, the anther discharging pollen.

F. Fruits.

G. Putamen (stone of the seed), the mesocarp (succulent part) removed.

No. 32.

Ventilago viminalis, Hook.

The Supple Jack.

(Natural Order RHAMNACEÆ.)

Botanical description.—Genus, *Ventilago,* Gaertn.

Calyx.—Five-lobed, spreading.

Petals.—Hood-shaped, or none.

Stamens.—Five, scarcely exceeding the petals when present.

Disc.—Flat or concave, filling the short calyx-tube.

Ovary.—More or less immersed in the disc; 2-celled; style short, with 2 short, erect stigmatic lobes.

Nut.—Globular at the base, produced into an oblong or linear coriaceous wing; 1-celled and 1-seeded, indehiscent.

Seed.—Globular; testa membranous; albumen none; cotyledons thick and fleshy.

Climbing shrubs or trees.

Leaves.—Alternate, penninerved.

Flowers.—Small, clustered along the branches of axillary or terminal panicles.

The genus is dispersed over the tropical regions of the Old World. The Australian species is endemic, differing from the others in habit and foliage, as well as in the absence of petals.

Botanical description.—Species, *V. viminalis,* Hook., in *Mitch. Trop. Austr.* 369.

A small glabrous tree.

Leaves.—Narrow, lanceolate, 2 to 4, or even 5 inches long, entire, narrowed into a petiole, coriaceous, the pinnate veins very oblique, and sometimes almost parallel with the midrib, without the elegant transverse venation of the rest of the genus.

Panicles.—Not much branched, or almost reduced to simple racemes, shorter than the leaves, solitary or clustered in the axils.

Calyx.—About 1 line long.

Petals.—None.

Disc.—Entirely adnate to the short, broad calyx-tube.

Ovary.—Slightly immersed in the disk.

Fruit.—Glabrous, about 1 inch long, including the wing, the turbinate adnate base of the calyx not attaining above a quarter of the length of the globular nut. (B.Fl. i, 411.)

The original description is as follows :—

V. viminalis (Hook., MS.); foliis anguste elongato-lanceolatis integerrimis nervis costa parallelis, paniculis axillaribus terminalibusque. The other hitherto known species of the genus have broad leaves, more or less denticulate, with patent nerves. The flowers and fruit entirely accord with those of the genus.—W.J.H. "Tree 20 ft. high, growing on high sandy ridges."

Botanical Name.—*Ventilago*; Latin *ventilo*, I blow (or winnow); *ago*, I drive gently, in allusion to the winged seeds; *viminalis*, Latin *viminalia*—all trees and shrubs yielding twigs fit to bind or make wicker-work, *e.g.*, willows.

Vernacular Name.—"Supple Jack," because of the flexibility of its stems and branches (referred to in the specific name *viminalis*).

I made the following notes while in the Bogan country :—

The Supple Jack takes its name from the circumstance that when young it often forms a thin supple stem, sometimes like a cane, and often this thin stem seeks the protection of an older tree, usually of its own kind, in its young state, often entwining more or less spirally.

This dependent stage is, however, not universal, the tree being often independent from the start.

The lateral branches have a marked tendency to grow inwards towards the larger branch or trunk from which they sprang. One clump may consist of a dozen stems intertwining, more or less, and they probably all have sprung from the same stock, suckering (they are so often cut down for stock) and their supple branches (sub-stems) intertwine with the original.

Supple Jack sometimes sends out lateral branches like vine tendrils which cling to the larger branches for support.

It seems to me that there is only *one* root for every clump of Supple Jacks, *i.e.*, it suckers freely. This is borne out by the fact that if you plough round a Supple Jack, suckers spring up wherever the root is injured.

Aboriginal Names.—"Cunnyannah," of the aborigines of north-western New South Wales; "Thandorah," of those of the Cloncurry River, North Queensland.—(E. Palmer.)

Leaves.—Speaking of the dry West, Mr. W. S. Campbell* says :—

The most valuable of our fodder trees seems to be, beyond all question, that known as "Supple Jack" in the western districts, or "Cunnyannah" in the north-west. Illustration No. 6 shows a typical specimen of a tree in its natural condition, and No. 7 shows one which has been lopped for fodder purposes for no less than five years in succession. This frequent lopping seems to have little or no effect on the "Supple Jack," which has wonderful recuperative qualities and adaptability for dry districts.

---

* *Agric. Gazette*, N.S.W., Nov., 1899, p. 1168.

Mr. R. W. Peacock's opinion of it as a fodder is thus expressed:—

And perhaps I may be deemed bold when I relegate such a widely-acknowledged fodder-plant as the Kurrajong to second place, but such I am forced to do, if any reliance can be placed upon the partiality of stock for them; for, from my own observations, backed by the experiences of others, to the "Supple Jack" (*Ventilago viminalis*) must be ascribed the place of honour.

I have been very much surprised that this valuable tree has not received the honorable mention due to it in this district. Upon plans of the lands on which the edible shrubs are given, no mention is made of it. Its general appearance, with its sparse foliage, is somewhat ragged, and would not catch the eye as would the Kurrajong and some others, it having in its natural state no pretensions to good looks; but after it has been properly lopped, a dense mass of suckers spring out; and I am of opinion that the amount of fodder is as great, or if not greater, than upon a similarly treated Kurrajong.*

Lopping of fodder trees should always be carefully performed. A sharp tomahawk, axe, or saw should be used, and the cut edge should be as clean and free from tears as possible.

Mr. F. B. Guthrie† has subjected the plant to analysis, with respect to its feeding value, with the following result:—

Water	33·16
Ash	6·61
Fibre	14·96
Ether Extract (Oil, &c.)	1·21
Albuminoids	11·03
Carbo-hydrates	33·03
Nutrient Value	$46\frac{3}{4}$
Albuminoid ratio	$1:3\frac{1}{4}$
Tannin (Oak Bark)	2·4

The leaves of *V. maderaspatana* are said to be a favourite food of the elephant in Ceylon.—(Trimen.)

Flowers.—This species differs from that of others in the absence of petals.

Bark.—The bark of the root of *V. maderaspatana* yields a valuable orange-red dye. It is also used for tanning, and also in native medicine in India. The bark of the stem is also employed for fibre purposes. It has not been ascertained whether the bark of the root or stem of our Supple Jack contains any useful substance.

Timber.—Wood soft and yellow; pithy. The natives use two sticks of the same wood from this tree for making fire with. It is generally used, and, being common, is the most generally used of woods for the purpose.—(E. Palmer.)

The tree is so small that its value does not lie in its timber.

V. maderaspatana, Gaertn., is described as—

A conspicuous forest climber of India and Ceylon. Wood yellow, porous, soft. Pores large oval, often transversely subdivided. Medullary rays moderately broad, undulating, bent at the pores.—[Gamble: *Manual of Indian Timbers.*]

It will be seen that the two species resemble each other a good deal in regard to their wood.

---

* Some edible trees of the West Bogan. *Agric. Gazette*, N.S.W., April, 1899, p. 263.

† *Agric. Gazette*, N.S.W., Oct., 1899.

SUPPLE JACK.

(*Ventilago viminalis*, Hook.)

Size.—Tree 20 to 30 feet high, forming a bushy tree. Its stem is under 1 foot thick.

Habitat.—The species is confined to the drier parts of South Australia, New South Wales, and Queensland. In South Australia it occurs north of the central district, chiefly comprising the basin of the Upper Finke River and its tributaries. In our own State it occurs in the dry west and north-west districts. Its southern limit is unknown to me. In Queensland it grows "on high sandy ridges" (Sir Thomas Mitchell), and it is found in many interior localities, extending northward as far as the Gulf of Carpentaria.

Propagation.—From seed, which is abundantly produced.

EXPLANATION OF PLATE 34.

A. Flower bud.

B. Flower.

(*a*) Sepal.

(*b*) Stamen.

(*c*) Disc.

(*d*) Style with two stigmatic lobes.

C. (*a*) Calyx. (N.B.—Drawn rather too narrow at *a*.)

(*b*) Ovarium in an early stage. As it ripens the two stigmatic branches or lobes fall away, while the top of ovarium flattens out to form the wing.

D. Flower (four sepals or calyx-lobes removed).

(*a*) Sepal.

(*b*) Disc.

(*c*) Stamen.

(*d*) Style.

E. Front and back view of anther.

F. Fruiting twig.

G. Winged fruit.

H. Nut.

No. 33.

Eucalyptus melliodora, A. Cunn.

The Yellow Box.

(Natural Order MYRTACEÆ.)

Botanical description.—Genus, *Eucalyptus,* L'Héritier (see Part II, page 33).

Botanical description.—Species, *E. melliodora,* A. Cunn.

Following is the original description:—

A. Cunn Herb. No. 57.—Schauer Mss.—Arborea glaucescens: ramulis pendulis teretib.; foll. coriaceis anguste lanceolatis subfalcatis in petiolum attenuatis acuminatis, margine incrassatis impunctatis concolorib. opacis; pedunculis axillarib; 3-5 floris petiolo duplo breviorib., pedicellisq. compressis, his cupula paullo longiorib: operculo coriaceo subhemisphærico vix apiculato cupula obconica triente breviori. Foliorum lamina 2½-3 pollices longa, 6 lin. circiter lata, pedunculus 3 lin. metiens, operculum 1 lineam altum cupulæ concolor flavescenti-virens. Flores mel redolentes.—In Novæ Cambriæ australis plagis interioribus occidentem versus frequens. (Schauer in *Walpers' Repert.* ii, 924.)

This description was published in 1843, and Allan Cunningham died in 1839.

Following is the description by Bentham, taken from his *Flora Australiensis*:—

A moderate-sized tree of irregular growth, with a smooth bark of a pale lead colour (A. Cunningham), scaling off in flakes in the upper part of the tree (C. Moore), furrowed and persistent (F. Mueller).

Leaves.—Lanceolate, usually narrow, acuminate and often falcate, mostly 3 to 4 inches long, rather thick, with very fine and rather numerous but oblique veins, the intramarginal one at a distance from the edge.

Peduncles.—Axillary or lateral, somewhat angular but not thick, usually short, each with an umbel of 4 to 8 rather small flowers on pedicels of one to two lines.

Calyx-tube.—Campanulate, about 2 lines long and diameter.

Operculum.—Hemispherical or shortly conical, with a small point, varying from a little shorter to rather longer than the calyx-tube.

Stamens.—About 2 lines long, the outer ones rather longer and anantherous, anthers of the others small, with contiguous cells opening in terminal pores, sometimes at length confluent.

Ovary.—Short, flat-topped; stigma dilated.

Capsule.—Sub-globose, truncate, not contracted at the orifice, or rarely ovoid and somewhat contracted; the rim rather broad, flat or nearly so, the capsule more or less depressed, but the valves somewhat prominent when open. (B.Fl. iii, 210.)

Botanical Name.—*Eucalyptus*, already explained, see page 34, Part II; *melliodora*—*mel*, *mellis*, honey, *odora*, of a sweet or pleasant smell.

Vernacular Names.—The commonest "Yellow Box" of New South Wales and Victoria. "Yellow Jacket" of the interior, the inner bark being of a yellowish colour. In the Merriwa and Cassilis district it is as often called Yellow Gum as Yellow Jacket (*see* "Bark"). It is sometimes called "Honey-scented Gum," owing to the perfume of its flowers.

Aboriginal Names.—By the aborigines of Gippsland it is known as "Dargan," according to Mr. A. W. Howitt. I do not know any New South Wales aboriginal name for a tree which is sure to have had a name.

Leaves.—The following particulars in regard to the oil from this species are taken from Messrs. Baker and Smith's *Research on the Eucalypts*:—

Specific gravity at 15° C.	Specific rotation.	Saponification number.	Solubility in Alcohol.	Constituents found.
0·9042 to 0·9321	+ 5·36° to + 6·19°	7·21 to 21·96	1½ vols. 70 % to 6 vols. 70 %.	Eucalyptol, pinene, phellandrene.

The same authors* give the specific gravity of the crude oil as 0·905 and of the rectified oil, 0·902, the latter containing 58 per cent. of cineol (eucalyptol). They further state that the cineol content of the oil increases towards the winter, but they are of opinion that the higher percentage of cineol has no influence on the specific gravity.

Mr. E. J. Parry, B.Sc.,† gives somewhat different figures, viz.:—Specific gravity, 0·917; specific (optical) rotation, 0°·37′ and 52 per cent. of eucalyptol. Mr. Parry challenges the statement that the percentage of eucalyptol is practically independent of the specific gravity.

Messrs. Baker and Smith's rejoinder follows.‡ Mr. Parry at the same place‡ maintains the correctness of his observations, and there the matter rests for the present.

Flowers.—This tree, like all of the Boxes, is an esteemed honey-yielder.

I send, by post, a sample of the great honey-producer, locally known as Yellow Box, and consisting of flowering blossoms and seeds, and wish to have same identified with a view to have this timber preserved on Forest Reserve No. 27,767 of 2,500 acres, as well as on new Goldfield Reserve of about 5,000 acres, as I am aware that this species of tree will produce more value in honey than the grass under them in wool. In fact, there are about 70 acres of this timber on my land, and some seasons I get more value in honey than if I had it cropped with good wheat at a fair price.—(James Brogan, of Attunga.)

* *Chemist and Druggist*, 17th February, 1900, p. 294.
† *Chemist and Druggist*, 13th April, 1901, p. 588.
‡ *Chemist and Druggist*, 6th July, 1901, p. 31.

Fruit.—The fruits are small and nearly hemispherical, and have a characteristic narrow band or rim, which usually encircles the slightly constricted orifice, and which is well seen on a side view of the fruit. The rim is similar in appearance to that observed in *E. sideroxylon* under similar circumstances. The fruit of the former species is, of course, much smaller.

Bark.—This tree has a characteristic inner bark, which is often as yellow as the proverbial guinea.

It is sometimes the case that it is difficult to discriminate this species from *E. Bosistoana*, another "Yellow Box," but a knife or axe will settle the question at once, the inner bark of *E. Bosistoana* being white.

In most parts of the country it has a sub-fibrous or "box" bark on the trunk or for a considerable distance up the butt, and smooth and even ribbony above it. Following are some notes made on the spot:—Bark flaky, ribbony, more like a cross between *E. tereticornis* and a Box than a true Box (Merriwa Creek). Many trees in the Merriwa and Cassilis district have, more than is usual, the appearance of a Gum than a Box.

In the Gulgong district, often with a considerable amount of clean stem.

Timber.—This is sometimes a remarkably gnarled, twisted tree.

The timber is pale-coloured, not white, but pale yellow, seasoning to a pale brown. It is remarkably interlocked, tough, hard, heavy and durable. In the south I have rarely heard the timber spoken of other than in terms of unqualified praise. In the north I have heard a few disparaging remarks, and two well-known experts say:—

> Not liked as posts in Liverpool Plains and Mudgee district. People will not accept it for posts for wire fences or for any other purposes if they can help it.—(Jesse Gregson and J. D. Cox.)

Another northern opinion says:—

> As a useful timber it nearly lasts in the ground twice as long as Box, and should be very valuable for mining purposes, as nearly every tree about would make lengths that would be long enough for this purpose. I wish to have it saved from the ring-barker.—(James Brogan, Attunga.)

It is said to be durable both in water and under the ground. The opinion of some Candelo (South Coast) people differs, however, on this point. A correspondent says:—"It is here considered the best timber all round, but does not, as far as I can learn, last long in the ground." There are many instances of such contradictory statements in regard to our native timbers, showing how much room there is for independent inquiry.

In many parts of the country it is much esteemed for posts, being looked upon as almost imperishable in the ground. It is excellent for culverts. It is often pipy, particularly in the dry west, but it is without doubt one of the most valuable trees the State produces.

THE YELLOW BOX.

(*Eucalyptus melliodora*, A. Cunn.)

It is often found with White or Grey Box (*hemiphloia*), in which case it is preferred to the latter, which is so hard and so difficult to split or square. This is the practical objection workmen have to it.

Exudation.—It has a reddish brown kino, which, when dry, readily crushes to a powder. It belongs to my "Turbid Group," that is to say it forms a turbid solution in water.

Size.—It is commonly 60 to 80 feet high, with a trunk diameter of 1 to 2 feet, but is not one of our largest trees.

Habitat.—The Yellow Box occurs in Victoria, New South Wales, and Queensland. As regards Victoria, Howitt says that it grows in a scattered manner over almost the whole of the State, lowlands and highlands alike, but nowhere exclusively as a forest.

The same observation can be made as regards New South Wales. It is found from south to north, in the mountainous country and table-lands, far away into the Riverina, and into country very dry, though not the driest, and away north-east and north to New England, even to Tenterfield. While I have not collected it in Queensland, I should be surprised if it does not grow in the country around Stanthorpe and the drier country to the west. If our country friends desire to assist scientific investigations, I would point out to them that of the vast majority of our plants we do not know the range, so that if they were to send twigs (or in the case of small plants, whole plants) our knowledge would rapidly increase.

The Yellow Box likes good soil.

Propagation.—From seed, which is readily procurable.

A few trees that I planted during the winter of 1895 are now (1902) beginning to bloom. When planted they were mere twigs and were removed into the holes in a spadeful of soil taken with them.—(J. Brogan.)

This is a highly ornamental and shade tree, usually of a drooping habit. It stands a fair amount of cold, while it is very drought-resistant. It will indeed flourish over large areas of country in this State and those who desire to cultivate Eucalypts should remember that this is one of the most desirable species.

EXPLANATION OF PLATE 35.

A. Young or sucker leaves.

B. Buds.

C. Flowers.

D. Fruits.

(All the above from a specimen from Rocky Hall, Eden to Bombala.—J.H.M.)

E. Fruits (from Wagga Wagga—J.H.M.).

No. 34.

Evodia accedens, Blume.

(Natural Order RUTACEÆ.)

Botanical description.—Genus, *Evodia* (for euphony) Forst. *Char. Gen.* (as Euodia), t. 7.

Flowers.—More or less unisexual.

Sepals.—Four or five, imbricate.

Petals.—Four or five, valvate or very slightly imbricate.

Disc.—Sinuate.

Stamens.—Four or five; filaments subulate or slightly dilated.

Ovary.—Of four or five carpels, usually distinct and style-like in the male flowers, more or less united in the females, styles attached below the middle, more or less united with a 4- or 5-lobed stigma.

Ovules.—Two in each carpel, collateral or superposed.

Fruit.—Separating more or less completely into coriaceous two-valved cocci, the endocarp separating elastically.

Seeds.—Seeds with a crustaceous testa, usually smooth and shining; albumen fleshy; embryo straight, with ovate cotyledons.

Unarmed trees or shrubs.

Leaves.—Opposite, usually digitately three-foliolate or pinnate, rarely one-foliolate or simple; leaflets entire, often large.

Cymes or panicles.—Axillary, or rarely terminal.

Flowers.—Small.

A considerable genus, spread over tropical Asia and the islands of the Pacific, and of the Madagascar group; all but one of the Australian species are endemic. The genus differs from *Melicope,* chiefly in the stamens equal to, not double, the number of petals, from *Zanthoxylum* by the leaves all or mostly opposite, generally by the more valvate petals and more united styles, besides minor characters offering occasional exceptions. (B.Fl. i, 361.)

Botanical description.—Species *E. accedens,* Blume, Bijdrag., 246.

An erect tree 70 to 80 feet high, thinly pubescent or glabrous.

Bark.—Light-coloured, somewhat thick and corky.

Leaves.—Trifoliate.

Petioles.—1 to 3 inches long.

Leaflets.—$2\frac{1}{2}$ to 5 inches long, ovate, shortly acuminate, chartaceous, pale on the under side, shortly petiolulate.

Cymes.—Lateral, the flowers crowded, pink, turning bluish as they die away.
Peduncles.—Short.
Pedicles.—About as long as the flowers.
Calyx-lobes.—About 1 line long.
Petals.—2 to 3 lines long, slightly imbricate.
Filaments.—Glabrous, filiform, 4 lines long.
Anthers.—Oblong.
Disc-lobes.—Semi-orbicular.
Style.—3 to 4 lines long, shortly pubescent.
Stigma.—Minute, capitate, 4-lobed.
Ovary.—Velvety.
Cocci.—Four or less by abortion, slightly compressed, globose-ovate, about 3 lines long.
Seeds.—Dark reddish-brown, ovate globose, $1\frac{1}{2}$ line long.

Botanical Name.—*Euodia* (*Evodia* for euphony), from the Greek *Eu*, *odmos*, sweet-smelling, fragrant in allusion to the foliage; *accedens*, Latin, approaching or near to (*i.e.*, resembling another species).

Vernacular Names.—I know of none.

Aboriginal Names.—"Bunnee-walwal," of those of Moreton Bay. "Boogoobi," of those of Herberton. (J. F. Bailey.)

Synonyms.—*E. Elleryana*, F.v.M. Fragm., v, 4, 56, 179 and vii, 22. Mueller in *Fragm.* IX, 102, gives the following synonymy:—*Euodia accedens*, Blume, *Bijdrag.* 246; Miq. *Annal. Mus. Bot. Lugd. Bat.* iii, 242, tab. vi. *E. macrophylla*, Bl. l.c.; *E. speciosa*, G. Reich. et Zoll. in *Nat. Tijdschr. Ned. Ind.* xxix, 255; *Xanthoxylon accedens*, *Miq. Flor. Ind. Bat.* I, sect. ii, 671; *X. macrophyllum*, Miq. l.c.

Leaves.—The leaves are sometimes infested with the fungus *Phyllosticta evodiæ*, Cooke.

Bark.—The bark of *Evodia meliæfolia* is used for dyeing, and also in medicine, in China and Japan. Perkin and Hummel* have investigated the colouring matter—the bark contains berberine. Considering the large number of *Evodias* which occur in this State and Queensland it seems appropriate to suggest that an Australian chemist should subject them to careful examination.

Timber.—Wood very white and rather hard. Its timber is not of high importance; it might be useful for carving. The chief value of this species is as an ornamental tree.

Exudation.—I have seen a little gum resin exuding from a tree of this species.

* *Proc. Chem. Soc.*, lxvii, 414, and *Journ. Soc. Chem. Ind.*, May, 1895, p. 461.

Size.—According to Mueller, this tree attains a height of 80 feet, but it is usually much smaller.

Habitat.—This tree is, in Australia, confined to New South Wales and Queensland. In our State it occurs from the Richmond River (its southern range is not yet known), and in Queensland it extends from end to end of the State, in the coast districts in brush forests. It is also found in Ceram and other localities in the Malay Archipelago.

Propagation.—From seed. It is a shapely, handsome shade tree which is only suitable for the warmer parts of the State, in rich brush soil, and where it can be well sheltered. It is, however, well worthy of care being taken with it.

EXPLANATION OF PLATE 36.

A. Inflorescence in a lateral cyme, growing out of last year's wood.
B. Flower, in vertical section.
C. Flower, seen from above.
The following letters, except *b*, apply to *both* B and C.
a. Sepal.
b. Petal.
c. Stamen
d. Disc.
e. Ovary.
D. Petal.
E. Stamens.
F. Flower, with petals and stamens removed.
G. Transverse section of ovary.
H. Fruiting branch.
I. Two of the four cocci.
K. Open coccus, containing two seeds.
L. Seed.

Sydney: William Applegate Gullick, Government Printer.—1904.

AN EVODIA.
(*Evodia accedens*, Blume)

INDEX OF TREES DESCRIBED.

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PART VII (ISSUED MARCH, 1904).

PART VIII (ISSUED MAY, 1904).

THE FOREST FLORA

OF

New South Wales.

J. H. MAIDEN.

Published by Authority of the

GOVERNMENT OF THE STATE OF NEW SOUTH WALES.

PART X.

Sydney: William Applegate Gullick, Government Printer.—1904.

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J. H. MAIDEN,

Government Botanist of New South Wales and Director of the Botanic Gardens, Sydney

PART X.

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No. 35.

Eucalyptus punctata, DC.

A Grey Gum.

(Natural Order MYRTACEÆ.)

Botanical description.—Genus, *Eucalyptus.* (See Part II, page 33.)

Botanical description.—Species, *E. punctata,* DC.

Branchlets.—Robust and very angular.

Leaves.—Scattered, elongate or sickle-shaped lanceolar, of thin consistence, beneath slightly paler and there not shining; the lateral veins numerous, very subtle, and much spreading, the circumferential vein close to the edge; oil dots numerous, imperfectly transparent; umbels axillary and solitary, or, at the summit of the branchlets paniculated; their stalks broad and strongly compressed, bearing generally from three to ten flowers.

Calyx-tube.—Almost semiovate or nearly hemispherical, merging gradually into an angular, rather thick, stalklet, of about the same or greater or lesser length.

Operculum.—Semiovate conical, as long as the tube or somewhat longer.

Stamens.—All fertile, inflexed before expansion; anthers almost oblong, but upwards broader, opening with longitudinal parallel slits.

Stigma.—Not or hardly broader than the style.

Fruit.—Nearly semiovate, three or oftener four, rarely five-celled, not large nor angular, rim finally rather broadish, flat, or convex; valves short, deltoid, at last exserted or convergent from the rim. (Mueller, in "Eucalyptographia.")

Variety *grandiflora,* Deane and Maiden (*Proc. Linn. Soc., N.S.W.*, 1901, p. 133). This is a large-flowered and large-fruited form.

Leaves punctate. Buds all ovoid. Double operculum. Rim at junction of calyx and operculum very sharp. The calyx-tube usually angled. Fruits, 7 to 8 lines in diameter. Valves usually not much exserted.

I have an intermediate form (from Wyee), with valves well exserted; shape hemispherical, or nearly so, to conoid. Rather broad rim. Bark and timber not to be distinguished from that of normal *punctata.* This large-fruited form is well-marked, and well worthy of being a named variety. As in *resinifera,* so in *punctata,* there is no line of demarcation between the normal and *grandiflora* forms, the transition being gradual.

Comparing this with the normal or small-fruited form, Mr. Augustus Rudder, a forester of considerable experience, writes in the *Agricultural Gazette*:—

This is one of two trees with the same vernacular (Grey Gum). In general appearance, to the casual observer, the trees are much alike, but the leaves of this are rather broader, and its fruits and blossoms are very much larger than those of the other variety; and the trees generally are not so large, and are more limited in range of habitat, and, as a rule, do not approach so near to the coast, though I have seen it at Raymond Terrace; and near the beach at Charlotte Bay and Wallis Lake, in this district, the two trees often grow together. I have mostly observed it on the lower ranges in the counties of Gloucester and Durham. The timber is red in colour, is hard and very lasting, and is well suited in the round for heavy timbers in bridges and culverts.

I have personally collected it within the range stated. Hitherto this form has only been found north of Port Jackson.

This tree has been frequently confused with the *grandiflora* form of *E. resinifera*, where herbarium specimens only are available; in the forest the two trees could not be confused for a moment, their bark immediately distinguishing them. The buds also are very different, those of the variety of *punctata* being, as already indicated, ovoid,* and the rim very sharp, with frequently a double operculum, while that of the variety of *resinifera* being conical and even rostrate.

The fruits of the variety of *resinifera* have the valves more exserted, and they sometimes have a tendency to be conical.

Messrs. Baker and Smith (*Research on the Eucalypts*, p. 128) have evidently overlooked this, and have renamed it var. *major*, stating—

This is a variety with larger fruits and flowers, and, as far as known, occurs only at Booral, New South Wales.—(A. Rudder.)

The same gentlemen (*op. cit.*, p. 127) describe a var. *didyma* :—

This variety is distinguished from the type by its having two opercula to each bud, and by the difference in its oil. The outer operculum is thin, and is shed very early in the budding stage, so that it is scarcely ever to be found in herbarium material. The fruits always have a broad groove below the rim, and the leaves are also larger and thicker than those of the type, while the wood is also more open in the grain and less interlocked. Otherwise, morphologically, there is little to distinguish it from the type.

It seems a pity to endeavour to establish a variety on such slender morphological grounds.

Botanical Name.—*Eucalyptus*, see Part II, page 34; *punctata*, Latin, dotted. In the original description it is stated, "Dots on the under surface of the leaves blackish." These blackish dots are almost invariably present; often the aid of a lens is required to see them properly. They are, however, not characteristic for *punctata*, being often present in *E. resinifera* and other species.

Vernacular Names.—Botanists are often blamed for not giving one common name, and one name only, to one particular species of Eucalyptus, and when it is suggested that there are difficulties in the way, such a suggestion is attributed to perverseness. I am afraid the millenium will have arrived before the reform hinted at can be carried out. The present species is a good one for illustrating one of the reasons why the "one species one common name" dictum cannot be realised. More than one other species is known as Grey Gum, for

* The bud reminds one exactly of an egg in an egg-cup.

example, *E. propinqua* and *E. tereticornis.* Then why another Grey Gum? Suppose we call *E. tereticornis* Red Gum (a name by which it is frequently known) instead of Grey Gum; then there will be more or less confusion between it and its brother, *E. rostrata,* the Red Gum *par excellence.* Or, to come back to the subject of our present Grey Gum, suppose we suppress Grey Gum, having assigned that designation to *E. propinqua,* then there remains the next best and most used name for it, which is Leather-jacket. But consider the number of other trees which have a vested interest in the name of Leather-jacket, which have indeed more claim to the name, because of greater appropriateness and use by a larger number of people, and we at once see that if we appropriate the name for *E. punctata* we shall be as far off our "one species one name" as ever. The fact of the matter is, that so long as people are so obstinate as to please themselves in the matter of names, and so long as the same object presented to different individuals is seen by them in different aspects, so long will this name difficulty continue. The Grey Gum people will not give up their name simply to please the Red Gum people, and so on. The former say: "Our name is the more suitable; we look at the bark,—see how grey it is." The latter say: "But look how red the timber is." It is of no use to blow up the botanist. He does not give the local names. The people at large do that, and who can control them? The chief reason why we give "botanical names" is in order to obtain a definiteness not obtained by vernaculars. Some of our species have at least eight or ten common names.

The term Grey Gum is applied to *punctata* because of the dull grey appearance of the bark. The bark has a roughish appearance, in contradistinction to a smooth and even shiny one, possessed by so many of our gums. It has smooth, white patches in places, caused by the outer layer of bark falling off. These white patches in their turn become grey, and the process of exfoliation of the bark is repeated until probably the whole of the bark on the trunk is shed at one time or another. Although rather difficult to properly describe, the bark of the Grey Gum is so characteristic that, when once pointed out, it could not be confused with the bark of any other hardwood tree.

It is called "Black Box" at Capertee, owing to the darkness of the bark, and Mr. Forester Sim, of the same place, says it is also called "Slaty Gum." The smooth bark is sometimes of a yellow ochre or pale brown colour, hence it might then be appropriately called "Brown-barked Gum."

Aboriginal Names.—George Caley, the botanical collector for Sir Joseph Banks, stated—9th February, 1807—that "Mandowe," or "Mundowey," was the name given by the blacks of the Sydney district. It is interesting to note that, half a century later, Sir William Macarthur gave the name "Maandowie," as the aboriginal name of the Camden blacks, for the local Grey Gum.

Synonym.—*E. tereticornis,* Sm.; var. *brachycorys,* Benth. (B.Fl. iii, 242).

Leaves (Oil).—Messrs. Baker and Smith (*Research on the Eucalypts*) give the following particulars in regard to the oil of this species, and of the so-called variety *didyma* :—

Species.	Specific gravity at 15° C.	Specific rotation, $[a]_D$	Saponification number.	Solubility in Alcohol.	Constituents found.
E. punctata ...	0·9129 to 0·9220	− 2·52° to + 4·44°	18·78	$1\frac{1}{4}$ vols. 70 %	Eucalyptol, pinene, aromadendral.
E. punctata var. *didyma*.	0·9033 to 0·907.	− 4·63° to − 6·53°	10·9 to 11·6	7 vols. 70 %. to vols. 80 %.	Eucalyptol, pinene. aromadendral.

Flowers.—Large handsome flowers, with a sour offensive smell like sour gum arabic.

Fruit.—Attention is directed to the fact that this is one of the species displaying considerable variation in the size and shape of the fruit.

Bark.—It belongs to the smooth-barked group of gum-trees, and yet as compared with the silky smoothness of the White Gum (*hæmastoma*), or of the Blue Gum (*saligna*), its bark is raspy to the touch. As a whole, its trunk may be said to have a dirty appearance, often inclining to a yellowish or brownish cast. Large pieces of thin, dark-coloured outer bark give it a blotched appearance. I have already alluded to this in speaking of "Vernacular names."

Timber.—It is so much like Ironbark in appearance that it is difficult to discriminate between the two timbers. That will be the best guide to its appearance. An expert would usually detect the substitution for Ironbark (if he suspected any substitution), by noting that a chip of Grey Gum is more brittle than that of Ironbark ; it also cuts less horny. Nevertheless, the two timbers are wonderfully alike, and for many purposes Grey Gum is an efficient substitute for Ironbark, for it is remarkably durable. Its inferior strength, as compared with Ironbark, precludes its use as girders of any length, and when substituted for Ironbark in sleepers the bolts and spikes work loose in them. I would encourage its use in every possible way for wood-blocks. The chief objectors to its use at the present time are the saw-millers themselves, as the logs often contain gum-scabs or gum-veins. At present, where unblemished timber is insisted upon for wood-blocks, a saw-miller cannot afford to cut up Grey Gum (although it frequently turns out unblemished), because of the risk of having it condemned. I will speak on this subject in connection with Bloodwood, and would emphasise the opinion that wood-blocks should not be condemned because they contain a few gum-scabs or veins. Such excess of care practically leads to great waste of really valuable timber. It is recommended for paving-blocks, as already stated. It is in high repute for posts, having excellent records when employed in this very trying situation. I have seen it used for felloes and for shingles. It is very largely used as an Ironbark substitute for railway sleepers, &c., which fact is in itself testimony to its excellence.

A GREY GUM.
(*Eucalyptus punctata*, DC.)

The use of shingles in this State is borrowed from England. In Gilbert White's *Natural History of Selborne,* at Letter IV of the "Antiquities of Selborne," he speaks of their value and durability for roofing in the following passage:—

> The whole roof of the south aisle, and the south side of the roof of the middle aisle, is covered with oaken shingles instead of tiles on account of their lightness, which favours the ancient and crazy timber frame. And, indeed, the consideration of accidents by fire excepted, this sort of roofing is much more eligible than tiles. For shingles well seasoned, and cleft from quartered timber, never warp, nor let in drifting snow; nor do they shiver with frost; nor are they liable to be blown off, like tiles; but, when well nailed down, last for a long period, as experience has shown us in this place, where those that face to the north are known to have endured, untouched, by undoubted tradition, for more than a century.

Exudations.—(*a*) Astringent: This tree yields a dark brown kino, which (amongst the kinos already known) is perhaps characteristic. When freshly exuded it has much the colour and viscosity of molasses, and has a somewhat vinous odour not easily described. In the course of a day or two it solidifies into a friable mass. It is highly astringent. (*b*) Saccharine: The Rev. Dr. Woolls first drew attention to the existence of manna in this species. I have seen manna on this tree frequently, but only on the edges of leaves which have been eaten by some insect.

Mr. H. G. Smith,* however, records (and gives a full account of) a saccharine exudation whose origin does not appear to be clear. "When exuding it must have been liquid, as it had run down the tree." The material obtained was more or less mixed with bark and débris, caused by boring beetles. An exudation of this character is very interesting, and I only know of one other instance of the kind, *i.e.,* where a saccharine mass from *E. Stuartiana,* Dalgety, Snowy River, was sent to me a few years ago. Mr. Smith's analysis is ample, but we require further investigation in regard to the physiological aspect, *i.e.,* the way in which sugar in such large quantities has been manufactured, and has exuded from the tissues of the plant.

Size.—A tree of large size, although not of the largest. Its height may be given as, say, 60 to 80 feet, with a diameter of 2 or 3 feet.

Habitat.—It appears to be confined to New South Wales. It is found in the coast districts and main dividing range and spurs. Conjola, near Milton, appears to be the most southerly locality recorded. In the north it has been collected as far as Lismore. In the west it occurs near the Jenolan Caves, at Capertee, and Rylstone.

EXPLANATION OF PLATE 37.

A. Sucker leaf.

B. Flower-bearing twig.

C. Fruits.

D. Fruits of variety *grandiflora*, Deane and Maiden.

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* "On the saccharine and astringent exudations of the Grey Gum (*Eucalyptus punctata*, DC.), and on a product allied to aromadendrin."—[*Journ. Roy. Soc., N.S.W.*, p. 177 (1897).]

No. 36.

Albizzia pruinosa, F.v.M.

A Stinkwood.

(Natural Order LEGUMINOSÆ.)

Botanical description.—Genus, *Albizzia*, Durazz.

Calyx.—Campanulate or tubular, 5- or rarely 4-toothed.

Corolla.—5- or rarely 4-lobed, with a cylindrical tube.

Stamens.—Indefinite, usually numerous and long, united at the base in a tube enclosing the ovary.

Pod.—Linear or oblong, straight or nearly so, flat, thin, rarely coriaceous, indehiscent or opening without elasticity in 2 valves.

Seed.—Usually orbicular, along the centre of the pod; funicle filiform.

Trees or shrubs, without prickles.

Leaves.—Twice pinnate, with a gland on the petiole below the pinnæ, and others between or below some or all of the pinnæ and leaflets.

Flowers.—In globular heads or rarely cylindrical spikes, usually hermaphrodite.

Stamens.—White or pink, rarely yellow, much longer than in *Acacia*.—(B.Fl. ii, 421).

Bentham (B.Fl. ii, 422) places this tree under *Pithecolobium.* I follow Mueller in placing it under *Albizzia.* See an important paper by the latter * where it seems fully proved that the Australian species come under *Albizzia.* Whether or no, the South American species with fleshy pods, hence eaten by apes and monkeys, should be placed under *Pithecolobium* (Greek *pithes* an ape).

Bentham distinguishes between the two genera as follows :—

Pod flat and thin, straight or scarcely falcate.—*Albizzia.*

Pod curved or twisted, 2-valved, and often reddish or pulpy inside, or separating into indehiscent articles.—*Pithecolobium.*

and his reasons in favour of separating the two genera, as given in B.Fl. ii, 421, should be perused.

Botanical description.—Species, *A. pruinosum*, F.v.M., in *Journ. Bot.* x, 9.

A beautiful tree, the young branches, foliage, and inflorescence rusty with a short pubescence, or glabrous.

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*"The genus *Albizzia;* its origin and systematic limits considered."—*Journ. Bot.* x, 7 (1872).

Pinnæ.—Very irregularly in one or two pairs, with or without an odd one, the petiole and each rhachis varying from 1 to 6 inches long; leaflets usually three or four pairs on the terminal pinnæ, but very irregular in number, size, and shape, mostly broadly oblong or rhomboidal and acuminate, rarely very obtuse, the larger ones often 2 or 3 inches long, but mostly smaller.

Peduncles.—Two or three together in the upper axils or shortly racemose.

Flowers.—Numerous, in globular umbels, on pedicels of about 2 lines.

Calyx.—Small, shortly toothed.

Corolla.—Fully 2 lines long.

Pod.—Several inches long, 7 to 8 lines broad, flat but much curved and twisted, the upper inner margin thickened and continuous; the outer one much sinuate and undulate, the valves smooth and reddish inside.

Seeds.—Ovate transverse.

Funicle.—Rather thick, but terete, folded under the seed.—(B.Fl. ii, 123, as *Pithecolobium*).

Botanical Name.—*Albizzia*, in honour of an old and noble Florentine family—the Albizzia—to whom the genus was dedicated by Durazzini, in the year 1772; *pruinosum*, Latin, frosty, or liable to frost, hence in botanical descriptions, having a whitish or frosted appearance, which the leaves of this tree sometimes have.

Vernacular Name.—It is sometimes called "Stinkwood" from the sour and rather unpleasant smell of the freshly-cut timber.

Aboriginal Names.—"Malla Waundie" of those of the Clarence and Richmond; "Talingora" of some Queensland aborigines.

Synonyms.—*Pithecolobium umbrosum* and *Acacia umbrosum*, A. Cunn., in the Cat. N.S.W. Products for the London Exhibition of 1862. *Acacia sapindoides*, A. Cunn., ex. Sweet, Hort. Brit. ed. iii, 198; Hill, in Cat. Queensland Exhibits, Lond. Exhib., p. 30.

Timber.—Wood of a light yellow colour, becoming brown near the centre; of a very disagreeable odour when newly cut. Wood soft, not durable.

In the *Cat. of N.S.W. Timbers, London Exhib.*, 1862, it is stated that the timber is hard and occasionally used for carpenters' tools. Hill speaks of it as soft, but tough. The fact of the matter is it is not an important timber tree at all, being only occasionally used for economic purposes.

Exudation.—The gum of this species is only partially soluble. It is rare and is not likely to be of commercial importance. Following is a note * on a specimen:—

This sample is in small amber-coloured pieces and is very much admixed with woody matter. It is fairly transparent, and breaks with a bright fracture. It is only partly soluble in water, the soluble portion being arabin; it forms a fairly adhesive liquid. It gives no precipitate with ferric chloride, nor does it form a jelly, and only slightly darkens when heated with dilute soda. The unsoluble portion is soluble in dilute alkalis, and is precipitated as arabin on acidifying with acetic acid and adding alcohol.

* Maiden and Smith, *Proc. Royal Soc. N.S.W.*, 1895, p. 400.

Size.—It is but a small tree, say 30 to 50 feet high, and with a stem diameter of 6 to 12 inches.

Habitat.—It is a brush tree, being a denizen of dense brushes. It is confined to the eastern parts of New South Wales and Queensland. In the *Flora Australiensis* it is recorded as far south as Kiama and the Illawarra. Mr. Baeuerlen has collected it on the Shoalhaven. It is not very rare on our northern rivers. Dallachy collected it at Rockhampton, Queensland, which appears to be the most northerly locality so far.

EXPLANATION OF PLATE 38.

A. Flowering twig.

B. Individual flower, showing stamens and pistil.

C. Calyx and corolla.

D. Stamens.

E. Legume (pod) showing the frequently circular twisting.

F. Pod, showing seeds.

G. Seed, with funicle.

H. Seed (enlarged), the shading round the margin rather too much accentuated.

A STINKWOOD.
(*Albizzia pruinosa*, F.v.M.)

No. 37.

Flindersia maculosa, F.v.M.

The Leopard Wood.

(Natural Order MELIACEÆ.)

Botanical description.—Genus, *Flindersia*, R.Br.

Calyx.—Small 5-lobed.

Petals.—Five, imbricate in the bud, spreading.

Disc.—Broad, concave.

Stamens.—Five, inserted on the outside of the disc, with as many or fewer staminodia alternating with them, sometimes wanting; filaments subulate; anther versatile.

Ovary.—Five-celled, 5-lobed.

Style.—Short, thick, inserted between the lobes.

Stigma.—Capitate; ovules 4 to 6 in each cell.

Capsule.—Oblong, hard, tuberculate or muricate, opening septicidally in 5 boat-shaped valves or cocci, without any persistent axis.

Seeds.—Flat, winged, two or three on each side of a flat placenta, which almost divides each cell into two; albumen none; cotyledons flat, radicle very short.

Trees.

Leaves.—Alternate or more frequently opposite, pinnate or rarely simple, marked with pellucid dots.

Flowers.—In terminal panicles.

Botanical description.—Species, *F. maculosa*, F.v.M., ex Benth. in B.Fl. i, 388.

A small tree, the trunk remarkably spotted by the falling off of the outer bark in patches.

Leaves.—Opposite or nearly so, glabrous, coriaceous, the glandular dots often only visible on the young ones, in some specimens all simple, linear oblong or lanceolate, obtuse or emarginate and mucronate, 1 to 2 inches long, or rather more; in other specimens a few of the leaves break out into two or three narrow continuous lobes; in others, again, all are pinnate, with three or five leaflets, like the simple leaves, but smaller, and a winged common petiole.

Panicles.—Terminal, rather dense, usually shorter than the leaves.

Sepals.—Scarcely 1 line long.

Petals.—About 2 lines long, glabrous.

Capsule.—Oblong and muricate, like those of the other species, but much smaller, often not more than 1 inch long when fully ripe.

Seeds.—Winged at both ends and along the back.—(B.Fl. i, 388.)

Botanical Name.—*Flindersia*, in honour of Captain Matthew Flinders so honourably identified with the early exploration of the Australian coast; *maculosa*, Latin, spotted, in allusion to the appearance of the bark.

Vernacular Names.—"Leopard Tree" and "Spotted Tree" are the two commonest names given to this tree, in allusion to the appearance of the bark. It is sometimes called "Prickly Pine," a most unsuitable name, for a reason which will be understood when the notes on the early growth of the tree are perused.

Aboriginal Names.—"Murki" of the aborigines of the Lower Lachlan, according to the late Mr. K. H. Bennett, of Ivanhoe, *viâ* Hay.

Synonyms.—*Elæodendron maculosum*, Lind.; *Strzeleckya dissosperma*, F.v.M.; *Flindersia Strzeleckiana*, F.v.M., *Fragm.* i, 165 (1859); *F. maculata*, F.v.M., *in Quart. Journ. and Trans. Pharm. Soc. Vict.* ii, 44 (April, 1859).

There are two forms of this species—(*a*) a simple leaved form with a membraneous disc, called *F. maculosa* (at one time described erroneously as *F. maculata*); (*b*) a trifoliate form with a more fleshy disc, *F. Strzeleckiana.*

Mueller originally (*Quart. Journ. and Trans. Pharm. Soc. Vict.* ii, 44) thought them distinct species, saying, "I have at present no hesitation in regarding these two plants as distinct on account of their foliage, until it is proved that like in certain *Boroniæ*, simple and pinnate leaved plants are produced by the genus *Flindersia*; all the specimens from near the Darling and its tributaries showing simple, all the tropical compound leaves." Later Mueller united his two species; in the Census he suppresses *F. maculosa*, F.v.M., and has *F. Strzeleckiana*, F.v.M., *Fragm.* i, 65 (1858)*; *B.Fl.* i, 389; *Fragm.* ix, 133 (1875). The last reference gives simply some New South Wales and Queensland localities and the note—

> Cl. Bowman varietatem foliolis pluries majoribus misit.

As he had just given the record "Bogan" (Bowman), Bowman's plant with some pinnate leaves is therefore recorded from N.S.W., and is, consequently, not confined to Queensland.

Bentham (*B.Fl.* i, 390) also combined the species, and adds these words—

> The simple-leaved specimens which are the most frequent in New South Wales have much the habit of *Geijera*, to which, in fact, the genus is very nearly allied; the pinnate-leaved specimens are chiefly tropical, but not exclusively so.

He, however, suppressed *Strzeleckiana* in favour of *maculosa*.

Casimir De Candolle (*Monogr. Phanerog.* i, 734) recognises two species, and Bailey (*Queensland Flora*) adopts his view.

I follow Bentham and Mueller in looking upon the forms as belonging to one species.

* Should be February, 1859.

It now becomes necessary to decide as to the name of the species. *Flindersia Strzeleckiana*, F.v.M., was published in *Fragm.* i, 65. This was Fasciculus IV, and at p. 96 we have the imprint "Fasciculus IV, editus Februario, 1859."

F. maculosa, F.v.M., in *Jour. Pharm. Soc. Vict.* ii, 44, quoted in B.Fl. i, 388, is a mistake. It should be *F. maculata*, F.v.M., and it was published in the *Quarterly Journal and Trans. of the Pharm. Soc. Vict.* vol. ii, p. 44, on 1st April, 1859.

As regards *Flindersia maculata*, F.v.M., I quote the following "Notes on some rare and medicinal plants of Australia," by Ferdinand Mueller, from the very rare serial publication just referred to, which has been copied for me by the kindness of Mr. Harry Shillinglaw, Secretary of the Pharmaceutical Society of Australasia, Melbourne:—

Amongst the plants constituting part of the Brigalow scrubs in the depressed interior of New South Wales occurs a small tree, which, on account of its spotted bark, attracted the attention of Sir Thomas Mitchell when tracing the course of the Maranoa River; and the squatters on the Darling have very appropriately applied to it the name of "Spotted tree."

It attains a height of about 20 feet. Its bark is irregularly areolate, the grey epiphlæum separates in small pieces, thus uncovering partially the livid or cinnamon-coloured inner stratum of the bark and thereby renders it singularly spotted. The wood is pale. Professor Lindley in describing this tree, evidently from flowering specimens only, referred it to the genus *Elæodendron* or spindleworts.

The Rev. Mr. Goodwin and Mr. Dallachy, on travelling lately over the Darling Plains, towards Mount Murchison, noticed the same tree, which is stated to make its appearance first above Moninda, and specimens with young fruit collected on those localities being communicated, I ascertained that this curious plant belongs to that sub-genus of *Flindersia*, which I have on account of habitual difference, and its hardly woody fruits, separated as *Strzeleckia* in Sir William Hooker's *Journal of Botany* for 1857, pp. 308 and 309, whilst with a more conservative view I united the only known *Strzeleckia* in the *Fragmenta Phytographia Australia*, i, 4, 65 and 66, to *Flindersia*.

Although I have failed in finding any clear distinction in the flowers or in fruits of *Strzeleckia dissosperma* and *Elæodendron maculosum*, of which I examined original specimens in Sir Thomas Mitchell's collection, I have at present no hesitation in regarding these two plants as distinct on account of their foliage.

The following diagnosis would characterise sufficiently the Darling plant:—*Flindersia maculata* (*Strzeleckia*):—Leaves opposite, rather small, simple, oblong, with cuneate base, with blunt or emarginate apex, and with short petioles; without pellucid dots; branches of the panicle opposite; lobes of the calyx almost orbicular, ciliolate; sterile stamens, five or less; stigma peltate, hemispherical, capsule small, ellipsoid, echinate by acute tubercles, glabrous; its subcells generally two-seeded, seeds around winged.

The leaves are minutely dotted, but the dots rather concealed and not transparent. The capsules deserve notice for the strong aromatic scent by which they are pervaded.

Let us leave consideration of the genus *Flindersia* for a moment

The tree was first discovered by Mitchell at the St. George's Bridge, on the Balonne River (depicted in his *Journey of an Expedition into the Interior of Tropical Australia*). At p. 384 of that work he speaks of—

A new *Elæodendron* with small panicles of white flowers, formed a forest tree 20 feet high, remarkable for its spotted bark.

Then follows a brief botanical description. One of the original specimens collected by Mitchell is before me as I write. The label reads—" 1846, Novr. Camp. 84, sub-tropical New Holland, Lieut.-Col. Sir T. L. Mitchell," and then *Elæodendron maculosum* in Lindley's handwriting. The fruit was unknown at the time.

The plant is a *Flindersia,* as already explained. If it were a mere question of *F. Strzeleckiana,* F.v.M., and *F. maculata,* F.v.M., as a specific name, then *F. Strzeleckiana* must be adopted, as it has a precedence of a few weeks. The Berlin rule of nomenclature No. 7* has been followed by Bentham in this case, intentionally or not. Its first specific name was *maculosum* (as *Elæodendron*) and at present I call the plant " *F. maculosa,* F.v.M., ex. Benth., in B.Fl. i, 388.

Early Growth of the Tree.—In its early stage it forms a tangled mass of long thin branches. These branches are not spinous or prickly, but form a hedge, so that while stock (chiefly sheep) prune the peripheral branches they cannot eat the whole of them. As growth advances, a leading shoot shows itself and is protected by the branchy entanglement which encircles the main stem for several feet. By degrees these tangled branches atrophy and leave more or less of the stout main stem with its characteristic blotchy or spotted bark. Sometimes the tangled branches persist for a considerable period near the ground, sometimes the stem is clean and the tangled mass is several feet up. In some cases the portion near the ground, in others that several feet above it, alone persists; in fact different trees show much variation.

The life history of the trees is excellently shown in the accompanying three photographs by Mr. W. S. Campbell, which are taken from the *Agricultural Gazette* for November, 1899, p. 1167.

Leaves.—During periods of drought sheep become exceedingly fond of the leaves of this tree, which they greedily devour, as well as the twigs up to the size of a goose-quill, and hence the tree is in danger of extermination, as it has not the recuperative power of some trees. This tree in particular should only be pollarded. Nature's method of protecting it from browsing animals has already been alluded to.

Mr. R. W. Peacock says:—†

> The " Leopard Tree " is very much prized for its fodder value, both cattle and sheep being very fond of it. It is one of the few which cattle thrive upon, and I have known milking cows fed almost solely upon it to give a fair quantity of milk. It is very easily recognised owing to its spotted appearance, which is due to the outer bark falling off in patches. It is fast becoming scarce owing to the partiality of stock for it. During its young stage the tree throws out a lot of angular lateral branches, which protect it in some measure.
>
> I have heard some people speak disparagingly of this tree, but upon extensive inquiries I find that their prejudices have not been substantiated, it being held in high esteem by those who feed very extensively upon it. It does not supply the quantity of foliage that many of the others do, although attaining the height of about 40 feet.

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* See my Presidential Address before the Linnean Soc. of N.S.W. (*Proc.* xxvii, 702, 1902), where this matter is discussed at some length.

† *Agric. Gazette, N.S.W.*, April, 1899, p. 264.

FIRST STAGE OF GROWTH.

SECOND STAGE.

MATURE TREE.

LEOPARD TREE *(FLINDERSIA MACULOSA).*

Mr. F. B. Guthrie has given in the *Agricultural Gazette* the following analysis of leaves :—

Water	41·70
Ash	3·42
Fibre	11·43
Ether extract (oil, etc.)	3·92
Albumenoids	9·31
Carbo-hydrates	30·22
Nutrient value	48¼
Albuminoid ratio	1:4¼
Tannin (Oak bark)	2·9

The young leaves are very aromatic, and the oil-dots may be plainly seen, showing the affinity to *Rutaceæ* as already pointed out by Engler.

Fruit.—The fruit when quite ripe tends to be flat like a five-pointed star. It is reddish brown externally. The fruit depicted is just opening to shed its winged seeds.

Bark.—Its characteristic appearance has already been alluded to.

Timber.—This is a small tree, and not important as a timber. At the same time it is used to a small extent. The timber is used for shingles, staves of tallow casks, and pick-handles.—(Hill). It is of a bright yellow colour when fresh, and exceedingly tough. Unlike many other timbers in the arid western districts of New South Wales it is very elastic, and is, therefore, used for the poles and shafts of drays, buggies, etc. A writer says, "It is white and very light, and is used by the blacks for making their 'heilamans' or shields. For all other purposes it is utterly worthless." Others say, "No good except for bullock-yokes." I saw it made into tool-handles at Bourke. In the rough state (*i.e.*, with the bark on) it is used for fencing, but it is useless for building purposes, as a coleopterous insect soon destroys it. About Wilcannia, N.S.W., it is, however, considered very durable by some, when sawn and used for inside work.

Exudation.—This is probably the tree referred to by Mitchell, in the following passage :—

In the ground beyond the plains (near the Darling) . . . . and an Acacia, with a white stem, and spotted bark, there grows to a considerable size, and produces much gum. Indeed, gum acacia abounds in these scrubs, and when the country is more accessible, may become an article of commerce. —(*Three Expeditions*, i. 203.)

For an account of the gum arabic from this tree, one of our best soluble gums, see the following paper. * Dr. Lauterer also gives an analysis of this gum.

During the summer months large masses, of a clear amber colour, exude from the stem and branches. It makes good adhesive mucilage, has a splendid taste, and is eaten by the aborigines. It is commonly used by bushmen as a remedy in diarrhœa.

* Maiden "On the gum of the Leopard Tree."—*Proc. Aust. Assoc. Adv. Science*, Melbourne, 1890, p. 379.

THE LEOPARD WOOD.
(*Flindersia maculosa*, F.v.M.)

Two samples have been examined by me, and the following is an account of them. In view of the scarcity of good gum-arabic, it would be a useful addition to our raw products if abundant supplies of it could be obtained. I have not heard of a gum being yielded by any other Australian species of *Flindersia* in quantity.

Sample I.—From between the Lachlan and Darling Rivers, N.S.W. A most valuable gum. It is in pieces as large as pigeons' eggs, and I have seen a piece half as large as an emu egg, clear and of excellent quality, with only a small portion of bark at the place of attachment to the tree. In parts of the interior it is said to be fairly abundant. In some cases it remains in the liquid state on the trees for some little time before hardening, or else exudes very rapidly, for it is frequently brought to Sydney in pieces as long as an ordinary earthworm, and of the same average diameter.

It dissolves readily and completely in cold water. It hardly appears to affect the transparency and absence of colour of pure water. In this respect it may be ranked very closely to picked Turkey gum-arabic. It possesses the faint cloudiness which an aqueous solution of gum-arabic soon assumes.

Size.—Height 20 to 40 feet, with a stem diameter of 12 to 18 inches.

Habitat.—This is a dry country species. It occurs only in New South Wales and Queensland. In our own State it is found over a large area of the Western Division, *e.g.*, in the vicinity of the Darling, Lachlan, Bogan, Macquarie, Castlereagh, and other inland rivers. I have it from a number of localities, but would be glad to hear of it from others in order to construct a "curving boundary" of its range.

As regards Queensland, Bailey only records *F. maculosa* from St. George, and *F. Strzleckiana* from "Brigalow Scrubs of the Leichhardt district and other inland parts."

EXPLANATION OF PLATE 39.

A. Flower, side view.

B. Flower looked at from above.
- *a.* Petal.
- *b.* Anther.
- *c.* Disc.
- *d.* Ovarium.
- *e.* Stigma.

C. Portion of flower.
- *a.* Filament.
- *b.* Disc.
- *c.* Ovarium.
- *d.* Stigma.

D. Anther, front and back view.

E. Section through ovarium.

F. Calyx.

G. Fruit (capsule) in act of dehiscence.

H. A valve of the capsule.

I. Winged seed.

No. 38.

Macadamia ternifolia, F.v.M.

The Queensland Nut.

(Natural Order PROTEACEÆ.)

Botanical description.—Genus, *Macadamia*, F.v.M., in *Trans. Phil. Inst., Vict.*, ii, 72.

Flowers.—Hermaphrodite.

Perianth.—Regular or slightly irregular, the tube opening earlier on the under side, and the segments, at least the lower ones, less revolute than in *Helicia.*

Anthers.—On short filaments inserted a little below the laminae, the connective produced into a gland or very short appendage.

Hypogynous glands.—Equal, distinct or united in a ring or cup round the ovary.

Ovary.—Sessile, with a long straight style, ovoid or clavate at the end, with a small terminal stigma ; ovules 2, descending, laterally attached at or near the top.

Fruit.—Globular, indehiscent, with a hard thick putamen, and rather thin fleshy exocarp.

Seeds.—Either solitary and globular, or two and hemispherical ; testa membranous.

Cotyledons.—Thick and fleshy.

Trees or tall shrubs.

Leaves.—Verticillate, entire, or serrate.

Flowers.—Pedicellate in pairs, in terminal or axillary simple racemes, the pedicels not connate.

Bracts.—Very deciduous.

Botanical description.—Species, *M. ternifolia*, *Trans. Phil. Inst., Vict.*, ii, 72, with a plate.

A small tree with very dense foliage, glabrous, or the young branches and inflorescence minutely pubescent.

Leaves.—Sessile or nearly so, in whorls of three or four, oblong or lanceolate, acute, serrate, with fine or prickly teeth or entire, glabrous and shining, from a few inches to about 1 ft. long.

Racemes.—Almost as long as the leaves, with numerous small flowers, the pairs often clustered or almost verticillate.

Pedicels.—At first very short, and not above 2 lines when in fruit.

Perianth.—Minutely pubescent or glabrous, nearly 3 lines long.

Hypogynous glands.—United in a ring.

Ovary.—Villous ; style-end clavate.

Fruit.—With a 2-valved fleshy exocarp ; the putamen globular, smooth and shining, thick and woody, often above 1 inch in diameter.—(B.Fl. v, 406.)

Variety *integrifolia*, Maiden and Betche.

In *Proc. Linn. Soc., N.S.W.*, 1896, p. 624, Mr. Betche and I described a *Macadamia* under the name *M. integrifolia*, from Camden Haven, N.S.W. It was stated that it is readily distinguished from *M. ternifolia* by the petiolate entire leaves, rather small fruits, and less hairy flowers and inflorescence. Although the tree looks sufficiently different from *M. ternifolia*, one of us has since examined the material in the Melbourne Herbarium, and we have come to the conclusion (*Proc. Linn. Soc., N.S.W.*, 1899, p. 150) that it can only be regarded as a variety. We found all degrees of transition between the two extreme forms, and have been forced to the conclusion that it is merely another instance of the great variability of the Proteaceous trees from which the Order derives its name.

Mr. F. M. Bailey (*Queensland Flora*, p. 1330) says:—

> There are probably three forms of this species, viz., the typical; another with nuts, only half the size of the typical. These nuts I have only received from the Pine River, but hitherto I have never received specimens of other parts of the tree or shrub. The third seems only to differ from the typical form in the leaves being usually more lanceolate, and in habit. It grows in the Maroochie scrubs, and instead of a single stem several arise from a spreading rhizome-like base some little distance from each other. These attain the height of 15 or more feet, and are said after fruiting to die early; the leaves are of a thinner texture than the typical form, but the nut differs in nothing from the common form.

Botanical Name.—*Macadamia*, in honor of John Macadam, M.D., of Victoria, Hon. Sec. of the Philosophical Institute of Victoria at the time the plant was described before that body; *ternifolia*, Latin, *terni* (three together), the leaves being commonly in threes. They, however, sometimes form a whorl of four, and in very rare instances, even five.

Vernacular Name.—The name Queensland Nut is in universal use, owing to the tree having been first discovered in the northern State. It was subsequently found in New South Wales also, but the first name is firmly fixed, and is likely to remain so.

Aboriginal Name.—"Kindal Kindal" of the aborigines, who knew the tree well.

Synonym.—*Helicia ternifolia*, F. Muell., *Fragm.* ii, 91; vi, 191.

Leaves.—The variation in the number of leaves in the whorl and of the margin has already been alluded to.

In *Bull. del Laboratorio ed Orto Botanico di Siena. Fasc.*, 2–3 (1898), Prof. Tassi describes, and at Tav. xii figures, a new fungus (*Macrophoma Macadamiæ*, n. sp.) on this tree.

Fruit.—This tree bears an edible nut of excellent flavour, relished both by aborigines and Europeans. As it forms a nutritious article of food to the former, timber-getters are not allowed to fell these trees. It is well worth extensive cultivation, for the nuts are always eagerly bought. Is said to take seven years from the time the nuts are planted before the tree reaches maturity and bears fruit.

E. André, in the *Revue Horticole*, speaks very highly of this ornamental and useful tree. He says :—

> The ripe fruit, however, is more particularly interesting. Usually one of the two ovules is abortive, and the surviving one fills the whole of the interior of the shell with its white, firm, close-grained albumen, forming a kernel which is as crisp as that of a hazel nut, but has a higher aroma, and a finer flavour. We have gathered and eaten these nuts in the month of December. *Macadamia ternifolia* is a tree which should be cultivated, both from an ornamental and economic point of view. Even if it yielded no fruit, it would make a fine appearance in gardens in the south of France, where the specimens already planted have passed uninjured through winters as severe as that of 1890–91, but how greatly enhanced would be the interest and importance attaching to this species if we could look forward to the discovery of some feasible mode of inducing the trees to yield a regular supply of their pleasantly-flavoured nuts.

Timber.—Wood firm, fine-grained, and ornamental, as all Proteaceous timbers are, and takes a good polish. It is of a reddish colour, and is stated to be occasionally used for staves, cabinet-work, veneers, shingles, and bullock-yokes. It seems a pity to use our best nut trees for any such purpose.

Exudation.—I have seen a small quantity of exudation from a log of this tree.

Size.—Rarely more than 30 feet high, with a stem diameter of 8 inches. Forms a fine bushy tree under cultivation.

Habitat.—Found in most of the brush country on the Tweed and Richmond Rivers, N.S.W. It comes as far south as near Camden Haven, which I believe is the most southern limit. The Queensland localities given in the *Flora Australiensis* are Pine River and Moreton Bay (W. Hill); Dawson and Burnett Rivers (Leichhardt); with the leaves less toothed, and the flowers rather larger.

EXPLANATION OF PLATE 40.

A. Perianth, opened out.

B. Sessile ovary, with long straight style, clavate at the end.

a. Hypogynous glands united in a ring round the ovary.

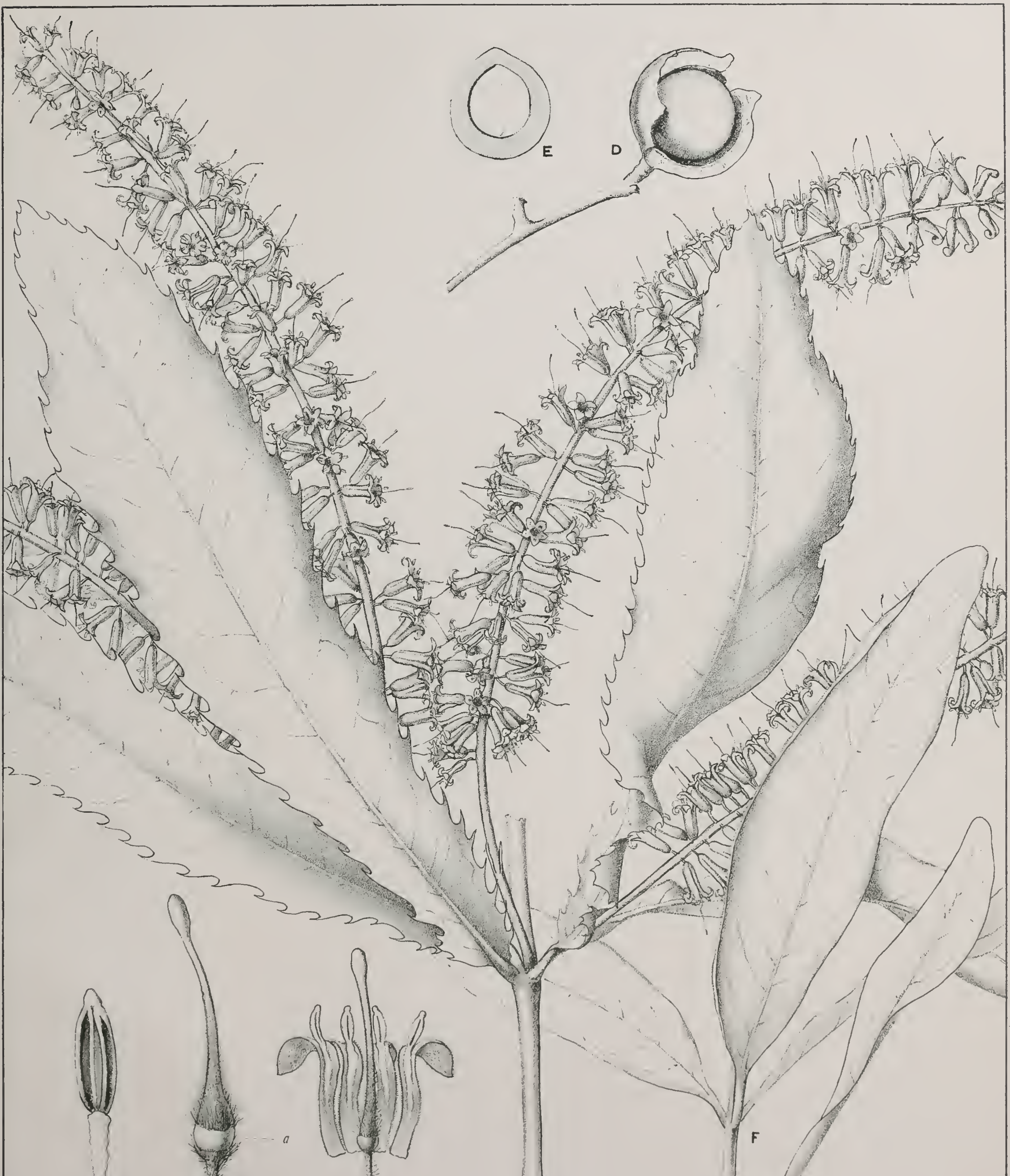
C. Anther.

D. Fruit, showing exocarp and putamen.

E. Vertical section showing two fleshy cotyledons.

F. Leaves of variety *integrifolia*.

Sydney : William Applegate Gullick, Government Printer.—1904.



THE QUEENSLAND NUT.

(*Macadamia ternifolia*, F.v.M.)

INDEX OF TREES DESCRIBED.