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Colour Photography by Frank Hurley

Blocks Courtesy of John Sands Ltd.
THE RED FLOWERING GUM—*E. ficifolia*

THE BLOODWOODS

Contributed by The Museum of Applied Arts and Sciences, N.S.W.

Reference has been made (Australian Plants, March, 1961) to a group of eucalypts possessing certain affinities with *Angophora* (or "Apple"). This group is made up of the "bloodwoods", so called because they frequently exude a red-coloured kino from lesions in the bark a character shared by the *Angophoras*. The kino originates from pockets or ducts ("gum-veins") within the wood, the wood cells frequently being blocked by it, and its retention by these cells imparts the deep red or dark brown colour characteristic of bloodwood timbers. In many bloodwoods, the property of kino production is a serious impairment to the strength qualities of the timber; nevertheless, Spotted Gum or Lemon Scented Gum—both bloodwoods—are high grade timber trees, whilst the kino liberally exuded by Marri (or Western Australian Red Gum) finds some use as a tanning material.

What other features set aside and unify into a botanical series the straggly-growing, small Scarlet Flowering Gum from the west, and the tall, shaft-like Spotted Gum of the east? We may answer this by reference to floral, leaf and bark characters. Combinations of these characters unify the species but no single feature alone can be taken, since for each there are modifications. However, the general pattern of the bloodwoods may be perceived by a consideration of the following characters:—

INFLORESCENCE: A branched system of floral clusters, the clusters brought more or less to a common level by a compensatory variance in length of their stalks (peduncles). Technically the inflorescence is a corymbose (common level) panicle (branched system) of umbels (strictly, contracted dichasia) terminating the shoots. The relatively large clusters of flowers are a conspicuous feature in bushland, the nature of the panicle giving the series name of the genus, *Corymbosae*.

FRUIT: A capsule deeply enclosed by an outer woody wall, predominantly with four or five locules within the ovary, i.e., the fruit is dehiscent by four or five valves. In shape, ovoid or globular, sometimes with a constriction and so becoming urceolate; in length, rarely below half-inch and in a few reaching two inches. Seeds are large (for the genus), biconvex and with sharp margins, frequently with a long terminal process or wing.

LEAVES: Venation almost straight and parallel, the angle of departure of lateral veins from the mid-rib greater than 45°. The characteristic intramarginal vein of eucalypts is very close to, often concurrent with, the leaf margin. Of minor incidence is the difference in colour of upper and lower surfaces.

BARK: Either persistent and then usually brittle, flaky or scaly and tessellated, or deciduous and smooth (sometimes persistent, but usually only at the base of the trunk).

Members sharing this general pattern may be grouped conveniently in terms of the regional map which appeared in the March, 1962 issue of this journal (No. 10).

1. North-west Tropical: (a) indigenous to region—*E. collina*, *lamprocalyx*, *zygophylla*. Range continued eastwards—*E. cliffoniana*, *dichromophloia*, *foelschiana*, *latifolia*, *ptychocarpa*, *polycarpa*, *setosa*, *terminalis*. All rarely above 40ft. high and often considerably less.
2. North Tropical (a) indigenous to region—*E. abbreviata*, *bleeseri*, *ferruginea*, *jacobsiana*, *nesophila*, *porrecta*. Of these, only *E. bleeseri* and *E. nesophila* attain 40ft. or more in height. (b) with the exception of the indigenes, species from the North-west Tropical.
3. North-east Tropical: (a) indigenes—*E. abergiana* (north, 36ft.), *citriodora* (up to 120ft., central to south), *torelliana* (north, 60ft.). (b) *E. dichromophloia*, *intermedia* (60ft.), *maculata* (central to south, up to 135ft.), *polycarpa*, *terminalis*, *trachyphloia* (70ft.).
4. North Eremaean: *E. dichromophloia*, *setosa*, *terminalis*.
5. North-east Eremaean: *E. terminalis*.
6. North-east Interzone: (a) indigenous—*E. peltata* (40ft.). (b) *E. dichromophloia*, *polycarpa*, *setosa*, *trachyphloia* (eastern edge).

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THE RED FLOWERING GUM

By L. D. Pryor and R. R. Willing—Australian National University

Western Australian Red Flowering Gum is one of the most beautiful and best-known of ornamental eucalypts. It has been planted widely both in Australia and overseas because of the magnificent show that it makes when in flower. This remarkable tree is limited in its natural occurrence to small patches in an area of a few square miles in the vicinity of Walpole



A graft of *Eucalyptus ficifolia* two years after grafting. Note the well developed flower buds on the terminal shoot and the graft union on the stem just below the lowest leaf. With the technique described it is possible to propagate the Red Flowering Gum, not only true to colour, but also to have it flowering from only a few feet high, as shown above.

in south-west Western Australia, where there is a high winter rainfall—in the vicinity of 60 inches per annum, with considerable regularity, and at the most light frosts in winter.

There are several reasons why the tree is sought so much for ornamental use. Firstly, when in flower many individuals have brilliant scarlet flowers which are arranged in terminal clusters so that they appear in the crown at the time of flowering, outside the leaves. The tree is small or moderate-sized and compact in form which makes it attractive for ornamental use and because it is unusual compared with many other eucalypts in cultivation.

The growing of Red Flowering Gum has been a rather haphazard matter for two reasons. Firstly there is great variation in flower colour from scarlet to crimson, pink, orange and almost white, and the particular colour that an individual specimen will be when it finally flowers cannot be determined until it actually produces its first bloom. Secondly, in cultivation, even in Perth it is a long way from its natural habitat, it has been subject to serious attack by *Sporotrichum* canker which has destroyed most trees planted there, leaving only a very few individual specimens which are resistant to the attack of this pathogen. It has also failed in other areas, such as Sydney; possibly for the same reason, or perhaps partly due to the general unsuitability of a species such as this from a winter rainfall area for prolonged growth in places where there is ordinarily a summer rainfall.

This situation has arisen in the past with many plants and has been overcome by well-known methods of breeding and propagation. For a considerable time all eucalyptus have been found difficult to propagate vegetatively. Experiments during the last four years in the Botany Department of the Australian National University have led to the development of comparatively simple and quite reliable techniques for propagation of the species by grafting and the oldest now nearly four years old, are healthy and vigorous.

Technique of Propagation:

The propagation of eucalypts by cuttings is possible but only with young seedling material, and this has not yet been developed to a stage at which it can be used for multiplying Red Flowering Gum with flower colour known in advance, but various kinds of grafting are highly successful, and Red Flowering Gum is one among the group of species in *Eucalyptus* which are the easiest to propagate.

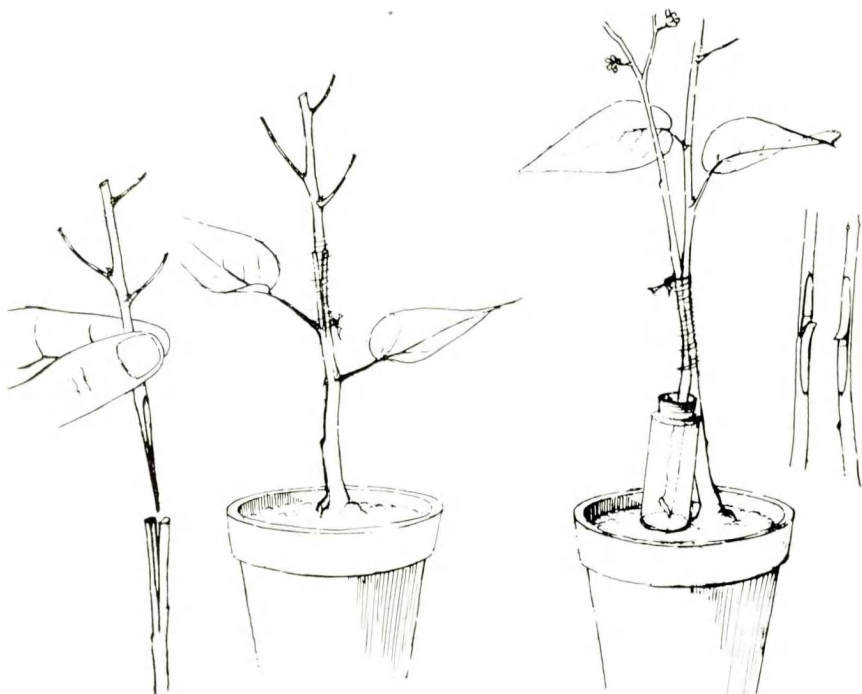
The first grafts were made as approach grafts from a young tree. Approach grafting, often practised in European nurseries in *Eucalyptus ficifolia* was recorded as far back in 1870 in the Canary Islands but seems to have

An approach graft showing the preparation of stock and scion.



was recorded as far back in 1870 in the Canary Islands, but seems to have been lost sight of in the meantime. Moreover, approach grafting, though simple in technique, does require space and time and is a more cumbersome method for producing grafts in large quantity than most would seek to use. Nevertheless, approach grafting is simply carried out by making clean cuts of bark and surface wood about three inches long on both scion and stock and bringing the seedling plants to be used as stock to the tree from which the scion is to be removed. The cut surfaces of the stock and scion which should be matched as to size, bound together with polythene tape (non adhesive) and left in position until a union is effected—usually in from four to eight weeks. As soon as a union of the callus tissue of both stock and scion is established, the scion can be cut from below the base of the union, removed from the tree and continued for a period as a bottle graft by inserting the base of the cut scion into a test tube for a further period of a month or so until the union has become more efficient. This method of grafting is safe and gives almost 100 per cent success.

The use of bottle grafting with severed scions is also possible, but losses are higher than if it is commenced as an approach graft, although because it is easier to carry out this may be preferred. It has been found recently that in making a bottle graft it pays to remove the leaves, leaving only petioles. This not only facilitates the transport of scions when they have to be sent from a distance but leads to better results.



LEFT: A tip graft. RIGHT: A bottle graft—showing in each case the prepared stock and scion and the completed graft.

Various other kinds of grafting have been carried out successfully, such as side grafting, bud grafting and crown grafting with moderate success, but with some irregularity which obviously is related to the condition of stock

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EUCALYPTS FOR YOUR GARDEN

Based on an original table by RON HILL with comments from Forestry

Authorities of each State

How many Australians realise the beauty of the dwarf Eucalypt. Plants with a mature height of six feet to 20 feet can be chosen to provide a wealth of flower in red, crimson, pink, orange, bright yellow or white, with individual flower heads up to six inches across. Other features such as glistening or mottled trunk, silvery or unique foliage, bright coloured and strange fruits, etc., are all possible from our Eucalypts.

Eucalypts are robust and hardy plants especially suited for cultivation without attention or watering as recommended in the flowering table. It is most important to grow or obtain suitable vigorous plants with a straight strong root system and to plant them with the root system straightened out and not coiled or crumpled. The secret to the success of the street tree schemes mentioned in the supplement is the method they describe for care of the young plants. Of outstanding value to property owners in all States of Australia is a booklet entitled, "Tree Establishment in the Wheatbelt", Bulletin No. 2616, available from the Forests Department, Government of Western Australia, Barrack Street, Perth.

For high rainfall areas see page 67.

EUCALYPTS TO FLOWER ALL YEAR ROUND

Eucalypt Species	Height ft.	Flower Colour	Native Rain	Environment Soil	Areas for Cultivation
JANUARY					
<i>E. dielsii</i>	15-20	Cream	15	XYZ	ABC
<i>E. macrandra</i>	15-20	Yellow	20	XYZ	ABC
<i>E. stricklandii</i>	20-30	Yellow	10	XYZ	ABC
<i>E. cornuta</i>	40-50	Cream	30	XY	CD
<i>E. erythronema</i>	15-20	Red	10	XYZ	ABC
<i>E. ficifolia</i>	20-25	Red	50	XY	CD
<i>E. lansdowneana</i>	15-20	Red	50	XYZ	BC

Species also recorded as flowering in Victoria—*E. torquata*, *E. forrestiana*, *E. nutans*, *E. platypus*, *E. tetraptera*, *E. stoatei*, *E. woodwardi*, *E. steedmanii*, *E. eremophila*.

FEBRUARY

<i>E. calophylla</i>	35-40	Pink	20	XYZ	CD
<i>E. xanthonema</i>	20-25	Orange	20	XYZ	BC

Species listed in January also flowering in February—*E. dielsii*, *E. macrandra*, *E. cornuta*, *E. erythronema*.

Species recorded in Victoria—*E. lansdowneana*, *E. stoatei*, *E. torquata*, *E. tetraptera*, *E. forrestiana*.

MARCH

<i>E. erythrocorys</i>	20-25	Yellow	20	XYZ	BCF
<i>E. gummifera</i>	40-50	White	20	XY	CD

Species listed in February also flowering in March—*E. dielsii*, *E. calophylla*.

Species also recorded in Victoria—*E. stoatei*, *E. torquata*, *E. lansdowneana*, *E. steedmanii*, *E. forrestiana*.

APRIL <i>E. kruseana</i>	6-15	Yellow	8	XYZ	BCD
<i>E. cosmophylla</i>	10-15	Yellow	15	XY	CD

Species listed in March also flowering in April—*E. erythrocorys*. Recorded in Victoria—*E. torquata*, *E. forrestiana*, *E. tetraptera*, *E. stoatei*.

MAY	<i>E. gardneri</i>	20-40	Yellow	14	XYZ	BC
	<i>E. forrestiana</i>	10-15	Yellow	15	XYZ	BC
	<i>E. leucoxydon</i>	30-50	Cream	15	XYZ	BCD
	<i>E. leucoxydon rosea</i>	20-40	Red	15	XYZ	BCD

Species listed in April also flowering in May—*E. kruseana*, *E. cosmophylla*. *E. campaspe* is recorded in Victoria and *E. gardneri* flowers in August-November.

JUNE	<i>E. eremophila</i>	10-25	Yellow	12	XYZ	AB
	<i>E. citriodora</i>	35-45	Cream	20	XYZ	BCD
	<i>E. stoatei</i>	25-30	Yellow	18	XYZ	ABC
	<i>E. platypus</i>	10-15	Yellow	15	XYZ	ABC

All species listed in May also flowering in June. Those listed here for June have not been recorded as flowering in the Wimmera area outside the summer months.

JULY	<i>E. gillii</i>	15-20	Yellow	15	XYZ	ABC
	<i>E. lansdowneana</i>	15-20	Red	15	XYZ	BC

All species listed in June flower in July. In Victoria *E. lansdowneana* flower June-March.

AUGUST	<i>E. preissiana</i>	10-15	Yellow	20	XY	CD
	<i>E. lehmannii</i>	10-15	Yellow	20	XY	CD
	<i>E. caesia</i>	10-15	Pink	15	XYZ	ABC
	<i>E. woodwardii</i>	15-20	Yellow	14	XYZ	ABC

E. platypus also flowers through to August.

SEPTEMBER	<i>E. pyriformis</i>	10-15	Red	13	XYZF	ABCF
	<i>E. grossa</i>	10-15	Yellow	14	XYZ	ABC

All species listed in August flower in September.

OCTOBER	<i>E. nutans</i>	10-15	Red		XYZ	BC
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Species also flowering through to October—*E. preissiana*, *E. lehmannii*, *E. woodwardii*, *E. grossa*.

NOVEMBER	<i>E. torquata</i>	6-20	Pink	10	XYZ	ABC
	<i>E. crucis</i>	15-20	Cream		XYZ	ABC
	<i>E. tetraptera</i>	4-12	Yellow	20	XYZ	ABC
	<i>E. orbifolia</i>	8-25	Cream		XYZ	ABC
	<i>E. tetragona</i>	8-25	Cream		XYZ	ABC

Species above also flowering in November—*E. preissiana*.

DECEMBER	<i>E. ficifolia</i>					
	<i>E. torquata</i>					
	<i>E. crucis</i>					
	<i>E. stricklandii</i>					
	<i>E. lansdowneana</i>					
	<i>E. tetragona</i>					
	<i>E. orbifolia</i>					

KEY—Soil Type X=Acid Soil, Y=Neutral Soil, Z=Alkaline Soil.
Areas for Cultivation; these divisions are not necessary when artificially watered in the garden:—

A=10-14 inches rainfall such as upper north and mallee of South Australia.
B=15-19 inches rainfall such as peninsula, mid-north, upper S.E. and Murray basin, mainly mallee areas of South Australia.
C=20-24 inches rainfall such as central districts, mid-south-east and Kangaroo Island of South Australia.
D=25 inches plus such as Mt. Lofty Ranges, Flinders Ranges, south-east of South Australia. Those marked with D are not recommended by Victorian Forests Commission for planting in areas with less than 26 inches rainfall.
F=Frost tender.

The Genus *Dipodium* in Australia

By LEO CADY, Kiama, N.S.W.

Dipodium is one of the most interesting genera of Australian terrestrial orchids, with the three species all being endemic.

KEY TO SPECIES

1. Plants with leaves. Flowers in fairly loose raceme, labellum, midlobe, broadly rhomboidal. Northern Aust.

D. ensifolium—1

1. *Plants with leaves reduced to sheathing bracts. Flowers in loose or dense raceme.

2. Flowers never yellow, but in varying tones of red, rarely white; usually spotted. Labellum midlobe ovate—lanceolate, two short ridges from near the base of lamina covering into a pubescent keel, a patch of calli also at apex. All States except W. Aust.

D. punctatum—2

2. *Flowers tones of yellow, spotted red. Labellum, midlobe, ovate-oblong; basal ridges not converging, lamina pubescent for almost anterior two-thirds. Queensland and N.S.W.

D. hamiltonianum—3

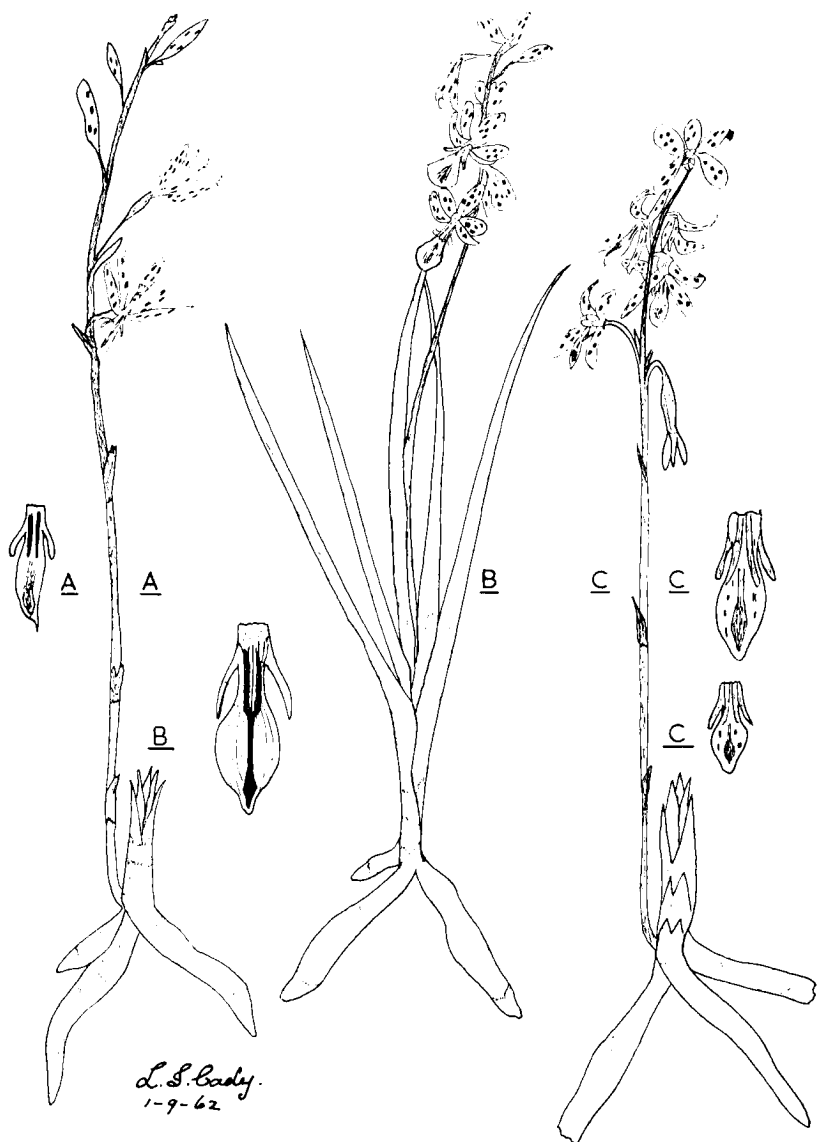


THE HYACINTH ORCHID

Photo by Pat Palmer

THE HYACINTH ORCHID

D. punctatum, The Hyacinth Orchid, is the commonest species in Australia. This species also shows an amazing association with a parasitical fungus, which is found invading the thick, fleshy root system of the plant, penetrating a few cells into the root, and then by some process, being digested by the plant. This connection with the fungus produces the glucose and some other simple compounds required by the plant.

DIPODIUM IN AUSTRALIA

KEY TO PLATE

- A. *D. hamiltonianum* plant and labellum
 B. *D. ensifolium* plant and labellum
 C. *D. punctatum* plant and labella

Plants approx. half natural size, labella much enlarged.

The work done by the fungus is normally carried out by the leaves of a green-leaved plant. This process in a green leaf is called photosynthesis, a process that *D. punctatum* is unable to carry out owing to its lack of leaves.

1. *D. ensifolium* F. Muell. (EN-SI-FOLIUM), "Sword-shaped Leaves."

Plant robust approx. 12 to 14 inches high. Leaves linear-lanceolate—acute strongly keeled, distichous. Raceme about 10 in. high, flowers pink, much spotted with darker pink. Sepals oblong-lanceolate, petals rather broader and more contracted at base. Labellum approx. same length as sepals, shortly connate to base of column, the lateral lobes placed much below the middle, linear spatulate, incurved; the midvein approx. twice as long as the lateral lobes, broadly rhomboid, the disc with two pubescent ridges between the lateral lobes, converging into one ridge at the base of the lamina, which then extends into a patch of scaly hairs at apex of lamina. Column short, pubescent in front.

Flowers: Spring and early summer.

A rather attractive species with a thick, fleshy root system and the only one of the genus in Australia that lends itself to culture. It is grown well in a tanbark, Cymbidium compost, with similar growing conditions, although in the southern States it would require glasshouse treatment, being a tropical species. It is easily distinguished by the sword-shaped leaves.

2. *D. punctatum* (Sm.) R. Br. (PUNC-TAT-UM), "Spotted."

Plant robust or slender, up to 3 ft. high, stems usually reddish-brown, but can often be green. Leaves reduced to sheathing bracts, acute in a tuft at the base of the stem. Flowers up to 60, in dense or loose raceme in varying tones from white (unspotted) to almost red-purple (heavily spotted). Most specimens exhibit some spots but unspotted forms are not uncommon. Sepals and petals equal, oblong-lanceolate: midlobe; lamina with two short ridges near the base. Column shortish, anthers hemispherical. Flowers most irregularly, but chiefly summer.

D. punctatum (Sm.), R. Br. variety *stenocheilum* (Sw.) Rupp.—Plant usually more slender than type, flowers usually smaller, unspotted, segments narrower and more obtuse than type; labellum narrow distinctly sac-shaped at the base, the margins hairy right to the base. Found from central N.S.W. to Cape York, Nth. Queensland.

D. punctatum (Sm.), R. Br. variety *album* Bail.—Plant similar to type, flowers pure white. Found only on the south coast of Queensland, very rare. (Cleveland.)

This species is one of the most variable of our native terrestrial orchids, in colour, habit and soil liking, but to the writer's knowledge it is almost impossible to culture for any extended period. This trait is almost surely due to the plants' association with the parasitical fungus at its roots.

3. *D. hamiltonianum* Bail. (HAMILTON-I-ANUM).

Similar in habit to *D. punctatum*, but often more robust, up to 60 cm. high. Stems greenish or brownish, often spotted, the basal bracts thick and obtuse. Flowers larger and narrower in segments than *D. punctatum*, brick yellow or greenish yellow, spotted and streaked with red. Labellum 12-16 mm. long, whitish usually the lateral lobes narrow, midlobe ovate-oblong, its lamina with two short basal ridges, the anterior two-thirds of the lamina pubescent. Column two-thirds as long as labellum, narrow, winged.

Found chiefly on the tablelands and western slopes in N.S.W., extending into Queensland. Flowers October to February.

The writer would like to thank Mr. A. W. Dockrill, of Cairns, North Queensland, for assistance with the description of varieties of *D. punctatum*.

DIPODIUM ENSIFOLIUM F. MUELL.

A. Plant	to 1/2 indicated Scale
B. Cross section of leaf	to Scale X2
C. Flower from the front	to Scale X2
D. Flower from the side	to Scale X2
E. Labellum from above	to Scale X3
F. Top of column, anther, pollinia and viscidium removed	to Scale X10
G. Column from the front	to Scale X5
H. Column from the side	to Scale X5
I. Anther from above	to Scale X10
K. Anther from the side	to Scale X10
L. Pollinia	to Scale X10
M. One pair of pollinia from the middle	to Scale X20
N. Pollinium from the front	to Scale X20

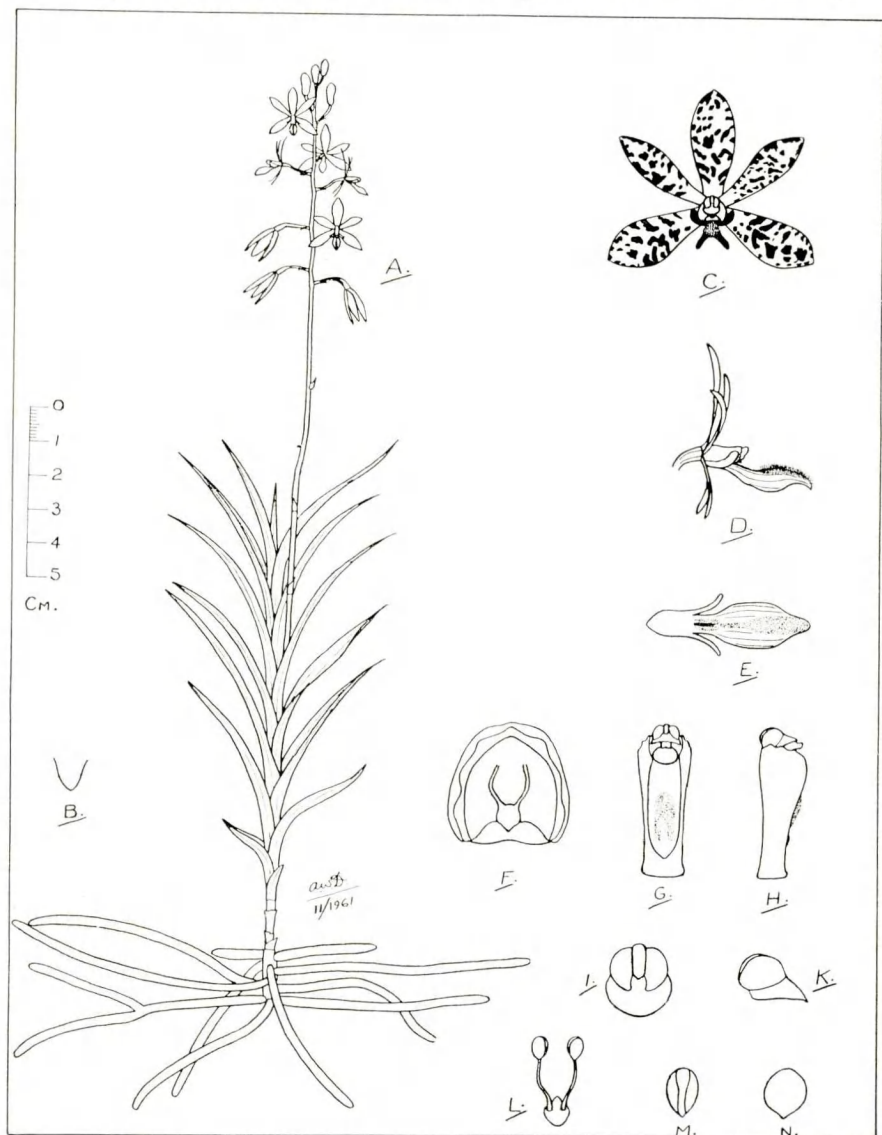
DISTRIBUTION: From the Herbert River to the Mossman River, North Queensland, coastal in its southern extremity, highland in the remainder. It seems to favour sandy soil.

FLOWERING PERIOD: Summer.

A North Queensland *Dipodium*

By A. W. DOCKRILL

This is undoubtedly one of Australia's most beautiful orchids, but its entire habitat is within a floral reserve. When plants are obtained from private property they are found to be readily cultivated (within the tropics, of course) in a "free", well drained mould or compost containing plenty of coarse sand or fine gravel, typical of that used for many large terrestrial orchids. The stems continue to grow and become unwieldy with continuous watering under cultivation and should be pruned back after flowering.



DIPODIUM ENSIFOLIUM F. Muehl. Fragm.

Germination of Orchid Seed

An old technique using new towelling on an overfilled pot.

By H. BOYD

Three parts fine used orchid compost (must be fresh) and one part by volume of sphagnum moss, is mixed well and placed in a well crocked pot. It is compacted and the pot overfilled to form a dome, which, in a 3-4 inch pot, can be 2-3 inches above the rim when compressed. A piece of new towelling is now tied tightly over the compost to achieve a domed pin cushion effect. It must compress the damp compost to keep the towelling constantly wet. Nylon fishing line is recommended for the tie. Both towelling and tie must last a year. In the initial wetting of the compost, it is better to use cold boiled water lightly applied, before seed is sown.

Seed can be distributed from a knife blade onto the towelling surface and then pressed into the towelling surface with the flat of the knife.

The above technique has not been developed by the writer, but with slight variations has been used for a hundred years. Some workers place the medium under a bell jar, others in a glass case and others suspend it in a glasshouse. Most are adamant that it should not stand in water. The writer suspended his work in a glass-house and watered it from above with cold boiled water to control algae infestation. Care must be taken not to wash off germinating seed. The medium must not be allowed to dry out. If alkaline water is encountered, the medium must be wetted with acidified water to a pH value of about 5.2. Sydney water is about 5.2 to 5.6 and is satisfactory for epiphytic orchids.

The writer has only propagated epiphytic orchids by this technique, but research shows that terrestrials have been grown by this method also. They include *Selenipedilum*, *Paphiopedilum*, *Phaius* and *Calanthe*.

Without a heated glasshouse this method can be used only in spring and summer. Temperature has a tremendous effect on germinating orchid seed. If low winter temperatures are encountered, germination is slowed down or absent. Spring is by far the better time to sow the seed so that plants are well advanced by winter.

Protocorms of fair size should be obvious in three months. Then the medium can be wetted fortnightly with a half strength solution of "Aquasol". As plants advance this can be applied in greater strength. If the medium becomes infected with small animals, use a water soluble of D.D.T.

It is most important to mix fresh used orchid compost in the medium. This tends to ensure, the infection of germinating seed with the right fungus. If soil or compost is taken from around the growing species that is to be propagated, this might help in germination.

GERMINATION OF SEED

Part 2—By HELEN LEE

There are many aspects to the physiology of germination and some of them are so specialised as to be beyond the scope of these articles. Firstly, however, we will consider the environmental conditions which must be fulfilled before germination will occur. Although the seeds of different plants are very variable, there are factors which affect them all. Germination is affected by water, temperature, oxygen and light and these will be considered in turn. If one or more of these factors is unfavourable the seed usually remains inactive or "dormant." This resting or dormancy condition must not be confused with true dormancy which is concerned with seeds which

CAN WE SAVE OUR NATIVE ORCHIDS?

The beauty of our terrestrial orchids is, to many, unsurpassed. Why do we not see more of them? Many are difficult to grow, much harder than the epiphytes, and this is the reason many growers of orchids do not try the terrestrials. They are even more difficult to obtain. Fortunately many are difficult to transplant from the bush and and we appeal to readers not to do this. The chief trouble is the extreme difficulty in propagating them from seed. A few competent workers are experimenting to solve this problem but we need more. For those who wish to assist, H. Boyd has given details of a simple method that does not require special skill, experience or equipment, just patience and determination. For others who wish to help, we need fresh seed. Send to the Editor in a paper envelope. Mr. Warren P. Stoutamire, Cranbrook Institute of Science, Bloomfield Hills, Michigan, U.S.A., is also working on this problem and requires seed.

will not germinate even though all the factors are favourable. True dormancy will be considered in a later article.

1. Water.

Seeds will not germinate unless water is available. Seeds take up water directly through the testa and through the micropyle. The amount of water taken up varies with the species, e.g., peas and beans take up about one to one and a half times their dry weight. Other seeds is usually less than 20% of their weight, but water is continuously absorbed prior to and during germination and the seedling will have a water content of about 80%. The role of water in the germinating seed is a complex one. Briefly, the stored food materials in the seed are in an insoluble form and when the water enters, enzymes are activated and the insoluble food is converted to a soluble form and as such can be utilised by the developing seedling.

2. Temperature.

If all other conditions are favourable, the temperature required for germination depends upon the plants but in general, seeds will not germinate at 32°F (0°C) or above 113°F (45°C), and the most favourable temperature is around 69°F (20°C). The seeds of any species will have a minimum temperature below which they will not germinate, a maximum temperature above which they will not germinate and optimum at which germination is best. Maize, min. 46°F (8°C), optimum 90-95°F (32-25°C), max. 112°F (44°C).

E.g., barley min., 37°F (3°C), optimum 68°F (20°C), max. 82°F (28°C).

These temperatures will vary with different batches of seed and also with the stage of germination. Temperature affects the rate at which the seed will take up water, the rate at which the enzymes will work and the growth rate. These temperature effects only hold for seeds which have taken up water, as dry seeds are very inactive and may withstand very low and very high temperatures (up to 212°F) without being injured.

3. Oxygen.

Air contains about 20% oxygen which is required by nearly all plants and animals for the process of respiration ("breathing"). Thus, the majority of seeds require air for germination. The seeds of some plants can germinate under conditions in which the oxygen content is very low or absent, e.g., the seeds of bulrush (*Typha*) and rice. These plants, under natural conditions, live in stagnant pools and their seeds germinate in the mud in the bottom in the complete absence of oxygen. However, the young seedlings cannot continue to live without oxygen and will die unless they grow up and out into the air.

2. Light

Seeds vary in their light requirements. Some, e.g., mistletoe, germinate only in the light, others only in the dark, while many, e.g., beans, clover, etc., germinate equally well in dark or light. On the other hand, some seeds, e.g., those of *Banksia marginata*, are partially inhibited light, that is, seeds kept in absolute darkness will germinate very much more quickly than those receiving even a short dose of light. The nature of the light response in

THE AUSTRALASIAN BEEKEEPER

This is the official organ of the various Apiarists and Beekeepers' Associations in each State of Australia. Published monthly, it contains news of the "bee world" and interesting articles on commercial and amateur beekeeping that will interest many property owners. A seed bank list is published regularly and seed of Eucalypts is available free on application. The March issue includes an article on "Growing Trees From Seed" and an article by W. Cane on "Plants of Value to Bees." The subscription is 16/- sent to Pender Bros., P.O. Box 20, Maitland, N.S.W.

THE LANGUAGE OF BOTANY

This excellent work of 64 pages turned out a much larger book than we at first expected. The price of 4/- is much nearer the cost price. Beautifully printed on art paper, it defines thousands of botanical technical terms for reference by the amateur or student botanist. It has been very enthusiastically received.

AUSTRALIAN PLANTS

Bound Volume 1, Issues 1-12 of Volume 1 of this publication, plus the publication "The Language of Botany," is available at £3, plus 2/- postage.

AUSTRALIAN PLANTS

Copies of past issues 1-8 are available as individual copies for 4/-, plus 5d. postage. Issues 9, 10, 11 and 12 are permanently out of print. Issues No. 13 onwards are 3/- plus 5d.

JOURNAL OF AGRICULTURE—WESTERN AUSTRALIA (PRICE 2/-)

Each State Department of Agriculture publishes such a journal but that produced by Western Australia possibly surpasses them all. It must be an essential reference to settlers in that State. Of special interest is a series, appearing at random intervals, by Mr. C. A. Gardner entitled "Trees of Western Australia".

INDEX SEMINUM—SEED LIST, KING'S PARK, WESTERN AUSTRALIA

To native plant growers who propagate from seed, the announcement of this publication will be the best news they have heard for years. Hundreds of Western Australian plants are listed and there is complete assurance that not only will the seed listed be available readily at the low price of 2/6 per packet, but it will also be carefully named and be fresh and viable.

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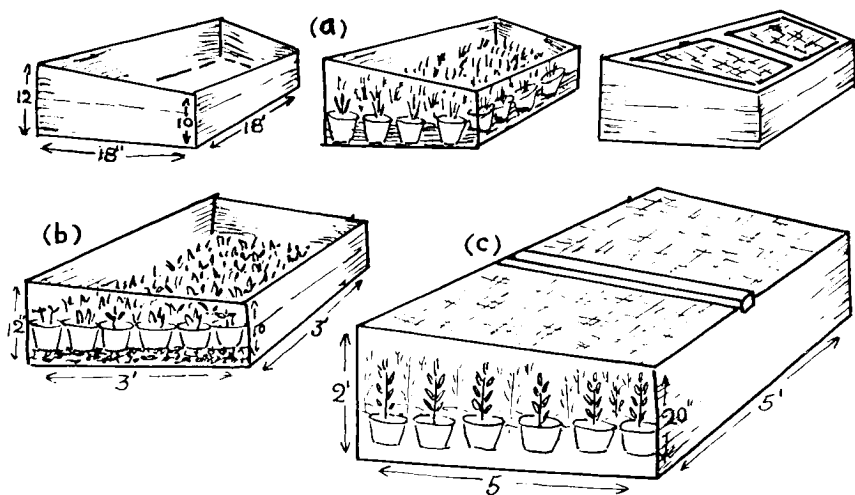
germinating seeds is not known. However, as soon as the food reserves in the seed are exhausted, the seedling requires light for continuation of photosynthesis during which the plant makes sugar by chemical reactions which can't be discussed at the moment.

These four factors, water, temperature, oxygen and light which are necessary for germination are all inter-related so that even if the temperature is at the optimum for particular seeds, they will not germinate in the absence of water or oxygen.

PROPAGATING FRAMES FOR THE HOME GARDENER

By R. HARDIE

Not many gardeners are fortunate enough to have the use of a glass-house and shadehouse. For those who wish to raise Australian plants from seeds and cuttings at home, they may do so cheaply and effectively by making some simple wooden propagating frames or boxes, as described and illustrated below. The frames should be stood in a level part of the garden which receives plenty of light, but is sheltered from wind and direct sunlight in the hottest part of the day. The frames themselves provide that additional protection so necessary for successful propagation and then later for hardening off.



Three Types of Frames are Recommended

(a) For Cuttings

Three or more small frames, each $1\frac{1}{2}$ ft. x $1\frac{1}{2}$ ft. square and each capable of holding about 16 $\frac{3}{4}$ in. pots of cuttings, are preferred to one large frame. The difficulty with one frame only is that newly made cuttings require more humidity and shade than cuttings which have already been inserted several weeks. Thus it is best to have distinct batches of cuttings, at different stages of striking, in separate small frames.

Cuttings are covered with a sash or "lid" made of glass or .004mm. polythene to give a humid atmosphere within the frame, and newly made cuttings need a hessian cover also, for extra shading. More air and light is admitted as the cuttings develop.

If the pots of cuttings are plunged to the rim in a base of moist sand or sawdust they will not dry out so quickly and the compost in the pots is held at a more uniform temperature.

(b) For Seeds

One larger frame, say 3 ft. x 3 ft. square, is sufficient to begin with. The seeds are sown in pans or small pots, stood on a base of moist sand or gravel and are covered with a sash made of hessian or of "Sarlon" plastic shade cloth. These materials protect the seeds from wind, sun and

heavy rain, yet admit air to the germinating seedlings. Polythene or glass sashes (though suitable for cuttings) would tend to raise humidity and encourage "damping off" of the seedlings.

(c) For Hardening-off

Rooted cuttings and seedlings are pricked off into small pots, tubes or tins and transferred into a larger (say 5ft. x 5ft.) and deeper hardening off frame. They are covered with a strongly made sash of Sarlon or lathes or hessian, until in due course they are gradually hardened off to normal outdoor conditions, ready for planting out.

(d) Hygiene in the Frames

Pots, etc., for cuttings and seed should be scrubbed clean with soap, e.g., "Clensel", and hot water before use.

A small quantity of seed soil can be sterilised by half-filling a sugarbag and placing the bag on some boards in a domestic copper which has a few inches of boiling water in the bottom; the boards are set about 6in. above the level of the water which is boiled for not more than half an hour. Washed sand and peat do not need sterilising. Sterilisation kills damping-off fungi (*Pithium spp.*) which attack the stems of germinating seedlings at soil level; thin sowing and adequate light also reduce the chance of attack. Should trouble occur, however, remove affected clumps of seedlings and water remainder with a Zineb solution.

Cuttings must be kept clean and free from "grey mould" (*Botrytis cinerea*) by regularly removing decaying leaves and stems; occasional waterings with Zineb are also helpful.

The only pests likely to give trouble in the frames are snails and slugs.

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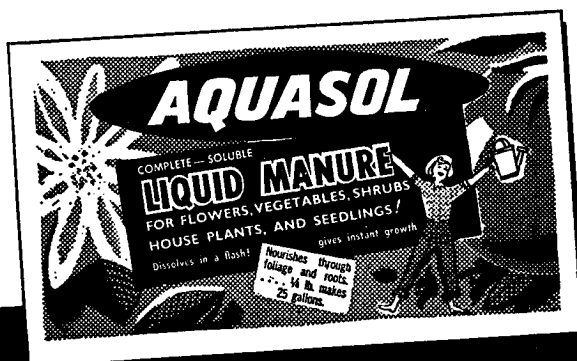
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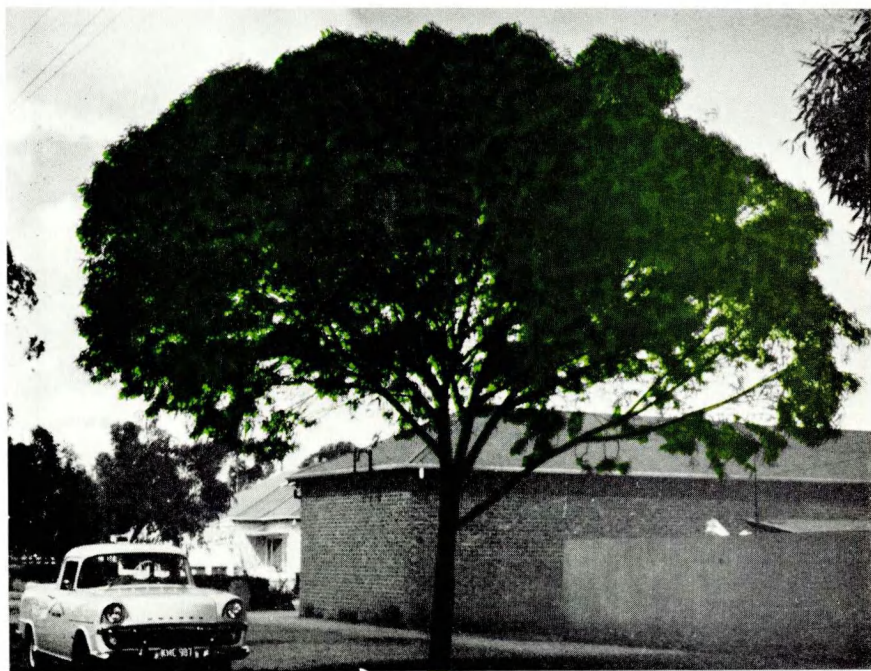
STREET TREES

This supplement is part of the street tree project. Local government authorities from all parts of Australia have accepted our invitation to participate in an investigation into the types of Australian trees suitable for street planting and the development of ideal forms for this purpose. The problems are considerable and just a few are described by C. D. Boosma on page 54. We are honoured to have received such wholehearted and spontaneous support from the local government bodies and are fully aware of the enormous task that confronts us.

The first year has been a period of review. Much has already been done by certain individuals or councils over the years but most of this has been lost as officers and procedures have changed. If we did nothing else but publish the accumulated knowledge of the competent men already engaged on street tree planting, then we have performed a noble task. Articles from three such pioneers are contained in this supplement.

EUCALYPTS AS STREET TREES

This is the theme of the supplement. We do not suggest that Eucalypts make suitable trees. However it does appear from the articles below that they are ideal for dry inland areas. Various aspects will be thoroughly investigated before firm recommendations will be made. Particular emphasis should be made to intended growers, professional or amateur, of the importance of preparation of young trees before planting out as described in these articles. You might call it the secret of their success.



Eucalyptus campepe—a form local to Kalgoorlie area. Nine years old, it is now 18ft. high. No attention given after the first year.

Eucalypts As Street Trees in the Town of Kalgoorlie

By J. WALLACE — Head Gardener

Native trees, as used for street trees, in the town of Kalgoorlie, with the exception of Kurrajongs, are all Eucalyptus species. When an extended programme of street tree planting was commenced in 1946, it was decided

to use *Eucalyptus* species from the drier areas, as being most suitable for the arid conditions prevailing. Many of them are indigenous to the goldfields of Western Australia. More than thirty varieties have been tested, only two or three being found unsatisfactory.

It would be preferable to standardise, and say no more than six varieties at the most. However the variations in the types of soil in the town area render the use of a considerable number of varieties essential.

The soil varies from a good, deep loam to in places, a rather heavy clay, and existing in many areas are reefs of diorite and other gold bearing rocks. Salt and other minerals also add to the difficulties in growing street trees. Rainfall is between nine and ten inches per year. Height above sea level, just one thousand feet.

Trees from other countries have been tried; with the exception of the pepper tree (*Schinus molle*) they have proved unsuitable.

Below is a list of *Eucalypts* which have been tried as street trees. Also, brief descriptions of colour of bark, foliage, height, locality where found and the class of soil they occur in, also time of flowering and rainfall of the particular district. Mention has also been made as to whether they stand pruning. Whilst varieties from the higher rainfall areas stand pruning better than those from the dry areas, it is much better to plant trees suitable for the location. The less pruning done the better. Experience here has been that where trees from the low rainfall areas have had to be pruned, for various reasons, losses have been considerable. Even where trees have recovered, the subsequent regrowth has never been as good as the original. The lower limbs should be left on the young trees as long as possible, otherwise the trees tend to become spindly. Sometimes, from a point of view of traffic visibility, that is not always possible.

If required, young trees should be staked, more so if in exposed situations. It is desirable to remove all split tops, otherwise the tree may become a total loss. Scale insects peculiar to *Eucalypts* sometimes make their appearance. These can be controlled with such sprays as white oil, malathion (according to the maker's directions), and fresh washing soda, one and half pounds to four gallons of water.

The mature heights shown are those likely to be attained under the most favourable conditions. As all street trees here have been planted since 1944, no data is available as to the ultimate height the trees will attain. The common names shown are those generally used in Western Australia.

SALT TOLERANT EUCALYPTS:

Whilst not much will grow in areas affected by salt the following *Eucalypts* are salt tolerant:—

Sargentii, *longicornis*, *gracilis*, *stricklandii* and *occidentalis*.

STREET TREES FOR SHADE:

Eucalypts listed in order of preference as street trees for shade, which are now being planted in Kalgoorlie:—

Eucalyptus dundasi, *E. campaspe* (hybrid), *E. torquata* (flowers and shade), *E. gracilis*, *E. camaldulensis*, *E. redunca* var. *elata*, *E. longicornis*, *E. salmophloia*, *E. sargentii*, *E. stricklandii*, *E. salubris*, *E. flocktoniae*, *E. erythronema* (flowers mostly), *E. gardneri*, *E. Astringens*, *E. brockwayi*, *E. campaspe*, *E. occidentalis*, *E. oleosa*, *E. woodwardi* (hybrids, flowers mostly), *E. occidentalis* var. *stenantha* (flowers mostly), *E. woodwardi* (flowers mostly), *E. brachycorys*, *E. oleosa* var. *kochii* (flowers mostly), *E. clelandi*, *E. intertexta*, *E. transcontinentalis*, *E. diptera*.

Eucalypts for Shade and Street Trees

***Eucalyptus astringens* (Brown Mallet)**

Tree 30 to 80 feet, bark smooth brown and grey throughout. Leaves dark green shining both sides. Narrogin, Wagin districts, laterite loamy soils and sandy to medium loams. Rainfall 16 to 20 inches. Flowers October-November. Dense head shows great promise as a street tree in suitable soils, for this area. Will stand some pruning if required.

***Eucalyptus brachycorys* (Ribbon Gum)**

Small tree to 45 feet. Bark smooth and white throughout. Leaves dark green, shiny. East of Southern Cross and Norseman district. Loamy sands in lake country Rainfall nine to 11 inches. Flowers October-December. Useful small tree for sand drift areas. Does not respond to pruning.

***Eucalyptus brockwayi* (Dundas Mahogany)**

Trees 30 to 80 feet. Bark smooth and salmon coloured throughout. Leaves dark green shining both sides. Narrogin, Wagin districts, laterite loamy sandy loams in flats near hills. Rainfall nine to 11 inches. Flowers March-April. Fast growing tree, fairly dense head. Good for confined areas. Will stand pruning if required.

***Eucalyptus camaldulensis* (River Red)**

Tree 50 to 120 feet. Bark smooth, white, pale grey or buff. Leaves pale green or sometimes greyish. In Western Australia flowers September to October. All mainland States. In Western Australia found along water courses from Leonora northwards. Best on deep, alluvial soils. Rainfall eight inches upwards. Good street tree in suitable soils. Fast grower, attaining large size under favourable conditions. Will stand hard pruning.

***Eucalyptus campaspe* (Silver Gimlet)**

Small tree to 35 feet. Trunk and main branches smooth and copper coloured. Upper branches smooth and glaucous. Leaves silvery grey glaucous. Eastern Goldfields in red loams light to heavy texture. Rainfall 8 to 10 inches. Flowers October-December. Useful shade tree in this area. Tolerant of saline soils. Will stand light pruning.

Campaspe hybrids

Small tree to 25 feet. Bark on trunk and main branches smooth and copper coloured, smaller branches glaucous. Leaves dark green, slightly glaucous and shiny. Eastern Goldfields in red loams, light to heavy. Rainfall eight to 10 inches. Flowers April to August. Excellent shade tree, good head. Salt tolerant a wide spread. Will stand hard pruning if need be.

***Eucalyptus cladocalyx* (Sugar Gum)**

Tree 50 to 100 feet. Bark white and smooth, leaves medium green above slightly paler beneath. Many districts of South Australia. Best on granite and red loams. Rainfall 16 inches or more. Flowers January-February. Good nectar tree, good shade tree. Not suitable for less than 16 inches rainfall. Use as street tree discounted here for that reason.

***Eucalyptus clelandi* (Clelands Blackbutt)**

Medium-sized tree 50 feet, sometimes more. Bark dark, hard and flaky at butt, remainder smooth and white, smaller branches glaucous, leaves dark green slightly glaucous. Eastern Goldfields on red loam flats and low hills. Rainfall nine to 11 inches. Flowers September-December. Drought resistant. Has been sparingly used as a street tree.

***Eucalyptus diptera* (False Gimlet)**

Small tree to 30 feet. Bark smooth and copper coloured throughout. Leaves thick, dark green and shining. Salmon Gums and Eastern Goldfields in heavy soils also saline areas. Rainfall eight to 16 inches. Flowers May-June. Dense head good spread, poor root stock, tends to be easily uprooted.

***Eucalyptus dundasi* (Dundas Blackbutt or Coffee Gum)**

Tree 30 to 60 feet. Bark on first 20 feet of trunk black and rough, remainder reddish coloured and smooth. Leaves bright green, shiny both sides. Norseman district on red loams or gravel. Prefers alkaline soil. Rainfall 9 to 11 inches. Flowers December-January. Fair nectar tree. Generally regarded as best street tree for hot inland districts in Western Australia. Has done well here as a street tree. Does not respond to pruning.

***Eucalyptus erythronema* (Red Flowered Mallee or Lindsay Gum)**

Small tree to 30 feet. Bark smooth, light grey in colour, leaves pale green. Southern Cross district on light sandy loams. Rainfall 11-14 inches. Flowers June-November. Flowers blood red, very attractive. Excellent small street tree, popular because of showy blossom. Will stand light pruning.

***Eucalyptus falcata* (Silver Maliet)**

Tree 20 to 30 feet. Branch smooth, yellowish, white; leaves glaucous. Narrogin and Ravensthorpe districts on laterite loamy soils and sandy to medium loams. Rainfall 15-20 inches. Flowers November-December. Disappointing as a street tree here. Not now in use for that purpose.

***Eucalyptus flocktoniae* (Merrit)**

Tree 30 to 60 feet. Bark smooth and white. Leaves very dark green and shining. Eastern wheat belt, Eastern Goldfields and Norseman districts, on sandy to medium loams. Rainfall nine to 12 inches. Flowers February-November.

Quite an ornamental and good shade tree under favourable conditions. Does not stand much pruning.

***Eucalyptus gardneri* (Blue Mallet)**

Tree 20 to 30 feet. Bark silver grey to light brown and smooth leaves, glaucous or bluish green. East of Great South Railway in laterite loamy soils and sandy to medium loams. Rainfall 15-20 inches. Flowers May-June, useful small tree in suitable soils. Does not stand much pruning.

***Eucalyptus gracilis* (Yorrel)**

Tree 30 to 60 feet. Bark on trunk dark and slightly rough at base, smooth and copper coloured for remainder. Leaves dark green, smooth and shiny. Southern Cross district. Sandy to heavy loams near lakes. Rainfall 11 to 12 inches. Flowers April to August. Excellent shade tree, good head. Salt tolerant. Does not respond to pruning.

***Eucalyptus griffithsii* (Griffiths Grey Gum)**

Tree 30 to 50 feet. Bark ash grey and rough in trunk. Smooth and grey on branches. Leaves thick and glaucous. Eastern Goldfields, on loamy soils, slightly saline. Rainfall nine to 12 inches. Flowers September-October. Has been sparingly used as a street tree.

***Eucalyptus intertexta* (Gumbarked Coolabah)**

Tree 40 to 80 feet. Bark on trunk grey and rough, upper branches smooth and grey. Leaves glaucous. Tree from the South-west and West of New South Wales on red loams. Rainfall 11 to 14 inches. Flowers May-June. Drought resistant, slow grower, promising as a street tree, head fairly dense.

***Eucalyptus kondininensis* (Kondinin Blackbutt)**

Slender tree, 34 feet. Bark dark and rough at base of trunk, then smooth, yellowish above. Leaves yellowish green. Found near Kondinin on loamy flats. Rainfall 14-28 inches. Flowers November-December. Rather a slender street tree.

***Eucalyptus kruseana* (Kruses Gum)**

Small tree to 10 feet. Bark smooth, copper coloured. Leaves very glaucous. Frasers Range on light sandy loams. Rainfall eight to nine inches. Flowers April to July. Best treated as a shrub. Rather a novelty in a shrubbery. Will stand light pruning.

***Eucalyptus lehmanni* (Bald Island Marlock)**

Small tree to 30 feet. Bark smooth, whitish grey. Leaves dark, green, not shiny. Bald and Middle Islands round to Eucla. On sandy loamy soils. Rainfall 16 to 26 inches. Flowers July-August. Flowers attractive, good nectar tree. Useful wind break and shade tree on better than 16-inch rainfall.

***Eucalyptus le souefii* (Goldfields Blackbutt)**

Tree to 40 feet. Bark dark and rough at base of trunk. Upper part of trunk and limbs white and smooth. Leaves dark green, slightly glaucous. Eastern Goldfields and Norseman district, on laterite ridges and loams of various textures. Rainfall eight to 11 inches. Flowers October-December. Has not been satisfactory as a street tree in this area.

***Eucalyptus longicornis* (Morrel)**

Tree 60 to 80 feet. Bark rough and dark on trunk and limbs, smaller branches reddish brown and smooth. Leaves dark green and shining. Great Southern and wheat belt on sandy loams covering layers of limestone. Rainfall 11 to 18 inches. Flowers April-September. Slow grower in early stages. Good street tree and shade tree where space available. Stands pruning.

***Eucalyptus occidentalis* (Flat-topped Yate)**

Fifty to 80 feet. Bark rough and grey on trunk and main branches, smaller branches smooth and white. Leaves thick, dark green, not shining. Near Great Southern, eastwards to Esperance and Salmon Gums, on sands over clay in poorly drained areas. Rainfall 12 to 25 inches. Flowers April-May. Yields much nectar. Salt tolerant. Useful in areas affected by salt. Stands hard pruning if need be.

***Eucalyptus occidentalis* var. *Stenantha* (Slender Yate)**

Tree to 40 feet. Bark smooth and grey, leaves dark green. Lake Cowan on sandy to loamy soils. Rainfall 12 to 20 inches. Flowers September-November. Flowers large and attractive. Slow grower, useful in restricted areas.

***Eucalyptus oleosa* (Giant Mailee Oily Gum)**

Tree 10 to 40 feet. Bark rough and grey on trunk, smooth and ribbon-like

on upper branches. Leaves light green and shiny. In Western Australia—Ravensthorpe, Eucla, Southern Cross and Eastern Goldfields, on red and sandy loams. Rainfall nine to 14 inches. Flowers May-July. Hardy tree suitable for arid areas. Fair shade and street tree. Will stand hard pruning.

Eucalyptus oleosa* var. *Kochii

Small tree 20 to 35 feet. Bark on trunk rough and grey. Upper branches smooth brown to brownish pink. Small twigs yellow. Leaves narrow, slightly glaucous. A few miles east of Pindar, Perenjori and Dalwallinu, on sandy loams. Rainfall 11 to 14 inches. Flowers January. Useful small tree for sandy loams in restricted areas. Fair shade tree. Very good nectar tree. Flowers cream coloured, large and attractive. Will stand light pruning.

***Eucalyptus redunca* var. *Elata* (White Gum or Warndoo)**

Tree 50 to 70 feet. Bark smooth, yellowish white, with red patches. Leaves grey green. Darling Ranges and plain country on heavy soils over clay. Does well in acid soils. Rainfall 16 to 20 inches. Flowers irregularly April to December. Yields much nectar. Good street tree here for heavy soils, giving good shade. Stands severe pruning if required.

***Eucalyptus salmonophloia* (Salmon Gum)**

Tree to 100 feet. Bark smooth and salmon pink throughout. Leaves dark green and shining. Western Australian wheat belt to Eastern Goldfields and beyond in sandy loams to heavy clays. Rainfall eight to 18 inches. Flowers September to December. The largest and best of the inland trees, requires a good soil. Early growth slow. Good street and shade tree in good soils.

***Eucalyptus salubris* (Gimlet)**

Tree to 50 feet. Bark smooth and copper coloured throughout. Leaves dark green and shining. Western Australian wheat belt and Eastern Goldfields in medium to heavy loams. Rainfall eight to 16 inches. Flowers March to October. Good shade tree in early stages, tends to become sparse as it ages.

***Eucalyptus sargentii* (Salt River Gum)**

Tree 30 to 60 feet. Bark smooth and copper coloured throughout. Leaves thin and green, not shiny. Meares Lake on saline soils. Rainfall 14 to 16 inches. Flowers September to October. Flowers cream coloured, large and attractive. Useful tree for saline soils, wide spread in head giving good shade. Stands hard pruning.

***Eucalyptus stoatei* (Pear Gum)**

Tree to 35 feet. Bark smooth and grey throughout. Leaves dark green, shiny. Ravensthorpe district on sand plain country. Rainfall 16 to 20 inches. Flowers October -November. Upright symmetrical tree, does not provide much shade. The large seed vessels, coloured red, hang like pears. Has not been satisfactory as a street tree in this area.

***Eucalyptus stricklandii* (Yellow Flowered Blackbutt)**

Tree 30 to 40 feet. Bark dark and rough at base, smooth and somewhat glaucous on remainder of trunk and branches. Leaves thick and glaucous. East and south of Kalgoorlie on poor laterite hills, and loams near hills. Rainfall nine to 11 inches. Flowers November-January. Flowers large yellow, rather attractive. Fair nectar tree. Good small street tree. Adaptable as to soils. Will stand pruning if required.

***Eucalyptus torquata* (Coral Gum, Coolgardie Gum)**

Small tree to 35 feet. Bark grey and rough throughout. Leaves dark green slightly glaucous. Coolgardie and Norseman, on rock hills, usually basic soils. Rainfall nine to 11 inches. Flowers August to January. Flowers coral red borne in profusion, good nectar flower. Popular ornamental and shade tree, adaptable as to soils. Will stand light pruning.

***Eucalyptus transcontinentalis* (Boongul)**

Tree 30 to 60 feet, bark white and smooth. Leaves bluish green or glaucous. Eastern wheat belt, Eastern Goldfields. Trans-Australian Railway Line, on sandy to medium loams. Rainfall nine to 12 inches. Flowers August to November. Flowers borne profusely, pale yellow. Fair shade tree. Will stand light pruning.

***Eucalyptus woodwardi* (Lemon Flowered Gum)**

Tree to 40 feet. Bark smooth and white throughout. Leaves very glaucous and large. About 100 miles east of Kalgoorlie on deep sandy loams. Rainfall eight to nine inches. Flowers July to November. Large showy yellow blossom.

Rather drooping habit of growth. Popular on account of striking flowers. Will stand pruning.

***Eucalyptus woodwardi* (Hybrids)**

Tree to 40 feet. Bark on some rough and dark, others smooth and glaucous. Leaves on some glaucous, others dark green, slightly glaucous. Leaves usually thick and large. Suitable for light sandy to medium loams. Rainfall nine to 11 inches. Flowers June to November. Flowers very large and attractive. Colours range from pale yellow to dark crimson and bronze. Also from light pink to deep coral red. The tree was propagated in the Kalgoorlie Municipal Nursery from seed collected from a *Eucalyptus woodwardi* growing in the grounds of the Kalgoorlie Primary School in 1948. The *E. woodwardi* was growing within 15 feet of a *Eucalyptus torquata*. The various trees show many of the characteristics of both *E. woodwardii* and *E. torquata*.

Much use has been made of these hybrids for street planting in the town, and they cause very favourable comment. They commence flowering in their third year. Can be lightly pruned.

PROPAGATION METHODS USED

The seed is sown direct into four-gallon containers, usually kerosene tins. Generally the first week in September. The soil selected is as near to the class of soil that the trees are to be grown in, as is possible. A mulch of lawn clippings is placed over the tins to keep them moist. Germination is usually ten days to three weeks. As the seedlings progress, they are thinned out to leave only one plant per tin.

This method may appear wasteful and extravagant, but is actually labour saving, and the results are 100 per cent. In this hot, dry area, large shade houses would be required to follow the normal practice. Even then all pricking off would have to be done in the cool of the evening to achieve any success.

PLANTING OUT

Trees grown under the method in use here range in height from three to eight feet, depending on the variety, when planted out in June, about nine months growth. Holes to take the trees in their permanent positions are usually four feet in diameter, two feet deep, with the bottom broken up. No special soil is used unless rock or rubble has to be removed. The container is cut away and the plant placed in the hole without disturbing the roots. Guards have to be placed around trees to protect from vandals and dogs. The guards remain on for two years. During the summer and until good rains fall in the autumn, each tree receives thirty gallons of water per week for the first year after planting only. Usually after one year the trees can fend for themselves. Only odd trees have to be watered for a second year.

To achieve the best results with *Eucalyptus*, it is advisable to leave the lower branches on the trees for several years. This tends to slow down the top growth and strengthens the trunk of the tree. Unfortunately, this can hardly be practised when the trees are used for street work. Visibility from a traffic point of view often requires the removal of the lower limbs earlier than is desirable.

Close on 8,000 trees have been planted in the streets here since 1946. Many have made good progress—some are almost forty feet high. Nearly all main streets have been planted. There only remains some odd side streets to complete the programme. When the planting programme was first commenced, about 700 trees were planted for the first two years. The number planted each year has been progressively reduced. At present, about 350 are being planted each year. Losses in newly planted trees number about one per cent. from all causes in each year's planting.

STREET PLANTING IN SOUTH AUSTRALIA

By C. D. BOOSMA

Despite a well appreciated demand by the Public for streets to be planted, it is not fully aware of the factors governing the choice of species nor does it accept without protest the removal of apparently healthy mature trees, since the removal may in a few hours account for the growth of 50 years or more. No doubt a contributing factor to the protest is the destruction of a life-long association between the street trees and the public.

To avoid their removal there has been a swing to the selection of species of small stature, which reduce the chance of overhead interference, and also of underground damage from a proportionately smaller root system. This

appears to be a proper approach to the engineer's criticism that large trees are apt to prove expensive to maintain, despite a progressive policy of using modern equipment. It seems that to satisfy the municipal maintenance budget, a small, neat tree is required with a clean, upright trunk which supports some ornamental feature such as the arrangement of the foliage or attractive flowers.

It is beyond argument that the cost of removal of excessive dropped material whether foliage or fruits should be avoided. Species which are now excluded because of such faults include: *Melia azedarach* (White Cedar) with its myriads of hard white berries as well as deciduous foliage; *Ficus macrophylla* (Moreton Bay Fig) with its host of pulpy figs; and deciduous species with extensive root systems as *Populus* spp. (Poplars), *Ulmus* spp. (Elms), *Fraxinus* spp. (Ashes). Also included are some of the larger evergreen trees such as some species of *Pinus*, *Araucaria*, and *Eucalyptus*.

However for planting in public parks free from overhead wires and underground pipes, the large stately tree is appropriate. Here the litter problem is not so pressing and there is scope for those species which are not acceptable as street trees.

It is well appreciated that a dense cooling shade is produced by a well spaced avenue of large trees if only for their rarity in this city of Adelaide prone to hot and dry summers, but it is unlikely that this type of planting will be given acceptance in restricted streets.

The recent extensive storm damage to trees again focuses attention on the need to select species which have either an inherent wind resistance, or those in which wind resistance can be induced through regular careful attention. Species which showed negligible damage in the recent gale which exceeded 80 m.p.h. included: *Eucalyptus citriodora* (lemon scented gum) and *Lagunaria patersonii* (pyramid tree).

This could be extended to include numerous additional species if close pruning had been undertaken to shorten leading branches to a length of a few feet. Regular inspections for growth defects should be made, and corrective action carried out, for the failure to carry out proper maintenance treatment invites unnecessary damage from wind exposure.

In the following list little is known of their potential habits as street trees, but it is surmised that their size (approximately 20 feet) will result in little maintenance of aerial portions, while the smaller root system should also be less prone to causing underground damage.

Soils: A=Acid, C=Calcareous or Alkaline, N=Neutral soils.

Area One—Receiving 10ins. to 14ins. Average Rainfall—Upper North and Mallee

Botanical Name	Common Name	Soils
<i>Eucalyptus eremophila</i>	Sand Gum	A—C
" <i>forrestiana</i>	Fuchsia Gum	A—C
" <i>intertexta</i>	Gum Barked Coolabah	A—C
" <i>microtheca</i>	Coolabah	A—C
" <i>platypus</i>	Round Leaved Moort	A—C
" <i>stoatei</i>	Pear Fruited Gum	A—C
" <i>stricklandii</i>	Yellow Flowering Gum	A—C
" <i>torquata</i>	Pink Flowering Gum	A—C
" "Torwood"	Hybrid Pink Flowering Gum	A—C
" <i>woodwardii</i>	Lemon Flowering Gum	A—C

Area Two—Receiving 15ins. to 19ins. Average Rainfall—Upper S. East, Mid-North and Peninsular's Species in Above +

<i>Eucalyptus nutans</i>	Nodding Gum	A—C
" <i>spathulata</i>	Swamp Yate	A—C
" <i>steadmanii</i>	Steedmans Gum	A—C

Area Three—Receiving 20ins. to 24ins. Annual Rainfall—Kangaroo Island, Mid South-East and Foothills of Settled Areas. Species Above + Species Below Only For Annual Rainfall of 25ins. +

<i>Eucalyptus ficifolia</i>	Red Flowering Gum	A—N
" <i>lansdowneana</i>	Port Lincoln Gum	A—C

EUCALYPTS AS STREET TREES

By A. WEBSTER—City of Burnside

PROPAGATION IN TINPLATE TUBES

In my capacity as Head Gardener of a large municipal council I had for a long time been aware of the need to plant advanced trees in our street planting programmes, but found that it was almost impossible to procure

advanced evergreen trees from nurserymen in either sufficient number or species desired.

To rectify this position our own council nursery was established and after several types of containers had been tried, we finally adopted a tube made from four-gallon kerosine tins which gives all that is desired: a reasonable-sized tree between 24ins. to 30ins. in height, with a well constructed root system and easily removed and planted by one man.

These tubes are made by first removing the tops and bottoms of the tins, then with tin snips cutting down two opposite corners giving two rectangles 18ins. x 14ins. (Fig. 1), next along the 18in. edge a series of one-inch cuts are made about two inches apart and at one corner a section is removed (Fig. 2), then three pairs of holes are made along each 14in. edge to enable the sheets to be rolled into tubes and wired with soft wire and twitched with pliers (Fig. 3), the small flaps are bent inwards to retain a tin disc that is dropped into the tube to form a bottom, the tube is now completed and ready for use.

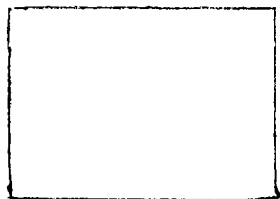


fig. 1.



fig. 2.

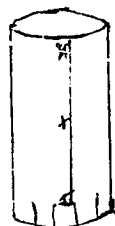


fig. 3.

As well as being easier to handle than the usual four-gallon container, the other main advantage of the tubes are that they do not require as much potting soil, or take up as much nursery space, but still give the same depth of soil and a straight root system. However, it is not intended to keep plant in these tubes for longer than one season as after this time the soil would be depleted of nutrients and growth would be retarded.

Our system is this: Seeds are sown in late September or early October and seedlings are potted into waxed drink container three inches in diameter and four inches deep as soon as they have four true leaves, and are kept in these until February-March. They are tubed up and are ready for planting in the autumn of the following year being 18-20 months old from germination.

EUCALYPTS AS STREET TREES

The following trees are growing well at the present time but only time will tell their usefulness as street trees, however, I would like to make a few comments about them at this stage.

Eucalyptus caesia: Variable habits, about 60 per cent. naturally good shapes, care must be taken to prevent forking as this constitutes danger of splitting later. Additional year in nursery could be beneficial.

Eucalyptus cneorifolia: Good foliage in windy areas, needs a lot of attention in early years to overcome mallee habit but can be made into a good shaped tree.

Eucalyptus gardneri: Very fast grower, upright tree, very attractive foliage when in full sunlight. Care in selection of site necessary.

Eucalyptus platypus: Very fast grower, dense foliage and good shape, should be very useful tree.

Eucalyptus spathulata: Very fast grower, useful tree in windy areas, fine foliage offers little surface to wind. Will possibly need pruning in early life to give a good crown.

Eucalyptus stricklandi: Fast grower making strong lateral growth in first years, but a very easily maintained and useful tree with a good straight butt. Care in selection of site is necessary.

Eucalyptus torquata: Very fast and shapely tree, carries much blossom, tends to be rather sombre in old age but can be easily rejuvenated by pruning.

Eucalyptus "Urrhrae Gem": Variable and indifferent grower, about 40 per cent good shapes naturally, needs a lot of attention to get good shape in trunk. Flower and flowering period only virtue. Additional year in nursery could be worthwhile.

Eucalyptus erythrocorys and **Eucalyptus landsdowneana:** To young yet.

The Genus *Melaleuca*

This series by C. N. DEBENHAM is continued

Part III. Mainly species with flowers forming spikes towards the ends of the branches.

A. Flowers forming dense or loose spikes at first at the ends of the main stems, the floral shoots continuing growth during the flowering period.

Series III. SPICIFLORAE Benth. Leaves opposite or alternate. Flowers forming dense or loose spikes at or near the ends of main shoots, rarely (as in *M. adnata*) on lateral shoots . . . or . . . when not forming spikes, either with leaves alternate or, when leaves opposite (as in *M. radula*), not at the base of new shoots.

i. Leaves alternate, flat, above 25mm. in length, narrowly to broadly lanceolate, multi-veined and usually obscurely pinnately veined. Paperbarks of the tropics reaching large tree size.



Broad-leaved Paperbark
MELALEUCA QUINQUENERVIA

Within the group a northward migration from the tropical mainland of Australia during the evolution of the genus appears to have taken place so that some members are elements of extra-Australian floras. The White Tree, *M. leucadendra*, is a conspicuous feature of lowland "padang-grounds" of poor soils or the "gelam-forests" on swampy sites throughout northern Malaysia. In Indo-China, the species follows the coast forming a *Melaleucetum*

zone between the mangrove swamp and the tropical forest, and a dwarf form is found at higher elevations. It has been introduced to China and India, and two species names proposed by Turczaninow apparently were based on a single tree cultivated in Manila of the Philippines. The tree either has not so successfully established itself on the mainland of Australia or has undergone a degree of speciation in its southward trend, for it does not appear (at least as the typical species) east of longitude 130 degrees and is then confined to the north-west coast.

The Cajuput Tree, *M. cajuputi*, appears to differ from *M. leucadendra* in habit and bark characters and is stated to be of more shrubby stature and to produce a woody, brittle bark quite unlike the thick, corky-textured bark of the latter species. Its distribution in Malaysia is obscured by its inclusion in most floras with *M. leucadendra*. Specht (1958) gives, as its range, from Arnhem Land and Cape York to Malaysia and Burma. Two other close allies of *M. leucadendra*, *M. viridiflora* and *M. quinquenervia*, have a more eastern distribution.

Specht fixes the range of *M. viridiflora* as from the coast and inland of North Queensland, around the Gulf to Arnhem Land while the broad-leaved paperbark, *M. quinquenervia*, extends as far south as Sydney (some remnants of what perhaps was a dense population may still be seen at North Head), and is present also in New Guinea and New Caledonia. The broad-leaved paperbark is a coastal species, frequenting swampy sites and forming a forest stage of a mangrove swamp succession. It forms a tree reaching 20m. in height and produces a thick, corky or spongy-textured white or greyish-white bark which provides a local industry with a filling material for pillows, etc. The tree is well-known to cultivation and is planted frequently as an avenue or park tree particularly useful where moist sites are poorly drained.

From Arnhem Land extending eastwards to Cape York and North Queensland is the inland species *M. nervosa*—it is of particular botanic interest for the partial or total tendency of the filaments of its stamens to remain free and not to cohere in bundles provides an inter-generic link with the callistemons. Eastwards to Cape Yorke and westwards to the Kimberleys is *M. saligna*, previously regarded as a form of *M. leucadendra*.

Found on stony or sandy sites along or in the beds of water-courses of the Kimberleys is *M. argentea* which forms large shrubs or small trees reaching 15m. in height. From the Kimberleys to the north-western Eremaean is *M. lasiandra*, a shrub from about 2m. high or small tree up to 10m. high with narrowly-lanceolate leaves 20-50mm. in length *M. loqui*, described by Fitzgerald for a shrub with small, narrow leaves from desert country south of the Fitzroy River in the Kimberleys may prove to be a form of *M. lasiandra*.

The paperbark, *M. qnidoides*, of New Caledonia appears to have affinity with the group and is described as a shrub in scrubland but reaching tree-size at 2,500ft. elevation in the mountains north and north-west of Ngoyi, either in the Casuarina forest or dry serpentine and occasionally on the bare mountain crests.

With no greater desire than to consolidate the scattered literature of the melaleucas, on his part to fill this gap, where insufficient observations have been made by him, would the writer feels that gaps must be left in this general account of the genus and that an attempt be presumption. The many forms taken by the members of this group in habit, leaf-shape and venation, degree of silky covering of floral shoots and flowers, and the colour of the filaments which range from white to red, can be resolved only by one able to survey over a long period the plants in their local habitats. It is fortunate for Australian botany that we have dedicated men of the science who are able to increase knowledge of our unique flora. Over recent years no authority has given so much clarification on the difficult problems of the taxonomy of myrtaceous plants than one dedicated to first-hand study of the leucadendra group. Publication of the results of this well-known researcher's work is eagerly awaited: the

writer attempting more than the brief sketch presented above would add confusion to an already confused group.

The following represents the approximate ranges of the species.

35. *M. leucadendra* (L.) L (1767) from west of long. 130 deg. of the north-west mainland coast (Map ref. F.) northwards through Malaysia to Burma and Indo-China.

36. *M. Cajuputi* Powell (1809) A (coast), Malaysia to Burma.

37. *M. viridiflora* Soland. ex Gaertn. (1788) A, B (coast), New Guinea.

38. *M. quinquenervia* (Cav.) S. T. Blake (1958) B, B-C, C New Caledonia, New Guinea.

39. *M. saligna* Schau. (1843) F, A.

40. *M. nervosa* (Lindl.) Cheel (1945). including *M. crosslandiana* W. V. Fitzg. F, B (north inland).

41. *M. argentea* W. V. Fitzg. (1918) F (restricted).

42. *M. lasiandra* F. Muell (1862) F, G, L.

43. *M. loguei* W. V. Fitzg. (1918) F (restricted) form of *M. lasiandra*.

44. *M. gnidioides* Brong. et Gris (1864) New Caledonia.

W.A. Mallees in Turramurra, N.S.W.

By ROSS DOIG

In February, 1960, I began growing W.A. mallees from seed and have continued to do so up to the present (January, 1963), experimenting with the following species.—

Eucalyptus crucis, *E. gardneri*, *E. macrocarpa*, *E. eremophila*, *E. kruseana*, *E. nutans*, *E. erythrocorys*, *E. orbifolia*, *E. rhodantha*, *E. erythronema*, *E. preissiana*, *E. tetraptera*, *E. grossa*, *E. pyriformis*, *E. forrestiana*, *E. spathulata*.

The following observations can now be made.—

1. Germination:

(a) By bog method (see *Australian Plants*, June 1960, page 3) which proved perfectly satisfactory except for some damping off if seedlings left in the container after the first true leaves had formed. Probably the result of feeder roots being in water constantly.

(b) A few seeds in sandy loam mix in 7lb. tins, glass-covered in a glasshouse. One seedling left in tin, remainder transferred when first true leaf appeared, to separate containers.

(c) Pots or tins in the open, some glass covered, other left uncovered. Not satisfactory in periods of dry weather as with the seed on, or almost on, the surface, drying out prevented germination.

In all sowing seed was pressed on to the damp surface, or in the case of larger seed, covered with $\frac{1}{8}$ of an inch of sand. Results at least 80 per cent germination in (a) and (b) with an average time of 7 to 10 days to emerge, although some species were still emerging three weeks after date of sowing. Success at all times of the year.

2. Transplanting:

(a) Into beer cans—satisfactory if plant put into the ground at a maximum of six inches in height. Staking is necessary because of constricted root system and drying out must be prevented if in sandy soil, until such time as the roots have spread into the new soil.

(b) Into nine inch tin tubes—adequate for plant up to 12 inches maximum height. Staking and after care is necessary as the root pruning inevitable in the use of an open-ended container may cause collapse of the plant in humid weather (*E. spathulata*, *E. forrestiana* particularly susceptible).

(c) Into 7lb. tins—satisfactory for plants up to 19 inches, or higher for hardier species. This container has proved the most suitable owing to the greater soil area and large amount of drainage soil, which serve to anchor the seedling, conserve moisture, make staking needless, give greater drainage control and allow the roots room to move when planted out.

(d) Soil mixtures used—

(i) River sand with no fertiliser—very poor growth made and at least

80 per cent. failures experienced when planted out.

(ii) Sand 4, loam 4, leaf mould 2, with no fertiliser—growth slow in nursery, little progress after planting out and 70 per cent losses in the first season.

(iii) Soil mixture as for (ii) plus one ounce fertiliser (fowl manure, blood and bone and superphosphate in equal proportions) per 7lb. tin. A top-dressing of a little dry Aquasol given once a month. Growth rapid and healthy for all of the species mentioned above with no chlorosis.

3. Planting out:

Effectuated at all seasons, with and without shelter, and with seedlings from four inches to 12 inches, into soil varying from six inches of light loam with clay at 18 inches, to three inches of sand and leaf mould over ironstone-riddled hard claypan (first broken up). Between 1960 and February, 1962, at least 80 plants of the species listed have failed and at present *E. rhodantha*, *E. macrocarpa* and *E. orbifolia*, survive—growing quite well.

Since February, 1962, *E. crucis*, *E. forrestiana*, *E. erythrocorys*, *E. nutans*, *E. orbifolia*, *E. preissiana* and *E. grossa* have been put out and survive in a healthy condition. This group was grown with fertiliser added to the loosened soil at the bottom of the planting hole.

4. Conclusions:

Although it is still too early to make any definite statements the following points would appear to be significant in growing W.A. Mallees.

Failures have occurred most often in two climatic conditions, the first an onset of sudden heat (80°F.-90°F.) in summer with over 70% humidity most noticeable in December, January and February and the second, sudden heat (70°F.-80°F.) with dry westerly winds usually in early summer. Total collapse of plant tissue has occurred in less than a week and mulching with gravel, leaf mould or partial covering with bracken, has not helped. On the other hand, periods of extended rain and periods of high wind do not appear to have caused failure.

The extraordinarily high (compared with earlier attempts) survival rate of plants put out since February, 1962, can be attributed to two factors, namely, a dry season for the Sydney area, and the addition of fertiliser in the promotion of growth. The relative importance of either factor will not be known until at least two more seasons have been withstood by the trees.

A final note: *E. ficifolia* has grown to 15 feet in the same soil conditions, and flowered sparsely this summer, after being planted as a nine-inch seedling in August, 1958.

For Effective Pest and Disease Control Use

Yates Garden-master

MULTI-PURPOSE SPRAY

Eucalyptus Calophylla var. Rosea

By J. E. WATSON, Superintendent, King's Park, Perth (retired)

In Russell Grimwade's publication "Anthography of the Eucalypt," 1930, there appears the following information about *Eucalyptus calophylla* var. *rosea*:

This most ornamental and sought-after variety has an obscure origin. In all its characters, save the colour of its flowers, it coincides with the type.

In 1893 a single specimen of *E. calophylla* in cultivation in the Melbourne Botanic Gardens flowered with deep rose-pink blooms. Seeds from that individual have been widely distributed and cultivated, and whilst some have flowered true in colour to the parent tree, many have reverted to the normal white of the type, and some have produced intermediate shades of colour. It is by no means certain that this popular "pink-flowered gum" will breed true to colour and even should its first flowers be true, that they will remain so. Instances of loss of colour with successive flowering seasons are numerous; conversely cases of accession of colour are well authenticated. Whether such variations are due to cross-pollination, soil influences, or environment, is not yet determined.

It is reported that in the Bridgetown district within the natural habitat of the tree a form with pink flowers occurs. These trees may have been the parents of the original pink-flowered tree cultivated in Melbourne which has been erroneously described as *E. ficifolia* var. *guilfoylei* and more correctly as *E. calophylla* var. *rosea*, hort.

In view of the extremely limited knowledge in Western Australia up to 1936 of anything pertaining to this tree, Grimwade's words, "seeds from that individual tree have been widely distributed and cultivated," apparently did not apply to Western Australia.

In 1936 whilst locating sites for tree climbing for fire control measures in virgin bush west of the Donnelly River, the writer and a forestry employee from Kirup came upon what we thought was a *Eucalyptus ficifolia* tree in full flower. Examination of the tree raised doubts as to its being *E. ficifolia* and it was later identified as *E. calophylla* var. *rosea*.

In 1939 the writer, then superintendent of King's Park, planted about 100 *E. calophylla* in the bush area of the Park. These trees were from seed supplied by the Forests Department and collected at Mundaring Weir. The trees were raised in the King's Park nursery. In about 1942 one of the trees produced flowers of a bright pink colour. This was repeated later with the same result. As far as the writer is aware no *E. calophylla* var. *rosea* have been reported from the Mundaring Weir area.

In 1940 whilst travelling with the Government Plant Pathologist (Mr. W. P. Cass-Smith) and the Assistant Government Botanist (Mr. G. Meadley) on the property of Mr. G. L. Henfry, about 14 miles south-east of Donnybrook, we came upon a tree that in our opinion was *E. calophylla* var. *rosea*. The tree was identical in appearance with *E. calophylla*, except for the red flowers and was composed of a number of stems springing from a butt and the whole rising to a height of about 60 feet, and having an excellent crown, with red flowers. As far as Mr Henfry was aware it grew naturally in its present situation and he and several other men stated they had seen three more of these red-flowered trees in a gully on private property in the district. Seed taken eventually produced pink flowers.

Over the intervening years from 1945 to date we have planted about 100 trees raised in the King's Park nursery from seed obtained from bright pink-flowered *E. calophylla* var. *rosea* growing in the Park; many of these are of good form and most pleasing colour of flowers while some, about 25%, have thrown back to the typical white *E. calophylla* flower. The fruits range in shape from the true *E. calophylla* to the true *E. ficifolia*, with varieties in between. In one instance two trees growing side by side near the Roe Memorial, both of which have beautiful pink flowers, have entirely different-shaped fruits, although both trees are from seed from the same parent tree. The flowering period is from November to February, with some late trees in March.

It is interesting and most important to note that no sign of *Sporotrichum* de-

structor, the disease that attacks *E. ficifolia* and to some degrees *E. calophylla*, has been seen in *E. calophylla* var. *rosea* in trees in the Park at this date, but this of course does not signify immunity. The above behaviour of the variety seems to indicate that it is of hybrid origin. Mr. R. D. Royce, the Government Botanist, informs me (private communication) that "the taxonomy of *Eucalyptus calophylla* and *E. ficifolia*, together with all the varieties and hybrid forms, is very unsatisfactory. Even the two main species when growing together show a marked convergence and in some instances are very difficult to distinguish."

The principal value of the variety for Western Australia is that it offers a substitute for *E. ficifolia* in areas where the latter is subject to disease.

THE STEM CANKER DISEASE OF RED-FLOWERING GUM

By DR. J. S. BEARD, D.Ph.—Director, King's Park and Botanic Garden,
Perth, Western Australia

This account has been prepared from notes given to the writer by Mr. J. E. Watson, Superintendent of King's Park (retired) and from data in the King's Park files.

The King's Park Board became concerned in 1935 because of the ravages of the disease in the original avenue of Red-flowering Gum (*Eucalyptus ficifolia*) which had been planted in the Park in 1897, and the second avenue planted to commemorate the State Centenary in 1929. Trees in the second avenue became infected very rapidly, probably by spread from the first one, in which disease was far advanced, and both plantings had to be entirely eliminated in 1938 and replaced with *E. citriodora*.

The disease takes the form of cankers resulting from necrosis of the cambium on the stem and main branches. Ultimately these spread to girdle branches which die, and finally the trunk. There is a record that in 1928 the Government Plant Pathologist, Mr. H. A. Pittman, reported the disease firmly established in Western Australia and well known to scientists for many years previously. The organism had been determined at the Imperial Institute, London, as a fungus named *Sporotrichum destructor*. It appears that this pathogen is endemic in *Eucalyptus calophylla* (marri or red gum), a related species of the bloodwood group (note that neither tree is a Gum in the strict sense) but does little or no damage due partly to exudations of kino which keep it in check. When *E. ficifolia* is planted in areas where *E. calophylla* occurs naturally, the former picks up the disease and is ravaged by it. It will be observed that *E. ficifolia* is not subject to *Sporotrichum destructor* outside Western Australia, in Victoria or South Australia, or in Western Australia outside the natural range of *E. calophylla*.

In December, 1938, the Superintendent of the Park, Mr. J. E. Watson, and Mr. Cass-Smith, Government Plant Pathologist, commenced experimental work and carefully examined 180 *Eucalyptus ficifolia* of about 40 years of age. Mainly because of the disease but also because of poor form and indifferent colourings of the flowers, all but 24 trees were rejected as unsuitable for experimental purposes.

In March, 1939, artificial inoculations with the causal fungus, bred from Bruce Street, Nedlands and King's Park infected trees, were carried out by Cass-Smith on the 24 trees. There were 80 inoculators and 24 controls and the fungal cultures were checked by inoculating known diseased trees. All these inoculations were inspected by Cass Smith and Watson from August to November, 1939, and it was found that 18 trees were infected leaving six trees which were considered highly resistant. Further inoculations were made and only two trees emerged as highly resistant, Nos. 14 and 90,

of which the latter remains entirely free of the disease to this day and may be considered immune.

As attempts to propagate red-flowering gums vegetatively were unsuccessful, later work on the stem canker disease mainly consisted of attempts to develop a resistant strain by crossing tree 90 with tree 14. On October 8, 1949, some 54 hybrids of this origin were planted in a specially prepared area at the Gngangara Pine Plantation, together with 47 other seedlings of this cross. However, the latter were of doubtful origin as during the hand pollination period the bags which enclosed the blossoms were torn and insects entered which may possibly have introduced foreign pollen. These hybrid seedlings were all raised at the Hamel nursery and the area at Gngangara where they were set out is in the middle of pine forest and away from marri with which species the red-flowering gum hybridises.

The Gngangara colony of seedlings was raised under very rigorous conditions and without any artificial watering—the object being to try and select for hardiness as well as for disease resistance. Subsequently 14 seedlings died from natural causes and the remainder were inoculated with two strains of the causal fungus during the summer of 1951. Those trees which showed no resulting infection were later re-inoculated. Also, to further test these specimens for resistance to the disease, badly affected young trees were not removed, but allowed to persist so that the disease might have an opportunity of spreading naturally to the remainder.

The proportions of resistant or apparently immune plants was encouraging, and it was planned to use the collection as a source of resistant seed by intercrossing the most resistant individuals. Such a programme would inevitably be a very long-term one as several generations of selections would be necessary. Much quicker results could be obtained if only vegetative propagation were possible, since in tree 90 there is already to hand material apparently totally immune.

PROPAGATION OF THE RED FLOWERING GUM—Cont. from Page 37
and scion at the time the graft is made. A variation used in *Eucalyptus* grown in New Zealand by Thulin is quite reliable and easy to use with *Eucalyptus ficifolia*, even with scions which have been transported some distance and during a few days.

In this method the stock, a seedling approaching one year old, is decapitated at about six to eight inches above the lignotuber and split down for a distance of about an inch from the top. Into this split a small scion with a flat wedge-shaped base is inserted, the scion having been prepared to leave a few nodes only (often only two) and with the petioles attached but the leaf blades cut off. The whole graft is bound with polythene tape and after two or three weeks union is effected. Growth is renewed generally from dormant buds or sometimes naked buds if they were on the scion at the time the graft was made, and in a matter of a few months a grafted plant, which is fully viable, is available for planting out.

In general, the technique of grafting depends upon having vigorously growing stock of suitable species, and so far as tests have proceeded at the moment, any species of Bloodwood is suitable as stock. The scion should be of firm wood and some protection to the graft is necessary in either a bush or glasshouse in the first month or two of grafting and for a short time subsequently before planting in the field. Good, clean, even cuts are necessary in preparing the material for grafting, and the use of polythene tape has considerably simplified this and many other grafting procedures.

GROWTH BEHAVIOUR AFTER GRAFTING

There is one important aspect of behaviour after grafting which will be of considerable benefit in the use of this tree in ornamental planting. If the scion used is taken from a part of a tree which has already borne flowers—and this would be the used source of scion material, because the flower colour of the tree to be grafted would be known—the scion comes into flower within the first year following grafting, so that plants only about two feet tall, in pots if necessary, carry large trusses of flowers within a short time, and they continue flowering in successive years, so that a tree could be kept as quite a small individual in a garden by this means, flowering though still at the height of a small shrub.

The grafted plants, as is to be expected, retain perfectly the colour of the parent plant, so that any colour which it is desired to preserve can be built up by grafting and used in planting arrangements. It has also been found that the New South Wales species of Bloodwood, the Red Bloodwood *Eucalyptus gummifera*, or the Pink Bloodwood, *Eucalyptus intermedia*, are perfectly suitable as stock for grafting scions of *Eucalyptus ficifolia*. While of course it will take some years to test the growth of *Eucalyptus ficifolia* in summer rainfall areas on stock of a species adapted to such areas, it is likely that better growth will be obtained with stock of species suited to these areas than if it is on its own roots, and one plant has entered its second year in this way, and looks healthy and vigorous.

RESISTANCE TO CANKER DISEASE

Perhaps the most important point of all, however, is the opportunity which is now available to propagate by grafting a few trees which are known to be resistant to Sporotrichum canker. The former splendid avenues of *Eucalyptus ficifolia* in Kings Park, Perth, were destroyed by this disease some time ago, and in the Perth area only a very few trees which are resistant to it have so far been located. One of these, Tree 90, considered by Cass Smith after many trials to be fully resistant to Sporotrichum canker, has been found easy to graft by the method suggested above, and with material supplied by Dr. J. S. Beard a clone has been built up of this material grafted on to Marri, *Eucalyptus calophylla*.

While grafted plants of the resistant scion on to Marri stock must be tried over a period of some years before all is known to be well, it is likely that they will give satisfactory results. It is highly probable that Red Flowering Gum can be re-established in Perth, the capital of its home State.

THE BLOODWOODS—Continued from Page 2

7. East Interzone: (a) indigenous—*E. bloxsomei* (45ft.), *watsoniana* (50ft.) (b) *E. gummifera* (up to 100ft.), *intermedia*, *maculata*, *polycarpa*, *trachyphyloia*.
8. South-east Temperate: (a) indigenous—*E. eximia* (central, 45ft.). (b) *E. gummifera*, *maculata*.
9. South-east Eremaean: *E. terminalis*.
10. South-east Interzone: *E. trachyphyloia* (northern tip).
11. South Eremaean: *E. dichromophloia*, *terminalis*.
12. South-west Temperate: *E. calophylla* (up to 130ft.), *ficifolia* (25ft.), *haematoxylon* (25ft.)—all indigens.

It may be seen that the bloodwoods are represented in most climatic regions of the continent. One notable exception is the South Temperate region, a region of maximum winter rainfall, where frosts, sometimes severe, are experienced. The majority of bloodwoods occupy the coast and

sub-coast northwards of the line marking the southern boundary of maximum rainfall in summer. The most southerly of this majority, however, reach into the uniform rainfall zone but within the arid regions only. Winter rainfall with an accompanying lowering of temperatures and severer frosts appear the major barriers to most bloodwoods. As in the South Temperate region, there are no bloodwoods native to Tasmania. The three isolated species of the south-west, however, show ready adaptation to cultivation in the South Temperate region. This indicates that climatic factors are not so limiting.

Some Species Representative of Bloodwoods

E. calophylla R.Br. ex Lindl. "Marri", "Western Australia Red Gum."

A small shrubby tree on the coast, but in forest areas frequently found as a densely-canopied tree 100-150ft. high. Range from sea level to 1,000ft. or more, on a variety of sites, but at its best on fertile, alluvial soils with annual rainfall up to 60ins. (with the greater portion falling in winter).

It is often associated with jarrah (*E. marginata*), and to lesser extent karri (*E. diversifolia*). Bark persistent, rough, grey to brown, short-fibred and flaky. Juvenile leaves peltate, with bristle-like and crenulate margins. Adult leaves up to seven inches long, lanceolate to ovate, darker on the upper surface, petiolate. Stamens creamy-coloured. Fruit up to 1½ inches long, ovoid or urceolate, thick and woody; valves three or four. Seeds without terminal wing.

A well-known ornamental shade tree, flowering February-April.

E. citriodora Hook. "Lemon-scented Gum." A graceful, shaft-like tree 80-130ft. high with a sparsely-foliaged but symmetrical crown; flowering June to July. Confined to the coast and near coast of tropical and sub-tropical Queensland, mainly between Mackay and Maryborough, where it extends about 200 miles inland (withstanding light frosts), and also found in a much smaller area near the Atherton Tableland.

Bark smooth, white or pink, deciduous. Juvenile leaves rough and with bristle-like hairs, often peltate. Adult leaves up to seven inches long, narrowly to broadly lanceolate, light green, concolorous, petiolate. Inflorescences mainly axillary. Fruits about ½ inch long, ovoid or urceolate; valves three or four. Seeds without terminal wing.

A valuable timber tree, its foliage is also of economic value, being distilled for its essential oil. The major component of the oil is citronellal which gives the pleasant aroma to the crushed leaves. It is a widely planted ornamental for both tropical and temperate regions free from severe frosts, fast-growing and adaptable to a variety of sites.

E. dichromophloia F. Muell. "Red-barked Bloodwood." Tree, either shrubby and small, or short-trunked and attaining 36ft. high, flowering April to May.

Bark smooth and white, deciduous, some persistent at the trunk base and then grey, mottled with reddish colour, at times persistent over a large part of the tree, sometimes almost absent. Of wide occurrence in the north on a variety of sites, extending southwards within the region marked by the ten-inch isohyet in both Western Australia and South Australia (e.g., Everard Range). Juvenile leaves elliptical to ovate, rough or bristly on both sides, the undersurface paler and with a close whitish pubescence. Adult leaves up to eight inches long, lanceolate (usually narrowly so), usually slightly paler on the undersurface. Fruits about ½-inch long, globular-urceolate, thin-walled, glossy and mottled.

E. eximia Schau. "Yellow Bloodwood." Tree up to 45ft. confined to coastal sandstone of temperate New South Wales from Gosford to Jervis Bay, flowering August to October.

Bark persistent, yellowish and scaly. Juvenile leaves broadly lanceolate to elliptical, sometimes peltate, usually with short hairs. Adult leaves up to seven inches long, lanceolate, falcate, green or slightly glaucous, concolorous or slightly paler on the undersurface. Fruits sessile, up to three-quarter-inch long, ovoid-truncate or urceolate; valves three or four. Seeds without a terminal wing. Timber white or pale yellow.

Recommended as an ornamental for poor sandstone areas.

E. ferruginea Schau. "Rusty Bloodwood." A spreading crowned tree reaching 40ft. in height but often of straggly growth, found scattered throughout mixed open forest on sandy or stony sites of the Northern Territory with slight extensions westwards to the Ord River district of Western Australia and eastwards to the extreme north-west corner of Queensland.

Bark persistent, grey and flaky. Adult leaves opposite, not markedly different from the juveniles, about five inches long, ovate to elliptical, narrowly cordate at base, with a covering of rusty-coloured scales and bristles which wear with age and become silvery, lateral veins few. Buds and fruits usually scaly, the latter globular or ovoid, about one inch in length. Flowers January to February.

The claim for this species as an ornamental lies chiefly on the rusty-coloured or reddish covering to twigs, buds and fruits, and the rounded, yellowish-green leaves.

E. ficifolia F. Muell. "Red (or Scarlet) Flowering Gum." Very close to *E. calophylla* but confined, as a straggly-mallee-like small tree from 20-30ft. high, to a narrow coastal belt west of Albany in the south-west, occurring in dense thickets on sandy soils. Adaptable to a wide range and able to withstand light frosts, flowering December to February. Widely planted in the south, frequently yielding a shapely crowned tree with a profusion of flowers, often brilliant red, but the colour intensity of the stamens is variable. Several presumed garden hybrids with *E. calophylla* described as varieties or forms of one or other of the species have stamens varying in colour from cream to scarlet.

E. gummifera (Gaertn.) Hochr. "Red Bloodwood." On suitable sites reaching 120ft. in height, its crown compact and well developed, but often limited to a short misshapen trunk. At best on moist, rich loams but adaptable to impoverished sandy soils, occurring from sea level to about 1,000ft. elevation along the eastern coast from south-east Queensland to the extreme eastern corner of Victoria. It is hence the southernmost of the bloodwoods.

Bark persistent, brown, rough and scaly. Juvenile leaves peltate, hairy. Adult leaves up to six inches long, lanceolate, darker on the upper surface, on flattened and broad petioles. Bud with operculum very short and not markedly distinct. Fruit urceolate, smooth, about three-quarter-inch long, seed without a terminal wing. Flowers January to March.

It is close to the northern *E. intermedia* R. T. Baker. This latter species differs in having light grey, rather soft bark which is paler beneath and persistent to the tips of the branches, a larger, more distinct operculum, a terminal wing to the seeds, and an absence of hairs from juvenile leaves which are never peltate.

E. jacobsiana Blakely, "Stringybark Bloodwood." A small tree, often straggly, up to 30ft. high, of rare occurrence, found on barren sandstone slopes of the Pine Creek area of the Northern Territory. Flowers in April.

Bark persistent, dark grey or yellowish, fibrous. Juvenile leaves linear to narrowly lanceolate, mainly white on undersurface. Adult leaves up to 3½ inches long, green and lustrous. Fruit about ¼-inch long, urceolate; seeds without a terminal wing.

Has been recommended as a hardy ornamental for tropical planting.

E. maculata Hook, "Spotted Gum." Of wide occurrence from Maryborough in Queensland (where it extends 250 miles inland), south to Bega (N.S.W.), with an isolated stand in eastern Victoria. In the south it prefers medium-rainfall slopes at lower elevation and avoids the Hawkesbury Sandstone. At its best on well-drained soils derived from shale and on clays where it may reach a height of 150ft. with girth of 4-5ft.

Bark smooth, white or pale pink, shed in large patches to give a mottled (or spotted) effect. The essential oil in the leaves lacks the aromatic citronellal of *E. citriodora*, but in other respects it closely resembles the latter species in botanical features, timber and general appearance. McKern, Spies and Willis (J. & Proc. Roy. Soc. N.S.W., 88 [1954] 15-21) regard the extensively distributed populations of spotted gum in Southern Queensland as morphologically indistinguishable from *E. citriodora*, the only difference being one of oil composition.

E. ptychocarpa F. Muell. "Red or Swamp Bloodwood." A drooping-foliaged, spreading tree up to 30ft. high with compact, fibrous and grey, persistent bark, flowering January to April. Native to the Kimberley division and coastal and sub-coastal Northern Territory, found usually lining banks of streams or around springs.

Juvenile leaves broadly lanceolate to elliptical, concolorous, petiolate. Adult leaves up to 14 inches long and five inches across, lanceolate to broadly lanceolate, on long petioles and sometimes distinctly peltate, darker on the upper surface. Buds and fruits with nine to 12 prominent ribs. Filaments frequently crimson. Fruits about 1½ inches long and broad, woody. Seeds with a long terminal wing.

Potential high as a choice ornamental shade tree for tropical planting.

EUCALYPTS FOR HIGH RAINFALL AREAS

What of the high rainfall areas? With proper care and selection it is possible to grow the mallee or dwarf Eucalyptus that generally come from low rainfall areas of Western and South Australia. W. R. Swynny, N.S.W. Forestry Commission, advises, "My opinion of the difficulties in raising W.A. species of Eucalypts, including *E. ficifolia*, is that under the salubrious conditions of the coast, growth is so fast that the tree tissue is like a tender lettuce and is invaded by all and sundry. Slower growth would result in tougher fibres (as in the case of lettuces again). Fairly dry, harsh, western aspect sites, particularly well drained, would suit such species best. Do not purchase advanced plants."

We could learn best from the example of others as follows:—

From J. S. Howard, Nunawading, Victoria.

Seeds of *Eucalyptus torquata* have been propagated to about 4" high seedlings using the wet bog method with excellent results. A plant purchased one year ago is now three feet high and bushy in a well-drained sandy bed (on clayey soil base) against sunny side of an east-west fence.

From J. Twyford, Willunga Nursery, N.S.W.

The following Eucalypts have been successful in the higher rainfall suburbs of Sydney, such as Thornleigh: *Eucalyptus preissiana*, *E. leucoxylon*, var. *macrocarpa* and *E. curtisii*. *Eucalyptus caesia* is flowering well at Wentworthville, a lower rainfall suburb.

From J. M. WILSON, 4 Regworth Court, Highett, Melbourne.

Eucalyptus lehmannii by *E. cornuta*.—Planted out seven years ago in the 4ft space between the garage wall and side fence in typical black sandy loam of the bayside area. It is now 20ft high and nearly as wide. As a large dense round-headed tree, it flowers profusely each year being vigorous enough to withstand occasional attacks of scale. It has never received artificial or run off watering.

Eucalyptus calophylla.—Planted adjacent to the hybrid tree above, it is only 5ft high and doing poorly.

Eucalyptus caesia.—In a garden on the north side of Melbourne in solid heavy black volcanic soil 6-Bins. deep over a heavy yellow clay. During the winter the area becomes completely waterlogged and in summertime it bakes and cracks. In three years it has grown to 8ft, flowers well, sets seed and is a beautiful specimen.

From A. M. Lyons, Chelsea, Victoria

All seven *Eucalyptus ficifolia* planted 15 months ago are doing very well one now being over five feet. A number have developed a kind of gall on the leaves. The N.S.W. Forestry Commission answer: "The damage to the leaves has been made by gall-forming insects. A curative spray of Rogor 40, 1 fl. oz. to 1½ gals. water used as a foliage spray is recommended. This may be mixed with a fertiliser preferably one containing trace elements.

From V. McHaffie, Park Orchards, Victoria.

Our attempts to grow plants of *Eucalyptus ficifolia* in an exposed position in heavy clay with little topsoil and in a lawn, failed. A neighbour's plant with similar exposure but in a raised bed is prospering. We have five *E. cladocalyx nana* in an exposed position in a paddock. Since planting on November 1956 and without further attention, they are now 10ft. high.

From R. Pearson, Highett, Victoria.

I have a *Eucalyptus torquata* four years old and seven feet high. I did have trouble with a scale (consisting of many clusters of soft brown lumps about the size of a match head which when broken oozed a red fluid) and tried spraying with white oil, nicotine sulphate, D.D.T., etc., without success. One dose of "Thiotox" and the scale dried up. The tree is growing in a fowl yard where the soil tends to be always damp.

SPECIAL NOTE FROM THE EDITOR

Opinions of readers that each issue should treat one or two subjects properly, as against those who think there should be a wide range of subjects dealt with not so fully, are equally divided. My decision is often dictated by the material available. Many will be disappointed with the breadth of treatment given our Australian Eucalypts. They will not be mentioned again until Volume 3 commences in 1964, so try all our suggestions and report results then. Plants are readily available from the Forestry Commission in your State and Willunga Nursery reports good stocks.

Future issues dealing with *Boronia*, Kangaroo Paws, Bauera, Hovea, *Eriostemon* and Pea Flowers are in preparation. Please send in your experiences and questions.

GROWING BORONIA?

From Jean Galbraith, Tyers via Traralgon, Victoria.

Are "Boronias notoriously hard to grow?"—Nothing in my garden is growing more strongly or flowers more freely than the *Boronias* (*B. mollis*, *B. serrulata*, *B. pilosa*, *B. anemonifolia*, *B. thujona*, *B. deanii*, *B. fraserii*). However, all are only 3-5 years since I learned from Mr. W. Cane that they need a cool root run, some shade, a free, well-drained soil, and frequent spraying of foliage in hot weather. Also a *Boronia* allowed to wilt and then watered in a hot position probably dies, but in a cool position it will recover. Before I learned these things, I killed every *Boronia* I had by breaking one or more of the above rules, especially the last one.

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WILDFLOWERS AS GARDEN CULTIVARS

AUSTRALIAN CULTIVAR REGISTRATION AUTHORITY

The National Herbarium of Victoria, in association with The Society For Growing Australian Plants, has established the above authority to register, in accordance with the International Code, garden cultivars developed from Australian plants. The garden exotics of today were wildflowers of other lands years ago, and it is one of the objectives of this Society to develop the unique and beautiful flora of our country, by careful selection and breeding. Orderly and accepted classification and registration is essential. The adjacent articles on *Eriostemon* mentions cultivar names of the species *Eriostemon myoporoides*.

Will all readers please assist by advising of any similar references to cultivar, variety or trade names of Australian plants, in literature, journals or catalogues. It does not matter how old or small the reference. Old books, etc., may be forwarded to the authority on loan or as a donation, c/o Royal Botanic Gardens, Melbourne. Recent horticultural journals with at least Victorian circulation are excepted.

ERIOSTEMON GARDEN CULTIVARS

MOUNTAIN GIANT

A luxuriant shrub or small tree with large soft bluish-green leaves and large flowers in crowded umbels along the stems, recorded amongst other places from Christmas Hills, Mt. Stanley, and W. Tree in Victoria, and from Cox's Gap (where it grows to 20ft high) in N.S.W.

Though Mountain Giant may need more shelter and moisture than others, most forms like the same condition; leaf mould, moisture, good drainage, some shelter, and moderate pruning, either by shortening the longer branches directly after flowering, or by cutting the flowering sprays.

CLEARVIEW DWARF

Dwarf shrubby bush, bright pink buds (except in shade) and an umbel of flowers and one solitary flower in each leaf axil. This is a most satisfactory shrub, thriving in my garden in a very shady position, though colour would be better with more light.

CLEARVIEW BOUQUET

Very dwarf and hardy, with flowers in a long leafless terminal panicle, as well as in axillary clusters. Pink buds, white flowers. No form could be more free-flowering.

CLEARVIEW APPLE BLOSSOM

Semi-double, with a flat outer circle of petals and an erect inner ring of petaloid stamens. Very red buds contrasting with very white flowers. Open and sparse in growth with flowers more scattered than in most forms and harder to grow than others, but very attractive.

CLEARVIEW PINK

Pink, deepening to red at the inflexed tips of the petals, and with deep red buds. The petals are narrow and concave, which makes the flowers look smaller than they are. With larger flowers of this colour it would be most attractive. Growth average.

There are three other forms which I have not seen in flower. They are: SWAINSONI

A hybrid, probably between *E. myoporoides* and *E. verrucosus* in Mr. Swansons' nursery at Frankston, Vic. A seedling, very like Swainsoni has also been grown by Mr. Lindner of Vectis, Vic.

CLEARVIEW SNOWY

A very dwarf form (18in to 2ft) from the Snowy River. Foliage like that of *E. trachyphyllus*.

Also a form with short oblanceolate leaves with reflexed tips from N.S.W.

A request for descriptions of the forms of *Eriostemon myoporoides* in cultivation has made it clear that, apart from those grown in two nurseries, we know very little. I realise that these notes cannot be complete, though they cover all the well-known forms. Special thanks are due to Mr. Cane, in whose nursery I have seen all the Clearview forms, propagated from forms which he has found in S.E. Australia, and who has checked my notes on them; and to Mr. Althofer who sent me nursery-grown specimens of N.S.W. forms. We should like to hear of any additions which readers can make to the following list.



Colour Photography By Frank Hurley

Blocks Courtesy of John Sands Pty. Ltd.

WHITE PERFUMED ERIOSTEMON

LONG-LEAF WAXFLOWER—*Eriostemon myoporoides*

This is the form usually grown, a hardy and beautiful shrub with firm narrow lanceolate foliage, the blade usually more or less raised on either side of the midrib. The abundant flowers grow in umbels of several flowers in the leaf-axils, and are waxy-white, pink or pale-green underneath and in bud. Shrub 2ft to 4ft, flowering as early as August in a sunny position but better for some shelter.

See Page 71 for *Eriostemon* Garden Cultivars

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