

Australian Plants

Registered for posting
as a periodical—Category B

March, 1979
Vol. 10, No. 78

75c



THE EUCALYPTUS—TREE OF THE AUSTRALIAN CONTINENT

What a magnificent, stately, odd, picturesque, stark, gnarled, beautiful, grotesquely grand collection of trees that are our heritage. Do they typify this vast land of ours? We should be using these faithful survivors of the past to frame and paint our landscapes, to trigger a greater appreciation of life around us.

No volume is complete without an issue on *Eucalyptus*. Past issues (see No. 61) have favoured the small coloured flowering eucalypt, but those grand, picturesque trees of larger stature have their place, especially in the country, as mentioned in this issue. There is a mention here of ornamental *Eucalyptus* as well.

WILDFLOWERS FOR DRY INLAND AREAS

This is the main theme of the issue. Surprisingly, many plants from the arid wilderness will flourish in garden conditions. What is more spectacular than a flowering Sturt's Desert Pea in the garden? Readers are referred also to our previous dry area issues, particularly No. 58 issue of Vol. 7 and No. 59 issue, particularly page 327.

WHERE HAVE WE FAILED?

While there are many wildflowers at home in our gardens, we have failed to establish many spectacular species as reliable garden subjects. In this age of technological advancement we in Australia are at a horticultural frontier. One cannot confidently select what should be a suitable species and be sure of success. What is a greater spectacle than a low growing mallee eucalypt in full flower—but how many are successfully grown in the Eastern States? You are invited to accept the challenge. All we ask is that you plant native species and develop the best and most reliable forms.

CONTENTS

	Page
"An Australian Town of the Desert"	47
Plants to Grow in Arid Inland Places	54
Some Eucalypts for Planting in the Arid Interior	55
Other Recommended Species for Planting in Arid Areas	59
Eucalypts—Let's Look Closely at Their Leaves", by O. Millett	62
Eucalypt Propagation, by David Kleinig and John Doran	65
Scribbly Gums, by A. A. Clemson	69
Ornamental Eucalypt Breeding, by D. V. Beardsell, D. L. Jones, C. Beardsell	70
New Eucalyptus, by David Kleinig	72
Root Systems of Myrtaceae, by Byron Lamont	74
Soils—Their Care, Fertilising, Health, by the Editor	79
Grow Eucalypt, by B. Ballingall	80
Wildflowers of Central Australia	83

COVER PLATE:

HELICHRYSUM BAXTERI

Photography by D. Woolcock

The centre can become a blaze of colour after rain, thousands of perennials and herbs springing up and bursting into bloom. These include many species of *Helichrysum*, the "sun-gold" everlastings. Unfortunately *Helichrysum baxteri* is not from the centre, but is a herb from western Victoria and South Australia. However, the narrow, white, floral bracts with soft fringed margins frame the yellow flowers in the middle, typical of some everlastings of dry areas. The point is that it will grow in eastern gardens. People of the dry country should collect seed of their ephemerals, and after rain scatter it on disturbed ground around their dwellings.

AUSTRALIAN PLANTS—No. 78 Issue of Volume 10, comprising issues 77-84. International Series Index ISSN 0005-0008. A National publication in 16600 copies. Published by The Society for Growing Australian Plants. For details see last page. Available to members or by subscription of \$3.00, including postage to your address. Send to the Editor, 860 Henry Lawson Drive, Picnic Point, N.S.W., 2213. Publication date of previous issue, No. 77, was 15th May, 1979.

Native Flora

for an Australian Town of the Desert

By M. BLACKWELL, Perth, W.A.

An article based on an illustrated talk at S.G.A.P. Conference, Perth, 1977.

The planning of a new town is always an exciting challenge, an opportunity to create the means for a new way of life with differences suited to that particular environment which people can enjoy, and in which they can find new interests and stimuli.

These days many people want to get away from suburban pressures, commitments and restrictions, but the success of a new way of life depends upon the participant's attitudes.

Great as is the enthusiasm of some, help is often needed during the transition stages. Thus time and thought needs to be spent in organising the setting up of a new town if the frictions of the change between the city and the outback are to be overcome. Areas of shock can often be anticipated and soon minimised by engendering interest in, and opening people's eyes to the new landscape around them; thus attuning their minds not only to the beauties of the vast open spaces and the harmonious balance of nature's muted colour tones, but also, if these are to remain in a state of integrity, to achieve a sympathy through insight into the fragility of our arid area ecology and the gregarious nature of many of its components under stress.

It is desirable that "a town of the desert" has a character "of the region" and provides a variety of opportunities hard to come by in the average suburban setting with restricted land availability. It is hoped that people will want to live here because of the different values which this life has to offer. In the creation of a town of this type the environment as a whole needs to be taken into consideration in the early thinking stages and all its positive attributes maximised for characterisation and for people's enjoyment. Intrinsic qualities of the site must dictate parameters of planning. Indeed, surrounding landscape, in the hands of a sensitive designer, will influence many facets of the development.

Often on the doorstep of a town in the desert are ready made amphitheatres, pony club arenas, orienteering possibilities, to mention but a few of the potential recreation opportunities.

Hand in hand with these topographical attractions, the second great eye-catcher of our arid areas is the vastly varied, and at times spectacularly flowered, desert flora. Under these arid conditions nature has succeeded in establishing a vegetation of great subtlety and sophistication which is not only drought resistant but has rare qualities for floral display. The flowers of these plants are often brilliant in colour and unique, even weird, in form. Flowering occurs erratically, depending primarily upon rain, but it is true to say that after good rains "the whole desert flowers", exhibiting vast carpets of everlasting, parrakeelias and other ephemerals beneath heavily flower-bedecked shrubs. Desert trees usually have very individual characters, often with interesting trunks, bark, branch design, canopy shape and density.

Though not advocating a puritanical approach, the dominant use of suitably adapted species of native trees and shrubs in the landscaping of the new town will, more than anything else, give it a character and help it to fit into its surroundings, making it part of the environment rather than being an intrusion into it. More particularly so, if the plants are massed in informal ecologically based patterns, so that they look natural rather than orthogonally organised, to provide shade, shelter, wind-breaks and other amenities where needed, as well as enhancement and interest in the new development.



ABOVE:

Photography by Marion Blackwell

Natural vegetation in the Western Arm of the Great Victoria Desert. This is our Perserverence campsite where the author rested a while and formulated her dreams of a town in the desert.

OPPOSITE:

Photography by Marion Blackwell

Alyogyne pinonianus

Incredibly, more favourable areas of the inland have evolved beautiful shrubs with considerable horticultural potential for hot dry desert-like conditions. Are they really desert conditions? The soil is sandy and dry on top but what of deep down? These shrubs show promise for any homestead garden in the inland Australia.



The creation of character has broad implications for human beings. Perhaps we should pause a little and think about identity and character and what their significance is.

For those who are sensitively aware, Australia presents a very definite individuality, due in great part to the power and harshness of the sunlight upon the vegetation, and to the worn-down nature of the terrain. It is an ancient continent with rounded contours, expansive horizons and extremely varied, rugged and often aggressive vegetation. It is a land of harmoniously subtle blending of colour tones, in which lies refreshment of the spirit for those hard pressed by civilised existence, and the anchor chain of those who grew up in the inland.

Sunlight is the active, effective power; from it stems most of the unique character of our vegetation, particularly that of the inland, which has evolved through the ages to conserve what little water there is available.

The greyish appearance of many of these plants, apparent even to the transient visitor, is directly related to water-conserving mechanisms such as protective waxes, scales, hairs, woolly proliferations, thickened cuticles and ridging of the epidermis. This glaucescence is a dominant characteristic of our flora; it forms the basic attraction for observant visitors and is the activator of the emotive power it has over those who have learned to enjoy it. So much of our flora is endemic and of individual character, different from the vegetation of other countries. Think for instance of the *Eucalyptus* or "Gum Tree", often quoted as "Australia's Gift to the Arid Areas of the World". This is our most widely distributed genus of trees. It has achieved, by the isobilateral organisation and vertical orientation of its leaves, not only a water-saving device which avoids much of the intense heat of the direct sun's rays, but a strong influence upon the type of vegetation associated with it. Because the leaves hang perpendicularly, sunlight penetrates the canopy to give dappled light to the shrubs beneath, resulting in the typical stratification of the ecological components of the so-called "Savannah" landscapes dominated by Eucalypts. There are over 400 species of gums to choose from, and more than 600 acacias or wattles; also think for instance of the unique banksias, grevilleas and hakeas. Many of these are currently being used overseas as ground covers, for street trees and for a variety of other landscape purposes. They have, as well as interesting forms, flowers as attractive as any garden exotic; besides which, from a practical point of view, species adapted to arid areas will require less water and maintenance, as they are already proven capable of standing up to the reigning conditions in the area.

Perhaps I should use the concrete example of a new town of the desert, into which has gone a lot of thought and pre-planning, to illustrate my point. One such is the town of Leinster being built by Agnew Mining Company in the north-western tongue of the Great Victoria Desert, about 330 km north of Kalgoorlie, in the arid interior of Western Australia. This is to house the personnel of a nickel mine they are developing in that area.

Detailed consideration was given by the company and the planner to the topographical form of the locality in the choosing of a town location. The chosen town-site, initially for 1,000 persons, is in the direction of least wind-blow from the mine site. It covers an area of stable desert dunes, which rise to 30 metres above the plains, thereby providing a welcome relief from the surrounding, generally flat landscape, as well as a pleasant view outlook from the residential areas and better chances of catching the prevailing breezes in hot weather. It is located close to a very scenically attractive breakaway.

The conservation of existing vegetation was a first priority. This meant not only designing around the existing trees, but also constructing roads as far as possible, on grade and with as little disturbance of nearby vegetation as could be reasonably achieved. At an early planning stage I carried out a research analysis of plants suitable for growing in this town in order to elucidate the best possible spectrum of landscape material.

Our long-term aim was to create with the landscaping, a town with identity, and to initiate an attractive setting with amenities in which the people would live in harmony with the surrounding environment and through which the people could more easily relate to the region with its outstanding beauties, and thus be able to see some of the advantages that this town had to offer over city life. If people are made aware that alternative advantages do exist in an area where space is not at a premium, they will be more prepared to give up their accustomed city life style.

This survey of landscape material was prepared in encyclopaedic form, with coloured illustrations (over 300) of a number of recommended trees, shrubs and ground cover plants.

The idea was that not only residents, but the engineers, architects and other instigators of the town plan would have readily available information, and wherever possible, visual representation of the plants to be used, so that they could, with conceptual plans at hand, visualise the character and theme of the proposed town landscaping worked out by our firm (my partner Peter Caia being responsible for the design element of this work).

Seeds and cuttings were collected from plant material growing on the site and from similar surrounding areas. Among the specimens I gathered there were some rare, one so-called "threatened", and 13 un-named species, one of which was a beautiful new "Gum Tree". From these cuttings and seeds some 18,000 plants are now in the process of being grown for the first stage of the landscaping of this new town, which involves the area of the single men's quarters and the initial family residential area.

Most of the species used in the landscape design had never been propagated previously and a number of genera, which had only previously been multiplied by seed, were grown from cuttings.

The selection of species of dominant trees was undertaken with the aim of ameliorating adverse conditions of dust and dryness, as well as perpetuating the attractive visual concept of elegant, blue-green foliaged gums with appealing white trunks, mottled in season with tans, greens and buffs, which contrast with the red soil and the intensely blue sky of the inland. It is of more than incidental importance that most of these trees also have good root habits, allowing shrubs and ground covers to be grown right up to their trunks, and thus the establishment of a more comprehensive soil stabilisation.

Research I have carried out on vegetation in arid zones of Australia over a number of years leaves no doubt in my mind that, although climate imposes some restrictions, the soils of these areas are capable of supporting a wide variety of plants, providing that adequate irrigation can be made available. It is clear that water (both quality and quantity) is the major limiting factor. Because the supply of water for this town is limited and expensive, having to be desalinated and pumped a considerable distance, prime attention was focussed upon the selection of plants which could be established successfully with the reliable application of minimal quantities of water, but also which are adapted to succeed under the harsh inland conditions—often limiting to growth—which here include extremes of temperature, the low and erratic occurrence of rainfall (averaging 6-7"), dryness of the atmosphere, reflected heat, and fragility of the existing ecology which, under disturbance, can lead to erosion and sand-blasting.

A survey of the less than 8" rainfall area of W.A., in the height of summer, showed that *Eucalyptus* species stand up to the hot, arid conditions much better than the other plants, looking green, active and thriving when others, including "Mulgas" and *Eremophila* species, were physiologically in a state of suspended animation, drab of appearance and sparse, having shed many of their leaves for water-conservation purposes.

Even if it had not been apparent initially, from a basic character appeal point of view, that gums were the obvious choice for dominant trees, all investigatory evidence pointed in this direction, and what a choice there is!





ACACIA INAEQUILATERA

Photography by O. Hockings

This is an arid area species of prickly, glaucous, sail-leaved wattle which I have encountered, from north of the Asburton River to around Dampier, Karratha, and Roebourne as well as on the Burrup Peninsula and Dolphin Island and eastwards to Roy Hill, Nullagine; on into the desert and across the border into the Northern Territory. It grows as a gnarled, corky-trunked, sturdy shrub or small tree 1-2.5 metres in height, usually with a single trunk, an upright habit and laterally spreading stiff branches clumped towards its top.

It has spiked sail-shaped grey leaves with the midrib to one side, and bears long inflorescences with large golden wattle balls on purple peduncle and with a purple rachis. Because of the deciduous purple petals the buds are also deep purple in colour — quite striking but prickly!

Acacia pyrifolia is superficially alike but this species is a slimmer shrub with the branches more evenly distributed along the one or more trunks (i.e. it grows as a maybe or single trunked shrub), more shrub-like and willowy in appearance, than the stiff *Acacia inaequilatera*. Both have glaucous, grey leaves but *Acacia pyrifolia* has a central mid vein and in *Acacia inaequilatera* it is lateral.

Acacia morrisonii is also somewhat similar being very like *Acacia pyrifolia* with the exception of having bright yellowish-green leaves, the colour of the leaves of *Canthum latifolia* (a colour not frequently encountered in the arid areas).

OPPOSITE, TOP — *Dodonaea boroniifolia*

Photography by M. Blackwell

A "Hop Bush"—A group of shrubs in the genus *Dodonaea*, generally found in drier areas, and widely grown for their brilliant "seed capsules". This is a small spreading shrub 0.5 to 1.5 m in height, with shiny, sticky, resinous, boronia-like, divided leaves and inconspicuous flowers followed by a profusion of sun-glinting 1-1.5 cm winged, bright mahogany-red "hop" like fruit.

OPPOSITE BOTTOM — *Calandrinia polyandra*

Succulent plants from red desert areas are easy to grow and lend colour.

Though little work has yet been undertaken on this, it is acknowledged that the goldfields (now nickel-fields) area of W.A. is a "Eucalyptus Speciation Region", with the astonishing total of more than one-fifth of all named species of Eucalypts occurring in this area, with great diversity of stature, shape, colour and form to choose from; both in upright trees and in shrubby Mallee types, many of which are attractive ornamental species, some with large coloured flowers. So here you have not only trees, but also numerous hardy shrubs.

Another section of planting which received particular attention was that of ground cover plants; firstly for stabilisation, but also for regional colour change. Atmosphere generators, such as "Everlastings", "Parrakeelias", "Brachycomes", "Mullamullas" and "Sturt's Desert Pea", sometimes breathtaking in their expanses of colourful flowers, are a characteristic phenomena of inland areas. The majority are easy to grow, just by the broadcasting of seed at the right time of the year.

To summarise, I feel that it is time we thought more deeply about the significance of the Australian landscape and what it means to us, and applied an understanding of this to the development of an Australian image in landscape design and execution. Even in the suburban scene this would mean the application of basic ecological principles in the development of an environment more pertinent to us and our way of life. We need to cast aside some of our inherited values and preconceived ideas and educate ourselves by observation of what is beautiful and valuable in our native surrounds.

Transplanting people into what may seem to be a foreign environment can be aided by informed assistance, and particularly by education. Changes in attitude can be remarkable if people get to understand their new environment, the special beauty of the flora and how they can use and enjoy it.

The irony of such a situation is that in general, and without help, people newly transplanted, setting out to create a "little bit of exotic paradise in the desert", in the process isolate and alienate themselves from seeing and realising the vast new world around them. In thinking that they are "prettifying up" their environment they are, in fact, making it and themselves foreign to their new way of life. Now what plants should be grown?

Plants to Grow in Arid Inland Places

There is no doubt that if you travel the arid interior of Australia (where rainfall is low and erratic) during the hotter months of the year there is one outstanding fact regarding vegetation. It's not the acacias, mostly "Mulgas" or the *Eremophila* "Poverty Bushes" (which is what I had been told were the things that do well in the arid interior) which "look good"; it is the Eucalypts or "Gums".

These look upstanding, healthy, shiny leaved and vital, as if they are still enjoying living, in contrast to the acacias and *eremophilas* and many other genera, which, although also surviving, are doing so "by the skin of their teeth" so to speak, and look like it. There is no doubt that these plants (perhaps "Mulgas" have been the most fully investigated to date) have evolved a great number of amazing adaptations towards survival under "drought condition", but many of these adaptations lead to a "dead" or at least "sombnambulistic" look, e.g. the curling back of leaves, leaf drop, minimalisation of leaf surface, etc.

Most inland gums are widely and deeply rooting, often phreatophytic (tapping the underground water table). When this is so they are, of course, able to transpire freely and still grow even in very dry periods. They can also achieve much greater dimensions than one would be led to expect under the prevailing climatic conditions with the aid of this additional supply of water. Now what *Eucalyptus* species are recommended?

Some Eucalypts for Planting in the Arid Interior

The demands of home-garden landscaping often differ from those of a town, though many of the criteria to be fulfilled are similar. These "gums" are chosen for their adaptation to arid conditions, as well as various additional attributes such as stature, smooth white trunks, interesting furrowed bark, or flowering prowess. Apart from three great stand-bys, some lesser-known and too seldom used species have been concentrated on.

Eucalyptus camaldulensis "River Gum" or "River Red Gum"

This picturesque tree to many people epitomises the character of the Australian landscape. It has been widely celebrated in poem, song and painting. Eucalypts are the dominant tree in the Australian landscape, and this particular species is the most widespread, naturally occurring eucalypt growing in every State except Tasmania, being present even in desert areas, chiefly along drainage channels. It occurs in many forms, having adapted to different combinations of conditions in different environments, even as a mallee in the desert; gnarled and somewhat stunted as it grows along the drier banks of the Condamine and Murray Rivers to, at times, a shapely giant in open savannah woodlands. It can be weeping or upright in form, large or small leaved; blue or green of foliage; stockinged or smooth (blotched) barked; a small straggly tree or mallee, 6-12 m (20-40'), up to a spreading giant of 46 m (150') or more. Colour plate on page 324, No. 43 issue.

Despite its natural habit of growing along water-courses, this tree takes readily to cultivation. It is one of the hardiest and fastest growing of Eucalypts, capable of reaching 18 m (60') in height over 12 years in areas with only an average rainfall of 245 mm (10").

It is drought and frost resistant, it tolerates periodic flooding and can stand saline conditions and alkaline soils, as well as great extremes of temperature, thriving in areas of frost and a number of centuries in summer.

Selection of seed used to obtain plants for growing in arid areas should be from adapted trees. Many of the desert forms are very beautiful, with both silvery blue or deep green foliage and usually with spectacular white trunks, blotched with tan, green and beige.

Eucalyptus microtheca "The Coolibah"

This tree, famed in song, is valued for its strong, durable timber. It can vary in size from 12 to 24 m (40-80') in height and has a dense broad crown.

It occurs in two distinct "bark forms". The tropical tree of the Kimberleys has a typical "box" bark—rough, grey and persistent, becoming at times deeply fissured in older trees. The southern form, on the other hand, presents a starkly white, powdery bark, which looks almost as if it had been white-washed and comes off on the hand when touched.

Eucalyptus papuana "Ghost Gum" or "Carooben"

This truly beautiful, tall and picturesque tropical "gum tree", 6-21 m (20-70'), has become a feature of brochures, postcards and aboriginal paintings, contrasting vividly with the colourful inland backdrop of red sands, great rocks and blue skies. It has a satin-smooth, white, lustrous-barked trunk and deep green, shiny, sickle-shaped leaves on drooping branchlets.

Of stately stature, with a well-branched, weeping, spreading canopy, this tree stands out and is much photographed by tourists.

It is most attractive planted in small groups.

Eucalyptus gongylocarpa "Marble Gum"

This little-known tree, sometimes of whimsical and usually umbraceous habit, is hardy and highly ornamental. It is a light-canopied, lacy, silvery-grey foliaged, white or silvery trunked Eucalypt, which occurs naturally in one of the hottest and driest parts of Australia in scattered locations in the south-west corner of the Northern Territory, the N.W. corner of South Australia and the adjacent areas of Western Australia. The rainfall received in this area is between 150 and 255 mm (6-10"), with high variability.

Although *E. gongylocarpa* was only named in (1936) it was observed by the Horn Expedition in 1894, in the narrative regarding which Professor Baldwin Spencer notes: "We were traversing low sandhills, on many of which grew a fine sandhill gum which reached a height of 15-24 m (50-80'). The trunk is silvery-grey in colour and very shiny the grey-green foliage usually forms a kind of umbrella-shaped mass, and it is somewhat strange to find a big tree like this right out amongst the waterless sandhills".



Brachychiton gregorii

Photography by M. Blackwell

The beautiful "Desert Kurrajong" is described on page 58. The apple-on-a-stick growth gives shade and lends character to the landscape.

Eucalyptus gongylocarpa (opposite, top)

Photography by M. Blackwell

The beautiful "Marble Gum" is described on page 55 where other *Eucalyptus* trees for planting in arid areas are described. Trees such as this grace any landscape and are needed for outback living.

Eucalyptus youngiana (opposite, lower)

Photography by M. Blackwell

A brilliantly flowered small mallee described on page 58.



It bears globular, marble-like (hence the name), silvery-grey gum nuts (with few seeds per nut). The juvenile foliage consists of arrestingly silvery-white, opposite, thick, ovate, almost sessile leaves.

Flowering is erratic, depending upon rain—usually February-March.

Eucalyptus* sp nov. aff. *aspera

A most outstanding and beautiful paper-fruited bloodwood, 7-15 m (20-50') in height, with broad, shapely crown—often somewhat pendulous in habit. It has a smooth, powdery, starkly-white trunk; in maturity dappled or ribboned in blues, tans, mushroom pink and beige, especially towards the end of summer; sometimes with a fine-grained super-imposed textured pattern. It has heavy, dense, pendulous foliage of an arresting, vivid, dark apple-green colour—to the effect that it can at times look most un-*Eucalyptus* like, and much more like a tropical exotic.

Juvenile foliage is glaucous and opposite, and appears to be fairly persistent.

***Eucalyptus kingsmillii* "Kingsmill's Mallee"**

One of our most ornamental and floriferous "Mallee Gums", to 5 m (15') in height, but more often 2-3 m (6-10'). Of an open spreading habit, 2-3 m (6-10') wide, it bears massed umbels of conspicuous sculptured buds, flowers and fruits. There are three flower colour forms—pale yellow, red with cream stamens, and red with pink stamens. Colour plate, Vol. 9, page 33.

Eucalyptus youngiana

A fairly recently named "Mallee Gum" with very large, ornamentally ridged, brightly coloured buds, flowers (red stamened) and fruits. Taller (to 7 metres) and of more open habit than *Eucalyptus kingsmillii* (which it resembles in some respects), it has multiple dark, rough stocking-ed-trunks and is eye-catching when in flower. Colour plate, Vol. 8, page 1.

***Eucalyptus pyriformis* "Large Fruited Mallee" or "Pear Fruited Mallee"**

A native of the Great Victoria Desert, this hardy, sparse-crowned, loosely-growing and often somewhat straggly shrub, 1.2-4.6 m (4-15') tall, bears large spectacular pendant blossoms in umbels of three. There are a number of colour forms, varying from lemon, through pink to dark red. The variety E.p. 'Elongata' from the Goomalling-Dowerin district, commonly known as "Dowerin Rose", has much more elongated buds, fruit and pedicels.

Eucalyptus pachyphylla

A most useful, hardy, dense, spreading windbreak shrub or mallee, 1.2-3 m (4-10') in height by 3-3.7 m (10-12'). It has conspicuously ribbed buds with long-beaked operculi (caps). Colour plate, Vol. 8, page 108.

***Eucalyptus oldfieldii* "Oldfield's Mallee"**

A dense, spreading mallee to 4 m (13') in height, with distinctly beaked operculi and ridged, almost stalkless buds, flowers and fruit.

This species is variable in height, growing in the north as a small, dense, shrubby mallee, and further south as an upstanding, much bluer-leaved, spreading, branched mallee to 4 m (12') in height. Colour, Vol. 9:132P.

Eucalyptus oleosa

This hardy eucalypt species occurs in a large number of widely differing forms. In the arid areas it is usually a shiny, bluish-green to green, narrow-leaved Mallett or tree 5.3-15 m (18-50') in height, often with a grey box-stocking bark to about one-third of the trunk height, smooth pinky-grey to cream above, and smooth reddish-brown to grey limbs. It is very floribund, bearing masses of small pale-cream flowers, strongly scented of honey all over the crown canopy.

***Eucalyptus lucasii* "Barlee Box"**

A somewhat wispy, hardy small tree or mallee, 4.5-12 m (15-40') in height, with a not very substantial trunk to 0.3 m (1') in diameter, which is often curved or crooked.

Other Plants for Backbone Planting in Arid Areas

Melia azedarach var *australasica*

"White Cedar" or "Cape Lilac"

—in other countries "China-berry", "Bead Tree", "Indian Lilac"
or "Pride of India"

This stately, handsome, remarkably fast growing, deciduous Australian native tree which occurs naturally in N.S.W., Qld., New Guinea and up the Malaysian Peninsular into the Himalayas, in relatively high rainfall areas; is equally at home in the semi-arid interior (and with a little help in the way of watering in the really arid inland areas). It is a joy at any season of the year, bedecked with khaki-golden berries on a lively tracery of limbs from autumn through until spring, when it bursts into fragrant lilac flower, followed by bright green, doubly compound leaves.

It has a well-clothed, wide, spreading, symmetrical canopy and is almost as characteristic of inland homesteads and settlements as the "Mexican Pepper", *Schinus molle*.

Brachychiton gregorii "Desert Kurrajong"

First and foremost in this genus, for the dry inland, is the utterly unexpected butter-yellow to acid-green foliaged (in the middle of the hot, hot summer of arid areas) "apple on a stick", slow-growing, West and South Australian "Desert Kurrajong".

Fly over the arid inland in mid-February and what hits you in the eye? Yellow to lime-green blobs amongst the dull grey sea of Mulgas.

On close acquaintance, each tree presents a multitude of virtues. Slim, sculptural, 3 to 5 fingered leaves (under good conditions to 7" in length). An elegant, symmetrical, round crown when young, expanding over the years (it is slow-growing and long-living) into a large spreading shade tree to 11 m (45') in height and 60' in diameter. Fragrant pale creamy-yellow "Monkey Beli" (3/4") flowers are followed by 2" long green fruit pods which turn black upon maturity. See colour plate on page 56.

Besides the Eucalypts this is the only tree of arid areas which stands out as "thriving" and "looking good" under the most adverse conditions.

Santalum acuminatum "Quandong"

A neat, round headed, often "lollypop"-shaped small tree 2-7 m (6.6-23') in height; with pallid grey-green, somewhat fleshy, often slightly sickle-shaped leaves and a rough brown trunk. It bears inconspicuous cream flowers followed by yellowish-white to green, firm fleshed, 2 cm diameter, round, edible fruit which turn bright red upon maturity and contain a pitted nut (used in the game of Chinese Checkers). The flesh of the fruit is used to make a distinctively tangy jam, greatly enjoyed by some. Colour pl., Vol. 7:337.

Duboisia hopwoodii "Pityurie" of the Aborigines

A large, dainty shrub to tree 1-4 m (3-13') in height and somewhat broader, clothed to the ground in graceful, weeping branches. It bears trusses of small white flowers, which have dark maroon streaks in their throats, from August to October. These are followed by small tomato-like green berry fruit, which turn black when ripe. Used by the Aborigines in place of tobacco.

Canthium latifolium

A large shrub or at times small tree 2-5 m (6.5-16') in height; with large, broad, fibrous, lime to apple-green leaves (a most unusual colour for arid area vegetation), held out on stiff twigs and branches dividing at right-angles. Flowers are inconspicuous and are followed by small round green fleshy berries black upon maturity.



Grevillea berryana

Photography by M. Blackwell

***Grevillea berrya* "Watertree"**

A misty-grey, inland tree to 6-7.6 m (20-25'), with finely-divided foliage and large trusses of sweetly-scented creamy flowers in September, followed by multitudes of shedding, typical boat-shaped, brown *Grevillea* pods, each with two winged seeds.

Grevillea stenobotrya

A large, dense, mid-green shrub or small tree 4-7.5 m (13-25') tall, with fine, narrow-ribbed 6.4-10 cm (2.5-4") long by 1.5 mm wide "leaves", and creamy white candelabra inflorescence in September/October.

Grevillea juncifolia

Shrub to tree 2-7 m (6.5-23') in height, pinacular to begin with, but becoming round-headed and somewhat sparse in old age, with long greyish phyllodes 26-30 cm in length and bunches of upright, brilliant orange bottle-brush inflorescences.

N.B.: "Stocking Treatment" is advisable to gather *Grevillea* seeds, as the fruit ripens rapidly and bursts explosively.

Hakea minyma

A greyish-green, upright, bushy shrub with veined leaves and creamy-white, bottle-brush inflorescences of flowers. These are succeeded by snail-like fruit with long pointed tips. The word *minyma* is from the Pitjantjatjara tribe, meaning "woman", and refers to the supposed resemblance of the fruit to a woman's breast.

Hakea coriacea

This medium-sized, hardy, grey, tough-leaved shrub, 2-4 m (6.5-13') in height, comes from a fairly restricted area of the arid interior of Western Australia. It bears a bright, outstanding, pink to red bottle-brush inflorescence, with a smooth (non-hairy) rachis and sculptured snail-like fruit. Its stiff, flat, linear leaves are held fairly upright and are a dull grey-green to steely-grey in colour, 6-16 mm wide, having 8 to 13 veins (more commonly 9 to 10) and 8-23 cm long (more usually 8-15 cm). Colour plate, Vol. 7, page 309.

Hakea francisiana

A magnificent, robust, hardy, upright shrub, with elongate, stiff, flattened, fairly narrow, 3-6 mm wide grey leaves with 5 or 7 main veins. It flowers for months, producing spectacular 7.5-16 cm (3-6") elongated spikes of usually salmon to vermilion flowers, which attract multitudes of birds. There are also cream, pink and apricot coloured forms. Colour, Vol. 5:337.

Hakea multilinea

A tall, upright, hardy shrub with linear, flattened, greyish leaves, 2-10 cm (1-4") in length, which have several to many veins. It bears multi-flowered racemes 2-10 cm long. It can be distinguished from species with similar flowers by the bicarinate ventral suture of the snail-like fruit.

Hakea grammatophylla

This shrub is restricted in distribution to the ranges of south-central Northern Territory. It is a grey, hardy shrub with linear, flattened, multi-veined leaves and pink to red inflorescences 2-10 cm in length, which have hairy rachis. Colour plate, Vol. 5, page 308.

Dodonaea viscosa

Native to breakaway country, this upright hop bush grows as a shrub or small tree to 7 m (23') in height. The flowers are inconspicuous, but are followed by unique, bronzy-red, top-like fruit in masses. The leaves are sticky. See page 53 for colour plate of *D. boronaeifolia*.

Melaleuca uncinata

A dense shrub 1-6 m (3-20') in height, with yellow tufty inflorescences and fine terete phyllodes about 3 cm (1.2") x 1 cm (0.4"), exhibiting oil glands and with pointed, slightly hooked ends. Colour, Vol. 7:80.

Eucalyptus

Let's Look Closely
at Their Leaves

By M. R. O. MILLETT*

Selections from an article; first published in "The Commonwealth Professional" June 1977, it was later published in "The Victorian Naturalist", January/February 1978; the full text of the article is available at \$1.20 from the journal's Treasurer, 124 Waverly Road, East Malvern, Vic., 3145.

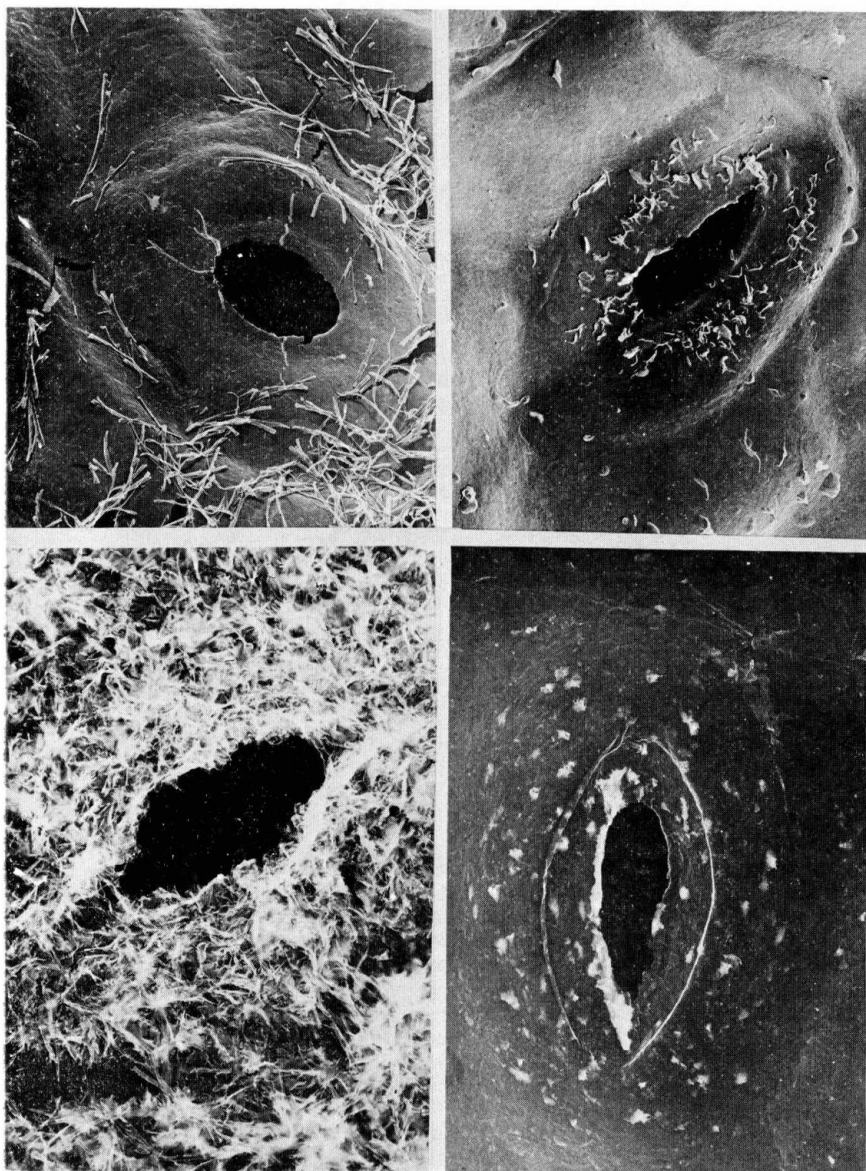
Australia's unique race of trees, the eucalypts, cannot fail to hold the interest of people who do not merely take them for granted. The stomata, minute elliptical pores which occur in the epidermis, or 'skin', of the leaves of the trees (as indeed, is also the case with all other terrestrial green plants) are much more important than is commonly realised.

Eucalyptus Species

First, a few words in general about Australia's genus *Eucalyptus* which is indigenous only to Australia, Papua-New Guinea, Timor, the Celebes and the Philippines. Only a very few (tropical) species are endemic outside Australia itself and these are confined to the listed countries to the north of Australia. Depending on the system of classification used, there are considered to be from 400 to 600 species of this remarkable group of trees. "Australia and the world have in the eucalypt a natural asset capable of further development and use in ways seldom adequately envisaged, let alone attempted, up to the present. We have barely scratched the surface of the problems; and the possibilities of exploiting the potentialities of our eucalypts in terms of better land use, increasing the economic resources and deriving greater benefits for mankind are immense . . . these trees grow over a wide range of climatic environments — from the mild coastal regions to the cold alpine tree line, and from the rain forests of the tropics and temperate winter rainfall areas to the hot dry interior and margins of the desert."

Because of the wide range of diverse environments, where different species of eucalypts are adapted each to grow in its own favorable native environment, these trees of many species are admirably suited for cultivation in other countries — for there is a suitable type of eucalypt for selection to grow in almost any situation where a tree will grow. Altogether, eucalypts are known to have been introduced successfully to more than 40 countries.

The appearance and shape of the stomata are shown in the accompanying photomicrographs and other illustrations. "A stoma is a pore formed by two specialized cells in the epidermis of plants. Stomata are present in large numbers, mainly in the leaves, and through them gaseous exchange with the atmosphere takes place. Each stoma is surrounded by two guard cells which are roughly crescent- or sausage-shaped. The guard-cells change their shape sufficiently, due to variations in starch content and pressure of fluid within them, to enlarge or diminish the size of the pore from a completely closed condition to one of maximum opening. The word stoma is also commonly applied to a pore and the guard cells surrounding it. The word stomate(s) is often applied to convey this latter meaning . . . vast quantities of water vapour are . . . released from the soil's subsurface to the atmosphere by the Earth's vegetation, and this is part of the hydrological cycle providing water to sustain life on our planet. Plants use the atmosphere's carbon dioxide (CO_2) in the respiratory process necessary for their development and growth. The carbon (C) of the CO_2 is retained by the plant to combine with hydrogen (H) and oxygen (O) in various forms. Some of the oxygen, derived from the original intake of the H_2O and CO_2 , is released to the atmosphere, thus contributing to the maintenance of the required four-fifths oxygen content of the air breathed by Man and other animals." Thus plants are, so to say, the "lungs" of our biosphere.



Photomicrographs, with the electron microscope, of the leaf surface of four *Eucalyptus* species, showing an open stomatal pore and the epidermal surface's wax formation, which varies from species to species. Approximate photographic scale of magnification varies from 2,000X to 3,000X. Top left is *Eucalyptus muellerana*; top right is *E. fastigata*; bottom left is *E. panda* ssp. *panda*, and bottom right is *E. obliqua*. Photographs from T. C. Chambers and N. D. Hallam.

Transpiration, or the amount of water emitted in vaporous form through the stomata of plants, is not easy to measure accurately, except where the plant is growing in the restricted and unnatural environment of a container which can be weighed for measurable water loss. It is estimated that plants growing in the temperate zone may transpire up to $\frac{1}{2}$ litre per square metre of leaf area per hour, that is to say, about .08 pint per square foot per hour, or about $\frac{3}{4}$ pint over a period of 10 hours of daylight. Certainly, the amount of water drawn up by the roots of a large tree and transpired through its foliage can be an immense quantity. It has been said that the aggregate area of the fully open pores, as a proportion of the total leaf area, is only 1 to 3 per cent; but even this estimate seems far too high. The fact that rates of stomatal transpiration are frequently 50 per cent (and sometimes more) of the evaporation from a free water surface, under similar conditions, is doubtless capable of explanation in terms of rates of gaseous diffusion in relation to aperture size; diffusion rate through apertures of smaller area tend to result in faster rates (relative to pore area) than through apertures of larger area.

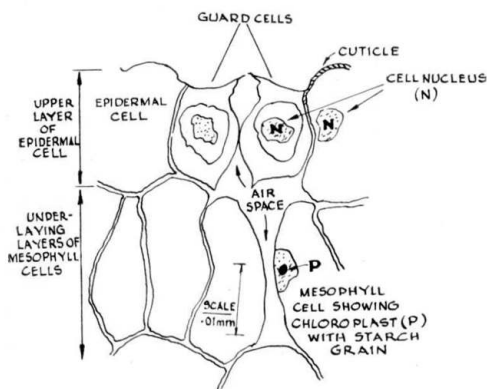


Diagram of transverse section through leaf of *Eucalyptus erythrocorys*, showing the two guard cells forming the stoma in a closed phase. Microscope at 2,750X, but scale on photo itself indicated by line of 1/100 mm on the drawing. Based on photo by D. J. & S. G. M. Carr in "Native Trees of Australia".

The size of the ellipse formed by the two guard cells is more significant than that of the pore, since the former's long axis varies little; whereas the pore itself varies considerably in size as it opens or closes in response to climatic and physiological changes throughout the day.

An investigation showed that there were some considerably significant differences in the epidermis as between some species — especially, for example, in relation to species growing in regions of very low rainfall as compared with tropical and temperate rain-forest species.

Research at the School of Biological Sciences, Australian National University, under Professor D. J. Carr and Mrs. S. G. M. Carr, and at the School of Botany, University of Melbourne under Professor T. C. Chambers, on the epidermis, has been mainly in differences in the detailed sculpturing of the cuticular layer and the protective waxes. The high resolving power of the electron microscope is able to show these sculpturings like a fascinating "moon-scape."

Just consider the leaf surface, to which the plant owes so much for its development, growth and survival, and what it presents in variety and ingenuity, and aesthetic attraction, even only to the naked eye, and a pocket hand lens. How much more so under the microscope! Consider alone the form and function of those cellular outgrowths from the epidermis, called hairs; soft and scattered hairs; fine and close; coarse, rough, bristly, cottony felt; woolly and glandular; ridged and wrinkled; flattening down; unbranched; star-like; straight or curved prickles; sticky secreting hairs . . . These and other features (so often affecting air flow at the leaf-surface, and therefore associated with transpiration in conjunction with the stomata) also open up a field of study, especially in understanding the physiology of plants.



Eucalyptus Propagation

INTRODUCTION

This article is reproduced from a leaflet entitled "Eucalypt Propagation on a Small Scale", by David Kleinig and John Doran, available from the C.S.I.R.O. Permission to republish it is appreciated, and the fine work of the C.S.I.R.O. in the improvement of quality of living in Australia is acknowledged.

The recommendations are based on the experience of officers of the Division of Forest Research, C.S.I.R.O., in producing small numbers of seedlings for research. The techniques described are not the only ones possible, and would be modified for producing large numbers of plants.

SEED AND SEED STORAGE

Most commercial eucalypt seedlots are sold, stored and sown as a mixture of viable seeds and chaff (mainly unfertilised ovules), which are difficult to separate in many species. The main features are the very small seed size of most species, the high proportion of chaff (from 5:1 to 30:1 by weight), and the similarity in size, shape and colour of the chaff and viable seeds of some species. The average number of viable seeds per gram of seed and chaff varies greatly with species and is in the range of seven to 4,000.

Eucalypt seeds are relatively easy to store. The mature seeds of most species remain viable for a decade or more when stored at a moisture content below 10% in sealed containers at room temperature. In dry climates, air drying of the seeds during extraction will give a satisfactory seed moisture content for storage (8-10%). In humid climates, however, air drying of the seed may leave the moisture content undesirably high for storage, although this can be partly offset by storage at lower temperature (1-4°C). Long-term maintenance of viability is better assured if seeds at a moisture content of less than 10% are refrigerated in sealed containers at 1-4°C. This treatment is essential for the successful storage of seed of *Eucalyptus deglupta* and *E. microtheca*.

CONDITIONS FOR GERMINATION

Temperature, Moisture and Light

Most eucalypt seeds germinate over a wide range of temperatures, generally 10-30°C. The optimum temperature for germination of most species is close to a constant 25°C, with some tropical species tending to have a higher optimum temperature and some temperate species a lower optimum. High humidity around the germinating seeds is essential, and they should be exposed to a period of light each day.

Stratification

The seeds of most eucalypt species germinate readily without preliminary stratification treatment when given appropriate conditions of temperature, moisture and light. However, seeds of species from high altitudes commonly require cold, moist stratification to break their dormancy. To stratify, sow the seeds in the moist substrate in the germination container (as described below), cover the container with a lid or a plastic sheet to minimise drying, and place in a refrigerated environment at 1-4°C. Check occasionally to see that the substrate remains moist.

Three (3) weeks of stratification is essential to break the dormancy of seeds of *E. perriniana* and will also ensure more rapid and even germination of seed of *E. amygdalina*, *E. dives*, *E. nitens*, *E. pauciflora* ssp. *pauciflora*, *E. regnans* and *E. stellulata*. Four (4) weeks of stratification is essential for the germination of seeds of *E. glaucescens* and *E. pauciflora* ssp. *niphophila*; six weeks is required by *E. kybeanensis*, *E. mitchelliana* and *E. pauciflora* ssp. *debeuzevillei*, while *E. delegatensis* requires 6-10 weeks, depending on seed source. On subsequent transfer to warmer temperatures, germination should commence within 3-5 days.

RAISING SEEDLINGS

A two-stage approach is recommended. This involves sowing a quantity of seed in a germination container, and then transplanting individual seedlings from this container into separate pots for growing on to the planting-out stage. Usually eucalypts grown in pots will transplant much more successfully to the field than seedlings taken as bare-rooted plants from a nursery bed.

Sowing

The time for this depends on local conditions, particularly on the optimum time for planting-out. For example, in Canberra sowing in the glasshouse in May allows the production of vigorous stock for planting-out in September-October after the last of the severe frosts and well before the hot, dry summer.

Choose a germination container of convenient size and depth. Plastic pots 7.5 cm in diameter are suitable for germinating 20-30 seedlings, and plastic trays 14 x 8 cm for 50-60 seedlings.

Suitable sowing mixes include 2:1 vermiculite and perlite, or 1:1:1:1 coarse sand, peat moss, vermiculite and perlite. If these materials are not readily available, a 1:1 mix of sand and loamy soil, or even a medium grade sand, will suffice. Heat sterilisation of all mixes is desirable. Nutrients are necessary once the cotyledons of the seedlings have developed, and can be provided by a slow-release fertilizer such as "Osmocote" or "Magamp" in the mix, or by regular weekly application of a liquid fertilizer such as "Aquasol". Suitable rates are given in the section on transplanting.

The sowing mix should be watered before sowing and the seeds sprinkled sparsely and evenly over the surface. Care is necessary to avoid sowing too densely, as this will result in unsatisfactory spindly seedlings. The smaller eucalypt seeds do not need to be covered, but larger seeds should be covered with a layer of the sowing mixture no thicker than the diameter of the seed.

Germination trays should be kept in a warm (20-25°C) shaded area (50-80% shade). A glasshouse is preferable but a sheltered shadehouse or verandah can be used. The trays should be watered at frequent intervals with a fine spray, so that the sowing mix is kept moist but not saturated. If "damping-off", the rotting of seedlings by soil fungi attacking at soil level is suspected (most common soon after germination), spray with an appropriate fungicide such as "Benlate" or "Captan".

Transplanting

The most convenient stage for transplanting is about 5-7 weeks after sowing, when the seedlings have 1-2 pairs of leaves above the cotyledons.

Containers of many types and sizes are suitable for transplanting eucalypts. For example, black polythene bags, 10 cm diameter and 14 cm deep (about 1.5 litres) are adequate for raising plants to 25-30 cm in height and are readily available. Other containers in common use include polythene tubes, plastic pots and peat pots of varying capacities.

A potting mix of adequate water-holding capacity, while still allowing good drainage, is essential for optimum plant development. Two such mixes which we find suitable are:

- (a) 1:1:1 coarse sand, sandy loam and peat moss;
- (b) 1:1:1:1 coarse sand, peat moss, vermiculite and perlite. Nutrients can be conveniently provided by the inclusion of "Osmocote" or "Magamp" in the mix at the rate of 1.75 kg/m³ (17.5 g/10l), or by the regular application of a liquid fertilizer such as "Aquasol". If fertilizers are not readily available, the inclusion of well-decayed animal manure in a mix with coarse river sand, and sandy loam in the proportions 1:2:3, is recommended.

The technique for transplanting into the separate containers is:

- (a) Fill the containers with potting mix and water thoroughly.
- (b) Take each container and prepare a hole in the mix with a "dibbler" (a pointed tool like a pencil). This hole should be about 1-2 cm in diameter and 2-3 cm deep.
- (c) Using the dibbler, carefully prise a group of seedlings out of the sowing container and detach an individual seedling. Handle the seedling by its leaves only and avoid squeezing the stem. Roots are frequently quite long and should be pruned back to a length of 2-3 cm. Care must be taken to prevent the root system folding upwards as it is placed in the hole. Hold the seedling at the side of the hole so that the topmost roots are a few millimetres below the soil surface and gently firm the soil around the root system with the dibbler.
- (d) Water gently after transplanting to ensure complete soil contact with the roots.

TENDING AFTER TRANSPLANTING

Initially plants should be kept in a shaded, weatherproof environment. Damage from heavy rain, wind, hail and frost can be very severe. Frost damage is less likely if the plants are on benches rather than at ground level. A permanent shadehouse is desirable, though temporary, portable covers of "sarlon" shade-cloth, hessian or similar material can be quite adequate. The need for shade after the first 2-3 weeks will depend on climate and season. Too much shade should be avoided, as it promotes the development of weak, spindly seedlings.

The potting mix must be kept moist, but not saturated, and never allowed to dry out. Before planting out, the seedlings should be "hardened off" by reducing the watering slightly and increasing the exposure.

Pathogenic fungi, insects and other injurious agencies can cause problems. The treatment of damping-off has already been described. Leaf diseases, including mildews and moulds, can also spread quickly; treatment with "Benlate" spray or dusting with sulphur powder often provides satisfactory control. Obviously it is better to prevent fungal problems by adequate ventilation, heat sterilisation of the potting mixes and good hygiene rather than to attempt often-too-late control with fungicides. Pyrethrum-derived sprays and dusting powders, which are not toxic to man, have been found most useful in controlling a number of insect pests, particularly aphids.

About 2-3 months after transplanting, seedlings should be 25-30 cm tall and ready for planting in the field.

Propagation for the Home Gardener

By THE EDITOR

The propagation of eucalypts from seed is quite easy if the seed is reasonably fresh. It is keeping the seedlings going that is the tricky part. For those who do not want to go to too much trouble, and do not care if they lose a few seedlings (after all, who wants more than a few plants of a species of large gum tree), this method is recommended:—

1. Sow seed only between April and June—send for seed now.

2. Prepare small plastic pots or tubes, crocked at the bottom, with 2 cm of clean, washed, coarse sand over a sandy loam soil in the bottom of the pot.
3. Sprinkle about 10 seeds on the top of each pot and cover lightly with more sand or fine gravel.
4. Water by dunking the tube up to halfway in a container of water. Water will seep up to the top, moistening the seed.
5. Keep the tubes in a bright spot, but with no direct sun. Keep, say, the tubes for one species together in a plastic ice-cream container and keep this on a window-sill—inside, away from the wind.
6. As seedlings shoot up, prick out all except the most vigorous one.
7. Pot on to large pots when the seedling is half as high as the depth of the tube, or pot as described elsewhere in this issue.
8. So you failed—try again. There are hundreds of fine seeds in each packet. After a few trials you will find the method that suits your conditions best, and then you will have plenty of plants.
9. The main cause of failure is fungal attack from the water, or because the sand around the seedling gets too wet. Try watering the pot with boiling water before you sow the seed, boiling the water and allowing to cool before watering, keeping the surface of the sand drier, or give the surface a little direct sun for an hour a day.
10. In the early stages vigorous growth is desirable, so that a little foliage fertilizer may help when the seedlings get a few centimetres high.
11. A deep pot or tube is essential to keep that tap-root straight down and not twisted, so plant out before the height of the plant equals the depth of your large pot.

Plants for Dry Soils and Dry Sites

By D. HOCKINGS

The description "dry soil" is a vague generalisation that is used rather carelessly and loosely. Because the dryness of soil or of particular sites is a relative term, it is worth attempting to define what is meant, in order to give it some perspective. Likewise the lists of plants for dry soils that are published from time to time are meaningless without this perspective.

There are a number of soil situations that may qualify as dry sites but only in relation to other sites with which they are being compared. For instance, reference to a dry soil or site out near Windorah in South-west Queensland would not have any application to a dry soil or site in Brisbane or Townsville in North Queensland.

Brisbane's annual rainfall of about 1000 mm or 40 inches falls equally on Brisbane's wet soils as on Brisbane's dry soils. However, the shallow podsoils that are so characteristic of much of the Brisbane area and in fact many of the areas along the east coast, may be very wet in the wet season and extremely dry in the dry season. This is because the depth of top soil and the nature of the substrata have a most important influence on how dry or wet the soil is.

Many gardeners misunderstand soil drainage and insist that their land is well drained simply because it is sloping. This is not necessarily so at all. During rain or watering, water percolates into and moves down through the soil. If the soil is shallow with an impermeable clay or rock layer close to the surface, the top soil will quickly become as full of water as a saturated sponge. Likewise, it can quickly and severely dry out in dry weather. Furthermore, the underlying strata may pond water below the surface and lead it out at particular points, forming springs or bogs.

(Continued on page 86, following description of other dry area plants)

Scribbly Gums

Reprinted from "The Australian Beekeeper", available from Penton Bros., P.O. Box 230, Maitland, N.S.W. 2520, at an annual subscription of \$6.00.

By A. A. Clemson

Several closely related species have scribbles on the bark caused by insect larvae. *Eucalyptus racemosa* and *Eucalyptus haemastoma* are common on the coast, *E. haemastoma* being mainly confined to the area between Jervis Bay and Newcastle, while *E. racemosa* has a much wider distribution extending from Bateman's Bay northward in New South Wales. *Eucalyptus rossii* is found on the Tablelands and Western Slopes. Other species of scribbly gums exist.

It is very difficult to distinguish between species, and for purposes of this article *E. signata*, with a distribution of the north coast of N.S.W. into Queensland, has been included in with *E. racemosa*. Similarly *E. sclerophylla*, with a distribution of the Blue Mountains to Southern Tablelands and the South Coast of N.S.W., has been included in with *E. haemastoma*, which is found from Newcastle to Nowra. It is relatively common on the Hawkesbury sandstone soils around Sydney, but intergrades with *E. racemosa* in both Royal and Kuring-gai Chase National Parks.

Scribbly gums are usually small trees and not of good form, but on the better-class locations, particularly on the North Coast districts, the tree may attain a height of 18-21 metres (approx. 60-70 feet) and 1 metre (approx. 3 feet) in diameter and be of good form and ornamental appearance.

The bark is usually white in colour, hence one of its common names is "White Gum". It may sometimes be greyish or bluish and mottled. The bark is marked with scribbles caused by insect larvae and is shed in flakes to ground level annually.

Adult leaves are coarse, alternate, are stalked and mainly lanceolate to narrowly lanceolate and curved in shape. Both surfaces are the same glossy green colour and are 76-127 mm (approx. 3-5 in) long and 13-20 mm (approx. 0.5-0.8 in) wide. Leaf venation is at 15-35 degrees to the midrib.

The inflorescence consists mainly of axillary umbels of 6-12 white flowers with prominent anthers. Buds are yellow in colour and club shaped 5 x 6 mm (approx. 0.2 x 0.25 in). The operculum is hemispherical and much shorter than the calyx tube which is conical and narrows into a short pedicel.

Buds form on new growth mainly during the summer and are carried for slightly more than 12 months, thus it is common to find small buds for the next flowering season on trees which also have mature buds and flowers.

The main flowerings occur on the Central Coast during late summer and autumn, but a considerable extension of flowering time occurs varying with the species, locality and season. On the North Coast, spring flowerings occur.

Fruits are small, 4-6 mm x 4-6 mm (approx. 0.15-0.25 x 0.15-0.25 in). In short pedicels. They are ovoid to hemispherical in shape. Disc is moderately wide, moderately flat or slightly convex and valves small.

The timber is pinkish-brown to reddish and brittle, being called "Brittle Gum" in some localities. It is sometimes used for fence-posts and is reasonable for fuel. It is generally of little value for milling with the exception of *E. racemosa* on the North Coast. *E. racemosa* is particularly suitable for planting on the coast on rather poor sandy soils where ornamental trees are required.

Scribbly gums are common in poor open coastal forests, sometimes in pure stands, but usually in association with any of a wide range of species growing in the forests. While *E. haemastoma* is more restricted in its distribution, *E. racemosa* grows at altitudes between sea-level and 300 metres (approx. 1,000 feet) and to 760 metres (approx. 2,500 feet) on the fringe of the Tablelands.

They are commonly found on flats near the sea, wide ridges and plateaux where soils are of sandstone origin and shallow and mainly poor. *E. racemosa* is also found on better-class sandy soils on the North Coast.

This species may combine with other species such as Red Bloodwood (*Eucalyptus gummiifera*), Grey Gum (*Eucalyptus punctata*) and Coastal Grey Box (*Eucalyptus moluccana*) to provide particularly good honey crops.

Straight lines of Scribbly Gum honey are rather rare because of its association with other species which flower at similar periods. Their honey is amber in colour, strong in flavour, and frequently lacks density.

Early Success with Ornamental Eucalypt Breeding

by David V. Beardsell^A, David L. Jones^A, and Cam Beardsell^B

Some success with the grafting of eucalypts at the Horticultural Research Institute, Knoxfield, together with the known ease of producing hybrids between different species of eucalypts, encouraged us to look at the possibility of producing horticultural purpose eucalypt hybrids. The large flowered, weeping form of *E. caesia* (cv. 'Silver Princess') has been grafted successfully on to *E. camphora*, *E. cladocalyx*, *E. leucoxydon* and *E. cephalocarpa*. These approach grafted plants are now three years old and are growing normally, although slightly stunted.

There are only a few small to medium-sized ornamental eucalypts that are suitable for hard sites, such as in street plantings in heavy clay soils. Both *E. sideroxydon* and *E. leucoxydon* have proved themselves as adaptable medium-sized trees in the eastern suburbs of Melbourne. However, they may grow too big for some sites. It was decided that *E. caesia* would be one of the best potential crosses to use with the two ironbark species because of its extremely ornamental appearance and small size. All three species have pink flowers.

The five crosses made were as follows:—

- (a) *E. leucoxydon* (a glaucous pink flowering form) as female
× *E. caesia* (large flowering, weeping form) as male.
- (b) *E. sideroxydon* (a glaucous pink flowering form) as female
× *E. caesia* (large flowering, weeping form) as male.
- (c) *E. sideroxydon* (a glaucous pink flowering form) as female
× *E. caesia* (large flowering, weeping form) as male.
- (d) *E. caesia* (small flowering bushy form) as female
× *E. sideroxydon* (glaucous pink flowering form) as male.
- (e) *E. caesia* (large flowering, weeping form) as female
× *E. sideroxydon* (glaucous pink flowering form) as male.

Crosses (d) and (e) were made in the first two seasons using pollen from *E. sideroxydon* on to approximately 200 emasculated *E. caesia* flowers. Half of the stigmas of these flowers were treated with hexane to increase the likelihood of producing hybrids (Pryor and Willing, 1974). Fruit set was extremely poor and only six fruits were collected after the second season. From these fruits 18 seeds were sown, but all seedlings turned out to be *E. caesia*.

In the third season crosses (a), (b) (c) were made using *E. sideroxydon* and *E. leucoxydon* as the female parents. This was due to lack of success when using *E. caesia* as the female parent. It was thought that the small amount of viable pollen from *E. sideroxydon* and *E. leucoxydon* flowers, as shown in pollen germination tests (Martin, 1972) may have been a limiting factor in the production of hybrids. *E. caesia* was found to have abundant viable pollen. The flowers on *E. sideroxydon* and *E. leucoxydon* were not emasculated and the flower stigmas were not treated with hexane. A large number of crosses were again made using *E. caesia* as the female parent.

^AVictorian Dept. of Agriculture, Horticultural Research Institute, Knoxfield, Vic. 3180.

^BLatrobe University, Bundoora, 3083.

EDITOR'S NOTE: Readers are especially referred to the article "Eucalyptus leucoxydon" on page 171 of Volume 9, where its many forms are described with a colour plate.

Again no hybrids were found using *E. caesia* as the female parent, even though 2,800 seedlings of *E. caesia* were raised. However, when using both *E. sideroxylon* and *E. leucoxylon* as the female parents a number of hybrids with *E. caesia* were detected at the seedling stage. It is fortuitous that *E. caesia* and the two ironbark species have widely differing cotyledons. This means that picking up hybrids at the cotyledon stage is very simple. From 1,700 seedlings of *E. leucoxylon* 22 hybrids with *E. caesia* were detected, while 36 hybrids out of 2,100 *E. sideroxylon* were found.

Since no special technique was used to get hybrids of *E. sideroxylon* and *E. leucoxylon* with *E. caesia*, it should be possible to raise them whenever the two ironbark species are planted in the proximity of *E. caesia*. This assumes that they flower at the same time (generally spring in southern Australia). Fruit should only be harvested from the ironbark species, since we have not been able to produce hybrids using *E. caesia* as the female parent.

All hybrids and their parents will be planted out at the Horticultural Research Institute for further assessment. It is hoped that some hybrids will turn out to be small, ornamental pink flowered trees that are reasonably hardy. It is too early to say whether the hybrids exhibit any heterosis, but the hybrids nearly always germinated slightly quicker than both parents. However, Pryor (1957) concluded that hybrids between widely different eucalypts usually had poor growth or poor viability. At the time of writing most of the hybrids were growing at a similar rate to *E. sideroxylon* seedlings growing with them. It is interesting to note that although *E. caesia*, *E. leucoxylon* and *E. sideroxylon* are in the subgenus *Symphomyrtus*, they are in widely separated sections—*E. caesia* is in section SI, while *E. leucoxylon* and *E. sideroxylon* are in the section SU (Pryor and Johnson, 1971; Johnson, 1976). With this in mind we intend to carry out further hybridising between various ornamental eucalypts from Western Australia and various hardy eucalypts in the same subgenus from Eastern Australia. Since Pryor (1956) has also produced hybrids between *E. caesia* and *E. pulverulenta*, the former species at least can be crossed with certain eucalypts in the subgenus *symphyomyrtus* from Eastern Australia. Some possible combinations in the subgenus *symphyomyrtus* are:—

E. largiflorens, *E. cephalocarpa*, *E. cinerea*, *E. chapmaniana*, *E. lansdowneana*, *E. melliodora*, *E. leucoxylon*, *E. sideroxylon* or *E. kitsoniana* may be crossed with:

E. caesia, *E. crucis*, *E. eremophila*, *E. erythronema*, *E. incrassata*, *E. nutans*, *E. macrocarpa*, *E. rhodantha*, *E. steedmanii*, *E. stricklandii*, *E. woodwardii*, *E. torquata*, *E. youngiana* or *E. pyriformis*.

ADDENDUM:

Since this paper was prepared we have produced 700 F₁ hybrids between *Eucalypts sideroxylon* and *E. caesia* by treating the stigmas of *E. sideroxylon* with hexane before brushing on pollen from *E. caesia*. Pollinations were carried out on warm, sunny afternoons, and the flowers were neither emasculated nor bagged to prevent natural pollination. Despite this approximately 80% of the seedlings raised from the artificially crossed flowers were F₁ hybrids. The immense number of hybrids produced by hexane treatment of the *E. sideroxylon* stigmas will allow us to evaluate *E. sideroxylon* x *E. caesia* hybrids for uniformity, vigour, hardiness, resistance to disease, and for their ornamental potential.

REFERENCES

- Pryor, L. D. and R. R. Willing (1974). Production of interspecific hybrids between incompatible pairs of Eucalypts. *Proc. Inter. Plant Prop. Soc.* 24: 264-268.
Martin, F. W. (1972). In vitro measurement of pollen tube growth inhibition. *Plant Physiol.* 49: 924-925.
Pryor, L. D. and L. A. S. Johnson (1971). A classification of the Eucalypts. A.N.U., Canberra.
Johnson, L. A. S. (1976). Problems of species and genera in Eucalyptus. *Plant Syst. Evol.* 125: 155-167.
Pryor, L. D. (1956). An F₁ hybrid between *Eucalyptus pulverulenta* and *E. caesia*. *Proc. Linn. Soc. N.S.W.*, 81: 97-100.

Four new species of Eucalyptus

by David Kleinig, C.S.I.R.O. Division of Forest Research, Canberra

Four new species of eucalypts were published in the Queensland Herbarium journal *Austrobaileya* (Vol. 1, No. 1, 1977). These were described by and published posthumously for S. T. Blake, who died in 1973. The species are *Eucalyptus brassiana* from Queensland and Papua-New Guinea, *E. henryi* from Queensland and New South Wales, *E. melanoleuca* from Queensland, and *E. urophylla* from Timor and some other Indonesian islands. The taxonomic positions of the species according to Pryor and Johnson (1971), "A Classification of the Eucalypts", are indicated by a letter code in the following digests. The bracketed numbers refer to Forest Tree Series leaflets published by the C.S.I.R.O. Division of Forest Research.

Eucalyptus brassiana—Cape York red gum. Gum-topped peppermint (Australia); Karo (Papua-New Guinea). SNEET. (213).

This species occurs on Cape York Peninsula from Cooktown northwards, in south-western Papua, and on some of the intervening islands. It occupies a number of habitats from well-trained rocky slopes to seasonally flooded flats and the margins of saltpans. *E. brassiana* is commonly a small tree of poor form 10-20 m in height and 30-50 cm in diameter. Trees generally branch from a low height or divide into several large stems from near ground level. The bark is dark grey, rough, irregularly longitudinally fissured for 1/3-1/2 tree height, smooth creamy-yellow above.

This species is most closely related to *E. exserta* (Queensland peppermint), which has persistent fibrous bark to the small branches, and to *E. morrisii* (Grey mallee), which is of mallee form. *E. exserta* occurs in Queensland as far north as Cairns, while *E. morrisii* barely extends into the south of the State.

E. brassiana is named in honour of L. J. Brass, a noted plant collector and taxonomist who led a major botanical expedition to the Cape York area in 1948.

Eucalyptus henryi—Broad-leaved spotted gum. CCC:C. (No leaflet published.)

E. henryi is a large tree of good form occurring in coastal eucalypt forest in south-eastern Queensland and north-eastern New South Wales; as far as is known at this stage, only between Brisbane and Grafton. The bark is smooth, greyish-white with darker greyish-blue blotches like the common spotted gum. The trunk is often characterised by many depressions or dimples.

This species is very closely related to *E. citriodora* (lemon-scented gum) and *E. maculata* (spotted gum). *E. citriodora* can be readily recognised by its lemon-scented leaves, which are also narrower than those of *E. henryi*. In addition the trunk is scarcely dimpled and it has smaller flowers, buds and fruits. Blake states that *E. henryi* and *E. maculata* "resemble one another in bark, but the much larger leaves of *E. henryi* give the crown a heavier and denser appearance. Herbarium specimens are coarser in every way". In addition, petiole seedling leaves, a feature of *E. citriodora* and *E. maculata*, are rare in *E. henryi*, and there are fewer bristles on the seedling and juvenile leaves.

This species was named in honour of N. B. Henry of the Queensland Forestry Department, whose field observations first aroused Blake's interest in it.

*See Australian Plants, Vol. 9, No. 71, page 132

Eucalyptus melanoieuca—Yarraman ironbark. SUV:C+. (No leaflet published.)

E. melanoleuca is a tree up to 30 m tall, having a restricted natural distribution in the Nanango-Yarraman region around 120 km N.W. of Brisbane. It occurs in association with other eucalypts in open forest and is also found in rainforest margins. The bark is typical of other ironbark species, black and longitudinally fissured. However, the smaller branches have smooth white bark. This contrasting black and white bark is the reason for the specific name (derived from the Greek words *melano-*, black, and *leuco-*, white).

E. melanoleuca belongs taxonomically in a group of ironbarks, the best known of which is *E. paniculata*, which occurs only in New South Wales and has persistent rough and lighter coloured bark to the smallest branches. Blake states that *E. decorticans* (gum-top ironbark) and *E. sideroxylon* (red ironbark) are other ironbarks in the area with smooth upper branches; the former has all or most of the branches white, *E. sideroxylon* has duller, less conspicuous smooth branches, while both have much larger buds and fruits and narrow juvenile and intermediate leaves".

Eucalyptus urophylla—Timor mountain gum (Australia); ampupu, palavao preto, airoo, popo (Indonesia). SNAA++ (214).

This eucalypt has an unusual history in that it has been recognised and planted extensively in tropical countries, particularly in South America, for more than 50 years and yet has only recently been officially named. It is one of only two species of *Eucalyptus* (the other being *E. deglupta*) which does not occur naturally in Australia. Timor mountain gum occurs on most of the Indonesian islands to the east of Bali. These include Timor, Flores, Adonara, Lomblen, Pantar, Alor and Wetar. Because of its importance as an exotic plantation species, a number of seed collection teams have visited Indonesia since 1963. These include three Australian, two Brazilian and one French expedition.

E. urophylla is generally a large forest tree of good form reaching 55 m in height and 2 m in diameter in favourable sites. Towards its maximum altitude (2,960 m) it occurs as small shrub-like plants a few metres in height. The bark of this species is quite variable, ranging from a basal stocking of sub-fibrous reddish brown bark with smooth bark above to the retention of the subfibrous bark to the small branches.

The specific name is derived from the Greek, *oura*, tail, and *phyllon*, leaf, referring to the prominent finely tapered tip on the adult leaves, commonly referred to as a "drip tip".

+The group of ironbarks to which *E. melanoleuca* belongs has been rearranged and added to since 1971, and this is a provisional new code.

++This is the code for *E. urophylla* in Pryor and Johnson (1971). It is now generally believed that this species may be more closely related to the group of eucalypts known as red mahoganies, particularly *E. pellita* (SECCA).

WHICH EUCALYPT SHALL I GROW?

Many hundreds species of *Eucalyptus* are described from areas throughout Australia in past issues of Australian Plants. Purchase a copy of the Index as advertised on page 91.

TRAVELLING TO THE WEST? UNDERTAKE A MALLEE EUCALYPT SAFARI

On page 82 there are details of "The Vegetative Survey of Western Australia". If not going west purchase a copy of the book.

Root Systems of the Myrtaceae

by Dr Byron Lamont

Biology Department, Western Australian Institute of Technology, Bentley, 6102

Root Systems

Young seedlings in the Myrtaceae produce strong tap roots from which arise a number of lateral roots quite close to the soil surface (see Fig. 1). The laterals branch several times until there is a fine network of roots in the humus layer. The taproot continues to elongate and perform the vital function of bringing water from depth, to enable the plant to survive periods of drought, for several years. However, the major laterals soon send out sinker roots not far from the rootstock which also descend vertically and finally reach just above the water table where they branch profusely in mature plants (see Fig. 2). Each sinker root may reach the same size as the taproot and often, in fact, the taproot dies back completely so that all water and nutrients are eventually supplied by the laterals and sinker roots.

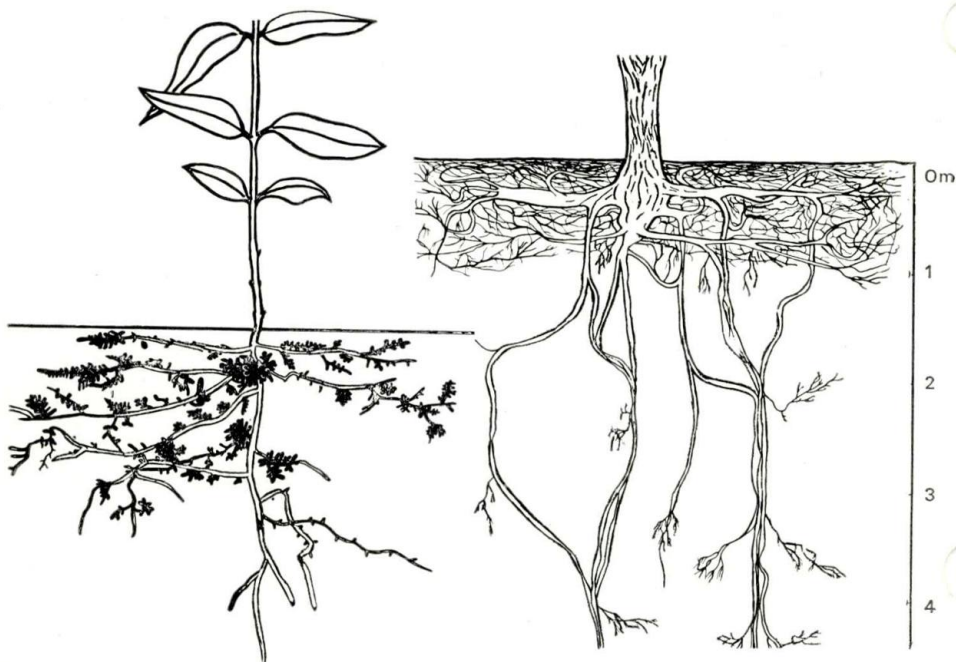


FIG. 1. An 8-month old seedling of the mountain ash (*Eucalyptus regnans*) showing a well-developed taproot, horizontal laterals and clusters of external mycorrhizas (black) which are concentrated near the soil surface. (Adapted from Ashton, 1956).

FIG. 2. An old specimen of jarrah (*Eucalyptus marginata*) growing in laterite over clay at 3 m showing a swollen rootstock (lignotuber), large laterals and many small roots in the uppermost m. numerous vertical sinker roots, at least as prominent as the taproot, arising from the laterals and descending to just above the water table at a depth of 15 m where there is another mass of small 'feeder' roots. (Adapted from Kimber, 1974).

Another feature of myrtaceous plants, especially those with a mallee habit, is the development of a swollen rootstock, or more correctly called a lignotuber, between the base of the primary stems and tap root (Fig. 2). One enormous lignotuber of *Eucalyptus gummifera* recently studied by Dr. Keith Mullette and his students in NSW had an average diameter at the soil surface of 10 m (Mullette, 1978). The lignotuber is seen as a remarkable adaptation to

severe damage to the shoots as a result of fire, prolonged drought, heavy grazing, severe disease or insect damage by enabling rapid recovery by means of its many hidden buds and large food stores. Some tropical eucalypts even produce woody rhizomes which serve much the same purpose.

TABLE 1

MEMBERS OF THE MYRTACEAE WHICH HAVE BEEN EXAMINED SO FAR FOR THE PRESENCE OF MYCORRHIZAL ROOTS

Species	Mycorrhizal type	Major reference
<i>Angophora costata</i>	external	Chilvers & Pryor, 1965
<i>A. intermedia</i>	"	"
<i>Callistemon citrinus</i>	non-mycorrhizal	Siddiqi, 1971
<i>Eucalyptus bridgesiana</i>	external	Chilvers, 1973
<i>E. calophylla</i>	"	Malajczuk <i>et al.</i> , 1975
<i>E. cephalocarpa</i>	"	Chilvers, 1973
<i>E. dalympleana</i>	"	"
<i>E. delegatensis</i>	"	"
<i>E. dives</i>	"	Chilvers & Pryor, 1965
<i>E. fastigiata</i>	"	Ling-lee <i>et al.</i> , 1977
<i>E. gigantea</i>	"	Trappe, 1964
<i>E. gomphocephala</i>	ext. &/or internal	Lamont & Lange, 1976
<i>E. grandis</i>	external	Chilvers, 1973
<i>E. gummifera</i>	"	Mulletto, 1978
<i>E. laucoxylon</i>	"	Chilvers, 1973
<i>E. macrorhyncha</i>	"	Pryor, 1956
<i>E. maculata</i>	"	Chilvers, 1973
<i>E. mannifera</i>	"	"
<i>E. marginata</i>	"	Malajczuk, 1975
<i>E. ovata</i>	"	Gullan, 1975
<i>E. pauciflora</i>	"	Chilvers, 1973
<i>E. pilularis</i>	ext. &/or internal	Chilvers, 1973; Khan, 1978
<i>E. polyanthemos</i>	"	"
<i>E. radata</i>	"	"
<i>E. regnans</i>	ext. & internal	Ashton, 1976
<i>E. rossii</i>	external	Chilvers, 1973
<i>E. rubida</i>	"	Samuel, 1926
<i>E. rudis</i>	"	Chilvers, 1973
<i>E. st-johnii</i>	"	"
<i>E. sieberi</i>	"	"
<i>E. viminalis</i>	"	"
plus over 100 more species	"	Chilvers & Pryor, 1965
<i>Leptospermum attenuatum</i>	internal?	Lau, 1968
<i>L. flavescens</i>	internal?	"
<i>L. laevigatum</i>	internal?	Burrell, 1969
<i>L. juniperinum</i>	ext. & internal	Gullan, 1975
<i>L. liversidgei</i>	"	Lau, 1968
<i>L. myrsinoides</i>	external	Gullan, 1975
<i>L. scoparium</i> N.Z.	ext. or internal	Baylis, 1970
<i>Metaleuca ericifolia</i>	external	Gullan, 1975
<i>M. lanceolata</i>	non-mycorrhizal	Lau, 1968
<i>M. quinquevneria</i>	"	"
<i>M. nodosa</i>	"	"
<i>M. squarrosa</i>	external	Gullan, 1975
<i>M. thymifolia</i>	"	Lau, 1968

But what of nursery-grown plants in which the taproot soon reaches the bottom of the pot or bag and coils around or dies, and the laterals which are forced to grow downwards and then, perhaps, to coil? The unfortunate results of such activity can often be seen by inspecting trees that have blown over in a wind. When placed into the ground, the plant will soon produce new horizontal laterals and sinker roots to replace the retarded laterals and prematurely dead tap root. To avoid strangling of the plant by coiled roots, however, these should first be teased apart if young, or cut away if old and brittle. Either way, the plant is going to need extra watering during establishment compared to a seedling in which no coiling has occurred.

More than this, most of the Myrtaceae are now produced commercially from cuttings, not seed (e.g. *Callistemon*, *Melaleuca*, *Chamaelaucium*, *Verticordia*, *Leptospermum*, *Calothamnus*, *Kunzea*, *Darwinia*, *Baeckea*, *Eremaea*, *Thryptomene*, *Hypocalymma*, *Beaufortia*, *Regelia* and *Calytrix*). This seems to result in a more fibrous root system of adventitious laterals which sometimes fail to produce sinker roots, and certainly lack a taproot and cannot form a lignotuber. For these reasons plants produced from cuttings may not be as drought-tolerant, perhaps throughout their life, as those from seed, and may very well need more watering than you think they ought! With increasing interest in low-maintenance gardens and the natural turning to native plants to fill them, research is needed on the relative hardiness of plants produced from seed or cuttings.

Aeration

Many *Eucalyptus*, *Melaleuca*, *Agonis* (peppermints), *Beaufortia* and *Leptospermum* species inhabit the edges of the sea, rivers, creeks swamps and lakes (containing fresh or saltwater). Since these plants are in effect floating on the water table, a taproot and sinker roots are usually absent. A feature of the stems of most of these species is the light papery bark, especially near their bases. It is of interest to learn therefore that the roots are also covered by this paperbark. Dr Paul Gullan in Victoria found that each layer of tissue is filled with rows of cells whose outer wall has collapsed onto the thicker inner wall (see Fig. 3A). This does not result in shrinkage of the bark, however, as the cells are held in place by radial rows of diamond-shaped cells, which act as walls across which the collapsed cells are strung. The net effect is that air, a rare commodity in these waterlogged soils, can be readily transported down through the large air spaces created by the collapsed cells to keep the roots functioning, rather than relying on absorbing air from the soil. In fact, it has been shown for other marsh species, that similar roots with large air spaces actually inject air into the surrounding soil, stopping the soil becoming toxic and enabling beneficial microbes to remain active.

Symbiotic Relationships

Unlike the family Proteaceae and the sedges and wire-rushes discussed in previous articles in this series, myrtaceous plants have few root hairs and their ability to extract soil nutrients would not seem to match up with their ability to grow in very impoverished soils. It has been known for nearly 75 years, however, that the fine roots of some eucalypts at least are ensheathed by fungal threads which are suggestive of roots hairs (Samuel, 1926). These fungus-roots are called external (ecto) mycorrhizas, and Table 1 shows that they are probably universally present in eucalypts and other closely-related tree genera (*Angophora*, *Tristania*), and well represented in *Leptospermum* (tea trees) and *Melaleuca*. No systematic study has been made of the other genera but it is highly likely that mycorrhizas are a feature of the family.

Mycorrhizas may appear on seedlings as little as six weeks' old where they cluster on the tips of the parent roots (Fig. 1) and may be white (young), yellow, brown or black (old). The fungal threads push between the epidermal cells but rarely enter any further into the host rootlet (Fig. 3B), mainly because the tissues develop several mechanical and chemical barriers to the continued growth of the fungus. The fungi forming these mycorrhizas are generally of the toadstool or puff-ball type, and are usually host-specific between, but not within, genera.

Like other specialised roots, mycorrhizas are concentrated in the well-aerated, upper humus layers. High light intensity and low to moderate soil fertility also favour their formation (Fig. 4). They are most abundant in the wet season, and individually survive 2-4 months. Extremes of temperature and moisture can reduce growth of the plant directly, or indirectly through detrimental effects on the fungal symbiont. Sometimes fungal threads even enter the root cells (at the beginning or end of the growing season, Fig. 3C), apparently in an attempt to improve their ability to grow or survive.

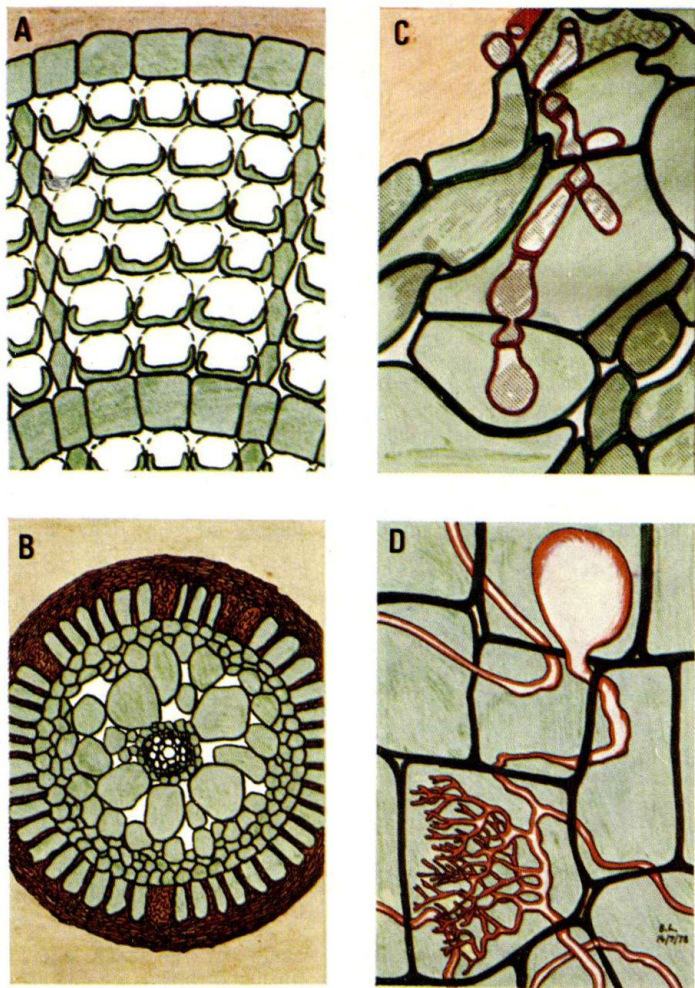


FIG. 3. A. — 0.2 mm wide cross-sectional portion of a 2 mm wide root of *Melaleuca squarrosa* showing the collapsed cork cells creating large air spaces which aid transport of air through the root, especially under waterlogged conditions. B. — Cross-section of a 1 mm wide external mycorrhiza of *Melaleuca squarrosa* showing the fungal sheath (brown) which has succeeded in squeezing between the other epidermal cells but no further into the root. Note the large spaces between the packing cells and the conducting cylinder in the centre. C. — A 0.05 mm portion of a rootlet of tuart (*Eucalyptus gomphocephala*) showing the thread of a mycorrhizal fungus invading the cells as it seeks protection at the start of the summer drought. D. — A 0.05 mm portion of an internal mycorrhiza of *Leptospermum myrsinoides* showing the two characteristic features, a food-storing vesicle (top right) and a nutrient-donating arbuscule (bottom left). A, B and D adapted from Gullan (1975), C adapted from Lamont and Lange (1976).

In fact, some fungi, among the more primitive moulds, always penetrate the root cells rather than forming a sheath and give rise to internal (endo) mycorrhizas, which otherwise look just like normal rootlets. They are distinguished under the microscope from decaying or diseased roots by the presence of finely-divided bunches of fungal threads (arbuscules) and balloon-shaped vesicles at the tips of some threads (Fig. 3C). Among the Myrtaceae, internal mycorrhizas appear to be a feature of tea trees, though some form sheathed-types as well (Table 1). As a rule of thumb in the plant kingdom, external mycorrhizas are a feature of trees (more efficient?) and internal mycorrhizas are a feature of herbs and shrubs.

Function of Mycorrhizas

It has been demonstrated experimentally now for a number of eucalypts that those with mycorrhizas grow considerably better than those without. Because the fungal threads are much narrower and longer than root hairs they can reach water and nutrients not otherwise available to the plant. This is not relevant in well-watered, fertile soils however, and, under these ideal conditions, non-mycorrhizal plants may grow as well as, if not better than, mycorrhizal ones. On the other hand, poor growth of plants in low-maintenance gardens could be due to, among other things, *lack of*, or unsuitable, mycorrhizas. This is not so unlikely, because nursery plants are usually reared in steamed, artificial soil mixes and may be transplanted into bare sand or soil lacking natural humus, or the appropriate fungus may not occur in the soil,

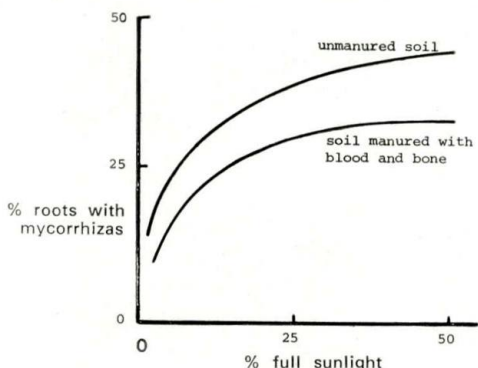


FIG. 4. Graph showing how heavy shading and manuring already fertile soil with blood and bone reduces mycorrhizal formation in the mountain ash (*E. regnans*). (Adapted from Ashton, 1976).

especially if it is remote from the natural locality of the genus, e.g. *Eremaea* and *Actinodium* (should they be shown to be mycorrhizal) planted in eastern Australia. If the plant is unexpectedly slow growing (many melaleucas seem to be in this category) there may be a case for mulching the surface with decomposing litter from beneath a stand of another, or the same, member of that genus, or at least family.

In addition to the above, the external mycorrhizas of eucalypts, in particular, protect the roots from dieback due to *Phytophthora cinnamomi* and other damping-off fungi (Malajczuk, 1975). They also protect the roots from toxic metals, salt and other substances in the soil, and increase the resistance of the plant to periods of drought. The day may well come when myrtaceous plants are routinely inoculated with mycorrhizal fungi on a commercial scale, as is well established with strains of bacteria which induce nitrogen-fixing root nodules in varieties of sub-clover used in the pasture industry.

References (for illustrations)

- Ashton, D. H. (1956). Studies on the autecology of *Eucalyptus regnans* F. Muell. Ph.D. Thesis, Univ. of Melbourne.
 Gullan, P. K. (1975). Vegetation at Cranbourne. Vol. II. Ph.D. Thesis, Monash Univ.
 Kimber, P. C. (1974). The root system of jarrah (*Eucalyptus marginata*). Forests Dept. W.A., Research Paper No. 10.
 Lamont, B. B. and Lange, B.J. (1976). 'Stalagmiform' roots in limestone caves. *New Phytol.* 76, 353-60.
 (The other references can be supplied on request.)

Soils — Their Care, Fertilisation, Health?

by the Editor

The health of a plant is very much dependent on its health below ground, which in turn is critically dependent on the soil conditions and composition. The early issues of Volume No. 9 featured the claim that "the growing of wildflowers is easy in **good garden conditions** if you select suitable species". A rather smug statement, but if you will read Issue No. 69 (the first of Volume No. 9 onward) you may appreciate the potential of this statement. It is the words "good garden conditions" that I wish to bring to your attention at this time.

Good Garden Conditions

The old experienced gardener will know what this means, but who can describe it? It is related to so many factors, some of which have been presented in issues of Volume 9. But let us get back to the basic theory of soils. Books have been written on the subject. Those that have been valuable have been heavy going. We in Australia are fortunate in that we have the C.S.I.R.O., the Commonwealth Scientific and Industrial Research Organisation, that does so much towards the standard of our living here.

The C.S.I.R.O. Division of Soils has produced a series of small booklets designed for the home gardener. Presented in simple terms, with good illustrations, the advice is easily followed, together with supporting technical data. They are invaluable, and so well done that we should adopt them as the most suitable reference for the time at least, and concentrate on the wealth of information of particular value in growing our wildflowers. The series is:

Discovering Soils No. 1—Soils, An Outline of their Properties and Management. This introduces us to soil and its properties. It has a good reference in the back to places in all States that will test your soil.

Discovering Soils No. 2—Australia's Greatest Resource. This booklet does not say much and is not of special value.

Discovering Soils No. 3—Composting. This is an especially valuable reference—a must.

Discovering Soils No. 4—What's Wrong with My Soil? Dealing principally with vegetable and commercial crops. The advice is so vividly presented it has very wide application.

Discovering Soils No. 5—Earthworms for Gardeners and Fishermen. Our greatest ally is the earthworm—we need them.

Discovering Soils No. 6—Food for Plants. We have all heard of NPK, mineral deficiency, the arguments over fertilizer. Read about the latest in world scientific research presented in very clear simple terms.

Each of the above booklets is available for \$1.00 each from the C.S.I.R.O. Publications Service, P.O. Box 89, East Melbourne, Victoria, 3002.

SOILS — THEIR CARE

The health of a soil is dependent on the health and balance of the micro-organisms in the soil. See *Australian Plants*, Vol. 9, No. 73, page 209.

SOILS — WATERING

The most vital factor in the cultivation of wildflowers is planned watering. Get the moisture deep by soaking the ground, but not too often. One way is to form a ring of soil to contain water and allow it to soak down. But!

SOILS — NEAR THE PLANT STEM

A critical area appears to be at or near the surface of the soil adjacent to where the plant enters the ground. This is the area inhabited by creatures that, if favourable for their breeding, will attack the plant stem to the extent that the outer layer rots and the plant collapses. Readers advised to refer to "The Growing Of Rutaceae", by H. M. Hewitt, on page 202 of No. 65 issue of Vol. 8.

Grow Eucalypt

By B. Ballingall, Brookvale Park, Oakey, Qld

Eucalyptus burdettiana is one of several of the series *Cornutae* which are growing well at Brookvale Park Botanical Gardens on the Darling Downs west of Toowoomba. Another with very similar characteristics is *E. megacornuta*, which produces its interesting buds and flowers regularly. *E. lehmannii* has proved more difficult probably requiring more attention to get it started.

These trees are a part of the Eucalyptus planting scheme at Brookvale Park; a project which aims to grow 2,500 eucalypts from all parts of Australia. Of course the above series plays a very small part as there are approximately 800 eucalypts growing at the Park consisting of close to 300 species.

The area for the main planting covers 80 acres of the gardens over a sloping site ranging from a low, frost area of medium loam with rock and stone, across a well drained slope to a low area with heavy frosts and black soil. Perhaps the main problem in the scheme has been with the frost tender species as most of these come from the wetter regions and the upper slopes prove too dry. Trees from the North such as *E. setosa*, *E. pachyphylla*, *E. miniata*, *E. ptychocarpa* and others have proved the most difficult, but will probably respond with more attention than it has been possible to give them. Severe cracking and movement in the soil accounts for some losses, while borer attack and over grazing by koalas is responsible for damage to, or even killing of other trees. The koalas are particularly fond of many of the mallee type from Western Australia and have killed quite a number. However, when the planting is more extensive this overgrazing problem could be overcome. Though these factors have played their part in hindering the project, the greatest problem has been a shortage of staff to give the young plants the attention they require when leaving the nursery. With such a worthwhile project it is hoped this can be overcome in the near future.

In a short space it is difficult to do justice to so many beautiful trees. Fine specimens of the silver leaved species *Eucalyptus macrocarpa*, *E. rhodantha*, *E. tetragona*, *E. pruinosa*, *E. kruseana* and many others create much visitor interest. Most of these have been established in the medium loam and gravel areas. Those with colourful flowers are very popular and include *E. tetraptera*, *E. leucoxylon* var *macrocarpa*, *E. lansdowneana*, *E. torquata*, *E. forrestiana*, *E. stoatii*, *E. stricklandii*, all of which flower readily. Some of these are successful in the heavier black soils. Specimen trees of interest include *Eucalyptus incrassata*, *E. argophloia*, *E. viridis*, *E. salmonophloia*, *E. tessellaris*, *E. le souefii*, *E. caleyi* and many more all of which do well in the heavier soils of the Downs. Tasmanian species have not done as well as others in the dry heat, but are excellent for the cooler mountain areas close by. There are several trees of the dainty species *E. orbifolia*, said to be becoming rare in its natural habitat in Western Australia. Descriptions of all these species are already available in past issues of "Australian Plants".

The influence of the scheme goes far beyond the boundaries of Brookvale Park. Many cities, towns and farms are growing fine specimens as a result of the project. The nursery at the park has a regular stock of over 70 species as well as numerous more specialised species from time to time. The cultivation of the Eucalypt as a specimen and shade tree is certainly proving very popular as a result of the project, and should play an important part in the conservation and appreciation of this fine genus.



Eucalyptus burdettiana

Photography by B. Ballingall

One of the small growing *Eucalyptus* species of considerable interest. It shows in a very exaggerated form the long operculum characteristic of the Western Australian species in the series *Cornutae*. In this respect it is perhaps more like *E. lehmannii* than any other. The stamens are rather coarse in this species too and the broad flattened peduncle is a prominent feature.

It is interesting that the specimen figured has produced flowers on old wood from a bud which has been dormant. This is infrequent in *Eucalypt* species and in many does not occur at all. The long operculum is associated always with a very long style and this can be seen on the flowers on the stem which have just finished flowering.

(Note by Prof. L. D. Pryor, Aust. Nat. Univ., Canberra, A.C.T.)

The Vegetation Survey of Western Australia

The Vegetation Survey of Western Australia is a project sponsored by the Department of Geography of the University of W.A. and by the Biological Survey of Australia, designed to provide vegetation map coverage of the State in two map series: the 1:1,000,000 Series of seven sheets covering the whole State (scale about 16 miles to the inch) and published in colour, and the 1:250,000 Series (4 miles to the inch) covering the south-west Botanical Province only and published in black and white. To date 5 sheets of the first series and 16 of the second have appeared.

The author of these is Dr. J. S. Beard, former Director of King's Park and Botanic Garden, Perth, and of the Royal Botanic Gardens, Sydney.

Now, what is a vegetation map and what use can be made of it by wildflower growers? A botanist has two ways of looking at native flora in the field. He can see it as a great number of individual plants to be classified and named as species, or he can see it in the mass as vegetation to be classified and described as plant communities. The first of these is the taxonomist's approach and the second the ecologist's. Vegetation takes a great number of different forms. It may be forest, woodland, heath, grassland and so on, and each of these major types may take different forms as well. Forest may exist as rain-forest with very numerous mixed species, as eucalypt forest with different species in different parts of Australia, as Southern Beech forest, Cypress Pine forest and so on. The vegetation mapper distinguishes as many of these forms as he can represent on his map (it all depends on the scale.) It is an accepted principle that vegetation forms are a response to environment — forests can only grow in wet areas, spinifex grasslands in dry; heaths often represent extremely poor soil, and so on. Each map is therefore accompanied by an explanatory booklet which details the climate, topography, geology, soils and human influences of the area as well as describing the vegetation types and component species.

The wildflower grower is interested like the taxonomist in knowing individual species of plants, but he/she has to be an ecologist as well and know the climate, soil and so on of the natural habitat of the species as a guide on how to handle them. This is where the vegetation maps come in. Let us suppose that you are undertaking a major wildflower tour of Western Australia. You go armed with the 1:1,000,000 Series of maps first, and the Nullarbor sheet begins as you cross the State boundary at Eucla. This tells you the type of country you are in, the extent of the great Nullarbor Plain, and the belt of mallee along its southern edge. After Balladonia you pass into eucalypt woodlands, and cross the interesting Fraser Range which has a unique vegetation, before arriving at Norseman. If you travel with the map, it will add interest to see the vegetation patterns change.

On arriving in the south-west of W.A., vegetation patterns become more intricate and detailed, so you switch over to the larger scale 1:250,000 maps. These show "original natural vegetation" irrespective of land clearing, i.e. what was originally there. Even if the land has been cleared for farming, the original vegetation is usually still there along the roadsides. Reserves are marked so that uncleared areas can be sought and found. All the roads are indicated as are the farm boundaries, so that the map is a complete guide to the traveller. The explanatory book includes lists of at least the commonest and a most conspicuous plant species in the different vegetation types.

As with all maps a little practice is required to get accustomed to using them, but once this is mastered the series provides the ideal guide to finding wildflowers in Western Australia in their habitats.

The University of W.A. Press, Nedlands, 6009, published the 1:1,000,000 Series, price \$6.00 each, and Messrs. Vegmap Publications, 6 Fraser Road, Applecross, 6153 the 1:250,000 Series, price \$2.50 (some \$3.50 if there are 2 maps per book). A Key Map and Catalogue will be sent on request.

Wildflowers of Central Australia

Four New Species of Plants Endemic In the Macdonnell and George Gill Ranges, Central Australia, by J. H. WILLIS — *Muelleria* Vol. 3, No. 2 (1975)—An abstract.

Ricinocarpus gloria-medii J. H. Willis

A most restricted species of the family Euphorbiaceae, occupying less than one hectare at the top of a steep rocky talus near the southern end of Simpson's Gap, only 22.5 km by road west from Alice Springs. It is astonishing that such a large shrub, so near to Alice Springs and so spectacular when in bloom, should have escaped detection until July, 1966. It was not until June, 1972, when Mr. H. Alan Morrison took the photographs shown here and procured good material, that I was able formally to describe the plant.

For sheer magnificence, with flowers resembling orange blossom, *R. gloria-medii* has no rival in the Centralian flora. "Glory-of-the-Centre" thus leapt to mind as an appropriate title for inclusion in the botanical name now adopted.

Ricinocarpus gloria-medii is a more or less erect or spreading shrub, 75-200 cm high, twiggy, the younger parts (and under side of leaves) closely stellate-pubescent and hoary as shown in the photograph. The leaves are narrow-linear 30-60 x 1.5-2.5 mm, their upper surfaces with only minute stellate hairs, or almost glabrous. The margins are strongly recurved so as often to obscure the mid-vein. The beautiful chaste flowers are 1.5-2.5 cm wide when fully expanded, borne in leafy terminal clusters of 3-5 and much exceeded by the floral leaves. Plants are either exclusively male or the inflorescence consisting of a single, longer-stalked female flower surrounded by 1-4 shortly stalked male flowers. The flower parts shown in the colour plate are described in the caption.

Affinities lie with *Ricinocarpus velutinus* F. Muell. from the Watheroo, Irwin River and Lake Deborah areas of Western Australia. The principal difference is that in *R. velutinus*, the floral leaves do not exceed the inflorescence as in *R. gloria-medii*, the flower pedicel is usually shorter, the style longer (4-7 mm) and split only half-way to the base and shiny (not woolly externally), while the ovary is tomentose and crowned by dense villous hairs 2-3 mm long. With *R. gloria-medii*, the ovary has a uniform indumentum less than 2 mm thick.

This makes the 15th species of *Ricinocarpus* known for Australia (ten are endemic in W.A.) and is the only one in the Northern Territory.

Sedopsis filsonii J. H. Willis

This remarkable little perennial in the family *Portulacaceae* is a prostrate succulent, reddish in colour; it springs from a tuberiform rootstock (to 10 mm thick) to form isolated determinate mats 5-10 cm wide, repeatedly and dichotomously branched. The branches are fleshy, pinkish brown, with branchlets 5-20 mm long. The fleshy leaves are opposite, round to kidney-shaped, mostly 5-8 mm long and wide, readily detaching, reddish green on top and purplish underneath; their entire margins are slightly recurved. Flowers are shortly stalked, few together in terminal axils of the leaf-like bracts. The calyx is tubular, red, densely papillose, 8-9 mm long; the corolla rose-pink, with tube 5-7 mm long and 1 mm wide, terminating in 4 lobes tightly imbricate until full expansion. Stamens 4, alternating with corolla-lobes and reaching halfway along the lobes, with yellow anthers. Capsule red, hemispherical, 3-4 mm wide.



Ricinocarpos gloria-medii

Photography by H. A. Morrison



Leucopogon sonderensis J. H. Willis. (Above)

Photo by H. A. Morrison

A slender erect or spreading shrub to 150 or even 200 cm tall with glabrous branches faintly canescent. The leaves are widely spreading, glabrous, 10-15 mm long, 2.5-4.0 mm wide, elliptic-lanceolate suddenly contracting at the base and tapering apically into a fine pungent point, as commonly occurs in species of *Leucopogon*. Flowers are solitary and not numerous, mainly in the upper leaf axils, pale greenish-white and 7-10 mm long. The crimson fruits are conspicuous, 6 x 5 mm.

It is the only member of the heath family (Epacridaceae) represented in the Centre and is confined to the summit region of Mt. Sonder above 1,000 m. Previously referred to as *Styphelia mitchellii* or *L. mitchellii*, it differs from this plant in that the dried leaves are dull and lustreless, the bracts and sepals white-fringed, the corolla-tube at least twice the length of lobes, style hairy and ovary 4-celled (5-celled in *L. mitchellii*).

Ricinocarpus gloria-medii (Opposite)

Described on page 83. The orange-blossom-like quality of these exciting flowers, set among stiff narrow leaves is well portrayed. Known only from Simpson's Gap near Alice Springs.

Sedopsis filsonii— continued from page 83

Its closest affinity is with *Sedopsis armitii* described from the riverine region of North Queensland; the latter has larger flowers (corolla tube 8-10 mm), with foliage not bullate ("bubbly"), and is the only other member of this genus known from Australia.

It is found across the George Gill and Macdonnell Ranges for at least 331 km between Kings Canyon in the west and Arltunga in the east, with northerly occurrences at Mts. Zeil and Sonder.

Described originally under the genus *Portulaca*, this species was transferred by its author to the more appropriate genus *Sedopsis* in April, 1977.

***Euphorbia sarcostemmoides* J. H. Willis**

This rather large, succulent, leafless, long-lived spurge seems to bear little relationship to the other Australian species of *Euphorbia* and is more closely akin to some African species. It is a shrub 40-150 cm high, tufted, erect, glabrous, grey-greenish and much branched with small inconspicuous flowers and of little horticultural interest. The species epithet is in allusion to a very striking resemblance to erect forms of the widespread caustic-bush, *Sarcostemma australe*. Localities in the Centre are George Gill Range (at least two places) and Ormiston Gorge, where rare. (Since publications of his paper the author has found that this plant occurs also in the northern Kimberleys, W.A., Werrego District near Quilpie in Western Queensland and at Mootwingie, N.S.W.).

PLANTS FOR DRY SOILS—cont. from page 68

The roots of plants need air as well as moisture. Soil drainage is closely related to soil aeration or the friability of the soil. Some soils, such as our podsoils, tend to set quite hard or tightly after they have been wet and subsequently aeration is reduced.

The apparent dryness of a soil or a site can be due to a number of factors such as the shallowness of the actual topsoil; elevation and exposure to drying winds and strong sunlight; a very open, free-draining soil texture with little ability to retain moisture; a surface that sheds much of the rainfall allowing little absorption; a site that is already carrying its limit of plants such as many large eucalypts that are using all the available moisture, and rendering the soil surface too dry for the establishment of other plants.

The treatment an area will receive must be taken into account if one contemplates selecting plants for dry soils. One must question whether the plants will be entirely dependent on rainfall; whether the area will receive run-off water from elsewhere; whether the site will be watered and how frequently. If you have a so-called dry site, one could question your need for plants for drysoil if you are going to apply water regularly.

In Brisbane, I suppose we would call the schisty, gravelly ridges our dry soils; they would be — in comparison with the lower slopes and low-lying land that have a high water table for a longer period of the year.

The inhospitable-looking, gravelly ridge tops are probably some of the best soils in Brisbane on which to grow native plants because here you can grow a larger range of the smaller showy sun-loving species.

On Brisbane's dry soils with a sunny aspect and careful watering, you would succeed with the following:

Inland plants such as *Baeckea jucunda*, *Micromyrtus*, *Hakea purpurea*, *Grevillea longistyla* and *Acacia*. (Acacias are particularly well adapted for exposure and dryness and can be chosen for foliage and plant form, foliage colour and year round flowering. Acacias only could be used

Wallum plants such as *Leptospermum whitei*, *L. semibaccatum*, *Callistemon pachyphyllus*, *Banksia robur*, *B. oblongifolia* and *Hakea gibbosa*.

North Queensland plants such as *Grevillea pteridiifolia*, *G. sessilis*, *Melaleuca viridiflora* and *Callistemon polandii*.

Local plants such as *Banksia collina*, *Hakea plurinervia*, *Baeckea virgata* and *Melaleuca nodosa*.

Mountain species such as *Callistemon montanus*, *C. comboyensis* and *Hakea salicifolia*.

Some Western Australian species such as *Melaleuca nematophylla*, *M. elliptica*, *M. steedmanii*, *Calothamnus villosus* and *Grevillea hookerana*.

Southern species such as *Grevillea rosmarinifolia*, *G. lavandulacea*, *G. speciosa* and *G. sericea*.

On Brisbane's dry soils but with a shaded or part-shaded aspect, you would choose plants from the gullies and slopes of the coastal hills (i.e. *Hovea*, *Oxylobium*, *Pultenaea*, *Hibiscus*) and some of the creek-margin and rainforest species.



MOLYNEUX NURSERIES Pty Ltd

Belfast Road, Montrose, 3765. Phone: 728-1353

trading as AUSTRALORA NURSERY

Open 7 Days a Week

MON.-SAT., 9 a.m.-5.30 p.m.; SUNDAY, 10 a.m.-5.30 p.m.

*The widest range of Australian Plants is also available
through our Agencies*

ADELAIDE:

Lawry's Native Nursery

Star and Arrow Road
COROMANDEL, EAST.
Phone: (08) 388-2118.

SYDNEY:

Yallaroo Gardens

R.M.B. 5179 Wattle Tree Road
HOLGATE Via GOSFORD.
Phone: (043) 67-7023.

CANBERRA:

Rodney's Nursery

24 Beltana Road
PIALLIGO, A.C.T.
Phone: (062) 73-2635.

WERRIBEE:

Grevillea Nursery

Derrimut Road
WERRIBEE.
Phone: (03) 741-3100.

WODONGA:

Mann's of Wodonga Garden Centre

116-126 High Street WODONGA.
Phone: (060) 24-1066.

AUSTRALORA IS AUSTRALIAN PLANTS



Generally 150-200 species available, many rare
Open Wed. to Sun. 10am to 5pm and by arrangement.

Cedar Wattles Native Plants

89 BLUES POINT RD. NORTH SYDNEY. PHONE 929-6583

DEANES ORCHID NURSERY

Specialising in Australian Native Orchids

Please send for descriptive list. Plants sent anywhere.

Nursery open every weekend — Weekdays phone (02) 651-1798

29 HEMERS ROAD, DURAL, N.S.W. 2118

JOHN and ANNA TOPP NATIVE PLANT NURSERY

Lot 58, Cranbourne-Frankston Rd., Cranbourne Sth., Vic.—Ph.: (059) 78-2288
(300 metres east of Hastings-Dandenong Road Intersection)

WIDE RANGE OF GOOD QUALITY PLANTS AT NEAR WHOLESALE PRICES
Closed Tues. and Wed. — Wholesale and Retail

LAKKARI NATIVE PLANT NURSERY

(Lakkari means Banksia
Integrifolia)

RUSSELL and SHARON COSTIN, *Retail & Wholesale
Growers of Native Trees, Shrubs, Ground Covers and
Creepers — Also Ferns, Palms, Cycads, Indoor Plants*
Specialists in Honey Flora

*Many selected Natives unique to Queensland as well
as new cultivars and hybrids.*

477 REDLAND BAY ROAD, CAPALABA, QLD. 4157
Open 7 days — Phone: Brisbane 206-4119

CLEARVIEW NURSERY, W. Cane, Box 19, Maffra, Vic. 3880. Specialist in developed plants

TASMANIAN FOREST SEEDS

T. WALDUCK

"Summerleas Farm", Kingston, Tas. 7150
All Tasmanian Tree Species and
Ornamental Shrubs.

Send S.A.E. for free list.
Sales by packet or in bulk

Support nurseryman

advertising in

AUSTRALIAN PLANTS

GREVILLEA OF THE NORTH AND CENTRE

Three species of *Grevillea* are recommended on page 61 for planting in the "Town of the Desert". There are a number of species that have not been properly named, two of which are illustrated opposite.

Grevillea species affinities *G. agrifolia* and *G. wickhamii* (opposite top).

This plant was found in the Ormiston Gorge, N.T.

Grevillea species (opposite bottom). This species was found 100 km north of Katherine in the Northern Territory. Other species are:—

Grevillea dryandrii. A beautiful low or prostrate shrub pictured in colour in our book North Australian Plants.

Grevillea goodii. Prostrate, hardy plant, pictured in North Australian Plants.

Grevillea pteridifolia. An upright shrub holding aloft plumes of golden flowers, as pictured in colour in our No. 62 Issue of Vol. 8.

Grevillea refracta. Incorrectly labelled *G. plurijuga* in Vol. 9, page 296, this shrub was found 60 km north of Henner Springs.

Grevillea wickhamii. As pictured in colour in Vol. 7, page 56.



NINDETHANA SEED SERVICE

LARGEST SELECTION OF NATIVE SEED IN AUSTRALIA

SEND 20c STAMP FOR FREE CATALOGUE

AVAILABLE IN 50c pkts, gram lots or kgs.

ADDRESS: NINDETHANA, NARRIKUP, W.A. 6326

BODDY'S — EASTERN PARK NURSERY

NATIVES

Large range of popular and rare varieties in tubes. S.A.E. for Catalogue.
Specialists in despatch.

Lot 2, Farm Road, Cheltenham, 3192

Phone (03) 550-5987; A/H 509-2804

NEWCASTLE
REGION

NORTHRIDGE COTTAGE

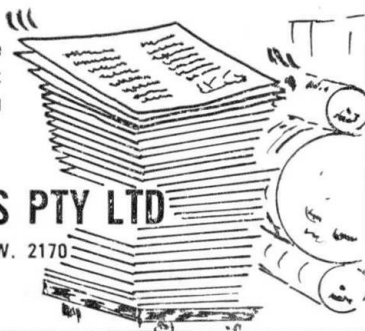
NATIVE PLANT NURSERY (049) 87-2397

RANGERS ROAD RAYMOND TERRACE, 2324
on the Western Shore of the Grahamstown Dam
Turn East off The Pacific Hwy. 4 km North of the Town

PRINTING

MAGAZINES, BOOKS, BROCHURES, PRICE LISTS,
CATALOGUES, OFFICE STATIONERY, LETTERHEADS,
INVOICES, STATEMENTS, ENVELOPES, BUSINESS CARDS

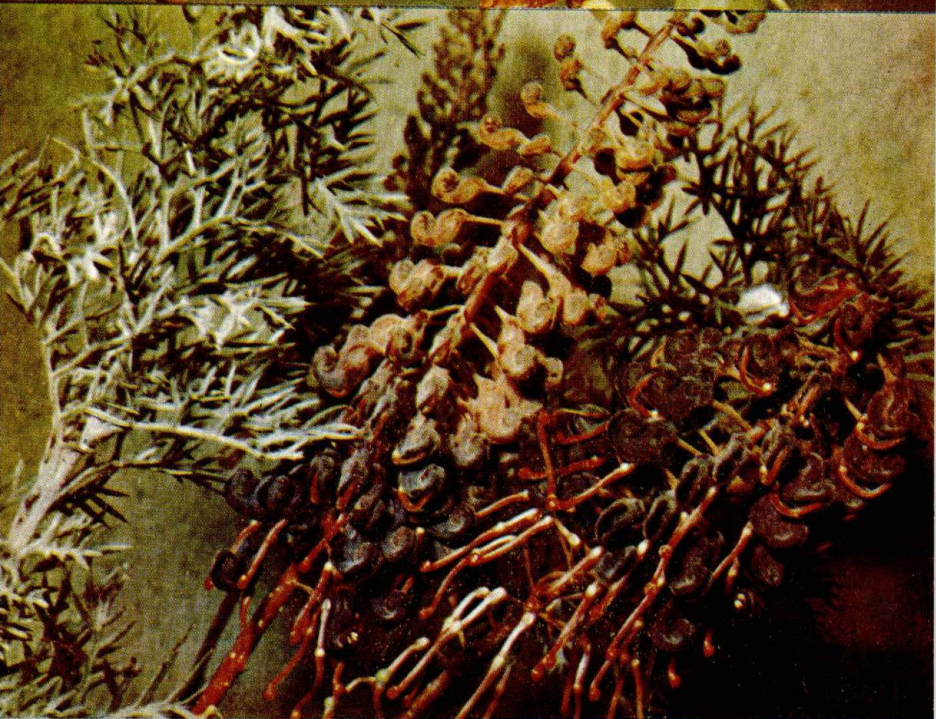
Consistent quality and unbeatable service
together with reasonable costs remove most
of the problems confronting people purchasing
printing at . . .



SURREY BEATTY & SONS PTY LTD

43 RICKARD ROAD, CHIPPING NORTON, N.S.W. 2170

Telephone: (02) 602-7404, 602-3126



PRESERVATION BY CULTIVATION

Closed Tuesdays

FLORALANDS

KARIONG, via GOSFORD, N.S.W. 2250 — Prop. Brian & Lyn Parry

A large variety of the most popular native plants at nursery

PHONE: Gosford 40-1142

Send \$1.50 for descriptive catalogue.

WANTED TO BUY

Palm, Shrubs and Tree Seed of
Australian and Exotic Species in
batches of 100 grams or more.

FLAMINGO ENTERPRISES PTY. LTD.

P.O. Box 1037, EAST NOWRA,
N.S.W., 2540

PARSONS NATIVE PLANT

NURSERY

Trees, Shrubs, Ground Cover, Climbers
Specialising in Grevilleas

Open Thur., Fri., Sat., 9-5; Sun., 9-1
Warrandyte Road, Research, Vic. 3096



FOREST NATIVE NURSERY

AUSTRALIAN NATIVE PLANTS FOR SYDNEY GARDENS

\$2.50 posted (Catalogue)

9 Namba Rd., Duffy's Forest, N.S.W. 2084
(beside Waratah Park), (02) 450-1785

MICHIE'S KENTLYN NATIVE PLANT NURSERY

Specialising in Australian Plants

9eth & Bob Michie invite you to call
96c George's River Road, Kentlyn, 2560
Phone: Campbelltown 25-1583

Closed Tuesday and Wednesday only

Cranebrook Native Nursery R23 Cranebrook Rd., Cranebrook, NSW

4 miles north of Penrith, between
Tadmire and Taylor Rds.

Open 10 a.m.-6 p.m. Closed Sundays.

(047) 77 4256 — No Mail Orders

CLOVERDALE PARK NURSERY

57 CLOVERDALE ROAD, DOOLANDELLA, 4077 (D. HANGER)

QUEENSLAND NATIVE PLANTS

including:

Kakea fraseri, Kunzea flavescens, Buckinghamia celsissima,
Cryptocarya laevigata v. Bowei, Ervatamia angustisepala,
Guilfoylia monostylis, Jasminum volubile, Lagerstroemia
archeriana, Microcitrus australis.

DAVID & MARGARET'S NATIVE FLORA

We have thousands of plants for your
selection. Set amidst acres of land-
scaped garden areas. Located two
miles past Woori Yallock at Braeside
Drive Launching Place, Vic.
(059) 64-7631, THURS. to SUN.
(Established 1974)

WIRIMBIRRA

Hume Highway, between Tahmoor and
Bargo, N.S.W. 2574

AUSTRALIAN PLANTS

Wide Range — Phone: Bargo 84-1112
OPEN SEVEN DAYS A WEEK



COLLECTORS

NURSERIES

NATIVE PLANT SPECIALIST

KEVIN REED

Cnr BELLEVUE CRES and SEAFORD RD SEAFORD

Vic. 3198

Huge selection from ground
cover to trees, rare and the
common, sizes large or small

Open Saturday and Sunday

(Closed Mon. and Tues.)

BELBRA NURSERY

In the heart of the Gramplans

LARGE RANGE OF AUSTRALIAN
NATIVES

Closed Wednesday only

BOX 12, HALL'S GAP, VIC. 3381

NAROOMA NATIVE NURSERY

(H. & N. RYAN, Proprietors)

15 TILBA ST., NAROOMA, N.S.W., 2546
PHONE 132

Good variety of Native Plants — Open
all week except Sunday morning.
First Class Holiday Accommodation
available at Nursery site.

Write for Brochure

NANGANA NATIVE PLANT NURSERY COCKATOO-WOORI YALLOCK ROAD

6.4 km from Cockatoo, Vic.
Large range, including over 100 Grevilleas
(5 cm to bucket size)

PHONE: (059) 68-8337

Open every day except Tues. and Wed.
(also closed June and July)

GRASSTREE

NATIVE PLANT NURSERY

BROWN'S RD., ROSEBUD SOUTH, 3939
(Opposite Hyslops Rd.)

10 a.m. to 5 p.m. — Wed. to Sun. Inc.
Over 1000 Species in Propagation.
Nursery in Natural Bushland Setting.

Past Issues of "Australian Plants" Available

Because of the vast wealth of our flora there is very little repetition, each volume becoming a valuable reference book in itself. Each volume has a separate abridged index, but a composite index for volumes 1-8 incl. will be available shortly as a separate book from the Editor for \$2.00 including postage.

It is intended to maintain all volumes in print in bound hard-cover form, beautifully presented with gold-lettered green vinyl covering. Each volume has bound with it another Society book as indicated below. The retail price is \$15.00, but they are available by mail from the Editor at \$12.00 each up to 1-1-80. Postage 50c per vol.

- VOLUME No. 1. Issues 1-12 — to be reprinted in 1980. Watch for announcements.
- VOLUME No. 2. Issues 13-20, no longer available—to be reprinted in 1980.
- VOLUME No. 3. Issues 21-28, bound with "Catalogue of Cultivated Australian Plants".
- VOLUME No. 4. Issues 29-36, with "West. Aust. Plants for Horticulture—Part I".
- VOLUME No. 5. Issues 37-44, bound with "The Language of Botany".
- VOLUME No. 6. Issues 45-52, with "West. Aust. Plants for Horticulture—Part II".
- VOLUME No. 7. Issues 53-60, bound with "North Australian Plants".
- VOLUME No. 8. Issues 61-68, bound with "The Cradle of Incense".
- VOLUME No. 9. Issues 69-76. Each issue to date available at \$1.00 post free.
- VOLUME No. 10. Issues 77-84. Each issue to date available at \$1.00 post free.

Other Books Published by the Society:

- "AUSTRALIAN INDIGENOUS ORCHIDS", by A. W. Dockrill, \$30.00 including postage. The only complete reference to Australian epiphytic orchids and tropical terrestrials.
- "WEST AUSTRALIAN PLANTS", "A descriptive catalogue" by Dr. J. S. Beard, \$7.50 plus 60c postage. The only complete reference to the flora of Western Australia.
- "WEST AUSTRALIAN PLANTS FOR HORTICULTURE", Parts 1 & 2, by K. Newby, each \$7.50 plus 60c postage. A valuable guide to the plants with horticultural potential.
- "NORTH AUSTRALIAN PLANTS", by Jenny Harmer, \$7.50 plus 60c postage. The most comprehensive reference to plants of the Darwin area available.
- "CRADLE OF INCENSE", "The Genus *Prostanthera*" by G. W. Althofer, \$12.00 plus 60c postage. The only reference to our Mint Bushes.
- "THE LANGUAGE OF BOTANY", by C. N. Debenham, \$3.90 plus 60c postage. An outstanding reference to botanical terms, with examples from Australian flora.
- "AUSTRALIAN PLANT INDEX—Vols. 1-8". A comprehensive index to all species, authors, etc. \$2.00 including postage. Not available until July, 1979.
- "A HORTICULTURAL GUIDE TO AUSTRALIAN PLANTS". Large colour plates of species with descriptions, etc., on rear for filing as issued in a D-ring binder. Sets of 32 sheets in each of 1-4 at \$2.50 per set, plus 50c postage; binder \$2.00 plus 80c postage. The whole series, sets 1-4 with binder — \$10.00 plus \$1.60 postage.
- "ACACIAS OF NEW SOUTH WALES", by I. Armitage. All N.S.W. wattles described and illustrated by sketches and colour. \$7.50 plus 50c postage.

The Society for Growing Australian Plants

The Society is for people interested in the Australian flora, its preservation and cultivation in the wild, in parks, and in public and private gardens. Preservation of our magnificent flora will, in the long term, depend on the knowledge accumulated, on its cultivation under a wide range of conditions. We hope to learn more about this by cultivating wildflowers in the garden, encouraging research on this aspect, and to record this in "Australian Plants".

The Society offers many services in all States, such as meetings, instruction, shows, field outings, seed, propagating aids and friendship, much on a mail basis for those who cannot or do not wish to attend meetings.

Enquiries for membership should be directed to:

- SOCIETY FOR GROWING AUSTRALIAN PLANTS—N.S.W. REGION:**
President: Mr. Hugh Stacy, 16 Booyong Avenue, Lugarno, N.S.W., 2210.
Secretary: Mr. Ray Page, 21 Robb Street, Revesby, N.S.W., 2212.
- SOCIETY FOR GROWING AUSTRALIAN PLANTS—QUEENSLAND REGION:**
President: Mr. L. Smith, Lot 29, Vores Road, Petrie, 4502.
Secretary: Mrs. R. Reid, P.O. Box 809, Fortitude Valley, Qld., 4006.
- SOCIETY FOR GROWING AUSTRALIAN PLANTS—SOUTH AUSTRALIAN REGION (Inc.):**
President: M. W. Pybus, 41 Harrow Road, Somerton Park, S.A., 5044.
Secretary: Wyn M. Spier, Box 10, P.O., Blackwood, S.A., 5051.
- SOCIETY FOR GROWING AUSTRALIAN PLANTS—TASMANIAN REGION:**
President: Mrs. Sib Corbett, 35 Pillinger Drive, Fern Tree, Tas. 7101.
Secretary: Mrs. Chris Howells, "Gwastadnant," Sandfly, Tas. 7104.
- SOCIETY FOR GROWING AUSTRALIAN PLANTS—VICTORIAN REGION:**
President: Mr. R. G. McDonald, P.O. Box 9, Upper Ferntree Gully, Vic., 3156.
Secretary: (Sister) E. R. Bowman, 4 Homebush Crescent, Hawthorn East, Victoria, 3123. Please do not call at private home—enquiries by telephone or mail only.
- SOCIETY FOR GROWING AUSTRALIAN PLANTS—CANBERRA REGION:**
President: Mr. Geoff Butler, 29 Milford Street, Latham, A.C.T., 2608.
Secretary: Mrs. Christine Tynam, P.O. Box 207, Civic Square, A.C.T., 2608.
- WEST AUSTRALIAN WILDFLOWER SOC. (Inc.):**
President: Dr. N. Marchant, P.O. Box 64, Nedlands, W.A., 6009.
Secretary: Miss B. Britton, P.O. Box 64, Nedlands, W.A., 6009.

"AUSTRALIAN PLANTS" IS AUSTRALIA'S NATIONAL PRESERVATION JOURNAL (A non-profit making venture, produced quarterly, dedicated to preservation by cultivation)

PUBLISHING SECTION FOR SOCIETIES—Produced as a non-profit venture.
Managing Editor: W. H. Payne, assisted by P. D. Leak; Despatch by E. Hubner, H. Jones. Do not telephone or call at private home—enquiries by mail only.

NON-MEMBERS: You may receive the next 4 issues direct to your home by forwarding an annual subscription of \$3.00. Overseas subscription \$4.20. Aust. \$2.80 in English currency or \$6.50 U.S. Send to The Editor, "Australian Plants", 860 Henry Lawson Drive, Picnic Point, N.S.W., 2213.

MALLEE TREES OF ALICE



EUCALYPTUS GAMOPHYLLA—"Blue Mallee"

Typical growth of a mallee eucalypt, this is a typical scene of the centre. North of Alice Springs this mallee would be *E. pachyphylla*, and south of Alice it would be *E. oxymitra*. See page 55 for recommended species for planting.

Will You Help Produce This Publication?

It is unlikely that you have any idea of the work by honorary officers that goes into the production of this periodical. Will you help in a small way? Grow the plants and advise the Editor of your results.

Photographs or slides are needed of *Comesperma*, *Polygala*, *Crotalaria*, *Brachycome*, *Calotis*, *Phebalium*, *Eriostemon*, *Westringia*, *Darwinia*, *Grevillea*, *Adenanthos* and *Plectranthus*.