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CALLISTEMON POLLANDII

WILDFLOWERS FOR LIVING

WILDFLOWERS AND BIRDS

From the Editor

A TIME FOR CONCERN AND ACTION

"Times have changed sadly. I no longer can, in good conscience, advocate that people attract native birds to their suburban gardens. Having observed the agonising deaths from chlorinated hydrocarbon pesticide compounds of all the birds who have come to my garden, I believe that it is wrong to attract innocent, useful birds to their doom. I have never used pesticides; nor have my neighbours since I educated them in this regard—but others obviously have.

"Ten years ago I had 400 lively, noisy honeyeaters and other species—today the garden is dead, like those poor birds. The city is loaded with poisons. Let the birds stay in the bush, if they can find any."

Barbara Salter, author of a book on how to attract birds to the garden, gives this discouraging report. My enquiries reveal that those people in Sydney who were attracting birds by supplementary feeding are still doing this successfully. Is Melbourne approaching its "silent spring"?

I refuse to give up this fight to keep our birds. Will readers with any knowledge on this matter please advise the editor. Unfortunately the radical conservationists have advocated the rejection of all pesticides and done more harm than good with such ill-informed hysteria. Governments have even over-reacted, such as the bans on the use of DDT.

We need to control some pests, as progress has created an artificial environment where they flourish and their natural predators are suppressed. We need to decide what pests are really at critical strength and a selective way to control them. It seems we must leave this research to governments for commercial cropping, but who will assist in evaluating the problem in the suburban gardening sphere?

THIS ISSUE

Without doubt the above comment has upset some people. It is time more people took an active interest in the environment of the future instead of leaving it to others or making a lot of noise. Help nature by the planting of trees and shrubs. This issue is not the usual "pretty" collection of colour plates but a guide to serious action.

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COVER PLATE

LEFT: *Callistemon chisholmii* on Burra Range, Queensland — Photography D. Hockings.

RIGHT: *Callistemon pollandii* from Water Fall Creek, Qld. — Photography M. W. Hodge.

Callistemon pollandii has proved very floriferous over a wide range of conditions especially Townsville, Qld. The last two issues were prepared by gardeners in Townsville and this colour plate, and a number in this issue, were to illustrate them but were not ready in time. The Editor apologises to the Townsville Group of S.G.A.P. for this and a number of other failures.

TREES AND SHRUBS

Benefits of Boundary Plantings Around Your Home by C. L. Wheller

INTRODUCTION

The advantages of gardens of one kind or another have not just been discovered—they have been known for centuries. The preferences for certain kinds of plants for their own sake and for the effects obtained by different combinations and layouts are fashions which come and go much as do other fads of modern society, while the benefits remain more or less stable, affected only to the extent that a current fad is compatible or otherwise with the growing conditions of the area and social needs of that community at that particular time. From the purely aesthetic point of view, we all agree that beautiful objects are enhanced by a suitable setting: a jewel by its mounting, a face by the hairstyle, a body of water by what grows on its banks with the added bonus of beautiful reflections, a sunset by the clouds in the sky, and a castle or even a hut by the natural or man made surroundings, and where enclosed spaces are concerned, this means the hiding of detracting objects and the softening of harsh lines and surfaces. In improving living conditions as a whole, there are however, a number of other factors to be considered.

All home-sites in exposed locations, particularly new subdivisions in developing areas such as the Keilor-Werribee Plains west of Melbourne in Victoria will be improved by the planting of suitable trees and shrubs around their boundaries, the degree of improvement from each of the specific benefits to be obtained depending on local conditions such as latitude, altitude, direction and force of prevailing winds in relation to vegetation and buildings and other climatic factors.

The concern of the present federal government for the living conditions in the suburbs of various cities has been expressed in efforts being made to assist councils and other bodies to encourage by example and publicity the planting of more trees and shrubs in home gardens and public reserves. The Victorian Regional branch of the Society for Growing Australian Plants through its various local groups has had a marked influence in this respect in many parts of Victoria; the Western Plains Group for instance, is co-operating with Keilor City Council in establishing a plantation of native trees and shrubs in Bonfield Park beside the river in Keilor township and plantings have been made in the Bulla Primary School grounds by the same group while more established groups in other suburbs and country areas have made more extensive plantings, carried out research projects, organised wildflower displays and brought into cultivation many rare Australian plants.

SPECIFIC BENEFITS

Privacy

As home sites become smaller, the degree of privacy once afforded by more liberal subdivisions becomes harder to attain even with single storey villas on flat land. With undulating land and the increasing intrusion of two or three storey houses and flats the problem increases. Not only is your backyard under scrutiny but the windows and doors of your home reveal the story of your life to all who care to watch.

Dust Control and Air Purification

Observation of dust deposits on sides of dirt roads will indicate a diminishing volume of dust at any given distance in proportion to height and density of intervening vegetation demonstrating the effectiveness of plants in this form of air purification, whilst the ability of plants to absorb carbon dioxide and expel oxygen is another. With the world wide destruction of native vegetation, the cultivation of as many trees and shrubs as possible becomes important.

Windbreaks

The effectiveness of shrubbery as a windbreak is widely accepted especially on farms where animals and crops may be adversely affected by strong winds. Scientific tests over many years have shown that solid barriers create turbulence above and beyond them and that the best results are obtained from objects such as trees and shrubs which reduce wind force without completely preventing air flow, thus improving the climate around your home.



Photography by D. Hockings.

MELALEUCA LEUCADENDRON

The wide-leaved form is a very large tree. The small-leaved form which occurs in the Ross and Black Rivers of Queensland is a much smaller tree and is recommended for suburban gardens. The point to be made is that Melaleuca are very hardy and useful shrubs much loved by the birds and there are species that grow to the mature height of one metre or to fine large paper bark trees as with *M. leucadendron*.

Beautification

The aesthetic value of trees and shrubs in hiding ugly fences as well as buildings is widely accepted and in landscape design is one of the important considerations and, in conjunction with other plantings, boundary plantings add value to a property by making it more attractive and hence more desirable to a prospective buyer.

BUCKINGHAMIA CELSISSMA — Ivory Curl

This small reforest tree is widely used for ornamental and street planting. In cultivation it rarely reaches 6 m which makes it an ideal choice for small gardens in warmer areas. The long spikes of creamy flowers appear in summer.

Photography by M. W. Hodge.



Temperature Reduction

Overseas experiments indicate considerable temperature reduction over areas of vegetation exposed to hot winds due to the cooling effects of moisture transpiration from foliage and the lower temperature of the air in the shade, again improving the outdoor climate. To quote Phillip Cummings in "How To Grow A Perfect Lawn" (*Readers Digest*, April, 1974): "On a hot day put your hand on a patch of bare soil, then on the ground under a lush growth of grass; the temperature difference can be 15 degrees C or more." So it is under larger plants which thus shelter smaller plants keeping the ground cool which, in conjunction with the cooling effects of shade on walls exposed to hot sun considerably reduces indoor temperatures during the day and hence also at night by reducing the amount of heat.

Noise Reduction

Although of dubious value for this purpose on small suburban properties, suitable plantations can make substantial contributions to noise reduction in certain circumstances according to recent overseas experiments. To quote Malcolm Bunzli, A.R.A.I.A., A.A.I.L.A., B.Arch. (Qld.), Dip.L.D. (Durham) in "Landscape Architecture As a Tool for Environmental Design" in a paper presented at the 1969 Annual Conference of the Nurserymen's Associations: "Again we find that trees are quite efficient sound absorbent barriers and, providing the correct species are selected to create a dense barrier from ground level up to the crown of the trees, a considerable reduction in the sound intensity can result and of course with marked increase in the amenity of the area."

Bird Protection

The planting of Australian native plants such as those mentioned below will provide nesting sites, protection and food for native birds as well as some of the more acceptable imported species which will help control insect pests, whereas some of the imported trees such as pines and cypress will tend to encourage sparrows and other bird pests.

CONCLUSION

To quote Malcolm Bunzli again: "We are aware of the advantages of climatic control within our buildings but apparently few of us realise the beneficial aspects of climatic control by landscape design within the open spaces surrounding these buildings . . . Unfortunately, our pioneering heritage of completely clearing the natural vegetation as a pre-requisite of developing it, coupled with our naive and illogical approach to ornamental gardening has created an intolerable physical environment . . . Australia is an exciting country and does not have any established landscaping tradition. The environmental designers are not hampered by the ghost of historical styles—the slate is clean, the future is what we make it. If we apply ourselves conscientiously, if we analyse all the influences objectively, eventually our homes, streets, suburbs, our towns and cities, our coastal and mountain resorts, in fact the whole of our countryside will be a continuous experience in environmental design; an environment which is based soundly on ecological principles, is flexible for and climatically correct for the multiple activities of humans and other living creatures, capitalises on the indigenous attributes, making full usage of native plant materials and an environment which is truly Australian in character."

Your home site and those of your neighbours are all part of this environment. Investing capital on improving your indoor climate which absorbs income in operating costs, while investing nothing in improving your outdoor climate which in turn will further improve your indoor climate as well as providing more usable outdoor living space for negligible operating costs is like shutting the blinds and switching on the light and heater on a bright sunny day, so *get your boundary plantings started now before your neighbour does*—you may even influence him to choose wisely.

SUITABLE PLANTS

The selection of colourful but hardy plants for regions such as the basalt plains west of Melbourne where plants are required to grow on heavy clay soils often subject to water-logging in winter and drying out and cracking in summer; where strong, cold southerly winds are interspersed between cold northerlies in winter and hot northerlies in summer, may perhaps serve as a starting point for gardens in similar harsh situations. Shrubs 8 ft. to 15 ft. (3 m to 5 m) such as *Melaleucas*, *Banksias*, *Grevilleas*, *Hakeas*, *Acacias* and *Callistemons* would be appropriate for average size sites in built up areas. Small trees 15 ft. to 30 ft. (5 m to 10 m) such as small and medium growing *Eucalypts*, taller *Banksias*, *Acacias*, *Melaleucas* plus *Tristanias*, *Lagunarias*, *Angophoras*, *Casuarinas*, *Pittosporums*, etc. in multi-row strips on small farms with even taller trees on larger properties.

In areas such as the Keilor Plains, where waterlogging is the most usual cause of plant losses, especially this year, experience has shown that *Melaleucas* such as *M. ericifolia*, *M. squarrosa* and *M. squamea* are amongst the most suitable shrubs in the 3-4 m range where this situation occurs. Many other *Melaleucas* are also successful where drainage is less than perfect, e.g. *M. armillaris*, *M. decussata*, *M. fulgens*, *M. tenella*, *M. nesophila*, *M. huegelii*, *M. styphelioides*, *M. bracteata*, *M. polygaloides* and *M. halmatuorum* are all worth trying with *Callistemons* to provide a dash of colour. The best species probably are *C. citrinus*, with the hybrid *C. "Harkness"* (Gawler) being by far the most spectacular and attractive.

Further evidence of the value of *Melaleucas* has been provided during the current record wet weather, where many established trees have suddenly collapsed after several years good growth.

Although a great many *Eucalypts*, *Acacias*, *Casuarinas*, *Hakeas*, *Banksias*, etc., succeed well enough in the better situations, and are generally suitable for boundary plantings, there have been numerous losses on badly drained sites.

Eucalyptus spathulata appears to be amongst the most tolerant, and it seems reasonable to suggest that close planting of plants in groups would not only minimise wind damage and be more effective in every way, but would also more quickly dissipate excess water from a given area.

TREES FOR HEAVY SOILS (not Limey)

Acacia acuminata, Gold Dust Wattle—see Trees for Limey Soil.

A. cambagei, Gidgee—bushy small rough-barked tree 10-15 ft., grey narrow foliage, cream flowers. Ref. 38:84.

A. cardiophylla, Wyalong Wattle—small bushy tree 10-12 ft., feather-like foliage with small leaflets, flowers bright yellow. Ref. 38:84.

A. harpophylla, Brigalow—upright tree 20-25 ft. Ref. 38:84.

A. normalis, Queen Wattle—ornamental tree, 15-20 ft., bright green feathery foliage, pale yellow blossoms. Ref. 38:84.

A. pendula, Weeping Myall—attractive tree up to 20 ft., pendulous branches, bluish narrow foliage, small flowers. Ref. 38:84.

A. salicina, Broughton Wattle—see Trees for Limey Soil.

Callistemon salignus, Willow Bottlebrush—upright tree 15-20 ft., new growths pink, cream flowers. Ref. 20:253, 287.

Casuarina cristata and *glauca*—see Trees for Limey Soil.

C. luehmannii, Bullock—tall, somewhat spreading tree to 25 ft., dark foliage.

Eucalyptus astringens, Brown Mallet—erect tree 35-40 ft., light brownish bark, shiny leaves, cream flowers. Ref. 14:50.

E. brockwayi, Dundas Mahogany—see Trees for Limey Soil.

E. caesia, Gungurra—most attractive graceful small tree to 15 ft., brown shiny bark, twigs whitish-purple, glaucous leaves, rose pink flowers. Ref. 14:51.

WATTLES

SOME INDIGENOUS ACACIAS OF THE UPPER HUNTER DISTRICT OF N.S.W.

By Forester J. Kennedy, Forestry Commission of N.S.W., Muswellbrook

The Upper Hunter area of N.S.W., comprising the districts of Scone, Muswellbrook, Denman, Merriwa and Murrumbidgee, is a part of the N.S.W. Coastal Division, but its natural flora is more akin to that of the Central Western Slopes, which it joins to the west without the intervening high Tablelands common to the rest of the State. The area is ringed by a loop in the Great Dividing Range, which forms a rugged and high boundary to the north and south, but a low one to the west is known as the Cassilis Geocoll. This area of gentle slopes up to about 550 m. has allowed an intrusion of typically western species up to and beyond the limits of coastal flora. Thus, in the Jerrys Plains district, "Western Wilga" (*Geijera parviflora*) and "Brush or Scrub Wilga" (*Geijera salicifolia*) can be found growing in close proximity. Likewise western acacias such as *A. homalophylla*, *A. pendula* and *A. salicina* are also quite widespread.

Because of the great diversity of rainfall and soils in the Upper Hunter District I have divided it, for the purpose of this article, into three areas:

1. The Northern Mountain Area, which includes the Western Slopes of the Barrington Tops on the Mount Royal Range and the Southern Slopes of the Liverpool Range. These areas range in elevation from approximately 900 m. to 1,500 m. and rainfall varies from 800 mm. to 1,500 mm. Soil is variable, but mostly of basalt origin overlying granite or sandstone.
2. The Central Lowlands, which includes the Flood Plains of the Hunter and its tributaries and adjacent slopes and valleys. Average rainfall is about 575 mm. and elevation ranges from about 100 m. to 500 m. Soil is very variable, ranging from sandy or gravelly alluvium to grey brown or red sedimentary soils and heavy dark cracking clays derived from basalt.
3. The Southern Mountains and Goulburn River Valley. This section occupies a wide tract of triassic sandstone country with a generally low average rainfall down to about 550 mm. except on the western boundary formed by The Great Dividing Range. This is by far the richest area as far as acacias and native shrubs are concerned.

Acacias which have been sighted in each section are:

1. *A. clunies-rossii*; *A. dealbata*; *A. decurrens*; *A. melanoxylon*; *A. mollissima*.
2. *A. amblygona*; *A. armata*; *A. botrycephala*; *A. brownii*; *A. crassa*; *A. cultriformis*; *A. cunninghamii*; *A. deanei*; *A. decora*; *A. decurrens*; *A. elongata*; *A. homalophylla*; *A. mollissima*; *A. pendula*; *A. salicina*; *A. spectabilis*; *A. suaveolens*.
3. *A. amblygona*; *A. armata*; *A. brownii*; *A. buxifolia*; *A. caesiella*; *A. cheelii*; *A. crassa*; *A. cultriformis*; *A. cunninghamii*; *A. decora*; *A. decurrens*; *A. doratoxylon*; *A. glaucescens*; *A. linearifolia*; *A. mollissima*; *A. parramattensis*; *A. prominens*; *A. spectabilis*; *A. stricta*; *A. uncinata*; *A. verniciflua*; *A. vomeriformis*.

Most of these species have been described in previous issues but the following have not been adequately mentioned.

A. clunies-rossii—Phyllodes narrow-oblong—elliptic, 4.6 cm long, 4.8 mm wide, obtuse with a short mucro, pubescent even when mature with short hairs. Flowers up to 10 in each head. Legume straight, up to 6 cm long. Shrub or small tree to 6 m.

WATTLE TREES ARE IDEAL SCREEN TREES

There is an *Acacia* for every conceivable application from prostrate plants, small shrubs, large rounded shrubs to sturdy trees. If you take advantage of their quick growing to fill in a space with colour as shown below or with good foliage character, remember they should be replaced every 3-4 years for best appearance.



TOP LEFT: *Acacia amblygona* — low spreading, prickly, 1.5 m.

TOP RIGHT: *Acacia uncinata* — tall shrub, ash coloured foliage.

BOTTOM LEFT: *Acacia caesiella* — shrub to small tree.

BOTTOM RIGHT: *Acacia spectabilis* — a famous free-flowering tree.

A. mollissima (syn. *A. mearnsii*)—Black Wattle—Phyllodes bipinnate, consisting of 6-20 pairs of pinnae, softly pubescent, the young shoots tinged with golden yellow. Pinnules short and broad, 1.2 mm-3 mm long. Glands numerous and extending along the whole length of the rachis. Legumes black sub moniliform, 4.9 cm long, 4.5-8 mm broad.

A. amblygona—Phyllodes lanceolate to ovate, usually oblique, 6-18 mm long, 2-5 mm wide, rigid. Legume coiled or curved, up to 6 cm long, constricted between the seeds on the suture lines, blackish, low spreading prickly shrub to 1.5 m high.

A. crassa—Falcate—elliptic prominently nerved phyllodes 5-15 cm long and 10-20 mm wide. Flower heads golden yellow spikes 3-5 cm long by 3-5 mm wide. Small to medium tree.

A. cunninghamii (Curcubab)—Phyllodes falcate—lanceolate 7-10 cm long, 10-20 mm wide. Spikes 2-6 cm long. Legume curved up to 10 cm long. Tall shrub to small tree.

A. caesiella—Phyllodes linear 3.7 cm long, 3-4 mm wide, acute and often with a short mucro, pubescent while young but becoming quite glabrous when mature. Flowers 20 in each head. Legume straight up to 7 cm long and 7 mm wide. Attractive shrub to small tree.

A. cheelii (*Motherum bung*)—Phyllodes and young branches glaucous. Phyllodes falcate—elliptic 6-10 cm long, 9-15 mm wide. Spikes 3-6 cm long. Legume straight up to 8 cm long. Small to medium tree.

A. uncinata (Syn. *A. undulifolia*)—Ash-coloured 6-12 mm long ovate or almost orbicular phyllodes. Flowers 20 in each head. Legume ovate to broad oblong, 4-5 cm long by 2.3 cm broad. Tall shrub often scrambling in habit.

A. linearifolia—Phyllodes linear, sometimes falcate, 5-10 cm long, 2-4 mm wide, usually with a short curved mucro bent at an angle to the phyllode. Phyllodes 1-nerved bearing a gland on the upper margin between the middle and the base. Legumes 3-6 cm long. Attractive pendulous tree often glaucous when young.

EDITOR'S NOTE: It is hoped that other readers will follow the example above and report on the "wattles" growing in their area. This is a good way to build up a full coverage of the many species of Acacia in Australia.

NATIVE CURRANT JELLY

by Miss E. Oakley, 6 Hewitt Ave., Wahroonga, 2076

When we lived at Hazelbrook we used the berries of the "native currant" *Leptomeria acida* to make a jelly or relish to eat with cold meat. We boiled them with sugar and water, strained the mixture and the jelly set fairly firmly. We were given the recipe by an old woman who lived in the district.

The shrub is parasitic on the roots of nearby plants. It has slender needle-like foliage similar to *Casuarina* and grows to one to two metres. I have found it growing at Turramurra and in Ku-ring-gai Chase National Park. On a good specimen the berries would be almost a centimetre across. They are too tart to eat raw. I think I have collected them in the spring.

Dr. L. A. S. Johnson, Chief Botanist, Sydney Herbarium reports as follows:

Leptomeria acida—There are several other species of *Leptomeria* native in Australia, the majority in Western Australia. However, *L. acida* is restricted to the forests and woodlands of eastern N.S.W. whereas most of the other species occur in drier, more inland habitats.

The shrub is semi-parasitic, not wholly parasitic, on the roots of nearby trees and shrubs. It has slender stems with small, scale-like leaves similar to *Casuarina*—the foliage (i.e. the leaves) is not needle-like! It grows to 3-4 metres high.

Editor's Note: I was pleased to receive this report from Miss Oakley as we are collecting this information for future publication so that it will not be lost. Naturally such reports are checked as far as possible and we wish to make sure that the plant cannot be confused locally with one with poisonous fruit.

Interesting Plants of the Flinders Ranges

by John Zwar, Horticultural Adviser, E.T.S.A., Leigh Creek Coalfields

The following group of plants can be found in the Northern and Central Flinders Ranges area of South Australia although some are widely distributed in other dry areas of Australia. Some, such as *Pittosporum phillyreoides* the "Native Apricot" and *Santalum acuminatum*, the "Native Peach" have been cultivated in gardens for many years, but others are certainly worthy of cultivation and may also be found successful in the future. Some of the plants described are particularly interesting in that they are native fruits e.g. "Native Plum" and "Native Pear" and some of them were important to Aborigines because of their food value.

Santalum lanceolatum—Family Santalaceae "Native Plum"

Is an attractive upright shrub or small tree to 4 metres in South Australia. Also a root parasite. Foliage is waxy and glaucous and leaves are lanceolate to ovate lanceolate and taper to a point. Leaves are 3-8 cm long and 1.5-3.5 cm broad. Pale coloured flowers are arranged in short branched sprays and appear in spring and summer. Small plum like dark blue fruits are about 1.4 cm long and 1 cm wide, and were eaten by natives.

There is also a var. *angustifolium* which is a tall erect shrub or small tree and has thinner narrow lanceolate leaves. The variety resembles *Pittosporum phillyreoides* in habit. *Santalum lanceolatum* has a wide distribution in the drier parts of South Australia and other mainland states.

Capparis mitchellii—Family Capparidaceae "Native Orange"

Is a shrub or small tree to 6 metres with a dense rounded crown. Branches, leaves and flowers are clothed with short dense tomentum. Foliage is obovate to broad lanceolate 2.5-3.5 cm long and usually 2 short stipular spines are present at the leaf base. Flowers can appear any time and occur singly near the ends of branchlets. Usually there are 4 or 5 cream to pale yellow partly woolly petals and numerous stamens. Flowers are about 1 cm long x 1 cm wide. The fruit is a globular dull greenish berry 2-5 cm diameter when ripe and the edible pulp contains several seeds. *Capparis mitchellii* is found in the North Flinders Ranges and Far North East of South Australia also Northern Territory, Queensland, New South Wales and Victoria.

Santalum acuminatum—Family Santalaceae "Native Peach" or "Quandong"

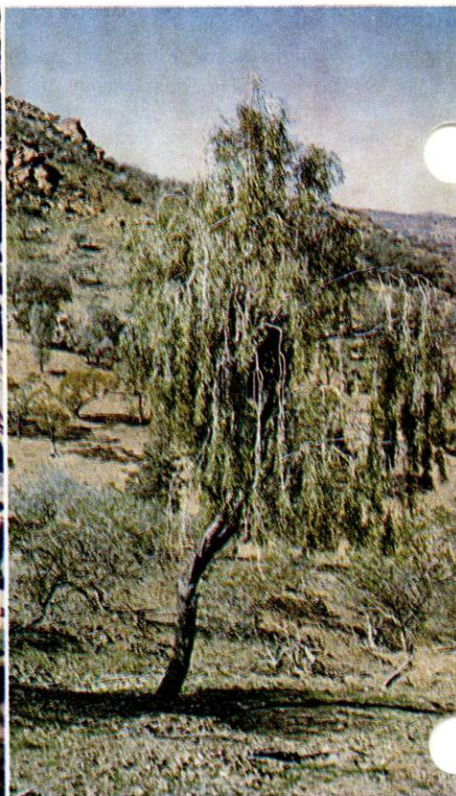
Is a shrub or small tree to about 4 m. It is a root parasite and has a smooth slender stem and a light crown of short erect branches. Foliage is light green and the lanceolate leaves are opposite. They are 5-19 cm long and taper to a short curved point. Creamy white flowers occur in spring in branched sprays at the ends of branchlets. Fruits are 2-3 cm diameter and a hard pitted spherical stone which contains an edible kernel is covered by a bright red fleshy outer layer, which can be eaten or used for jam making. The "stones" can be used for necklaces etc. *Santalum acuminatum* is widely distributed in the warmer parts of mainland states. In South Australia it is found in Mallee areas, the Flinders Ranges and other highlands, and in parts of the Far North and West.

Codonocarpus pyramidalis—Family Phytolaccaceae

Is a small attractive tree with horizontal or drooping branches. It grows to about 6 metres and has a neat erect habit. The foliage is a fresh green colour and leaves are linear acute, about 5-12 cm long. Flowers are small and insignificant and appear in spring or summer after good rains. The carpels form a bell shaped campanulate fruit about 15 mm long. *Codonocarpus pyramidalis* is endemic in South Australia occurring only in the North Flinders Ranges. The flowers and fruits are similar to those of *C. cotinifolius*, the "Desert Poplar" which is widespread in sandy areas of inland Australia. Unlike the "Desert Poplar", *Codonocarpus pyramidalis* will live for many years.

Eremocitrus glauca—Family Rutaceae "Desert Lime"

Is a prickly shrub or small tree to 15' with numerous ascending branches and sparsely spaced small scurfy green leaves and numerous spines. New plants often originate as suckers from a long lived underground rhizomatous stem. The small white flowers usually appear in spring and occur either singly or in small leafy clusters of 2 or 3. After flowering small lemon coloured berries form which vary from lemon shaped to spherical. The inner edible pulp which contains the seeds is enclosed by a thin outer rind.

*Pittosporum phillyreoides*—Family Pittosporaceae "Native Apricot" (above)

This is a small graceful tree or shrub from 4-6 m with long narrow pendulous willow like foliage. The linear lanceolate leaves are 3-10 cm long and 3-10 mm broad and ends are either tapered or hooked. The inconspicuous pale yellow flowers appear in spring and develop into an apricot coloured ovoid shaped capsule, 1-2 cm long, which splits open to reveal numerous sticky red seeds. *Pittosporum phillyreoides* has widespread distribution in all mainland states and in South Australia occurs all over the state except the Southern Mount Lofty Ranges and the South East. It is easily propagated by seed which takes 3-4 weeks to germinate. This small tree combines the advantages of being both ornamental and very hardy. I have even seen them growing in 4" average annual rainfall country North East of Marree. The sticky seed is probably distributed by birds.

Marsdenia australis—Family Asclepiadaceae "Native Pear"

This plant is a long slender twiner with hoary stems and branches. It usually climbs in other shrubs e.g. Acacias and the rootstock may be some feet away from where the foliage appears. Leaves are linear and acute and hoary when young, 4-10 cm long. Flowers occur in dense solitary umbels. Fruits are 4-10 cm long and about 3 cm thick. They ripen from a green colour to a dark purple brown colour and when dry split open to reveal a mass of seeds with silky white comas which are then dispersed by wind. *Marsdenia australis* is found in the Flinders Ranges and Far North and West of South Australia and other dry parts of Australia, generally near water courses. The young fruit is eaten by aboriginals. Seed germinates readily.



Photography by F. W. Humphreys

ALYOGYNE HAKEAFOLIA

A beautiful shrub found on the Flinders Ranges and ideal for the garden. The flower in the centre has the most unusual colour. The flowers are very similar to "Sturt's Desert Rose" *Gossypium sturtianum* featured in other issues.

PLANTS FOR DRY INLAND

Trees suitable for planting in the dry hot inland and their care are given on page 164. A whole issue was devoted to wildflowers of Central Australia and their cultivation, well illustrated in colour — Issue No. 58. The principal author, Des Nelson, reports further:

I have seen reports that claimed *Brachychiton gregorii* was deciduous or opportunely deciduous, i.e. having leaf drop in severe drought. My experiences refute this. *Brachychiton gregorii* proved itself to be one of the most drought resistant trees in the Centre during the big drought of 1958-1966. I travelled frequently through Ammaroo station, en route to Argadargada station during the drought. On part of Ammaroo is a strip of red sandy desert country in which there is much *Eucalyptus gamophylla*, *E. pachyphylla*, assorted *Acacia* spp. and quite a lot of *Brachychiton gregorii*. I knew this area before the drought began having helped bring a mob of cattle through it in the early 1950's. Of all the trees and shrubs in this area, *Brachychiton gregorii* was the toughest, looking healthy and green right till the end of the drought and retaining a full canopy of leaves. Below the ground this species has a very large swelling. I guess it is similar to the lignotuber of some eucalypts and no doubt this aids the species to survive dry times. I did in fact pay a lot of attention to the performance of trees and shrubs in that drought. Other species very drought resistant were "Supplejack", *Ventilago viminalis* and Gidyea, *Acacia georginae*. One of the least resistant was "Mulga", *A. aneura*, which died in great numbers from about the fifth year of the drought. I used to use the area of *Brachychiton gregorii* as a dinner camp area as there was always a nice shady Desert Kurrajong.

PLANTS FOR ALPINE AREAS

Please refer to our No. 60 issue devoted to wildflowers of Alpine Areas.

TREES FOR EVERY SITUATION — THE EUCALYPTS

Our No. 61 issue was devoted to describing many Eucalypts.

PROPAGATION

Most issues have sections describing the home propagation of wildflowers. The plants described in this issue, as well as being hardy and helping to cheer your environment are very easily propagated by the many simple methods described in previous issues. The following method is for those who want to try growing from cuttings but could be used also for seeds. In a warm or hot position use a piece of hessian bag for a cover instead of plastic.

PROPAGATION IN MINIATURE

Four or five holes are cut in the sides of a half gallon plastic bucket with a knife. This provides drainage for a medium which for cuttings could be two parts of sphagnum or peat moss and one part of coarse sand or perlite. A second wire handle is attached to the original handle at right angles and hooked onto the lip of the bucket. These form a frame for the "tent", a large plastic bag dropped over the handles and secured under the bucket lip by cord or rubber band.

Not only does it require little space it is easily moved with seasons to get the correct amount of sun or shade. You can get full sun in winter forcing those late cuttings on while filtered sun in summer will ensure good results in the automatic humidified conditions.

Some Current Research on Australian Plants

By Dr Byron Lamont

Department of Biology, W.A. Institute of Technology

This article examines papers on Australian plants given at recent meetings of the Australian Society of Plant Physiologists (May 1974, Adelaide) and the International Plant Propagators' Society (October 1974, Canberra).

The Australian flora contains about 15,000 species of flowering and spore-bearing plants of which 85% are probably restricted to this continent. Following clearing for agriculture, settlement, forestry and mining, and invasion by numerous exotic species, however, the stability and diversity of the flora has diminished. For example, six species in Western Australia alone have become extinct since European settlement, 100 are considered endangered or rare by the Western Australian Herbarium, and 300 have been collected only once (Specht, Roe and Boughton, 1974). In addition, variation at the sub-Eucalypts, is virtually unknown (Boden). For example, ecotypes of *Boobialla* (*Myoporum insulare*) were revealed when specimens from inland Australia grew poorly on saline coastal soils compared with specimens of the same species propagated from parent plants indigenous to the coast (Aitken). The strongest argument for the prevention of further loss of this genetic diversity species level is important in biological and horticultural research, but the existence and safe-keeping of any biotypes and ecotypes, apart from some is the outstanding potential of the flora for use in ornamental horticulture (e.g. *Grevillea*), silviculture (e.g. *Eucalyptus*), food production (e.g. *Macadamia*), agronomy (pastures — e.g. *Astrelia*; fodder — e.g. *Acacia*; possible disease resistant relatives of established crops — e.g. native sorghum, cotton and tobacco), and medicine and cosmetics (essential oils — e.g. *Boronia*; alkaloids — e.g. *Duboisia*; anti-cancer agents — e.g. *Scaevola*), as well as making rewarding subjects for studies in evolution (e.g. *Isotoma*) and methods of adaptation to environmental extremes (e.g. *Atriplex*). The following are examples of recent attempts by nurserymen and scientists to explore some of this potential.

Sterile culture in the propagation of Australian plants

McIntyre and Whitehorne of the Canberra Botanic Gardens reported on their work with tissue culture of the Kangaroo Paw (*Anigozanthos*). The technique involves extricating small pieces of tissue from the apices of stems or leaves, sterilising with sodium hypochlorite, and placing on agar medium containing a synthetic plant hormone (naphthalene acetic acid). This induces the tissue to produce an amorphous mass of cells called callus. This tissue is cut into smaller pieces and placed in another flask, containing macerated bananas as well this time, but lacking growth substances. Gradually shoots develop from the mass of cells. To induce root formation the new plantlets are then placed in another flask containing a different plant growth substance (kinetin), but lacking banana extract, the whole process taking about 12 weeks. By this means McIntyre & Whitehorne estimate that at least 600 Kangaroo Paw plants may be obtained from the one stem apex. This could become a rapid method of increasing the number of plants of otherwise sterile hybrids of Kangaroo Paw which, for example, Keith Oliver of the W.A.I.T. Chemistry Department has produced over recent years.

Similar work on the Sturt Pea (*Clianthus formosus*) showed that plantlets could be produced from green stem tissue in five weeks. No plantlets developed when non-green callus was used. While the Sturt Pea is a highly prized ornamental plant, it has the disadvantage that it is an annual and must be re-planted each year. However, its New Zealand relative, *Clianthus puniceus*, is a vigorous perennial. Miss Whitehorne has therefore developed a technique

(Continued on page 161)



TOP: Flowers of *Stylidium graminifolium*. In the flower on the left, the column has been fired and the labellum, the modified fifth petal against which the column rests when set, is visible as a yellow structure. The mobile region of the column is clearly distinguished by its red colour.

BOTTOM: Plants of the alpine form of *Stylidium graminifolium* and flowers.

S. lineare, similar species which grows in S.E. Australia.

in which young Sturt Pea seedlings, grown under sterile conditions, are grafted onto *Clianthus puniceus* stock. When the seed leaves of a young Sturt Pea seedling are fully opened the apex is removed by a V-cut at the base of the young stem. This portion is inserted in a vertical slit in the decapitated tip of the stem of a 6 week old New Zealand Pea seedling, also grown under sterile conditions. The resulting micrograft is held in place by a fine pin, pushed through the overlapping portions of the two species — a very delicate operation. The grafted seedling is returned to the jar for a further six weeks, after which time the plant is gradually introduced to normal levels of humidity. The final result is a vigorous perennial creeper bearing magnificent red and black pea flowers.

The operation of the column of Trigger Plants

A feature of the flowers of the Trigger Plant, *Stylidium*, is the presence of a curved column or trigger which bears four pollen sacs and a receptive stigma at its apex. The column is sensitive to mechanical stimuli, such that an insect gathering nectar from glands at the base of the column is liable to trigger the movement of the column. Drs G. P. and C. H. Findlay of Flinders University, South Australia, have found that on firing, the column turns through an angle of 160 to 300° in 10 to 30 thousandths of a second, depending on the species of *Stylidium*. In so doing, the apex of the trigger dongs the hairy thorax or abdomen of the insect visitor (they have been known to knock some insects stunned to the ground) transferring pollen to them or picking up pollen already caught on the insect. This ingenious method helps ensure that the flowers are cross pollinated. After firing, the column takes ten or so minutes to return to its original position before it will respond again. These researchers have also found that within the mobile bend of the column, unlike in the rest of the column, there is a region of thick-walled cells. They have proposed a model to explain the movement of the column following stimulation which involves a rapid movement of water and salts out of one side of this region causing cell contraction and hence forcing the column to bend. The water and salts are then slowly pumped back to the original cells to reset the trigger.

The production of hybrids between normally incompatible species of Eucalypts

Pryor and Willing of the Australian National University, Canberra, have been able to produce healthy offspring between Eucalypt species which normally are not able to cross-fertilise. At the outset, the hundreds of pollen-bearing stamens are removed from a flower just as the bud cap is about to drop off, and then the emasculated flower is bagged to prevent pollination occurring. After two days the now-receptive stigma is lightly brushed with an organic solvent, such as hexane. This disorganises the incompatibility factor that is present on the surface of the stigma. Stamens from the other parent plant are now brushed over the stigma to transfer pollen to it. After germination of the resulting seed, the existence of a hybrid can be verified by the leaf shape and venation of the seedling lying mid-way between both parents, obviating the need to wait for flowering to occur. *Eucalyptus grandis* (sub-genus *Symphomyrtus*, section *Transversaria*), and *E. leucoxylon* (*Symphomyrtus*, section *Adnataria*), have been hybridised by this technique. These studies open the way for the production of cultivars with new and valuable characters, while the relative ease of removal of such incompatibility barriers gives an indication of the affinity between species, to supplement information already available on their morphology.

Do Sundews really devour insects?

The rosette and climbing sundews (*Drosera*) with their sticky hair-like tentacles which catch insects, are well known. It has always been assumed that these plants digest the insects as a means of supplementing their nutrient supply — but it is another thing to prove it! So Chandler and An-

derson of La Trobe University, Victoria, set about feeding vinegar flies to some sundews. After two months they found that these *Droseras* had grown 30% more than those not fed any flies. This was only the case if the plants received distilled water or nutrient solution lacking nitrogen. If the plants were watered with a balanced nutrient solution containing nitrogen instead, then those not fed insects grew just as well as those supplied with insects. This indicates that if the plant is not receiving adequate nitrogen from the soil, as is the case in the sandy habitats of most *Drosera* species, then this supplementary nitrogen from the insects helps sustain growth.

However, sundews grown under sterile conditions could only digest the flies to a limited extent. Substantial growth of the sundews occurred only when microorganisms were present in the slime on the tentacles. These microorganisms secrete a range of enzymes necessary for the complete digestion of the insects.

Specialised roots in the *Banksia* family

Most members of the Australian Proteaceae (e.g. *Banksia*, *Hakea*, *Dryandra*, *Grevillea*, *Conospermum*, *Telopea*) and one legume, *Viminaria*, produce dense, bottlebrush-like clusters of rootlets called proteoid roots. In Western Australia, experiments by Lamont have helped develop a model of the conditions under which the production of these specialised roots is enhanced. Low levels of soil nutrients reduce general growth of the plant, but favour the production of proteoid rather than non-proteoid roots. Proteoid roots are formed provided certain microorganisms envelope the parent root to supply an extra biological stimulus (or cofactor) required for the initiation of proteoid rootlets. It is interesting that while these roots are not produced under sterile conditions, they are not themselves inhabited by microorganisms, unlike other symbiotic associations, such as root nodules. While the high concentration of normal roots just beneath the litter layer in field soils is probably due to the high levels of nitrogen in these regions, the high concentration of proteoid roots in these same regions is probably due to their high microbial activity.

Since proteoid roots make up 50% or more of the root system and are situated in the humus layer, where most soil nutrients and water are found, these structures must be of major importance to the welfare of the plant, and helps to explain why members of the *Banksia* family are most abundant in the poorest of sands, sandstones and lateritic soils. On the other hand, the presence of these delicate surface roots probably explains why these plants are soon killed by digging around them, applications of inorganic fertiliser, and the presence of Jarrah dieback disease (a soil fungus).

Effects of shoot damage on subsequent growth of *Eucalypt* seedlings

Wilson and Bachelard of the Australian National University were interested in the extent to which seedlings of the Mountain Ash, a major source of hardwood timber, could recover from damage to the shoots. They found that if the shoot of an actively-growing seedling was cut back to ground level, or all the leaves were removed, then the plant died within two weeks. If they left two or more leaves, then it survived. When the sap in the root systems of defoliated plants was examined after eight days it was found to contain unusually high levels of tannins, phenols and other toxic substances. The plant was in fact poisoning itself!

But were these poisons produced by the roots or the shoots? Since the bark is the passage for sap to pass from the shoots to the roots, these scientists prevented sap in the shoots reaching the roots by ring-barking the stem. The roots and shoots continued to grow vigorously indicating toxic substances were not being formed and accumulating in the shoots. When the inner sapwood was girdled as well as the bark, the leaves wilted after one week, the plant eventually dying from the base upwards. Now, the wood is the passage for sap passing from the roots to the shoots. It is the loss of

water from the leaves by transpiration which "pulls" the sap from the roots through the wood to the leaves. Wilson and Bachelard therefore concluded that decapitation or defoliation prevents transport away from the roots of potentially toxic substances which would otherwise be deposited or converted to less harmful substances in the leaves. Their next task will be to determine how the toxins inhibit root growth.

Concluding remarks

The research described here is making a significant contribution to our knowledge and appreciation of the Australian flora. For the sake of perspective, two points should be noted however. Firstly, the examples discussed are not necessarily representative of the work currently underway on Australian plants, for such active fields as taxonomy, anatomy, cytology, palaeontology and biogeography were not covered by these conferences. Despite this, even from these conferences, it is clear that the genus *Eucalyptus* is receiving more attention than would be anticipated from its mere 4% contribution to the total number of species in Australia. This is no doubt due to its complete dominance, in terms of height and biomass, of much of the vegetation, and hence its central role in the forestry industry.

And secondly, of the papers dealing directly with plants, only 20% of the research was conducted on indigenous species. This is understandable on at least two counts. Most of the frontiers of biology are now at the subcellular level; the main question being asked is "what goes on inside the plant?" The descriptive phase has been largely replaced by a mechanist phase. (Though the presence of the electron microscope has introduced a vigorous descriptive component as well). The tragedy for Australian botany is not so much that we have adopted the concerns and approaches of other twentieth century scientists, but that we largely missed out on the nineteenth century approach (except perhaps for Bentham's monumental *Flora Australiensis*) while the flora was still intact.

It is almost irrelevant to much of the current, rather esoteric, research as to the origin of the plant material examined. So agricultural (exotic) plants are used: they are more easily obtained, more vigorous and easier to cultivate in the glasshouse and field trial area, and less trouble to prepare for analysis (softer tissues) than native plants. In addition, Australian plants have nothing like the economic implications of the traditional species used in agriculture and horticulture. It follows that more employment opportunities, potential profits and research funds exist in these areas. Nevertheless, the studies reported here indicate that the scope for Australian plants as subjects for pure and applied research is certainly being realised. To quote Aitken "We have in our flora an almost unlimited source of experimental material. At the present time it is something of a national disgrace that more use of our plants has been made by Floridians, Californians and Israelis than by ourselves. It is time we got on with the job."

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TREES IN DRY AREAS

THE SALINITY PROBLEM IN DRY AREAS OF AUSTRALIA AND HOW IT CAN BE OVERCOME

By J. Zwar, formerly Horticultural Adviser, Leigh Creek, South Australia

There are many problem areas in the drier parts of Australia which are caused by excess salinity of the soil and often worsened by saline irrigation water. The problem has been faced by people in inland and dry coastal towns for many years, and with the expansion of these places and new towns being built for mining and other purposes many more people will be confronted with salinity. It is by no means impossible to overcome this problem, and I will describe methods of combatting salinity which can be used by home gardeners or property owners.

Salting is caused by a rise in the water table or by a fluctuating water table which brings the salt solution to the soil surface and when the water evaporates salts remain at the soil surface. High water tables occur when there is an impervious clay pan in an area of enclosed drainage, and this prevents the saline water from soaking away to lower levels where it would not cause damage to plant growth. The reason that this water is saline is that in low rainfall areas soil often has a high concentration of salts, and when leached down to the water table by rain or irrigation the solution in the water table becomes more concentrated.

In Leigh Creek we have a situation where there is a low average annual rainfall (about 6½ inches) with a very high rate of evaporation. The soil is extremely heavy clay. When the town was established about twenty-five years ago people planted gardens and over the years watered heavily, because of the dry hot climate. All went well for a number of years but eventually the water table rose because of the heavy watering and impervious clay sub-soil. A situation occurred then when extremely heavy summer rains caused the water table to rise sharply and this was followed by extreme heat wave conditions. Naturally, large numbers of trees with their root systems in very saline water and faced by prolonged extreme temperatures, collapsed and died within a short space of time. The problem has been serious ever since. Eventually it may be possible to remedy the situation by an extensive and very costly drainage system which would keep the water table down to a certain level.

I will describe how the situation can be overcome on a small scale, for example in a home garden, assuming that it is not possible to lower the water table. The reclamation of saline soils involves:-

- (1) The neutralisation of excess salinity and replacing exchangeable sodium with calcium.
- (2) Leaching of soluble salts.
- (3) Improving the physical condition of the soil.
- (4) Growing salt tolerant plants.

I will now discuss these points in more detail.

(1) Excess salinity is in effect neutralised by the addition of gypsum (calcium sulphate) to the soil. Gypsum is fairly cheap and should be added to saline soil at the rate of twenty pounds to one hundred square feet. Regular heavy watering washes the gypsum into the soil where it "neutralises" the soil salts. It should be cultivated into the topsoil for best results. Gypsum improves the structure of heavy clay soils without increasing alkalinity. This treatment can be repeated every four to six months on badly affected sites. (Aust. Plants Vol. 3, No. 28, page 344.)

Correct watering

(2) Correct watering is most important in overcoming a salinity problem. Soluble salts are leached out of the soil by heavy regular watering. Frequent light waterings are most harmful as they leave salts near the soil surface and encourage poor root growth. A heavy soaking once or twice a week (depending on the time of year), is best as this leaches salts to the water table. The more saline the irrigation water, the more should be applied each irrigation to keep the water moving down through the root zone to leach out any salt that would otherwise begin to accumulate. It is most important to keep the surface of the soil covered with vegetation or mulch as this lessens evaporation of water from the soil and a consequent accumulation of salts in the soil surface. Watering is most effective at night in hot dry areas as evaporation is lower then. If watering with brackish water, apply it to the ground by flooding, rather than by using sprinklers which wet foliage so causing burning from salts. Drip or trickle irrigation systems are relatively cheap and easy to operate and are most effective. They apply water where it is needed and little evaporates. They can be laid on or just below the soil surface. By this regular deep watering of gardens, salts as well as being leached down to the water table are leached to the outer edges of the watered area but at least the area within can be kept relatively salt free and gardened quite successfully.

Soil improvement

(3) The physical condition of the soil can be improved by mulching, preferably with organic matter, digging in rotted down mulches, animal manures and compost. The value of mulch cannot be over emphasised. As stated earlier gypsum "opens up" and improves the structure of heavy clay soils. If available sand can be incorporated with heavy clay topsoil to improve its physical condition.

Choice of plants

(4) Salt tolerant plants should be grown. Aim to cover all bare ground with lawn or ground cover plants which are low and dense. Paths or bare areas should be thickly gravelled or paved (which in effect mulches the soil surface and helps prevent an accumulation of salts), and bare ground in garden beds mulched heavily. Lawn cuttings or other organic matter is best as it improves the physical condition of the soil as well as covering the surface. After a time as the salts are gradually leached from the soil surface a much wider range of plants can be grown than at first, but measures to help salts down in the water table must be constantly undertaken.

The following is a list of native salt tolerant plants which were successful at Leigh Creek. The notes refer to their growth and habit under Leigh Creek conditions which may vary considerably in other areas.

Acacia iteaphylla, "Flinder's Range Wattle", S.A. Fairly salt tolerant and forms a beautiful dense bush to 2 m high with pale lemon flowers and attractive bluish pendulous foliage.

A. ligulata, "Umbrella Bush", S.A., W.A., N.T. Moderately salt tolerant large spreading shrub with deep yellow flowers and green foliage.

A. oswaldii, "Miljee", S.A., N.T., N.S.W., Vic. A small slow growing shrub or small tree with greyish foliage. Fairly salt tolerant.

A. pycnantha, "Golden Wattle", S.A., N.S.W., Vic. A very fast growing upright tree but short lived—8-10 years. Spectacular golden flowers and will tolerate some salt. 6-8 m.

A. retinodes, "Wirilda", S.A., Vic. Bushy shrub with yellow flowers and is fairly salt tolerant.

A. rostellifera, W.A. Large bushy shrub 3-4 m with attractive bluish foliage and spectacular golden flowers. Very hardy and salt tolerant.

A. salicina, "Broughton Willow", S.A., N.T., W.A., Qld., N.S.W., Vic. An attractive tree 3-10 m tall with pendulous foliage. Very salt tolerant and hardy. Appreciates occasional flooding.

- A. sowdenii*, "Western Myall", S.A. Slow growing bushy tree with silvery needle-like foliage and attractive when in flower. Fairly salt tolerant. 4-6 m.
- A. victoriae*, "Elegant Wattle", S.A., N.T., Qld., N.S.W. A hardy shiny shrub, often not attractive but showy pale cream flowers. Fairly salt tolerant. 2-3 m.
- Alyogyne hakeifolia*, "Red Centred Hibiscus", S.A., W.A. A hardy erect shrub to 8 ft. with green foliage and mauve or cream hibiscus like flowers. Fairly salt tolerant.
- Brachychiton gregorii*, "Desert Kurrajong", S.A., W.A. An attractive upright small tree with glossy green lobed leaves. Moderately salt tolerant. 4 m.
- B. populneum*, "Kurrajong", Qld., N.S.W., Vic. A shapely upright shade tree with glossy dark green leaves. Fairly salt tolerant. 9-11 m.
- B. rupestre*, "Bottle Tree", Qld. Shapely upright tree with lobed glossy green leaves and distinctive bottle shaped trunk. Fairly salt tolerant. 6 m.
- Cassia artemisioides*, S.A., N.T., Qld., N.S.W. A hardy shrub with narrow silvery foliage and masses of rich yellow flowers. Fairly salt tolerant. 1-2 m.
- Casuarina cristata*, "Black Oak", S.A., N.S.W., Vic. Hardy upright tree with drooping foliage and grey green colour. Fairly salt tolerant. 9 m.
- C. glauca*, "Swamp Oak", Qld., N.S.W. A tall upright hardy tree with dense dark green foliage. Very salt tolerant. 16-18 m.
- Eucalyptus camaldulensis*, "River Red Gum", Australian mainland states. A tall upright sometimes spreading tree with whitish bark and bluish foliage. Fast growing and very salt tolerant. 16-25 m.
- E. campaspe*, "Silver Gimlet", W.A. Small tree to 9 m. Attractive mealy bark and glaucous foliage. Fairly salt tolerant. Old bark is smooth red brown colour.
- E. calycogona*, "Square Fruited Mallee", S.A., W.A., Vic. Small hardy mallee to 4-6 m which is moderately salt tolerant.
- Eucalyptus occidentalis*, "Flat Topped Yate", W.A. A very fast growing upright tree. Fairly salt tolerant. 8-12 m.
- E. pterocarpa*, W.A. An upright shapely tree with cream flowers which is fairly salt tolerant. 4-6 m.
- E. salmonophloia*, "Salmon Gum", W.A. A tall upright tree with glossy green foliage and lovely salmon coloured smooth bark. Moderately salt tolerant, 16-18 m.
- E. sargentii*, "Salt River Mallet", W.A. An upright tree with smooth green to red coloured bark. Fairly salt tolerant.
- E. spathulata*, "Swamp Mallet", W.A. An upright to bushy tree with smooth red brown bark and narrow attractive blue green foliage. Very salt tolerant. 8-12 m.
- E. torquata*, "Coral Gum", W.A. Spreading small shade tree 6-8 m. Masses of white, yellow, orange or pink coloured blossom. Moderately salt tolerant.
- E. woodwardii*, "Lemon Flowered Gum", W.A. Small tree with whitish bark and large glaucous leaves. It has large lemon coloured flowers and is moderately salt tolerant. Grows to 6 m.
- Grevillea nematophylla*, "Water Bush", S.A., W.A., N.S.W. Small tree with long silvery needle-like foliage and masses of creamy white flowers. 3-8 m. Fairly salt tolerant.
- Hakea leucoptera*, "Needle Hakea". All mainland States. A small tough tree to 9 m. Rough bark and sharp needle-like silvery foliage. Moderately salt tolerant.
- Melaleuca armillaris*, "Bracelet Honey Myrtle", Qld., N.S.W., Vic. An upright shrub inclined to be chlorotic at Leigh Creek. Useful as a tall hedge and moderately salt tolerant.
- M. glomerata*, "Inland Paper Bark", S.A., N.T., W.A., N.S.W. A shrub to small tree with white papery bark and small greyish foliage and white to cream flowers. Fairly salt tolerant. Useful for hedges. 2-7 m.
- M. halmaturorum*, "Kangaroo Island Paperbark", S.A., Vic. Small dense bushy tree or shrub with papery bark and small leaves. Very salt tolerant. 3-5 m.

- M. lanceolata*, "Dryland Tea Tree", S.A., W.A., N.S.W., Vic. A shrub with rough bark and small grey leaves. Moderately salt tolerant.
- Melia azedarach* var. *australasica*, "White Cedar", N.S.W., Qld., P.N.G. and Asia. A deciduous but very fast growing upright shade tree. Fairly tolerant of salinity. 4-12 m.
- Myoporum montanum*, "Myrtle", S.A. A hardy erect bushy shrub with green foliage and white flowers. Subject to scale insects. 2-4 m. Extremely salt tolerant.
- M. platycarpum*, "Sugarwood", S.A., W.A., N.S.W., Vic. An attractive rounded bushy green shrub or small tree. Pendulous foliage and white flowers. 4-7 m. Fairly salt tolerant.
- Nitraria schoberi*, "Nitro Bush", S.A., W.A., Vic., N.S.W., Asia Minor-Mongolia. Rigid spreading shrub 1-2 m. Glaucous foliage and purple red fruits. Very salt tolerant. Ground cover or low hedge.
- Pittosporum phillyraeoides*, "Native Apricot", dry temperate Australia. Small graceful tree to 6 m with pendulous foliage and orange yellow fruits. Fairly salt tolerant.
- Santalum lanceolatum*, "Native Plum", S.A., N.S.W. Small tree with glaucous foliage, 3-4 m. Fairly salt tolerant.

These plants listed above are those most likely to succeed on a saline site under conditions similar to those at Leigh Creek.

In Leigh Creek we have found that although the extremely saline water table is very high, by careful selection of plants and following the procedures mentioned, very attractive gardens have resulted, although gardens surrounding them have been all but destroyed by salt damage.

SOIL IMPROVEMENT — USE OF MULCHES

To supplement "Soil Improvement" above, a report:

Clay subsoil can be turned quickly into quality top soil by incorporating sawdust which has a high carbon-nitrogen ratio and ammonium nitrate mixed to provide 24 pounds of nitrogen per ton of sawdust.

A study on mulches for their ability to influence plant growth was made by the Dept. of Horticulture of the University of Minnesota, U.S.A. Although a honeysuckle was used as the trial plant, the results are of interest as all mulches produced better growth than a control plant without mulches.

Ranked in descending order of growth produced—black plastic, chopped hay, wood chips, black plastic overlaid with 2" of a granite rock, fibreglass mat, granite rock, cottonseed hulls, sawdust, a calcined clay and corncobs. The greatest growth was achieved with the mulches that maintained highest soil temperatures. The black plastic kept the soil 10° warmer than corncobs and resulted in 30% more growth. (In most temperate to warm areas it is not warm soil temperature that is the criterion and with natives that require a cool root run these mulching materials are given in the reverse order of desirability).

In an extremely dry season, the mulches that conserved moisture best produced the most growth being in order, fibreglass mat, chopped hay, wood chips, black plastic, black plastic and rock, cotton seed hulls, rock, corncobs, sawdust and the calcined clay.

The point is that mulching does improve growth and conserve moisture and previous issues have described various mulches and their application.

TO MULCH OR NOT TO MULCH

There has been considerable debate over this. This issue is devoted principally to the cultivation of trees and shrubs in hard situations and the use of mulches is usually best — keep them away from the trunk of the tree where it enters the ground to enable the trunk to dry out and get strong.

The next few issues will be devoted to the cultivation of more delicate shrubs in reasonable garden conditions and will describe how not to use mulches.

HARDY FERNS

THE GENUS *PYRROSIA* MIRBEL IN AUSTRALIA

by David L. Jones

The genus *Pyrrosia* Mirbel consists of over 100 species of fern ranging from Siberia to south-eastern Asia and Australia, where there are five species confined to the eastern mainland states. They have a creeping rhizome and entire or simply branched or bifurcated fronds with large exindusiate sori which generally become confluent with age. The frond surface, particularly around the sori, is usually covered with masses of white or brownish stellate hairs.

All five Australian species are epiphytes or lithophytes in rainforest, scrubland bordering rainforest, on rock faces near streams or less commonly in open forest situations. They often grow in large patches festooning tree trunks or rocks and usually in association with other epiphytes. At least two species are quite drought tolerant.

All are very easy in cultivation requiring slab culture or a coarse epiphyte type potting mixture (fimbriae, charcoal, fibre, coarse sand, etc.). They make excellent basket subjects and respond well to feeding with liquid fertilizers. They do best in the humid atmosphere of a glasshouse but three species can be successfully cultivated without this protection at least as far south as southern Victoria. Propagation is readily carried out by division of the rhizome or spores sown onto chopped up tree-fern fibre.

KEY TO AUSTRALIAN SPECIES

1. Sori restricted to extreme apex of fertile fronds, usually as a confluent horseshoe shaped band *P. confluens* 2
2. Sori scattered over at least half the length of the fertile fronds 2
2. Fertile frond narrowing in the upper half to a linear portion bearing massed sori (sori small, rhizome scales edged with fimbriae) *P. adnascens*
- Fertile frond of uniform shape throughout and not contracting to a fertile portion 3
3. Fronds very thick and coriaceous; sori large; rhizome scales edged with fimbriae *P. dielsii*
- Fronds not thick and fleshy; sori large or small; rhizome scales not edged with fimbriae 4
4. Fronds markedly dimorphic, the rhizome densely clothed with loosely appressed, entire, papery scales (diminutive fern) *P. rupestris*
- Fronds not dimorphic, the rhizome sparsely clothed with papery, winged scales and attractively patterned (stout, robust fern) *P. longifolia*

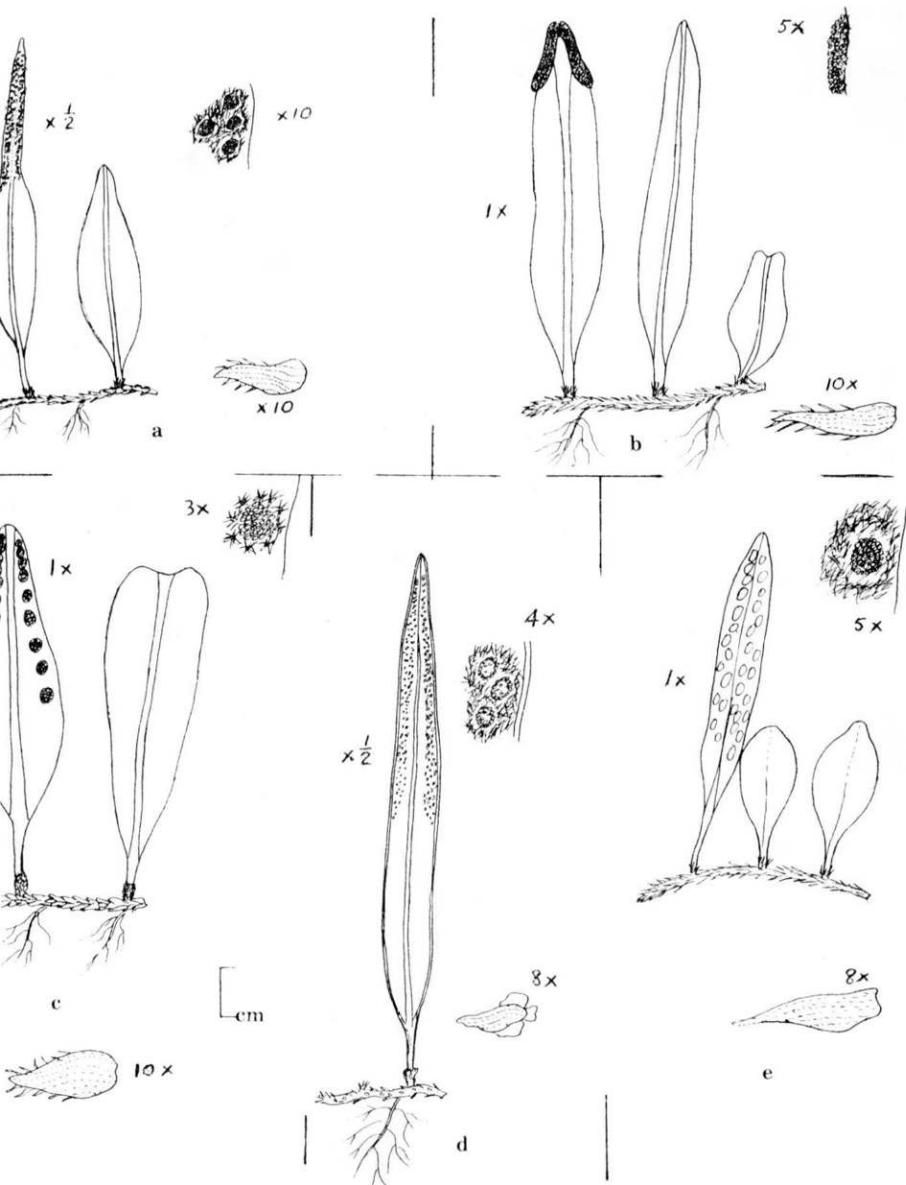
P. adnascens (Forst. f.) Ching

Rhizome long creeping, branched, clothed with loose squarrose, papery, lanceolate scales bordered with short fimbriae. Fronds scattered along the rhizome, dimorphic, simple, coriaceous, rugose when dried. Sterile fronds 5 to 9 cm long including the stipes, lanceolate to oblanceolate or spatulate; apex obtuse or truncate. Fertile fronds 10 to 17 cm long including the stipes, narrower than the sterile fronds, narrow-lanceolate in the basal half then abruptly tapering to a linear-caudate fertile section; apex acute to subacute or obtuse. Sori 0.5 to 1 mm in diameter, irregularly crowded along the fertile portion and becoming confluent with age.

Distribution: In Australia confined to central Cape York Peninsula, particularly in the area of the McIlwraith and Iron Range; extending northward through New Guinea and various islands to Malaya.

Notes: An uncommon to rare species in Australia found only on trees in the monsoonal rainforests of the ranges of central Cape York Peninsula, extending to about 760 metres (2500') altitude. It can be readily distinguished from other Australian species by the narrowed fertile section of the fronds.

Cultivation: An easy species to grow but one that is frost tender requiring a minimum temperature of 10°C (50°F). It can be grown successfully on slabs of tree fern or in pots or baskets of a coarse mixture.



Sori and scales variously enlarged from normal size as shown.

- (a) *Pyrrosia adnascens*. Plant less than $\frac{1}{2}$ full size
- (b) *P. confluens*. Plant about $\frac{3}{4}$ full size (1 cm scale measures 0.7 cm).
- (c) *P. dielsii*. Plant about $\frac{3}{4}$ full size.
- (d) *P. longifolia*. Plant shown less than $\frac{1}{2}$ full size.

AUSTRALIAN FERNS

This is one of a series of articles on ferns. The last issue described the life cycle of a fern and gave details of their propagation.

P. confluens (R.Br.) Ching

Rhizome long creeping, much branched, clothed with narrow-lanceolate dark brown or glossy scales bordered with short fimbriae. Fronds scattered along the rhizome, dimorphic, simple or occasionally bifurcate, coriaceous. Sterile fronds from 1 to 18 cm long including the stipes, linear-lanceolate to narrow-oblancheolate; apex rounded, truncate, emarginate or subacute, usually shorter than the fertile fronds. Fertile fronds 3 to 30 cm long including the stipes, linear-lanceolate to narrow-elliptical; apex rounded, obtuse or subacute. Sori 0.2 to 2 cm in diameter, usually restricted to the extreme tip as a confluent, horseshoe shaped brown patch; occasionally forming a single rounded patch or rarely as rows of separated sori.

Distribution: Widespread in Australia from north-eastern Queensland to the Hunter River area of northern N.S.W., ranging from sea level to over 920 metres (3000') altitude; also New Caledonia, Norfolk Island and Lord Howe Island.

Notes: A very common species growing principally in rainforests but also extending to rockfaces and trees in open forest (particularly *Casuarinas*) where it often grows with clumps of large epiphytes such as *Platycerium bifurcatum* and *Davallia pyxidata*. In sunny situations the fronds became dwarfed, leathery and bleached to a pale yellow-green. In times of drought the fronds may curl and shrivel but swell again with rain. The species does not spore freely in dense shade and fronds which are sterile in such situations may rapidly develop sori when placed in light. In shady situations the fronds may become very long and a lush dark green. The species is easily recognised by the confluent spore patch confined to the apex of the fertile fronds.

Cultivation: An extremely easy species to grow and one that is sufficiently hardy for bush-house conditions in southern Australia. It can be grown on slabs of tree fern or in pots of a coarse mixture and is ideally suited for basket culture.

P. dielsii (C. Chr.) Tindale

Rhizome long creeping, much branched, clothed with broad-lanceolate, closely appressed, dark brown scales bordered with short fimbriae. Fronds scattered along the rhizome, dimorphic, simple or occasionally bifurcate or even lobed, very thick and coriaceous. Sterile fronds from 3 to 8 cm long including the stipes, oblong to spatulate, usually shorter than the fertile fronds; apex rounded, obtuse or broadly emarginate. Fertile fronds 5 to 12 cm long including the stipes, lanceolate to oblanceolate; apex rounded, obtuse or emarginate. Sori 3 to 5 mm in diameter, usually scattered along a single line on each side of the midrib, becoming confluent with age, particularly towards the apex.

Distribution: In Australia confined to the ranges and tablelands of south-eastern Cape York Peninsula, above 610 metres (2000') altitude.

Notes: Despite its restricted distribution in Australia this species is locally abundant in the highland areas of north-eastern Queensland, particularly on the Atherton and Evelyn Tablelands. It grows on trees along the edges of rainforest and in particular colonizes individual trees left after clearing. It can be easily recognised by the thick fleshy fronds and large sori. Sterile fronds often have a silvery sheen on the back from the massed white stellate hairs.

Cultivation: An extremely easy but fairly slow growing species that is hardy in the scant protection of a bush-house in southern Victoria. Cultural requirements as for the earlier species except that it is not as tolerant of shade and for best results requires a fair amount of light.

P. longifolia (Burm. f.) Morton

Rhizome long creeping, much branched, sparsely clothed with pale, papery, winged scales and dark spots giving an attractive patterned appearance. Fronds scattered along the rhizome, hardly dimorphic, simple, not coriaceous and with thickened margins. Both sterile and fertile fronds 10 to 40 cm long including the stipes, linear to narrow-lanceolate; apex rounded to subacute, often unequal. Sori 0.5 to 1.5 cm in diameter, scattered along the upper half of fertile fronds in irregular rows and becoming massed towards the apex and confluent with age.

Distribution: In Australia confined to north-eastern Queensland from sea level to 460 metres (1500') altitude.

Notes: A very striking and spectacular species that is abundant in the coastal belt around Tully and Innisfail in north-eastern Queensland. It forms large dense clumps in rainforest and readily colonizes street trees, farm trees, etc. The clumps are very crowded and the stiffly erect long leaves give a unique appearance. The young leaves have a fresh silver-green sheen but in nature quickly become covered with fungi and lichens. The species is easily recognised by its long stiff leaves with thickened margins and the attractively patterned rhizome.

Cultivation: Once again an easy species to grow but it is very frost tender and requires a minimum temperature of 10°C (50°F). Because of its vigour it is best grown on a large slab or in a basket.

P. rupestris (R.Br.) Ching

Rhizome creeping, much branched and forming matted patches, densely clothed with pale, rusty, papery, lanceolate scales. Fronds scattered along the rhizome, very dimorphic, coriaceous, simple, densely clothed on the lower surface with rusty coloured stellate hairs. Sterile fronds 1 to 8 cm long including the stipes extremely variable in shape from rounded to oblanceolate or spatulate; apex obtuse, truncate occasionally emarginate. Fertile fronds 2.5 to 20 cm long including the stipes linear-elliptical to narrow lanceolate, usually narrower and longer than the sterile fronds; apex obtuse. Sori 1 to 3 mm in diameter, crowded into 1 to 4 irregular rows on each side of the midrib for about three-quarters of the length of the fertile frond, becoming confluent with age, especially near the apex.

Distribution: Widespread in Australia from north-eastern Queensland to eastern Victoria ranging from sea level to over 760 metres (3000') altitude; also New Guinea.

Notes: This is probably the commonest and best known member of the genus in Australia. It is commonly found adorning trees in rainforests and along creeks but also extends to rock faces and open forest in similar situations to *P. confluens*. In sunny situations the fronds become dwarfed and the hairs dense and very reddish. The fronds may curl and shrivel with drought but quickly swell after rain. A specimen with fronds up to 20 cm long was collected near Wollongong in N.S.W.

Cultivation requirements as for *P. confluens*.

KEEPING DRIED SPECIMENS

I have started a specimen collection—pressed leaves, flowers, fruit, etc. I guess lots of members do this. I would like some suggestions about the best method; plastic bags with a card inside saying date, place, etc. is my method. Does anyone sell cards printed for the purpose or some box for the bags? What is the best method?—Ian M. Johnstone, P.O. Box 196, Armidale, N.S.W. 2350.

There may be many members making a collection of plants in certain areas. Please advise editor of details and your recommended methods. Such a collection mounted for display would be ideal for shows. How would you mount it?

PLANTS AND INSECTS

There is a wide interest in plants that devour insects and Australia has many such plants occurring naturally. Previous issues have described these plants and illustrated them in colour, references being given below. The way in which one group of these plants, *Drosera*, digests insects is examined on page 161.

The cultivation of another carnivorous plant is described below.

The dependence of plants on insects for pollination is also widely known and the action of the "Trigger Plants" in "banging a bee on the bottom" is described on page 160 with a colour plate to illustrate the report on the action of this trigger mechanism described opposite. Some reference in last issues listed below may be of interest.

PEOPLE, PLANTS, INSECTS and BIRDS are necessary for harmony in the garden and for survival of all, so let us be more tolerant with nature, sit back and observe the wonders of nature and use that spray gun only rarely.

Australian Carnivorous Plants — Vol. 3, No. 27, page 219 mentions them all including:

Nepenthes mirabilis, the "Tropical Pitcher Plant". 27:319.

Aldrovanda vesiculosa, the "Water Wheel Plant". 27:319, 35:291.

Byblis gigantea, *B. liniflora*, the "Rainbow Plant". 8:28p, 9:23, 27:321.

Drosera, "Sundews". Many species. 27:319, 35:287-291, 60:355, 359.

Cephalotus follicularis, the "W.A. Pitcher Plant". 8:26, 28p, 27:319, 29:28, 34, 36p.

Polypompholyx, the "Pink Petticoats". 35:293, 324.

Utricularia, the "Fairy Aprons" or "Bladderworts". 35:292.

Trigger Plants — *Stylidium*. 9:15-17, 32, 23:106, 133, 40:168, 42:267.

GROWING *CEPHALOTUS FOLLICULARIS*, THE ALBANY PITCHER PLANT

Though this plant was thoroughly treated in Vol. 1, no. 5, page 86 (Sept. 1961) the important subjects of its cultivation and propagation were not well covered and it is hoped that this article will complete this.

In Sydney this plant is easily grown in plastic pots of peat moss which stand in saucers of water. Ordinary peat moss straight out of the packet is satisfactory after a thorough mixing with water. As the peat tends to splash over the plant a topping with sphagnum or another medium is desirable.

In Sydney tap water is satisfactory but in some districts it is not and rain water needs to be used. This plant often grows among scrub and reeds I find it grows best in a sunny position and if shade is too great the plant grows poorly. The hottest weather Sydney gets has caused my plants no harm and on several occasions it has frozen solid during heavy frosts. It merely thawed out again—undamaged. The use of fertilizers, manures and insecticides is dangerous and should be avoided.

Theoretically this plant can be increased by seed and vegetatively. I know of many failures from seed including all my own despite very fresh seed and a variety of treatments. The only deliberate attempt to raise seed which resulted in a few small seedlings was as follows. The seed was scattered on a pot of sphagnum and covered with glass. A few seedlings appeared after about 8 weeks and more 6 weeks later. This was not done by me and my attempts to imitate it produced nothing. A friend who has several plants of it had a few self sown seedlings appear in a pot of another plant nearby. It was growing in sphagnum and the seedlings appeared where they had been sheltered by its leaves. Recently I also have had a few self sown seedlings appear.

Fortunately vegetative propagation is easier but as the plant is fairly slow growing it tends to be rather slow. Plants may be simply divided. Often all leaves and pitchers die if the disturbance is too great but the rhizome remains alive and more growth soon starts. Plants also will start from cut up pieces of rhizome and I recently found one which had grown from a piece of root which was old and thicker than most roots and though much thinner than a rhizome was rather like one in texture. Experiments with this are desirable because the other methods require the breaking up of the rather slow growing plant.

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NORTH QUEENSLAND ORCHIDS

In the previous issue Bob Smythe gave advice on the cultivation of orchids in the garden at Townsville: Suitable *Dendrobium* are:

Dendrobium johannis

This is a hard cane dendrobe very resistant to winds and harsh conditions. The plant grows well on small garden trees; on large trees it tends to be shed, as to hold on, the roots need to wrap around the branches. The flowers are yellow to yellow brown and are most attractive though not outstanding as the colour tends to blend into the background. Flowers are long lasting and some large flowered forms exhibit an outstanding large bright yellow diamond shaped lip.

Dendrobium linguiforme "Thumb Nail Orchid"

A very attractive small orchid which although uncommon in the mountains near Townsville is quite plentiful on the Atherton Tableland. The plant establishes easily within the crown of native shrubs covering quite considerable areas. The flower is white and feathery with the racemes appearing from below the short squat leaves which lie flush against the host plant. Flowering occurs in Winter.

Dendrobium luteocillium

This orchid makes an attractive basket subject if grown in fern fibre under the shade of a tree or in some other protected area. In the garden the stems tend to hold their leaves and the plant grows into an attractive clump. If you are fortunate enough to see this plant in flower you will be very pleased with the clusters of yellow flowers which grow in pairs along the stem. Unfortunately this plant, like its close relatives *Dendrobium baileyi* and *Dendrobium cancrroides* has extremely short lived flowers. *Dendrobium luteocillium* can be found from Cardwell north, *D. baileyi* extends down to Mt. Spec whilst *D. cancrroides* ranges south to the tributaries of the Tully River.

Dendrobium rigidum

This small dendrobe grows exceptionally well in Townsville gardens where it reaches a height of 15 cm. It flowers almost the whole year round. The favoured hosts of this plant are mangroves and since it does so well in Townsville, it is surprising that its natural range does not extend further south than the Russel River. In appearance the plant is a series of short thick closely packed leaves which form a semi-pendulous clump.

The flowers are small (less than 2 cm in diameter) and are cream coloured with a red edged lip. The quantity of flowers and the frequency of flowering make this plant more than just a botanical curiosity.

Dendrobium smilliae "Bottle Brush Orchid"

An attractive epiphyte found growing north of the Cardwell Range which has both attractive form and flower. The old pseudobulbs are leaflets but produce flowers year after year and should not be removed unless they have dried out or have been attacked by the orchid beetle. Individual flowers are quite small being approximately 1 cm across but they are tightly packed on a spike which looks very much like a bottle brush. The flower colours range from green and white to green and pink. The latter is considered more attractive. This plant is a lowland species which cultivates very well especially when grown in old coconut husks.

Dendrobium tetragonum "Spider Orchid"

Dendrobium tetragonum var. *giganteum* grows prolifically near Ingham where it is almost always found on trees overhanging water. Forms from southern or mountainous regions do not flower well in Townsville. The yellow flower is very large and spider like and is heavily spotted with maroon patches. The plant is easily identified by the pseudobulbs which are square in cross-section. Flowering season is Winter.

ORCHIDS IN THE GARDEN

by M. Reynolds

At the time of writing (fourth of May, 1974) twenty seven different West Australian terrestrial orchids have reproduced in my garden in Yorkine, which is four miles from the heart of Perth.

These are easily the best results since I started growing orchids in 1961.

Over the past two years I have covered almost the whole of my garden area with screened gravel to a depth of about four to five centimetres. I believe that this has helped in the retention of some moisture in the soil so that the tubers of the orchids have not been dried right out by the heat of our coastal sand. The garden area is also covered to a large degree by rocks, large and small, hollow logs and mallee roots, which are used as hosts for tree orchids and complete the ground cover which has given such a successful start to this season. To emphasise the point, I feel the reason for success is the layer of gravel over the garden.

One other method I have found quite successful is to plant orchids around clumps of fibrous rooted plants. I feel that possibly the moisture is retained more in these clumps and the tubers do better than they would in an open situation.

When transplanting orchids from private land about to be cleared, I make sure that all soil is washed off. In this way the plant gets a completely new start and if it survives the change of soils it seems to thrive much more quickly. I found when I first started growing orchids and bringing back the plants in their soil they grew quite well for some time and then died off. My theory was that as soon as the mature plant roots penetrated into the new soil they weren't able to sustain the change of soil.

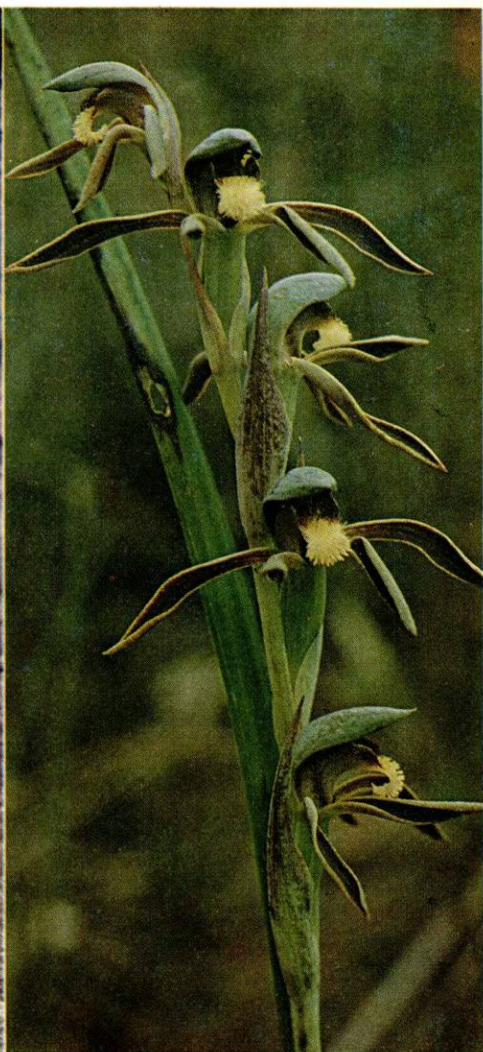
The terrestrials which have done best for me in the garden situation over a number of years are *Diuris longifolia*, *Caladenia patersonii*, *Caladenia menziesii*, *Caladenia latifolia* and to a lesser extent *Elythranthera brunonis*.

The first four have done particularly well.

1. *Caladenia patersonii*—This plant has kept reappearing for four years.
2. *Caladenia menziesii*—Has multiplied from approximately twenty to one hundred and fifty over an area of about three metres.
3. *Caladenia latifolia*—Five plants planted in 1969. This year twenty-three plants.
4. *Diuris longifolia*—Has grown in the same garden area for six years and has multiplied. The plants have grown up to the rocks on the side of the garden, then outside the rocks into the lawn.
5. *Elythranthera brunonis*—Plants seem to reproduce easily, but flowering is uncertain and lacking in colour. This year could be different as more plants are growing and look much healthier.
7. *Pterostylis recurva*—Has reproduced—but uncertain.
8. *Pterostylis barbata*—Has reproduced—but uncertain.
9. *Caladenia gemmata*—Very uncertain.
10. *Caladenia flava*—This is the hardest orchid I have tried to grow. I have succeeded in getting the full plant out and planted and had it flower but the plants just have not showed again.
11. *Cryptostylis ovata* (evergreen)—I have this plant growing in (a) sunny position, (b) shaded position, (c) in a basket in a shady situation and all plants have been growing well for four years. So far I have had only two flowers.

Over the years many of these plants have produced seed cases and shed, but I have not as yet found any plants from seed. If there were it is doubtful I would find them as they would most likely be pulled out with the many weeds with which I have to contend.

THE GROUND ORCHIDS *LYPERANTHUS*



Photography by C. J. Winn

LYPERANTHUS NIGRICANS (left): Found in all states except Queensland this robust orchid to 30 cm high is found growing in colonies in damp sandy conditions. The large fleshy leaves at the base identify this species.

LYPERANTHUS SERRATUS (right): Found only in W.A. where it is the only narrow-leaved species, this robust plant grows to 36 cm.

Flowering of these plants in cultivation over a period has proved frustrating and reports from those successful would be appreciated.

I have experimented with *Lyperanthus nigricans* and although the plant has come up for three years and I have built fires over it when it died off I have not been successful in getting it to flower. This year is the first year also that I have been able to get *Lyperanthus serratus* to come up again.

The first of the orchids to be observed was *Thelymitra crinita* which has come up in large numbers. I am also carrying out experiments with *Thelymitra crinita* and *Pterostylis recurva* using Magamp. The orchids which have the fertiliser are looking much larger and healthier than the plants in the garden situation at the moment.

I also have two large pots of *Elythranthera brunonis* on which I have also used Magamp and I am eagerly awaiting the results, as this orchid flowered very well for me in the garden last year.

At the beginning of 1972 I became interested in Australian epiphytes and lithophytes and now have a fairly large collection which have to endure outdoor conditions. Most of the *Dendrobium* spp. have done reasonably well but it appears that most of the *Bulbophyllum* and *Sarcochilus* need a shadehouse at least. I have five *Bulbophyllum* plants still growing well, but as yet they have not flowered.

The whole of my backyard is now encircled by trees and shrubs and has almost completely, filtered light. With many creepers and ferns humidity is kept up fairly well and moisture is retained thus helping considerably in our very dry summer conditions.

Since January 1972 I have had twenty four tree orchids flower. Those which have done best are *Dendrobium falcorostrum*, *D. gracilicaule*, *D. beckleri*, *D. racemosum*, *D. aemulum*, *D. adae*, *D. bigibbum*, *D. teretifolium* var. *fasciculatum* and *D. ruppianum* (all of which have flowered in successive years), *Cymbidium canaliculatum*, *Calanthe triplicata* (which grows very well in a shady spot near a small fish pond) and six *Dendrobium* crosses.

Dendrobium speciosum and *D. kingianum* have grown very well but as yet have not flowered although the six *Dendrobium* crosses have been crossed with either *D. speciosum* or *D. kingianum*.

As well as growing plants on trees and in tree baskets I have built rock mounds which have been topped by hollow logs and log trays which are proving very successful.

When I started growing epiphytes I treated them much as you would a *Cymbidium*, giving them plenty of the potting medium in which to grow, but I have since found that they do not appreciate having their roots buried deep. As long as the roots are firmly fixed (and even semi-exposed) so that the plants are not unsteady they seem to do very well. Some orchids which were deep planted have certainly done much better since they have developed new exposed roots.

The main components I have used as a "potting" medium are charcoal, tree fern cuttings (chopped up fronds) and the toughest bark I can find, in about equal parts. I have also used old gum-nuts, sheoak nuts and even the tough seed coverings from the Jacaranda trees. In fact anything of this type which does not break down readily may be used.

With this mix I have used Magamp and poultry manure and almost without exception the orchids in my garden have thrived on this combination.

I am looking forward to the flowering season to see if the plant flowering this year increases or decreases, then I will have a better idea as to how well these plants have adapted to the conditions I have established in my backyard.

Australian Indigenous Orchids by A. W. Dockrill — Price \$21.00 plus \$2.00 postage.

This is the only complete reference book to all the epiphytic orchids of Australia and those terrestrial orchids found in the northern areas. Every species is shown in detail with enlargements of the parts on a separate full page beautifully drawn sketch. Opposite the sketch is a full botanical description with references, but for the non botanist, the description is repeated in simple terms. No other book can match it for detail, accuracy and colour. It will never be out of date as supplements are produced (two to date) and sent free on request to each purchaser of the book.

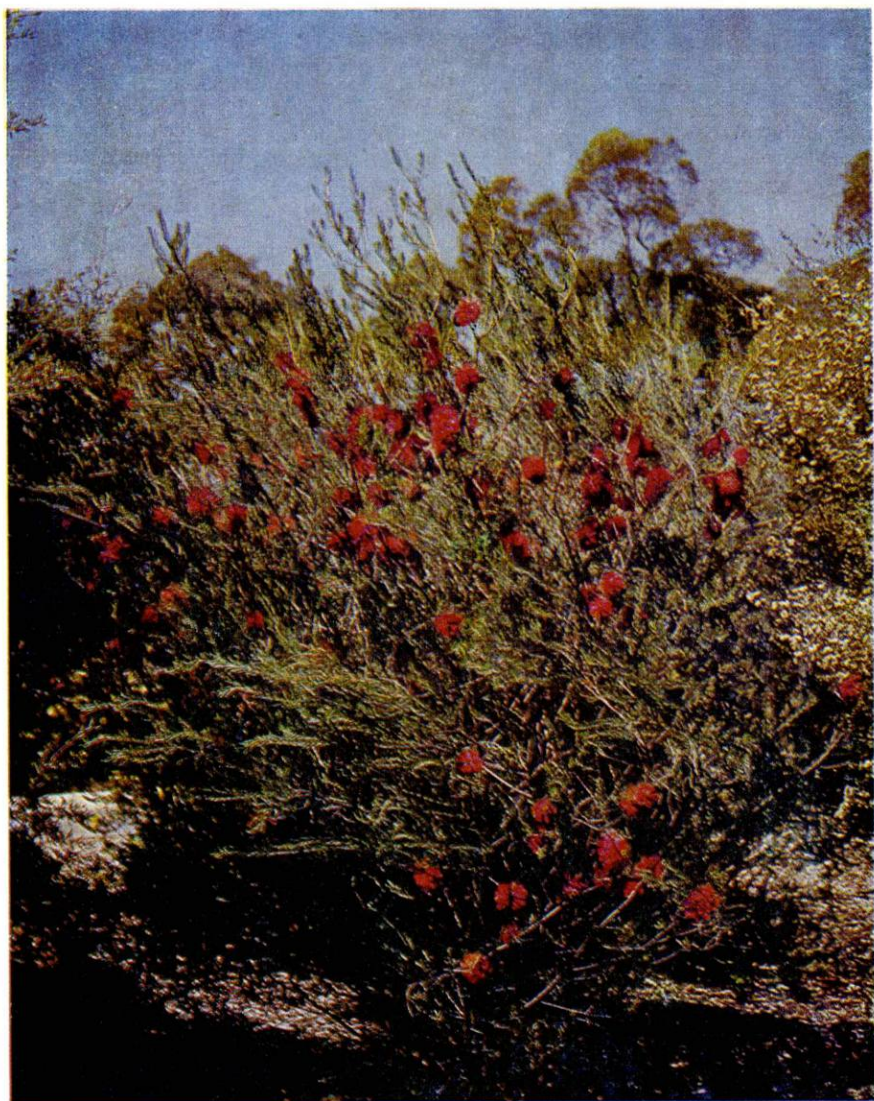
TREES FOR HEAVY SOILS (NOT LIMEY)—continued from Page 151

- E. campaspe*, Silver Topped Gimlet—neat hardy tree 15-20 ft., silvery branches and leaves, cream flowers. Ref. 14:51.
- E. cladocalyx* and *E. cladocalyx* v. *nana*—see Trees for Limey Soil.
- E. cneorifolia*, Kangaroo Island Mallee—small tree or mallee to 20 ft., deep green narrow leaves, cream flowers. Ref. 43:316.
- E. dielsii*—see Trees for Limey Soil.
- E. dundasii*, Dundas Blackbutt—erect tree 25-30 ft., upper trunk smooth, reddish brown, green leaves, white flowers. Ref. 14:51.
- E. eremophila*, Tall Sand Gum—see Trees for Limey Soil.
- E. erythrocorys*, Red Cap Gum—attractive, white-trunked small tree to 15 ft., glossy green leaves, spectacular large yellow flowers 3 ins. diam., red caps. Ref. 11:8.
- E. erythronema*, Lindsay Gum—neat, free-flowering white-trunked small tree to 10 ft., glossy leaves, red flowers. Ref. 14:51.
- E. falcata*, White Mallet—see Trees for Limey Soil.
- E. flocktoniae*, Merritt—mallee or shapely small tree 15-20 ft., shiny leaves, abundant deep cream flowers. Ref. 14:51.
- E. forrestiana* and *E. gardneri*—see Trees for Limey Soil.
- E. gillii*, Curly Mallee—somewhat gnarled small tree 15 ft., blue cordata foliage, white flowers. Ref. 43:314.
- E. hemiphloia*, Grey Box—erect tree to 35 ft., rough bark, greyish foliage, white flowers. Ref. 38:84.
- E. lansdowneana*, Crimson Mallee Box—mallee or small bushy tree to 12 ft., green foliage, colour range of flowers from cream to purple. Ref. 43:317.
- E. largiflorens*, Black Box—vigorous rough-barked tree to 30 ft., dull narrow foliage. Ref. 43:315.
- E. leucoxydon* and *E. leucoxydon* "Rosea"—see below.
- E. lehmannii*, Bushy Yate—low bushy tree 10-15 ft., yellow green foliage, flowers long, green in tight heads. Ref. 48:164.
- E. maculata*, Spotted Gum—beautiful tree, 25-30 ft., dappled grey bark, broad green foliage, white flowers, frost tender whilst young. Ref. 48:163.
- E. nutans*, Red Flowering Moort—small bushy tree 10-15 ft., rounded leaves, flowers nodding, cream to crimson in colour. Ref. 38:85.
- E. occidentalis*, Swamp Yate—tall tree 30-35 ft., with rough grey bark, large yellow flowers. Ref. 38:85.
- E. platypus*, Round Leaf Moort—compact, vigorous small tree to 15 ft., thick rounded leaves, greenish yellow flowers. Ref. 38:85.
- E. salmonophloia*—see page 182.
- E. salubris*, Gimlet—neat tree to 20 ft., fluted trunk, smooth shiny greenish red bark, dark olive green leaves, whitish flowers. Ref. 38:85.
- E. sargentii*, Salt River Gum—medium-sized tree to 20 ft., smooth. Ref. 38:85.
- E. spathulata*, Swamp Mallet—small attractive bushy trees 15-20 ft., erect narrow bluish leaves, cream flowers. Ref. 41:213.
- E. steedmannii*, *E. stoatei*, *E. stricklandii*, *E. torquata*—see previous list.
- E. wandoo*, Wandoo—tall straight white-trunked tree 35-45 ft. Ref. 38:85.
- E. woodwardii*, Lemon Flowered Gum—small tree 10-15 ft., whitish trunk, semi-pendulous branches, foliage whitish, broad, thick, showy, yellow flowers in clusters. Ref. 14:53.
- Ficus macrophylla*, Moreton Bay Fig—robust spreading tree 35-40 ft., broad brownish green leaves, frost tender when young. Ref. 38:85.
- Lagunaria patersonii*, Pyramid Tree—erect broad conical tree 25-30 ft., grey green foliage, pink hibiscus-like flowers.
- Melaleuca armillaris*—see over page.
- M. lanceolata*, Dryland Tea Tree—small tree, spreading habit 10-15 ft., deep green leaves, white flowers.
- Pittosporum undulatum*, Sweet Pittosporum—bushy, shady tree 15-20 ft., large oval-pointed shiny leaves, scented flowers in bunches.
- P. phylliraeoides*, Native Apricot—see page 182 and on page 157.

TREES FOR LIMY SOILS

- Acacia acuminata*, Paspberry Jam Wattle—small tree 10-12 ft., brownish green foliage, deep yellow flowers. Ref. 38:83*.
- A. *aneura*, Mulga—rounded or tall bush or small tree, grey foliage, yellow flowers. Ref. 18:202, 58:262.
- A. *cyanophylla*, Orange Wattle—spreading small tree to 12 ft., long bluish green leaves, deep orange flowers. Ref. 55:129.
- A. *loderi*, Nealie—similar to A. *sowdenii*, but broader leaves. Ref. 59:327.
- A. *salicina*, Broughton or Willow Wattle—weeping tree to 15 ft., thin foliage, pale cream flowers. Ref. 51:306.
- A. *saligna*, Golden Wreath Wattle—dense spreading small tree, 10-12 ft., green leaves, bright yellow flowers. Ref. 48:155.
- A. *sowdenii*, Western Myall—young tree weeping, mature semi-erect, long thick linear grey leaves, clear yellow flowers. Ref. 38:83.
- Brachychiton populneum*, Kurrajong—pyramidal tree to 20 ft., glossy green leaves, pale pink bell-shaped flowers in pendulous clusters. Ref. 9:6, 59:328.
- Callitris preissii*, Murray Pine—stately conical grey or green foliaged tree to 15-20 ft. Ref. 46:65, 59:328.
- Casuarina cunninghamiana*, River Oak—tall conical tree to 25 ft., deep green foliage. Ref. 25:228, 234.
- C. *cristata*, Black Oak—somewhat stiffly branched tree, black green foliage, 10-15 ft. Ref. 25:228.
- C. *glauca*, Swamp Oak or Grey Bullock—tall sombre tree 20-25 ft., often suckering grey-green foliage, shelter. Ref. 25:228.
- C. *littoralis*, Black Sheoak—upright attractive tree 15-20 ft., dark green foliage, red topped in spring. Ref. 25:228.
- Eucalyptus brockwayi*, Dundas Mahogany—tree 20-30 ft., smooth salmon bark, shiny green leaves, white flowers. Ref. 38:83.
- E. *cladocalyx*, Sugar Gum—tall tree, clean trunk, 30-40 ft., high, shiny leaves, cream flowers.
- E. *cladocalyx* v. *nana*, Dwarf Sugar Gum—small bushy compact branching tree 10-15 ft., useful for low shelter. Ref. 58:254.
- E. *dielsii*, Diel's Mallee—small bushy tree 12-15 ft., cream flowers. Ref. 38:83.
- E. *diptera*, Two-winged Gimlet—small tree 15 ft., narrow thick leaves, greenish yellow flowers. Ref. 38:83.
- E. *diversifolia*, Soap Mallee—mallee, grey trunks, thick deep green leaves, cream flowers, 12-15 ft. Ref. 38:83.
- E. *eremophila*, Tall Sand Gum—compact small tree or mallee, thin leaves, long greenish cream or pink flowers in stalked groups. Ref. 38:83.
- E. *falcata*, White Mallet—small tree 15-20 ft., smooth dazzled bark, dark green leaves, white flowers. Ref. 14:51.
- E. *forrestiana*, Fuchsia Gum—there are two forms: (1) small tree, 8-10 ft., densely foliaged, reddish green leaves, flowers yellow, red four-winged receptacles, long operculum; (2) smaller, more spreading, but short rounded operculum. Ref. 41:213.
- E. *gardnerii*, Blue Mallet—tree 15-20 ft., smooth silvery brown trunk, bluish foliage, long greenish flowers. Ref. 14:52.
- E. *gracilis*, Yorrell—mallee or small tree, rough bark, thin leaves, white flowers.
- E. *intertexta*, Ccolabah—tree 20-25 ft., rough or smooth trunk, sparse foliage, small white flowers. Ref. 59:331.
- E. *leucoxylon*, S.A. Blue Gum—attractive spreading tree, grey, yellow and white bark, large cream flowers, 20-30 ft. high. Ref. 43:311.
- E. *leucoxylon* v. *rosea*—smaller than above, large red flowers, also yellow, orange, deep pink flowers. Ref. 58:254.
- E. *oleosa*—forms often glaucous, small trees 10-15 ft., floriferous, cream flowers.

MANY MELALEUCA ARE BRIGHT



Photography by D. Verdon of a plant growing in Canberra Botanic Gardens.

MELALEUCA FULGENS

There is a melaleuca for every situation. This species prefers a well drained situation. To maintain a dense well shaped shrub, some pruning and shaping is needed immediately after flowering. An added attraction of flowering time is the appearance of many and varied Honeyeaters. The No. 52 Issue is devoted to the presentation of Melaleuca of horticultural value.

- E. salmonophloia*, Salmon Gum—beautiful tall tree, bark salmon and smooth, shiny small leaves, small cream flowers. Ref. 14:53.
- E. steedmannii*, Steedman's Gum—attractive bushy small tree, deep green shiny leaves, cream flowers, four-winged fruits. Ref. 38:84.
- E. stoatei*, Pear Gum—erect, compact small tree 10-15 ft., thick roundish leaves, flowers yellow, fruits pear-shaped, red, rough. Ref. 14:53.
- E. stricklandii*, Yellow Flowering Gum—spreading open tree, 15-20 ft., large thick leaves, large yellow flowers in clusters. Ref. 14:53.
- E. torquata*, Pink Gum—neat rough-barked hardy tree 10-15 ft., thick leaves, attractive sculptured buds, pink flowers. Ref. 8:25.
- Eucalyptus*, "Torwood" Hybrid Pink Gum—tall, vigorous, well-furnished tree, cream, yellow or red flowers. Ref., 38:84.
- Geijera parviflora*, Wilga—attractive broad conical tree, long narrow leaves, flowers small. Ref. 59:331.
- Melaleuca armillaris*, Bracelet Honey Myrtle—densely branched attractive tall shrub, cream flowers. Ref. 53:32.
- M. halmaturum*, Kangaroo Is. Paperbark—paperbark, spreading dense tree 10-15 ft., small grey foliage, white flowers. Ref. 54:76.
- Pittosporum phylliraeoides*, Weeping Pittosporum—attractive pendulous open tree, thin foliage, cream flowers, orange fruits.

TREES — LIGHT, NEUTRAL OR SLIGHTLY ACID SOILS — NOT SALINE

Acacia aneura, Mulga—see Trees for Limey Soils.

A. brachystachya, Umbrella Mulga—similar to *A. aneura*, with shorter spikes of flowers. Ref. 38:85.

A. homalophylla, Yarran—small spreading tree 10-15 ft., narrow curved leaves, deep cream flowers.

A. pendula, *A. salicina*, *A. sowdenii*—see previous list.

Bauhinia carronii, Queensland Ebony—umbrageous tree 20-25 ft., twin leaves. Ref. 51:299.

Brachychiton gregori, Desert Kurrajong—open spreading tree 15-20 ft., smooth greenish trunk, forked leaves, creamy flowers. Ref. 9:4-10, 58:259.

B. populneum—see Trees for Limey Soils.

Casuarina cunninghamiana, *C. cristata*, *C. lehmannii*—see previous lists.

Callitris columellaris (glauca), White Cypress Pine—small attractive dense conical tree 15-20 ft., green or glaucous foliage. Ref. 35:312.

C. endlicheri (calcarata), Black Cypress Pine, Red Cypress Pine—attractive conical tree to 20 ft., green foliage. Ref. 38:86.

C. preissii (propinqua), Murray Pine—see Trees for Limey Soils.

Erythrina vespertilio, Batwing Coral Tree—medium spreading tree 20-25 ft., pointed lobed leaves, flowers orange-brown in spikes. Ref. 58:270.

Eucalyptus brockwayi—see Trees for Limey Soils.

E. desmondensis, glaucous mallee 10-15 ft., white bark, cream fl. Ref. 38:86.

E. dielsi and *E. dundasii*—see previous list.

E. eximia, Yellow Bloodwood—tree to 20 ft., yellow, scaly bark, large falcate leaves, large white flowers. Ref. 14:65.

E. forrestiana, *E. gardneri*, *E. largiflorens*—see previous lists.

E. longicornis—tall rough-barked tree to 50 ft., dark green shiny foliage, white flowers. Ref. 14:52.

E. macranda—graceful small tree 10-15 ft., roundish leaves, green flowers.

E. megacornuta, Warty Yate—vigorous grower 20-25 ft., dark green shiny leaves, warty long cap, greenish yellow flowers. Ref. 38:86.

E. microtheca, Coolabah—erect, often gnarled, 30-40 ft., grey green foliage, white flowers. Ref. 58:258.

E. papuana, Ghost Gum—graceful attractive tree to 40 ft., white bark, light green foliage, white flowers. Ref. 58:259.

E. pilligaensis—slender tree to 30 ft., rough barked, white flowers. Ref. 38:86.

E. salmonophloia, *E. salubris*, *E. stricklandii*, *E. torquata*—see other lists.

Geijera parviflora—see Trees for Limey Soils.

Melaleuca halmaturum, *M. lanceolatum*—see other lists.

PESTS AND THEIR CONTROL

We have certainly upset the balance of nature and suppressed the natural predators of many creatures we regard as pests. The answer is not to spray poisons and help to eliminate everything that moves. Equally disastrous is to ban the use of poisonous sprays and other controls.

For survival mankind needs greater yield from plants, not only for sustenance but to beautify this artificial world we are creating. To do this we must learn to understand other creatures and their place in the life system, so that we may live in harmony and mutual benefit. For example, previous literature would indicate that nematodes are a scourge and if you want a beautiful garden, eliminate them. The article below will illustrate that in fact we need nematodes in some balance.

Fortunately, more effort is being put into research on this problem as follows:

INHERENT PESTICIDES

A new approach to safe pest control is the study of substances in plants which make them resistant to insects. Research is naturally concentrated on the cereals of economic importance but it is on these crops that the larger quantities of pesticides are used. A compound occurring in several varieties of corn that were corn borer resistant has proved effective as a spray on borer susceptible corn. Recently it was found that benzyl-alcohol is of similar use on barley and sorghum. It appears to effect only the target greenbug insect, is non-toxic to higher animals and is readily biodegradable.

WHAT CAN WE DO?

As our gardens are not large, it is possible to remove most pests physically — scrape off scale with a toothbrush — squirt any liquid such as fly spray or kerosene into a borer's hole and lift him out with a pin when he comes up for air — burn off virus-affected growth, etc. Propagate from hardy plants that may be resistant. Encourage bird life by growing suitable wildflowers and supplementary feeding. (This has been described in previous issues). Educate our neighbours and Local Government Authorities.

Now is not the time to give up as mentioned inside the front cover of this issue, even if we appear to be doing the birds a bad turn. Would the birds that died have lived at all if no one provided succour and sanctuary. Take heed of this issue and grow wildflowers.

NEMATODES

by P. B. Beaumont

Nematodes are microscopic round worms, sometimes called eelworms or simply "nemas" and they play an important part in the ecology of the soil fauna. They have a tubular body with a mouth and a well developed alimentary canal, the mouth being provided with lips or hooks which are thought to provide aid in eating.

Most nematodes found in the soil are saprophytes living on decayed organic matter, or are predators preying on other nematodes, protozoa, bacteria or other such organisms. These nematodes are harmless to plants and even beneficial.

Some nematodes however are specialised for the parasitism of plants and are known to reduce crop yields. The mouthparts of parasitic nematodes are armed with a hollow, protrusible spear which can be inserted into the living tissue to suck out the cell contents. This feeding may damage cells directly by removing vital cell contents, or indirectly by stimulating cells to enlarge and become giant cells which then interfere with the translocation of water and plant nutrients.

To feed, some nematodes may enter the tissue of the plants (endoparasites), whilst others may just sting roots, parasitism being incidental

to their free existence in the soil (ectoparasites). Not all nematodes are root parasites for some attack stem, leaves and flowers of plants, and also bulbs, corms, rhizomes and tubers.

Light, sandy loams containing adequate moisture are especially suitable for nematode development, reproduction and migration. Many plant parasitic nematodes must have frequent access to a suitable living plant or they will fail to reproduce and will die. This is why plant or crop rotation can play a large part in the eradication of any specific type of nematode. In soil, nematodes are members of a complex community of living things which may be either favourable, neutral or antagonistic towards them.

A—ROOT ATTACKING NEMATODES

(a) *Root knot nematodes . . . Meloidogyne spp.*

Infestation of plants by these widely distributed nematodes gives rise to characteristic galling on the root systems ranging in appearance from discrete swellings on the lateral roots to large confluent galls on the main roots. This nematode attacks a wide range of plants, although individual species may have a restricted host range. This is why rotation of plants or crops in infested areas is important.

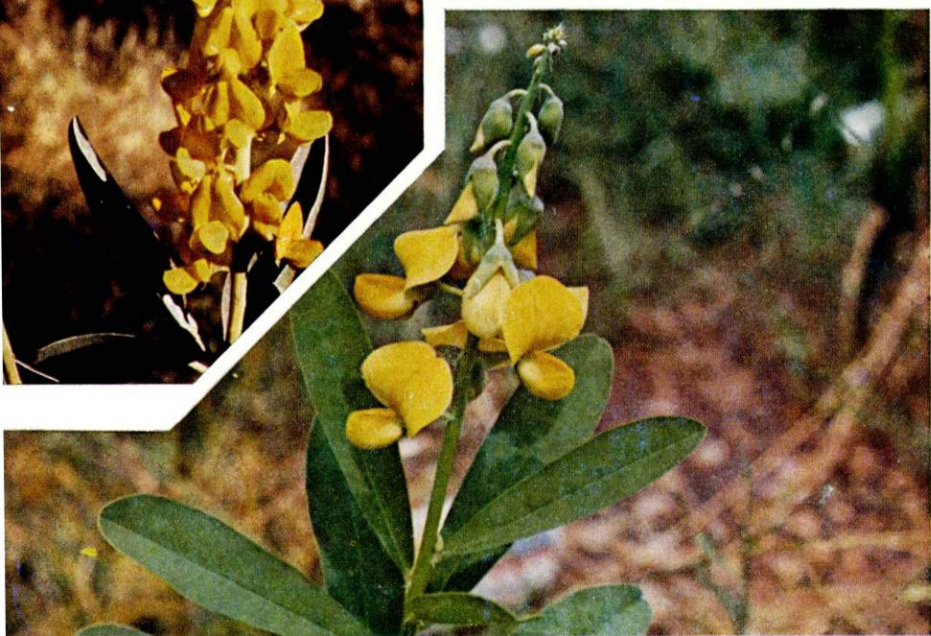
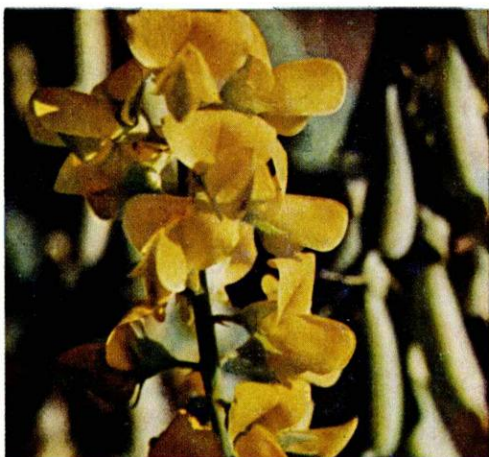
Susceptibility of a plant appears to depend on the ability of the cambium cells in the root to form giant cells when stimulated by the larvae which penetrate the root. If the larvae fail to stimulate giant cell formation or if the cells surrounding the larvae are killed, the larvae cannot be nourished by the plant and do not survive to complete their development within the plant (see personal observations later).

Control by use of a trap crop: It was found some years ago that the summer legume *Crotalaria spectabilis* could become infested with large numbers of root knot larvae but does not allow these larvae to mature. This measure of control is of practical importance because it may be possible to trap the larvae and then utilise the legume as a green manure crop.

Control by use of correct fertilizer balance: A short note on the sodium/potassium relationship as a control method for nematodes. The root of a plant is a complex arrangement of cells and tissue. There are some thick walled cells although these are not usually shown in a schematic drawing of a root. If they are fed with food in an available form with the correct NPK ratio they function as they should and it is difficult for root knot larvae to malform plant cells by their parasitic method of stimulation. They provide a degree of strength to the tissues surrounding the cambium tissue which inhibit the formation of giant cells. Incidentally these thick walled cells are not present in cambium tissue which is the vascular system in advanced plants.

One one occasion I mass planted *Myoporum parvifolium*. Soon after flowering, the plants started dying off and when these plants were lifted the lateral roots showed a heavy root knot nematode infestation and had to be burnt. A check of the rest of the garden showed large galls on nearby peach trees, a lemon tree and all the dicotyledenous weeds.

At this stage *Crotalaria* was introduced as a trap crop. Some plants removed a month later were already heavy with knot infested roots but cutting of knots with a razor blade showed the larvae to be inactive. The infestation became even heavier during the following month. At the end of the two month period the *Crotalaria* was dug in as a green manure crop which would provide nitrogen and I added a heavy dressing of a molybdenised super phosphate and blood and bone to give a 12:12 PK ratio (derived by calculation based on an analysis of the two ingredients). The soil was then watered and cultivated for a month and two samples were taken. One was put in a pot and planted with *Crotalaria* and the other I analysed using paper chromatography as determinations done on ash samples can be very misleading. There was no sign of root knot attack on the control plants and the analysis showed a 6:8:8 NPK ratio which (disregarding leaching which would have been minimal due to the very high amount of organic matter in the soil)



TOP LEFT: A flowering spike of *Crotalaria crassipes*.

TOP RIGHT: A close-up of the flowers and pods of *Crotalaria crassipes* growing on the roadside at Mudginberry.
Photo by J. Harmer

BOTTOM: *Crotalaria retusa* growing in an open area just south of Darwin.
Photo by J. Harmer

indicated that the initial high PK ratio had a positive effect on any residual nematodes in the soil. The area was then replanted with *Myoporum parvifolium* and it thrived. NOTE: The plant originally infested was used intentionally as a different plant could possibly have a greater resistance to a root knot nematode infestation.

(b) *Root Lesion Nematodes . . . Pratylenchus spp.*

Root lesion or meadow nematodes are becoming widespread in Australia and are rapidly becoming recognised as a primary cause of fibrous root destruction in cultivated crops. *P. coffeae* has been shown to be responsible for the apple replant at Stanthorpe and I have found this nematode responsible for the death of *Grevillea alpina*, *Eucalyptus obtusiflora*, *E. microcorys* and *E. globulus*.

Pratylenchus vulnus and *P. scribneri* are associated with the unthriftiness of grapes in the Murray Valley and appear responsible for their decline: I have found this infestation on several specimens of *Hardenbergia violaceae*. *P. penetrans* is almost certainly the cause of black root in strawberries, a disease most common in N.S.W. and there is good evidence to incriminate this spp. as the cause of severe root rot injury in tobacco, celery, pineapples, peaches, cherries, walnuts and several other perennials. I have found this nematode in several of the Myrtaceae.

The above-ground symptoms are variable and non-specific, generally reflecting an impaired absorbing system, but frequently the leaf symptoms resulting from root injury by this genus of nematodes resemble the symptoms produced by a deficiency of an essential element and in the past have been mistaken for it. Distinct necrotic lesions are produced on the roots by some of the *Pratylenchus* spp. whilst other spp. tend to ringbark the root causing the whole rootlet, distal to the lesion to die. Although the plant may put out new roots under conditions of heavy infestation these too will be damaged and the plant will have a very branched but restricted root system.

Root lesion nematodes do not become sedentary and with the onset of necrosis following wounding of the root the nematodes migrate from root to root, eggs are laid in the soil or on the root surfaces and because of their migratory habit a small population of *Pratylenchus* can do considerable damage to roots. As this nematode is diverse in mode of attack on plants and can usually only be detected after infestation has occurred extensively it is hard to control. At the present time the only worth while control appears to be removal of infested material and replanting with resistant or immune plants following treatment of the soil with gassing by methyl bromide.

(c) *The burrowing nematode . . . Radopholus spp.*

Only one species of this nematode appears to be parasitic and that is *R. similis* which is found world wide. Unlike the root knot nematode the roots are damaged but the actual death of the plants is caused by the entry of other pathogens via the attacked areas.

It appears there are several strains of this nematode and it is likely each strain will be specific for a particular host plant. The burrowing nematode feeds only on the soft outer tissues of roots in which it forms extensive burrows and cavities. Subsequent invasion of these lesions by fungi and bacteria leads to extensive root necrosis.

I have found *Lagunaria patersonii*, *Syncarpia glomulifera* and *Tristania conferta* (all in very damp situations, although this may not signify that these conditions are prerequisite) infested with burrowing nematodes and in all cases the following pathogen was *Armillaria melia*. I could not find information which would give control method for a drench or spray so the infestation was removed and the area covered with timber and fired. This is the control method for the tobacco nematode and it worked.

Altogether I have found 18 trees among these genera affected but none of the adjacent material infested so it must be presumed that specific strains of *R. similis* developed, as often happens with soil micro-pathogens.

These are nine different genera of root stinging nematodes and two species of cyst forming nematodes (heterodera, which are known to attack the Gramineae, Chenopodiaceae and Cruciferae), but as I have never found these associated with native plants they do not warrant discussion at this time.

CONTROL OF ROOT NEMATODES IN THE FIELD

Once established, nematodes may only be completely eliminated from the soil by steam, hot water treatment or dry heat sterilization. Thus the elimination of nematodes from the soil desirable as it may be, is clearly impracticable except for glasshouses and other very intensive small-scale enterprises.

Field control measures are therefore designed to temporarily reduce the nematode population in the soil to a level where crops or plants can be grown without serious interference from the nematodes which remain. Alternatively, selected varieties of crops or plants known to be resistant to a high nematode population without showing a significant drop in yield are grown. Field control can therefore be achieved in three ways.

(a) Soil fumigation

This involves introducing into the soil by means of a hand-operated or tractor-drawn applicator a measured amount of a liquid fumigant, or alternatively gas can be released from a cylinder under a cover placed above the soil. Fumigants are available which will kill a wide range of nematodes and which will escape from the soil quickly, leaving no residue toxic to plants.

At present the use of fumigants such as methyl bromide (kills all soil fauna), D-D, Ethylene dibromide (E.D.B.) chloropicrin (tear gas) etc., cost from \$50.00 to \$100.00/acre and thus are only economical in market gardens, home gardens, tobacco (seedling only) and a few other high value, annual crops.

(b) Crop rotation

This is the most practicable method available at present for dealing with nematode infestations. Rotation is based on the principle that *parasitic nematodes are obligate pathogens which can neither live indefinitely nor reproduce unless they have ready access to a living and suitable host plant*. If a subject is planted which is unacceptable to them, their numbers will fall and the following susceptible crop will benefit accordingly.

Insufficient research has been done in the identification of trap crops so that at present rotation is limited in scope. Grasses, cereals, velvet beans, some onions and species of *Crotalaria* are known to be unsuitable hosts for root knot nematodes, and the growing of these crops interspersed with periods of bare fallow has been shown to effectively reduce the nematode population, however, if one susceptible crop is grown the nematode population increases rapidly once more.

Home gardeners are notoriously impatient (and I guess this applies to many of our members) so they would hardly consider a bare fallow period. As far as the trap crops are concerned the *Crotalaria* is readily obtainable, fast growing from seed and very efficient. I would personally stay right away from the grasses, onions and peanuts (unless they have the conditions in which to grow them) but use any cereal as long as it is dug in before flowering. The velvet bean is also a good trap crop and being a legume supplies the soil with nitrogen fixing bacteria if dug in; however I have found it can be expensive and often in short supply.

I prefer trap cropping to Nemagon 90 because as with this method there is a visual indication of nematode entrapment and soil samples can be taken for replanting with the same trap crop to determine when the nematode population has been inactivated. The best and quickest results occur when the area is sown very heavily but it must be noted that the trap plants need heavy feeding prior to planting and during growth. A second reason why I think this is the best method is that it can be used

among nematode resistant subjects and the careless usage or over dosage of Nemagon 90 may have a deleterious and cumulative effect in the soil.

B—THE BULB NEMATODE—*Ditylenchus dipsaci*

This nematode infects the bulbs and foliage. Entry is through the neck of the bulb and causes a brown decay of the scales. If the bulb is cut transversely the characteristic brown rings can be seen and badly infested bulbs are soft and spongy.

The foliage produced by infested bulbs is twisted, distorted, often pale, with raised bumps or thickenings which are easily felt if drawn between the fingers. If bulbous plants are planted in mass the disease usually shows up in patches with a diseased bulb in the centre. If members have an infestation of the bulb nematode then it has most probably been introduced by the purchase of infested material and if the damage caused by the pathogen is very far advanced then I seriously doubt that Nemacur would be effective as unthrifty bulbs are generally open to attack by fungus and virus infections. However, if members also grow their own vegetables and they have peas among them, then they may have unwittingly introduced this nematode for the reason below.

C—THE STEM NEMATODE—*Ditylenchus dipsaci*

The same nematode which attacks bulbs will also attack the stems of some plants such as lucerne, beans and peas. I have found members of Mimosaceae and Caesalpiniaceae infested by this nematode. Infested shoots become swollen and distorted causing clustering of leaves towards the end of the stem, diseased plants are typically dwarfed and distorted. The infestation usually occurs in patches and severely affected plants die.

The danger emerges from the fact that the nematodes spread mainly by:

- (a) escaping from diseased plants into the soil infesting new plants,
- (b) remaining in a quiescent state within dead plant fragments in which they may be transported by shoes, tools, wheel-barrow or other forms of handling etc., resulting in infestation of previously nematode-free soil.
- (c) by hand harvesting of seed from diseased plants which may contain large numbers of nematodes adhering to the seed coat or pod and the situation mentioned above could still arise.

D—THE LEAF NEMATODES

The leaf attacking nematodes belong to the genus *Aphelenchoides* and the main species are:

- (1) *A. ritzema-bosi*—this is mainly recognised as the nematode leaf disease of chrysanthemums, but all members of the Compositae are susceptible to attack from this nematode (including "Australian Plants").
- (2) *A. fragariae* (the strawberry genus)—this genus attacks many exotics but as far as we are concerned this is the nematode responsible for disease of ferns and *Anigozanthos* spp.

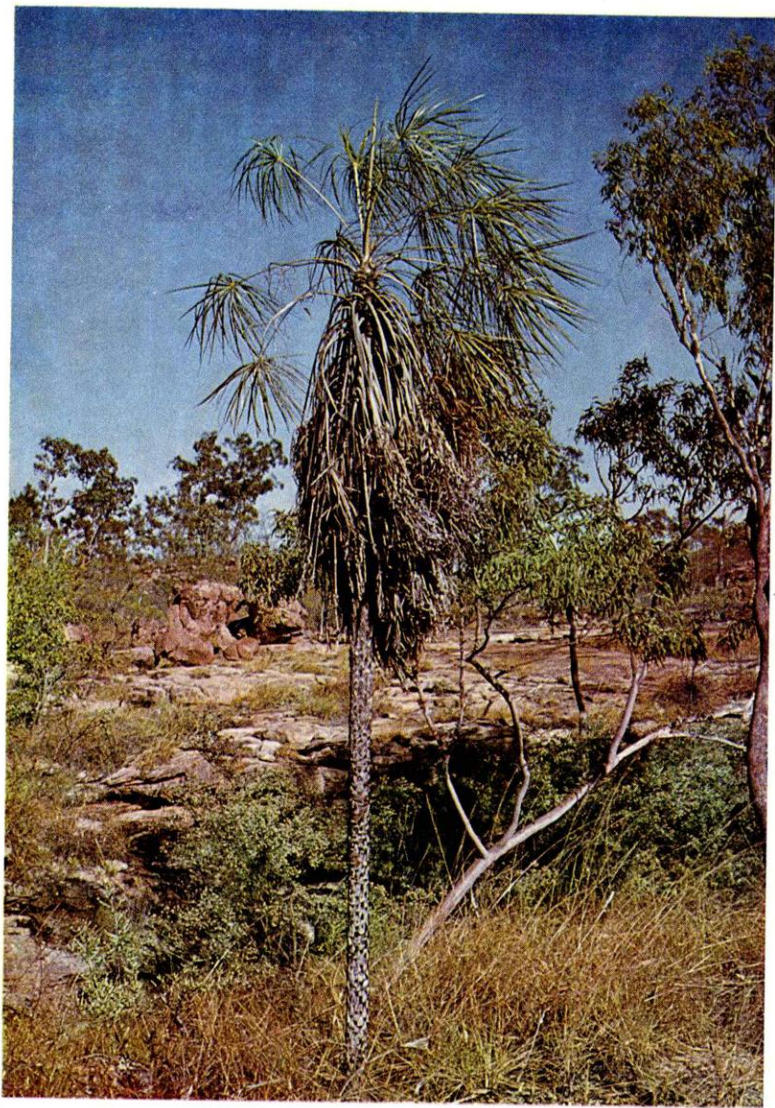
These nematodes move from the soil to the leaves either by water splash or by migration up the stems. In *Anigozanthos* there is a strong tendency for the lesions caused by the leaf nematodes to be triangular, being bordered on both sides by the main veins. The lesions are usually dark brown and finally black.

In ferns such as *Asplenium*, *Adiantum* and *Pteris*, the main symptom is patchy discolouration of the fronds. Affected areas may be small and angular bounded by veins, or whole leaflets or sections or fronds may be involved, and in extreme cases all fronds die prematurely. This has the effect of reducing the vigour of the whole plant. The disease is most severe during the cooler months of the year and the periods of rain facilitate the spread of the nematodes. During the summer, affected plants usually remain fairly free of symptoms.

Control: Infested plants should be sprayed with fenthion (Lebaycid (R)), Baytex (R) at the rate of 1 oz. of 55% emulsion in 4 gallons of water.

NORTH AUSTRALIAN PLANTS

By Jenny Harmer



The comparatively fine-leaved palm, *Livistona loriphylla*, growing on a sandstone slope in the Katherine area. Photo by G. Chippendale

Livistona loriphylla

loriphylla—from Latin *lorum*, a thong or lash and Greek *phyllum*, a leaf—a reference to the shape of the leaves.

HABITAT: Sandstone hills and escarpments.

Description: A slender tree to 5 metres high. The leaf stalks are flattened on one side, rounded on the other and have a fibrous sheath at the base. The leaf blades are fan-shaped and deeply divided almost to the base, into pointed segments about 60cm long. The flowering spikes, 15-25 cm long, contain many minute yellow flowers. The fruit is black, hard, oval and 1-1.5cm long.

Distribution: Kimberleys, W.A.; Victoria River District, Darwin to Katherine area, Arnhem Land, N.T.

Cultivation: A delicately attractive palm suitable for cultivation. It should grow from seed treated as for *L. humilis*.

BOOKS ON WILDFLOWERS

The picture on the previous page is one that was prepared for our new book "North Australian Plants — Part 1 — Top End Wildflowers" but had to be left out due to space limitations. The text below it is part of the text prepared also.

Much could be said about the courage of Jenny Harmer to undertake a book on such a little-known and new field. The book has been prepared with a competence and feeling for our Flora that a reader must sense. The acknowledgement of the work done in her own time by her employer, Department of Northern Territory, Animal Industry and Agriculture Branch, Botany Section, will be appreciated by all who have thirsted for information on our Northern wildflowers. It is as accurate as a competent, thorough botanist can make it within the limits of present day knowledge and records. As this periodical is produced quarterly to support our other publications we have the advantage of being able to update all information published and as Northern development and discovery progresses this will no doubt be necessary. Part 2 will not be to hand for another 4 years yet so await announcement of this and other books in this series of books on wildflowers of specific areas of Australia. Price \$4.50 plus 50c postage.

ORNAMENTAL CONIFERS by C. R. Harrison

Price \$18.95 plus \$1.05 postage

This outstanding book describes and illustrates in colour 550 of the world's most attractive ornamental conifers. Australia does not have many conifers but our few species that have horticultural appeal are described and illustrated. As the title implies the work is confined to ornamental conifers and what a fine pictorial presentation it is. All species are given a hardness value relating to their growth rates in various climates which in this case can be equated to the temperature range in which they can be grown for best results.

WHAT WILDFLOWER IS THAT by A. M. Blombery — Price \$6.95, 85 cents postage.

Because of exceptional demand this book so'd out before I could review it for readers. Further supplies are now available and the book may be ordered by mail from the Editor. The book is excellent value being 304 pages, 27 cm x 20 cm with 760 full colour plates illustrating over 700 species of wildflowers. The intent of the book is to illustrate as large a range of species as possible so that the non-botanically competent need not try to dissect flowers and decipher botanical jargon, but simply leaf through the book until they come to a colour photograph that resembles the plant they wish identified. The photographs are arranged alphabetically in order of the generic name and the range of genera is very wide indeed.

I consider a major feature of the book is in the introduction where the author has divided the natural habitats of plant life throughout Australia into 46 categories and there is a full colour plate of each, 46 scenes of our Australian landscape. We could adopt these categories for our future recordings of distribution of species.

GROWING MORE AUSTRALIAN NATIVE PLANTS by F. J. C. Rogers — Price \$5.95, 65c postage.

Fred Rogers will be well known to many for his enormous work for the Society. Possibly more widely known is his first book "Growing Australian Native Plants", still available at a cost of \$5.95, 65c postage. In the new book many hardy Australian wildflowers are described with recommendations for their cultivation in the garden. Of special interest are the chapters entitled Ferns, Aquatic Plants—Making a Pond, and Rockery Plants. This 80 page 28 cm x 21 cm book illustrated in beautiful colour is good value.

LANDSCAPING WITH AUSTRALIAN PLANTS by G. Wilson — Price \$6.50, 70c postage.

A well prepared 90 page 28cm x 21cm book by a professional landscaper with obvious experience in the proper use of Australian wildflowers in a garden setting. This very difficult subject is carefully presented in chapters entitled — 1. Basic Design, considering such aspects as maintenance, spacing and grouping of trees; 2. Plants in the Landscape, shading, screening, shape and profile, spacing, leaf shapes and their blending, boundary planting, etc.; 3. Landscapes in the Australian Character; 4. Water in the Native Landscape; 5. Sculpture; 6. Construction Materials; 7. Farm Landscaping; 8. Guiding the Native Landscape; to Maturity; 9. Some Technical Points. Unfortunately the illustrations overemphasise the large garden and the use of space but the treatment is pertinent to all gardens.

USEFUL NATIVE PLANTS OF AUSTRALIA by J. H. Maiden — Price \$9.90, 90c postage.

A reprint of the original book first published in 1889. 696 pages, 13 cm x 21 cm — a very faithful reproduction of the text covering such subjects as food plants, perfumes, dyes and resins etc. There has been no effort to bring the book up to date and many species' names must be considered as doubtful. Readers are also warned to be wary of plants recommended as being edible as more recent researches have not been considered.

PAST ISSUES OF "AUSTRALIAN PLANTS" AVAILABLE

Because of the vast wealth of our flora there is very little repetition.
 VOLUME No. 1 Issues 1-12 — to be reprinted in 1977. Watch for announcements.
 VOLUME No. 2 Issues 13-20, all available only fully bound at \$8.00 plus 80c postage, including "A Descriptive Catalogue of Western Australian Plants".
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 VOLUME No. 6, Issues 45-52, all available only fully bound at \$8.00 plus 80c postage, including "Western Australian Plants for Horticulture—Part II" valued at \$4.50.
 VOLUME No. 7, Issues 53-60, all available only fully bound at \$8.00 plus 80c postage, including "North Australian Plants" valued at \$4.50. Available Nov. 1975.
 "Australian Plants" is produced as a continuing series each issue adding to the information recorded over the past issues. The most valuable and complete reference.

OTHER BOOKS OF THE SOCIETY

West Australian Plants for Horticulture. Parts 1 & 2 each available at \$4.50 plus 40c postage from the Editor. On the right-hand pages of these books there is a full colour plate of a W.A. wildflower and on the page opposite is a description of this plant together with another plant or plants from the same genus. The descriptions are clear and in simple terms with a special section on propagation and horticulture treatment and potential. Part 2 recently published carries 42 colour plates never before presented—excellent value.

West Australian Plants—A Descriptive Catalogue (2nd Edition)

This is the only complete reference to the flora of Western Australia. Thousands of species are listed and many shown in full colour. Against each species is recorded the height of the plant, the flower colour, the period of flowering and the native locality. Available from the Editor for \$4.50 plus 40c postage.

NORTH AUSTRALIAN PLANTS — 1 by Jenny Harmer. Price \$4.50 plus 50c post.

This is the first book giving a reasonable coverage to the flora in the North of Australia and will be an authoritative reference to it. There is a reference to 380 species. While this is a lot of flowering plants it is still a long way short of the Northern Australian Flora. As such it is Part 1 of a series and describes those plants of horticultural interest that are to be found in the Darwin area and Arnhem Land, known locally as the "top-end" of the territory.

This book will be of interest to all. On each right hand page is a large full colour plate of a wildflower usually showing the tree or shrub, and a detail of the flower. Opposite is a reference to the plant family in which it belongs together with other genera in the same family that occur in the area, a description of the genus together with all other species of the same genus occurring in the area followed by a clear description of the plant pictured, its distribution and economic value. Of special interest, on each page there is a separate paragraph on Cultivation.

THE SOCIETY FOR GROWING AUSTRALIAN PLANTS

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Shrubs for Home Shelter and Bird Attraction



MELALEUCA SQUARROSA

A handsome erect shrub, dense, 2-3 metres but often to 6 metres high. As mentioned on page 151, this plant has proved especially suitable in waterlogged heavy soils for a shade or screen plant.