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Photography by A. S. George

BANKSIA LEHMANNIANA

This species from Western Australia is a large bushy shrub, often with an open upright habit. Flowers are yellow or yellow-green in colour and are 10-16 cm long.

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GROWING WILDFLOWERS

"The growing of wildflowers is easy in good garden conditions if you select suitable species". This is the theme of the last two issues and we shall attempt to continue on from here. The plants recommended in this issue are *Banksia*. Provided you stick to growing eastern species in the east, and western species in the west, and follow the recommendations to date, you should be quite successful. Why should we have this restriction? We have all seen colour photographs of the magnificent *Banksias* from the west and we would love to grow them in the eastern States.

We suspect a major factor is below ground conditions. This aspect has not been presented adequately before and will be the major concern of the following issues. To really stir up comment and I hope thought, see the articles on pages 109, 114 and 115.

The series on simple propagation is continued on page 122.

Gardening in Limestone Areas will be of special interest — page 119.

For the beginner I suggest you read "Proteaceae . . ." — page 116.

Readers will also note further changes in presentation. — Editor.

THE SOCIETY FOR GROWING AUSTRALIAN PLANTS

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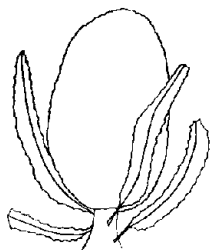
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Banksias

PROPAGATION AND CULTURE

by F. D. Hockings

There are over 60 species of *Banksia* all of which are endemic in Australia with the exception of *Banksia dentata* of northern Australia which extends to Papua. A review of the genus to be published in 1978 will extend this to 80 species so I will not dwell on the classification of the species. *Banksia* reaches its greatest development in Western Australia with about two-thirds of the species. There are 10 to 12 species in Queensland.

The name *Banksia* perpetuates the name of Sir Joseph Banks who collected the first specimens of *B. serrata* and *B. ericifolia* at Botany Bay in 1770. The accepted vernacular name for banksias seems to be Australian Honeysuckle. The flowers are rich in nectar but the honey that bees make from it is usually dark and strongly flavoured and of little value. However, the pollen is quite important for bees in some districts. The Aborigines of Botany Bay apparently soaked the large flower heads of *B. serrata* in water to make a slightly sugary drink which they called Beal. A major reason for its cultivation in gardens is the number of birds it attracts.

The Banksias are woody xerophytic trees or shrubs; xerophytic, of course, means they are adapted to dry conditions. Some of the shrubby species have peculiar forms of growth, for instance, there is a small group with prostrate branches either at or just below the surface of the soil. The xerophytic characters can be seen in the hard leathery leaves and the peculiar woody fruits. Many species also develop a lignotuber, this is a swollen woody crown just below ground level and it is an adaptation for survival of fire.

FLOWERS, SEEDS AND LEAVES

The flowers of Banksias are formed into rigid, dense and usually showy heads which are characteristically held more or less perpendicularly and either pointing upwards or downwards. One species has its flowers in depressed heads like a *Dryandra* but the others have cylindrical, oblong or globular heads. A Banksia "flower" is really composed of a great many individual small flowers, perhaps over 1000 in some species, arranged on a stiff central stem that becomes very woody as the follicles enclosing the seeds develop. These follicles are very hard and woody. With some species the follicles are very large and only a few develop on each head; with other species the follicles are smaller and so many develop that the fruit looks like a cob of corn with the follicles as the grains.

With most species, the winged seeds take 12 months or more to develop, and then they remain enclosed and protected within the follicles, perhaps for many years, finally to be released after a bushfire or a severe drought. A few species such as *B. integrifolia* and *B. menziesii* release their seeds more quickly and spontaneously when it is ripe.

Banksia leaves are usually arranged alternately on the stems but a few species such as the eastern *B. integrifolia* have the leaves arranged verticillately, which of course, means in whorls. The leaves of some species are quite remarkable in shape, perhaps divided to the midrib into triangles or squares or finely divided like a feather.



Photography by F. W. Humphreys.

BANKSIA PRIONOTES

An upright tree 6-10 m high. Widely distributed species in Western Australia.



Photography by F. W. Humphreys.

BANKSIA BAXTERII

An erect shrub up to 3 m high, native to Western Australia.



Photography by Hugh Stacy.

BANKSIA SPINULOSA

This species grows along the East Coast of Australia and is rarely more than a small or medium sized shrub.

Many of the tree species have a picturesque irregular stout trunk with gnarled rough bark. The characteristic conspicuous fruit are a feature of all species. The large shaggy fruit of *B. serrata* which bear few but prominent large woody follicles protruding through the dried flowers, were featured by May Gibbs as "the big bad banksia men" in her series of delightful children's books.

The swampy coastal strip of Queensland generally referred to as the Wallum, takes its name from the Aboriginal name for *Banksia aemula* which is or was common in this class of country. Incidentally, *B. aemula* does not grow in the swampy parts, it is quite susceptible to root rot and it actually grows on the sandy rises in the wallum country.

SOIL

In general Banksias require an acid soil and very good drainage. They are nearly all very susceptible to root and crown rots such as that caused by *Phytophthora cinnamomi*. The Western Australian species are particularly susceptible and this is the reason we see very few in gardens in Coastal Queensland. The problem is particularly bad in soils that have an impervious layer or bottom within a foot or three of the surface.

As with other members of the Proteaceae family, banksias apparently can obtain their requirements of phosphorus from the soil in which this chemical occurs in very low concentrations. Even moderate amounts such as may be applied in mixed complete fertilizers or blood and bone, can be too much for many species and may cause yellow leaves and cessation of growth. More concentrated phosphatic fertilizers such as Magamp and superphosphate cause intense yellow leaves, scorched tips, dieback and death of the plant. Regular light applications of a nitrogenous fertilizer such as Sulphate of Ammonia or Urea will help slightly to overcome the effects of phosphorus.

To generalise, a soil pH reaction much above 6.5, such as could be caused by the presence of an appreciable amount of calcium (Lime, Dolomite, cement, superphosphate) could cause yellow leaves and tips on many species of banksia. The severity of the symptoms (calcium induced iron deficiency) increases as the pH rises even higher. As will be seen from another article in this issue, particularly for some western banksias, the effect of high pH can be overcome by application of Iron Chelate which is a very soluble form of iron. This is watered into the soil around the plants. It is also advisable to apply some material to lower the pH reaction. At reactions up to about pH 7.0 it may be sufficient merely to apply several small amounts of Sulphate of Ammonia about four weeks apart. At reactions above pH 7.0 one or more applications of sulphur will probably be required.

For the above purposes Sulphate of Ammonia and Iron Chelate can be applied together by adding one or two heaped teaspoons of each to a bucket of water per plant. This treatment can be repeated if necessary several times at about four weeks apart. If sulphur is to be used the best form is Wettable Sulphur (Colloidal or Microtomic Sulphur). It should be sprinkled evenly around a plant at the rate of about 1 ounce per square yard. Application of sulphur should not be repeated sooner than 3 to 4 months and then only if indicated by a pH test.

A few of the Western Australian species are probably tolerant of lime but one should not lose sight of the fact that an acid soil rich in humus can form close beside or in a layer on top of limestone.

As the occurrence and incidence of lime has received such importance in other articles in this issue, it would be appropriate to record here results of pH tests I carried out on the roadside soil using a C.S.I.R.O. soil pH Test Kit. I was hampered by lack of time in making more tests and in identifying species. The accuracy of the tests could have been affected by alkaline water for working the equipment. My rough field notes could be summarised as:

	pH.
South of Jurien Bay on Cervantes Road — No <i>Proteaceae</i> present — Limestone pillars evident.	9.0
Cervantes Road — <i>Pimelea ferruginea</i> — white sand with limestone pieces	9.0
Near Cervantes — No <i>Proteaceae</i> — <i>Pimelea</i> , <i>Scaevola</i> — yellowed sand and limestone.	8.5 to 9.0
Top of last ridge before Jurien Bay — last <i>Banksia</i> and <i>Conospermum</i> on fringe of change in vegetation — adjacent to limestone.	7.0
Close by above — group of <i>Banksia</i>	6.5
Quarry just out of Jurien Bay — Western slope of first ridge from surface Jurien Bay. No <i>Proteaceae</i> , very few <i>Myrtaceae</i>	5 ft. 8.5 8 ft. 8.5
<i>Banksia</i> patch ½ mile east of quarry	6.0 to 6.5
Geraldton Wax patch (5 plants) close by above — pieces of limestone.	8.5
Geraldton Wax patch nearby.	8.0 to 8.5
<i>Banksia</i> — 8 to 10 feet away	8.5
<i>Banksia</i> patch close by.	5.8 to 6.0
Geraldton Wax — odd plants a little further out.	6.0
Geraldton Wax and <i>Banksia</i> .	6.5

The limit of *Proteaceae* and occurrence of limestone was most striking around Jurien Bay — Cervantes and Cape Lewin and Hamelin Bay. There was an entirely different flora on the limestone and I haven't made sufficient effort to identify plants but they included *Templetonia retusa*, *Mezaleuca huegellii*, *Mezaleuca densa*, *Pimelea ferruginea*, a tall *Scaevola*, *Acacia pulchella*, a *Diploleonea* sp., *Anthocerus littoralis*, an *Exocarpus*?, *Leucopogon*?, a *Dryandra* (possibly *D. sessilis*) showed a tendency to encroach on limestone in many places, but I omitted to test soil around roots.

SEEDS AND SEEDLINGS

In general *Banksia* are not long lived plants or certainly not the above ground portions. Like many other Australian native plants they have evolved to fill a niche between bushfires. Many of the species develop a lignotuber which survives fires that burn the above ground portions and strong healthy growth is produced from the lignotuber following fire.

Periodic fire is very important for the banksias because it is necessary for the fruit to be scorched or even charred before the follicles open up to release the winged seeds. Fire also plays a very important part in preparation of a seed bed so the seed can germinate and the seedlings become established. *Banksia* seedlings are very susceptible to damping off fungi which are common amongst rotting vegetable matter and probably fire plays an essential part in partially sterilising the surface of the soil and reducing the effect of these fungi.

Now and again we see advocated the adding of rotting leaves, etc. to potting mix so as to introduce the beneficial mycorrhizal fungus that lives in association with the roots of healthy *Banksias*. This is a rather dangerous practice because of the ease with which damping off fungus could be introduced. I don't believe it is necessary to worry about this mycorrhizia because it always shows up at a very early stage on seedlings I raise. Possibly it is carried on or in the seed.

Incidentally periodic fires also clean up the borers, scale insects and other pests that attack native plants.

Often would-be growers of *Banksias* collect the fruit and then can't get the seeds out for planting. The easiest method is to barbecue the fruit over an open flame. A burner on a gas stove is excellent if your cook is not looking. If the fruit is of one of the species that retains dead flowers over the follicles, it will smoke a bit and drop ash. The follicles crack open almost immediately and in about half an hour or if left until the next day, the seeds can be shaken out.

There is little danger of an open flame harming the seeds. Baking in an oven is often advocated and apparently is used successfully but long exposure to penetrating heat would be much more liable to damage the seed.

In each follicle there are two seeds, each with a papery wing. Often only one of these seeds develops properly. The seeds are separated by a thicker, hard separator and on a number of occasions I have had a packet of separators sent me, the more fragile seeds having been thrown out with the rubbish.

Continued on page 101



Photography by J. Glass.

DRYANDRA FRASERI

A highly ornamental small shrub which has yellow flowers, sometimes tinged with mauve. It has attractive glaucous fern-like foliage and can be used as a ground cover, growing to about 1.2 x 1.2 m.



Photography by J. Glass.

DRYANDRA CIRSIOIDES

An upright slightly spreading shrub which grows to about 1.5 m high, in a well-drained position. The dark, rigid prickly foliage is offset by the bright yellow terminal flowers. Native to Western Australia.



Photography by R. W. Burbury.

DRYANDRA SPECIOSA

Found in gravel and sandy heath 150-250 km east and north of Perth, Western Australia. It is a dense, much-branched shrub, from under 1 m to 3 m in the wild. The flower heads hang and are protected by long wispy-haired bracts.

The inflorescence illustrated is still in bud, the flowers turning dark red as they mature. The bracts eventually open out like a sunflower, excellent for dried art work. Almost unknown in cultivation (notes by B. Lamont).

GROWING DRYANDRA?

Please forward reports of your experiences with the cultivation of *Dryandra*. Treatment is generally the same as for western *Banksia*. See page 107.

BANKSIAS — Propagation and Culture—cont'd from p. 99

SEED RAISING

Banksia seed, once it is extracted, will germinate quite quickly and easily without any treatment such as by hot water or filing. However it is very susceptible to fungal attack unless some simple principles of hygiene are followed. Commercially available, sterilised seed raising mixes are useful provided they do not contain too much fertilizer. Alternately, clean washed sharp river sand or a mixture of sand and peat moss is suitable. As an extra precaution, pots or containers in which seeds are planted should be kept up off the ground and out of reach of fungus carrying splash from the soil.

I prefer to plant the large types of banksia seeds such as those of *Banksia aemula* and *B. serrata* individually in 3 inch tubes or similar sized containers of sand / peat mix so that the young plants don't have to be handled or transplanted. I usually tear off the wing and poke the sharp end of the seed into the surface of the potting mix so that the seed is flush with the surface.

A number of seeds of the smaller seed species such as *B. collina* and *B. robur* can be planted together in a 4 or 5 inch pot of clean washed sharp river sand. If there is any doubt about the cleanness of the sand it can be sterilised by running hot water through it for a few minutes and allowing it to cool before planting.

I plant the seeds by removing some or most of the separators, then rubbing the seeds gently between my hand to remove most of the wings. I then sprinkle the seeds on the surface of the sand and stir them into the top ¼ or ½ inch of sand with a biro, tamp the surface down and then stand the pot in a saucer of water, about one inch deep.

Banksia seeds usually germinate in 1 or 2 weeks.

When the seedlings have at least 2 or 3 true leaves they can easily be transplanted singly from the sand filled seed raising pot, to containers of sand/peat mix.

CUTTINGS

Banksias can be raised from cuttings but there are some problems such as a tendency for cuttings to over-callus. Quite often cuttings will develop a large knob of callus ¾" or more in diameter and will remain dormant for about 12 months without growing roots.

There are also instances where plants grown from the lower sprawling branches of *B. collina* have continued to be sprawling and lacked any tendency to erect growth.

Tip cuttings or small heel cuttings 2 to 4 inches long appear to be the most satisfactory. *Banksia meisneri*, a low growing, fine leaved species from W.A. is the one I have had most success with in the past.

The following quote on banksia cuttings, taken from The Illustrated Dictionary of Gardening, published in 1885, gives advice we could very well follow and which could give us better results. "Banksia — cuttings are generally supposed to be difficult to root but this is not the case if properly managed. Let them be well ripened before they are taken off; then cut them at a joint and place them in pots of sand, without shortening any of the leaves, except on the part that is planted in the sand where they should be taken off quite close. The less depth they are planted in the pots the better so long as they stand firm when the sand is well closed around them. Place them under hand glasses in the propagation house but do not plunge them in heat. Take the glasses off frequently to give them air and dry them or they will probably damp off. When rooted transfer to small pots".

GRAFTING AND BUDDING

Grafting and budding offer a solution to the root rot problem to which many banksias, particularly the W.A. species are susceptible here. In theory at least, you should choose as a root stock a species (if one exists) that is resistant to the disease and you graft or bud the susceptible species onto the upper portion.

BANKSIA FOR COASTAL QUEENSLAND GARDENS

Banksia robur is probably the hardiest of the banksias. It occurs in the coastal wallum swamps but is able to grow in either very wet or over-drained positions. For instance, it has grown well in the past at Myall Park, Glenmorgan. This large leaved species has flowers that progress in colour

from an intense blue-green to cream then brown. In cultivation, *B. robur* varies from a 4 to 6 foot shrub with several erect stems to a more spreading shrub perhaps 8 ft across.

B. oblongifolia is another hardy south Queensland species from poorly drained soil. It has attractive creamy yellow flowers. Plants are usually 2 to 3 ft in height and somewhat sprawling or sometimes more upright to about 6 or 7 feet.

B. integrifolia is a very variable species that occurs in a variety of situations from the frontal dune at the seaside to mountain tops of the ranges and the sands of the Granite Belt and Condamine River near Cecil Plains. Some forms are very hardy. It varies from forms with short wide leaves, to those with long narrow leaves and from small shrubby trees to tall trees with up to 3 foot trunk diameter. Flowers vary from greenish cream to creamy yellow.

B. collina is also a very variable species both in leaf size and shape and in flower colour. Leaves can be about $\frac{1}{2}$ inch wide or very narrow. Flowers vary from lemon yellow to rich orange and with styles from yellow to orange to maroon red to jet black. Some forms of *B. collina* are very hardy in our coastal gardens. It occurs naturally in various areas in and around Brisbane and a magnificent stand is in the process of being demolished for housing in the Chermiside Hills between Hamilton Road and Rode Road. It is one of the plants that qualifies better than *Grevillea banksii* as a floral emblem. *B. collina* is as showy as any of the W.A. banksias and is relatively easy to grow. We should make a lot more of it than we do.

B. spinulosa is fairly similar to *B. collina* and the two have been confused. Its leaves are always very narrow and it seems to occur only on sandstone. It probably needs a better drained soil than does *B. collina*.

B. aemula grows into magnificent gnarled specimen trees in the wild but is rather touchy in cultivation. It requires good drainage.

B. serrata is very similar to *B. aemula* but appears to be much more dependable in cultivation. There are shrubs of about 18 years of age existing in Brisbane gardens.

B. sp Glasshouse Mts. This unnamed species is being grown in a few gardens in Brisbane and appears to be quite hardy. One plant has been thriving in a Toowoomba garden since the early 1960's.

B. ericifolia doesn't extend any further north than Byron Bay in northern New South Wales. It is quite a common garden plant here and is fairly hardy. In some situations it grows to a huge size and flowers poorly; in others it flowers at 3 or 4 feet.

B. marginata is another species from N.S.W., Victoria, Tasmania and probably S.A. that is occasionally grown here. Some plants thrive. It has small yellow flowerheads.

OTHER EASTERN BANKSIA — Notes by Hugh Stacy

Banksia robur features huge toothed leaves and soft red velvet new shoots; southern forms seem to succumb over dry winter conditions. Suitable for wet areas with poor drainage.

Banksia aspleniifolia (referred to above as *B. oblongifolia*) is also suitable for wet areas. The foliage is russet brown to a height of 1.5 m; the yellow flower spikes appear in March-April. This shrub is also suitable for loams or sand and will tolerate short dry periods.

Banksia paludosa requires sub-soil moisture, so plant in damp places with good drainage and full to half sun. It needs some protection. The same conditions are necessary for *B. canei* that I describe over the page.



Photography by Hugh Stacy.

Banksia canel (above) occurs in a few scattered communities in the eastern highlands of southern N.S.W. and northern Victoria. Bushes are generally less than 2 m high. Winter conditions are usually wet or cold, while in summer the area could be wet or dry. Flower spikes are yellow, 13 cm long, their width about half their length. Flower parts soon fall from the seed cones, which are always clean. Mature leaves are up to 55 mm x 14 mm, nearly spatulate, always mucronate to a pungent tip with edges recurved, dark green and shiny above, pale below. The above photographs of *B. canel* are from Wadbilliga Mountain, N.S.W.

BANKSIA IN SYDNEY GARDENS — *By Hugh Stacy*

Some eastern banksias can be grown in nearly every native garden in Sydney. However, plants must be selected according to conditions available to minimise disappointment.

All banksias love the sun, but are sensitive to drying out, especially in the early stages. By mulching to within 5 cm of the stem in late autumn some protection will be given and root development will be encouraged while ground temperatures are still moderate.

Natural and inorganic slow-release fertilisers are the only suitable fertilisers to use. Superphosphate must be avoided.



Photography by C. H. Shipway.

BANKSIA COLLINA

Bushy shrub 2-4 m high. Found along the East Coast of Australia. Closely related to *Banksia spinulosa*.

BANKSIA STUDIES

A very active study group on the genus *Banksia* is led by Trevor Blake, 12 Little John Crescent, Vermont, Victoria, 3133. The reports on the activities by this Group will be of wide interest. You may obtain the report from Trevor by mail. Each report will cost \$1.00 plus postage (1 Report 20c; 2 Reports 40c; 3 and 4 Reports 60c).

Report No. 3 — 1973

Eastern *Banksia* species — A key, full descriptions of each species, illustrated by full size sketches of the leaf and its various forms with distribution maps of where they occur. Other articles on these species include field reports, notes on cultivation and germination.

Frost tolerance of *Banksia* species — A very good report.

Tolerance to salt laden winds — A very good report on most species.

Seed germination — methods, time to germinate, report on results.

Grafting techniques described with results — A method of producing hardier plants by grafting western species onto root stock of hardy eastern species.

Where the Western Australian species grow with indications of habitat.

Report No. 4 — 1974

Cultivation requirements for Eastern *Banksia* species in various States based on reports by members of this group.

Identification of *Banksia* species at the seedling stage.

Germination of seed — Reports on trials by members.

Grafted *Banksia* — a further report on trials.

Phytophthora cinnamom — A report on this deadly fungus.

Cultivation of *Banksia* — Further reports.

"Australian Plants" — *Banksia* Reports

As with all our study groups it is proposed to publish a summary of the work of the *Banksia* Group in future issues. We would never have the space to supply notes of all members in the group as contained in their Study Reports so they are well worth obtaining. They take the form of duplicated foolscap sheets usually about 30 pages per report.

Following the publication of a complete revision of the Genus in the next year, we will include much more descriptive articles on the magnificent *Banksia* in future issues.

STUDY GROUPS

ACACIA — Leader: Mr. John Arnold, P.O. Box 89, Armidale 2350, N.S.W.

BANKSIA — Leader: Mr. Trevor Blake, 12 Little John Court, Vermont 3133, Victoria.

BEAUFORTIA — Leader: Mr. Brian Walters, 19 Hurley Street, Toongabbie 2146, N.S.W.

CALLISTEMON — Leader: Mr. Bill Tongue, University Farms, Private Bag, Camden 2570, N.S.W.

CALYTRIX — Leader: Mrs. Joan Doney, 64 Cary Street, Wyoming 2251, N.S.W.

DRYANDRA — Leader: Mr. Tony Cavanagh, 2 Wilkinson Street, Ocean Grove 3226, Victoria.

EREMAEA — Leader: Mrs. Lyn Parry, "Floralands", Karlong 2251, N.S.W.

EREMOPHILA — Leader: Mr. G. Needham, 2 Stuckey Ave., Underdale 5032, S.A.

EUCALYPTUS — Leader: Mr. L. J. Daniels, Research Station, P.O. Box 201, Biloela 4715, Qld.

FERN — Leader: Mr. Steven Clemesha, c/o Post Office, Moonee Beach 2450, N.S.W.

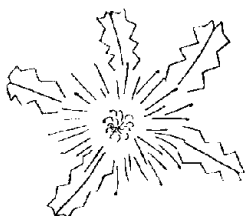
MELALEUCA — Leader: Mr. Ralph Campbell, 58 Lee-Steere Crescent, Kambah, A.C.T. 2902.

RUTACEAE — Leader: Dr. Mervyn L. Turner, 14 Rose Avenue, Boronia, Victoria 3155.

Study groups comprise a number of members, usually without any prior experience, who undertake to grow plants in their gardens and report results. They usually operate by mail through a leader, who supplies seed, advice and, in some cases, plants. The objective is to grow and develop better forms of species, or to determine the best growing conditions of species already available.

To become a member send \$1.00, with a stamped, addressed envelope, to one of the leaders above. No more members for the fern group at present.

We need a study group leader for *Grevillea*. Who will help us get it started?



Banksia and Dryandra

Cultivation In Western Australian Gardens

by C. A. Oxnam

The growing of plants of *Banksia* and *Dryandra* from seed by sowing straight into the garden as described in my article in 1971 (Australian Plants No. 46, page 73) is still recommended where the garden is of well drained sand. I have not done this for some time as I do not have any more space for large shrubs.

At that time no one, not even the nurseries, seemed to have any luck with growing any seedlings in pots because of the damping off. It seemed to be a few years later, when "Osmocote" came on the market here, that nurseries first had stocks of well established plants of *Proteaceae* in pots. We home growers started to try again and have met with success using the following method:

We use a coarse mixture in the pots comprising clean coarse river sand, bush sand and German Peat in the proportion of 3:2:1. A mixture of 3 parts perlite to one part peat, also gives good results.

As soon as the two leaves appear we feed with "Osmocote".

Planting time for the seed is about May when the winter rains have become established. At this time and until about September we can let nature do most of the watering. Of course we have to make sure the pots do not dry out before germination takes place. We mostly plant a seed per pot, using the 8 cm square pots to avoid having to prick out.

BANKSIA

As these plants were described in my article in No. 46 issue I will confine this report to results.

I have found *Banksia burdettii* much the hardest *Banksia*. Two bushes each about 8 years old produce masses of flowers each January. I have two fine plants of *B. prionotes* left, losing a large one recently. Two plants of *B. grandis* have died after 12 years so I suppose I cannot complain. Others I have lost after reasonable success are *B. victoriae* and *B. hookerana*. Plants of *B. media* are still growing although not flowering as well as at first. *B. occidentalis*, looks healthy, but has not flowered although at least 10 years old. Some of the southern plants are most obstinate here in Perth. My plant of *Banksia coccinea* is eight years old, doing well, but still no flowers. I still have flowering specimens of *B. pilostylis*, *B. dryandroides*, *B. speciosa*, *B. prostrata* (from Lake King), *B. ashbyi*, *B. baxteri* and *B. praemorsa*.

DRYANDRA

The most successful plant I have had of *Dryandra* is *D. praemorsa*, *D. polycephala* is treasured though I keep losing them. I still have one large plant that flowers well, but does not seed. *D. nana* and *D. tridentata* do well. I lost a beautiful plant of *D. formosa* and have never been able to get another one going.

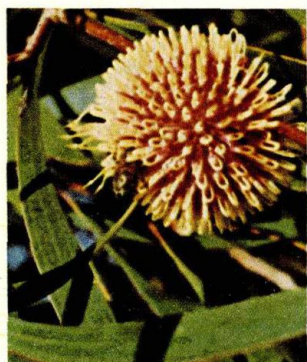
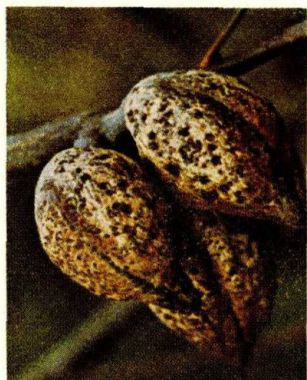
ISOPOGON — OTHER PROTEACEAE

Two plants of *Isopogon cuneatus* two years old are doing well but have yet to flower. *Conospermum*, *Adenanthos*, *Lambertia*, *Petrophile*, *Synaphea* and *Xylomelum* are seldom seen in cultivation. Many would be good garden subjects but are not available from nurseries here.

Hakea and *Grevillea* are represented in most wildflower gardens but not a wide variety. The nurseries mainly offer eastern species whereas the western species are often more spectacular.

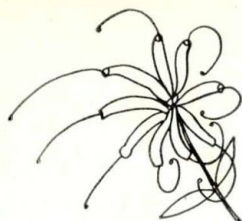
OTHER PROTEACEAE

The next two Issues will present other *Proteaceae* very suitable for garden cultivation such as the well known "Pin-cushion Hakea" below.



Photography by Peter Althofer.

HAKEA LAURINA



Why can't we grow all the Western Australian Plants in the East?

By Jim Webb, Canberra

This question, even if unasked, must be foremost in the minds of those native plant growers in the Eastern States, who have progressed to the point of having grown successfully most of the choicest or rarest of the Eastern species.

Some have accepted fully, no doubt, the verdict of the plant pathologists, who, carrying out a post-mortem on the corpse, have isolated the root-fungus *Phytophthora cinnamomi*. Others living in areas like Canberra, who see the small plant die in winter or autumn, blame frost. I reject this explanation, except in a small minority of cases, and instead put forward the hypothesis that pH on the acidic side of the scale throughout the root-zone, and in particular lack of calcium in the root-zone, is the prime cause of failure.

In short, applications of lime can enable us to grow the hitherto difficult plants successfully, but with certain provisos.

The immediate reaction of growers to this statement is: "Nonsense, I am growing such and such a species from W.A. perfectly and I have never used lime, and never will, as it causes chlorosis." I am aware of this apparent anomaly, but would suggest that only by experimentation and observation by all Eastern growers can these two differing culturally demanding groups be separated.

In part this has been done already, if we accept that those Western Australian plants that grow readily in all Eastern States, and feature in Commercial Nurserymen's lists, are generally those that can get by with the levels of calcium available in the bulk of Eastern State situations.

The second group consists of those that grow well in some Eastern areas and are failures in other areas. This group has a higher demand for calcium, or perhaps those generally unknown combinations of assemblages of plant nutrients that the presence of calcium releases from the soil if added.

The third group comprises plants that are almost total failures in the East. These are the high-lime demanders, or is it that they are the least efficient extractors? I like to think of it as the latter.

My first experience with growing W.A. plants on a large scale goes back to 15 years ago, when I was growing these in Broken Hill, Western N.S.W.

The only restrictions to growth I experienced there with W.A. species were those directly associated with lack of water, salting and unavailability of seed. Heavy frosts did occur, but were never a problem.

On later moving to Canberra I accepted, at the time, frost as the culprit. Like everyone else I planted close to the house under eaves, where often these plants succeeded, whilst those planted out perished; further apparent confirmation of frost damage.

But, of course, it is in this area that builders love to bury mortar, plaster and cement, all adding calcium and mostly raising the pH. Even cement rubble and proximity to concrete areas is enough often to ensure good growth for a limited time while the plant is small.

It was about four years ago I first started experimenting with lime, and I became rather confused with the results I obtained. With hindsight I did not use a large enough range of species and fell into the error of assuming that all species of a genus behave in a similar fashion. Because of the extreme ranges of lime tolerance, and lime intolerance, the levels of application I chose were in retrospect far too low. It was not until I visited Southern W.A. for five weeks in 1975 that I was able to check out the anomalous species in situ.

From this trip I found that the species that grew well in Canberra in lime-free situations in fact grew in the few situations in W.A. where no part of the root-zone was alkaline. These were granite areas of the Darling and Stirling Ranges, and areas near Albany and in other areas such as peaty swamps (albeit with lime and alkaline sub-soils surrounding).

Surprisingly to me, laterite and bauxite of the few areas I examined also had alkaline areas in depth. Travelling by car with the family I could only measure pH, so propose that at least some calcium is involved here. In the rest of the Southern area of the State onshore, westerly winds in the recent and past geological ages have carried large deposits of calcareous sand derived from coastal and offshore limestone inland. Except for the higher exposed granite areas, the ground water can contain appreciable amounts of calcium, and in such a dry area in summer plants need to seek it out, even at great depth. I was greatly impressed by Karri roots over 100 ft down in limestone caves at Augusta and elsewhere. I think it is reasonable to propose that interference with existing patterns of natural drainage of water tables, and hence vegetation patterns, could prevent water table levels charged with calcium reaching root-zones. I think here we may be looking at the cause of death of susceptible West Australian plants in the S.W. for reasons similar for their failure to grow in the East, with *Phytophthora* finally giving the "Coup de Grâce".

Let us now look at the hypothesis in general before I give the results of my more specific experimentations, which may be valid only for Canberra soil and conditions.

Firstly, dealing with N.S.W., and Sydney in particular. One would expect that here on the Hawkesbury sandstone W.A. plants would thrive, but this is not so. The few cases I have seen of thriving plants are related to builder's rubble, Aboriginal shell middens, or ground previously limed for exotics. Taken all around one would expect worse results with the extreme of group 3, West Australian plants on the Wianamatta shales, than sandstone, but some of the best results occur on these shales, despite heavy clay and closer texture. Naturally occurring higher calcium levels present here could be the answer.

Move west in the State, beyond Bathurst, calcium and soil pH levels rise, and so does the success with W.A. plants, the Burrendong Arboretum here being a good example in the middle range, and on to Broken Hill, where the W.A. species predominate.

Success rate has always been better in Melbourne than Sydney, and once again basalt soils rich in calcium give better results than other areas despite clay. Proceeding inland, the same pattern emerges in Victoria as in N.S.W.

In S.A. the picture is much clearer, with the contrast between the Adelaide hills and the plains. The story of Micro climates being the reason for success or failure I cannot subscribe to. True, I can believe this for exotic conifers, but not for natives, especially when odd calcareous strata coincide with excellent growth in the hills, comparable with otherwise overall excellent growth on the alkaline plains.

At Mt Gambier, on limestone, excellent growth is achieved, and what I believe to be significant—one of the few areas where *Phytophthora* has not been recorded.

Also very significant, I consider, is the fact that in Adelaide one begins to see the mirror image of the situation in the east. Here, and to a greater extent also in Perth, one sees chlorotic pathetic examples of Eastern State plants being grown, and in the few cases where local State species are grown they are thriving alongside.

But let us return now to more specific information of trials I have carried out in the past 12 months in Canberra. These are not great in the total number of trials that are required to evaluate fully the hypothesis of calcium deficiency, but have given me some valuable information, summarised briefly as:—

(1) Levels of lime calculated at an area basis per 5 in. pot (15 cm) of 3.18 grammes equivalent to 1 ton/acre or 2.51 tonnes per hectare, or roughly 5 bags per average suburban allotment induced chlorosis in East Australian plants emanating from Sydney sandstone areas and grown in Black Mountain Canberra soil.

Plants used: *Actinotus helianthi* and *Banksia ericifolia*.

(2) The same level applied to W.A. plants—improved colour and growth, and maybe frost resistance.

Plants used: *Melaleuca diosmifolia* (sold to me as *Verticordia grandis*), *Hypocalymma cordifolium*, *Hakea multileneata*, *Banksia speciosa* and *Pimelea rosea*.

(3) In an effort to reach lethal levels of lime I added lime at the rate of 250 grammes per 8 in. pot (20 cm), i.e. 30.7 tons per acre or 77 tonnes per hectare, or 145 bags per suburban block—at this level the following W.A. species were thriving:—

Darwinia leiostylis, *D. meeboldii*, *Banksia praemorsa*, *Banksia grandis*, *Eremophila laanii*, *E. dempsteri*, *Templetonia retusa*, *Hypocalymma cordifolium*, *Dryandra formosa*, *Pimelea rosea* and two species shared between West and East; *Prostanthera aspalathoides* and *Clianthus formosus*.

Most of the controls with no lime have died and with temperatures down this year to -5° celsius. Twelve months ago I too would have said frost was the cause. With this group I did not use Black Mountain soil, known to be very low in both calcium levels and phosphorus, but used soil mix with a higher phosphorus status; this has complicated the response of other species to lime somewhat, and is at present the subject of further experimentation.

Sufficient to warn here that some W.A. plants short of calcium will suffer an overdose of phosphate if the phosphate is supplied in the usual calcium forms, but will tolerate non-calcium forms of phosphate until such time as lime is applied.

The subsequent chlorosis is similar in appearance to lime-induced iron-deficiency chlorosis, but does not respond to iron chelates. The plants recover in time, as the excess phosphate is fixed to insoluble forms in the soil, but bear in mind these levels of lime worked with these species with phosphate present. With no phosphate present the list of species can be extended in terms of lime response, and I will be reporting later on this aspect in detail.

Result 1—Author has colour slides to illustrate the following.—Ed.

(4) Calcium-deficient plants of *Hakea multileneata* grown indoors in a heated glasshouse have shown the appearance of frost damage, blackened leaf tips and shoots. Added lime plants were normal and healthy. All other essential plant elements were supplied at adequate levels.

Result 2—Illustrated on colour slide with author.

Outdoors heavy applications of lime have removed from new growth the symptoms of blackened leaf tips in Canberra grown Kangaroo Paws (*Anigosanthos flavida*, *A. manglesii* and *A. viridis*).

(5) In all cases, lime refers to agricultural lime, ground limestone as sold by Southern Limestone Pty Ltd, Moss Vale, and Slag Lime Fertilizers Ltd, Marulan, and never to hydrated builders' lime. Where excess phosphate is known to be present, or the expected level of lime is not known, heavy levels of limestone gravel-road metal has mostly enabled satisfactory levels of growth to be maintained.

Experiments are still proceeding, but so far it appears that some plants like access through their root system to an acidic humic region, and with other parts of their root system to limestone.

One group of W.A. plants which so far have not responded in growth or colour to extra lime do not appear to suffer any symptoms of excess; this is in contrast to Eastern species tested, where excess induces iron deficiency. One such species is *Banksia baxteri*, where pot trials are not sufficient to establish depression of growth by lime in the absence of other visual symptoms.

(6) Experiments to determine relative effects of magnesium/calcium ratio components always present in commercial limestone were not very conclusive, except that straight magnesium carbonate did not substitute for calcium, as the carbonate, and calcium present as Gypsum (calcium sulphate) was not as effective as calcium carbonate, indicating pH alone may be a factor. Chemically pure lime was as effective as agricultural lime, which tends to point to trace elements in the limestone not being present or effective.

Only three plant species were used in these trials: *Banksia speciosa*, *Banksia baxteri* and *Hakea multilineata*. *Banksia baxteri*, as it turned out, was not affected by limestone, as detailed in (5).

Hakea multilineata exhibited good growth response to lime, but genetic seedling variation tended to mask the effect where only three replicas of each treatment were used.

Banksia speciosa proved to be a good choice; it responded to very low levels of calcium, in the low calcium status, Black Mountain sandstone soil pH 4.7 to 5.3 and, more importantly, having a meristematic leaf apex has proved to be a good indicator plant.

Plants given full lime nutrition can fully expand the leaf in an 8-inch pot to 40 cm long, and having 36-37 lobes. With calcium deficiency, plants have leaves to 10 cm long and the meristematic apex blackens and withers away, resulting in only 12-14 lobes. Subsequent responses to lime do not allow the leaf to elongate any further if the tip has withered, but new leaves give us a ready visible status of lime sufficiency.

Other *Banksia* in the same group have similar leaves and may prove to be better indicators of different levels of calcium nutrition.

CONCLUSION

In conclusion I wish to emphasise that I am not advocating the use of lime as a simple cure-all. The principles of drainage, watering, mulching and all the other proven techniques for Australian Native Plant cultivation still apply over and above the use of lime.

Perhaps the hardest concept for native plant growers to accept will be that lime will have to be used as in exotic gardens, where its use is accepted by all without question.

No lime on your potatoes, azaleas or camellias, but lime your beds of asparagus, roses and beans for best growth is widely accepted.

I believe similar impositions to these will be nothing compared with the increased range of native plants we can successfully grow in the Eastern States with full experimentation. Let us all see how much is needed, where and on what.

West Australian Banksias in Canberra

By J. GOTHAM and G. BUTLER

At the June, 1975, meeting of S.G.A.P. in Canberra an interesting and most informative talk was given by Mr Jim Webb of the Australian National University Botany Department proposing a theory deduced by observations he had made of West Australian plants growing in their natural environment. He stated that many W.A. species grew naturally on limestone-based soils, or soils that had a limestone substrata somewhere beneath the surface soil.

The theory put forward was that some, not necessarily all, W.A. species may require calcium and/or magnesium for satisfactory growth. This raised some very thoughtful questions from the audience and he invited all to experiment with the ideas and report any observations.

Not long after this it was noted that at the Girls' Grammar School in Adelaide Avenue, A.C.T., there were many plants of *Banksia prionotes* and *Banksia baueri* growing extremely healthily, flowering and setting seed to profusion—a very unusual occurrence in Canberra. It was also noted that two Eastern States species of *Banksias* were growing in the same garden-beds. These were *Banksia ericifolia* and *Banksia serrata*. Whereas the *Banksia serrata* were reasonably healthy, the *Banksia ericifolia* were stunted and chlorotic.

The garden-bed was situated against the N.W. wall of a two-storey building of cement/brick construction. The natural soil, a heavy clay, had a 2"-3" layer of a friable sandy loam as a topsoil. It was fairly well cultivated, being relatively weed free and had no mulch on top.

It was decided to obtain a core soil sampler and to do pH tests from varying spots on the bed. These were done at five spots, taking a sample from the top and at a point 12" to 18" immediately below.

	1 top	1 bottom	2 top	2 bottom	3 top	3 bottom	4 top	4 bottom	5 top	5 bottom
SALT	120 ppm	280	610	200	350	420	280	610	200	420
pH	8.6	7.2	7.3	6.9	8.1	8.4	7.4	8.0	7.8	8.2

Calcium Analysis—Hole 1: less than 150 ppm. Hole 4: less than 150 ppm.
Hole 2: less than 150 ppm. Hole 5: less than 150 ppm.
Hole 3: approx. 2,000 ppm.

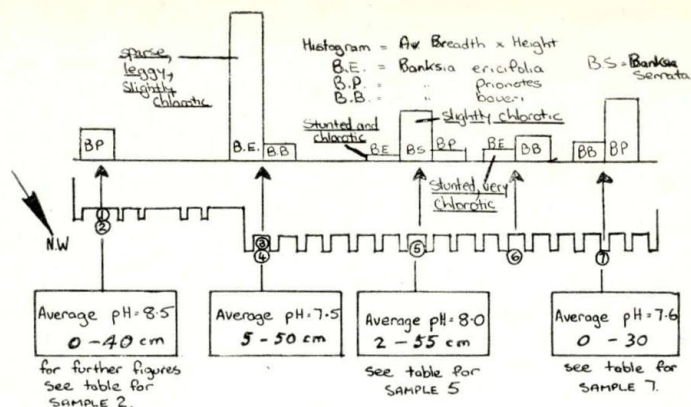
As can be seen by the figures, the garden-bed had figures reading on the alkaline side of the scale, with only one figure on the acid side registering at 6.9, very close to being neutral.

While taking the core samples from the bed it was noticed that there was some brick and mortar rubble not far beneath the surface soil forming a plate over the underlying clay. This was probably a result of the backfilling of foundation trenches on completion of the building.

On the strength of the first figures more detailed information was undertaken and analysed. Examples of the results are:—

SAMPLE 2—

	Top soil	pH
1-10 cm	Top soil	7.6
10-15 cm	Brown clay	8.5
15-23 cm	Yellow/brown clay	8.5
23-26 cm	Brown clay	8.8
26-28 cm	Mortar layer	8.6
28-35 cm	Yellow clay	8.5
35-40 cm	Yellow/brown clay and coarse particles	8.6



Soil content at the 5 cm to 20 cm level comprises: Coarse sand 29 per cent, fine sand 22 per cent, silt 13 per cent and clay 35 per cent.

Cations: Ca 8.9, Mg 4.7, Na 1.0 and K 0.27. Sum of Cations: 14.9. Cation Exchange Capacity 14.0.

SAMPLE 5—

(One metre from pillar between two poor *B. prionotes* and one chlorotic *B. ericifolia*.)

0-8 cm	Topsoil	pH 7.8
8-15 cm	Brown/yellow clay	8.5
15-20 cm	Greyish clay and mortar	8.6
20-28 cm	Brownish clay	8.2
28-35 cm	Yellow/brown clay	8.0
35-43 cm	Yellowish clay	8.0
43-47 cm	Yellowish clay	7.1
47-80 cm	Yellow/brown clay	6.8

Soil content at the 0-5 cm and 5-20 cm levels respectively comprise: Coarse sand 38 per cent and 29 per cent, fine sand 35 per cent and 22 per cent, silt 13 per cent and 13 per cent, clay 15 per cent and 35 per cent, and pH 7.7 and 8.5.

Cations (mg/100 g, dry wt): Ca 7.8 and 8.9, Mg 1.0 and 4.7, Na 0.09 and 1.0, and K 0.2 and 0.27. Cation Exchange Capacity 9.6 and 6.5.

SAMPLE 7—

(One metre from pillar by the best *B. prionotes*.)

Soil content at the 0-5 cm, 5-15 cm and 15-30 cm levels respectively comprise: Coarse sand, 43 per cent, 34 per cent and 28 per cent; fine sand, 44 per cent, 26 per cent and 25 per cent; silt, 7 per cent, 14 per cent and 14 per cent; clay, 6 per cent, 27 per cent and 35 per cent; pH 6.4, 7.9 and 8.3

Cations (Mg/100 g, dry wt): Ca 2.4, 9.7 and 9.6; Mg 0.24, 2.9 and 5.0; Na 0.13, 0.32 and 0.96; K 0.12, 0.43 and 0.39. Cation Exchange Capacity 14.0, 14.5 and 12.0.

This article is aimed to promote discussion, trial and experimentation by others. Hopefully the growing of many of the glorious W.A. species in Eastern States gardens will become more of a reality with a little more research.

W.A. Plants and the Use of Lime

Jim Webb has not recommended the use of lime on all plants from Western Australia. For a certain range of plants, however, he has discovered a marked improvement in health and vigour in the presence of limestone. Perhaps the following comment by A. S. George, Botanist, Dept. of Agriculture, W.A., will be significant:

"The article by Jim Webb seems a good report on experiments in growing Western Australian natives. Many of our species occur in areas where lime is present to a greater or lesser extent, e.g. in coastal areas, around inland salt lakes, etc. I wonder if some interaction between the applied calcium and the soil assists natives which usually do not inhabit alkaline soils?"

Comment by Dr. Lamont, Dept. of Biology, W.A. Inst. of Technology:

"While it is true that a significant number of W.A. species prefer calcareous soils — both coastal and inland species — the flora reaches its greatest richness in deep, acid sands. They have certainly confirmed that species occurring naturally in calcareous soils benefit from the addition of lime to the soil. This should not be construed as a general indication that W.A. species benefit by the addition of lime supplements. In fact more serious problems of chlorosis and stunting could result from over-enthusiastic applications of lime. Experiments are needed to determine if species which are normally regarded as confined to acid soils, respond favourably to additions of lime.

RESEARCH

We have an offer by a well-equipped institution, with the competence to achieve results, to conduct research on the optimum requirements for the cultivation of Western Australian wildflowers in the garden situation. The first investigation is to follow the lead given by Jim Webb in this issue.

We need finance. Who would be prepared to contribute to a fund to finance this investigation? Not a great deal is needed. Please advise the Editor if you can help.



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AUSTRAFLORA IS AUSTRALIAN PLANTS

So different from other flowers

A series for the young in spirit by Nuri Mass

For anyone with a special interest in flowers, the early days of exploration in Australia must have been extremely exciting, considering how many of Australia's wildflowers are not to be found anywhere else in the world. Imagine seeing a Waratah for the first time — a *Banksia*, *Hakea*, "Mountain Devil", *Dryandra* — all of those strange, beautiful things, and hundreds of others besides, just growing wild in this ancient faraway continent!

It must have been a very nice feeling indeed for Sir Joseph Banks — the botanist who sailed here with Captain Cook — to have such a handsome "new" flower as the *Banksia* named after him.

As it happens, all of the flowers mentioned up there in the first paragraph belong to the same family — *Proteaceae*. And if you were a flower, you could scarcely belong to any family more fascinating — full of interest and colour and variety.

The glorious Fire Wheel Tree is a member of *Proteaceae*. So is the magnificent Silky Oak, and all of the other Grevilleas, the quaint little Geebung and Drumsticks, and of course, among ever so many others, the ones we are going to look at specifically here — the *Banksias* and *Hakeas*.

As with most of the *Proteaceae*, a *Banksia* "flower" isn't a single large one, but ever so many little ones, all crowded together. In fact, in one *Banksia* head, there can sometimes be about a thousand flowers, packed into a large, upstanding "cylinder". And if *Banksias* are sometimes called Native Honeysuckle, it is because their flowers are so rich in nectar that they provide a regular feast for honeyeaters and nectar-loving insects. Even the Aborigines back in the early days, used to soak a *Banksia* head in water to make one of their favourite drinks.

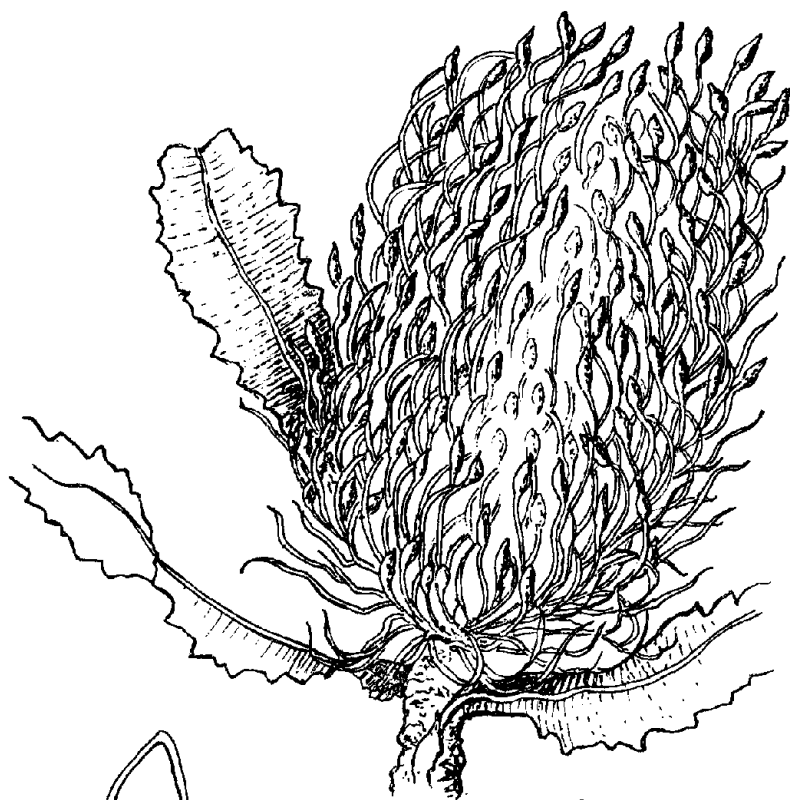
Most of the *Proteaceae* are completely different from other flowers, and the *Banksia* is no exception. Look carefully at a single one of them through a magnifying glass, and see what a quaint little thing it is, with a tiny stamen (only the anther part of it) attached to the inside of each of its four petal-tips, and with a style far too long to fit into the closed flower, so that it has to poke out from it in a loop. Then, when the petal-tips unfold, it springs up straight, carrying the tiny stigma well out into the open, to collect pollen from visiting birds and insects. And the petals are prettily covered with fine silky hairs — and there aren't any sepals at all.

Then, when the flowers die, they still cling on to their big central stem in a bristly sort of fuzz, while a few of them produce seedboxes — amazingly large woody ones, considering how tiny the flowers have been. And it's at this stage that the popular name "Old Man *Banksia*" comes in.

There they are, those seedboxes, nestled into the dry fuzz that used to be flowers, and so tightly closed and hard that sometimes years go by before there's a season hot and dry enough to crack them open. In fact sometimes it's only a bushfire that will open them. Then two small seeds fall out — or fly, if there's a breeze to carry them, since they have delicate little wings — and soon, perhaps, a new *Banksia* plant is born.

It might be a spreading shrub, or a tree with thick rugged branches twisting out at the wierdest angles into shapes which are at once freakish and strangely beautiful. Its leaves might be small and heath-like, or quite large with saw-tooth edges. And its flower-heads might be flame-coloured, greenish-yellow, red, or even bluey grey. But whatever its shape or colour, it will be one of Australia's most unique and attractive wildflowers.

At first, you might not see any resemblance at all between a *Banksia* and a *Hakea*, for *Hakea* flowers tend to grow in delicate little thread-like



A Banksia "flower"
is actually a
huge collection

like of tiny flowers
this



The bud
of one
tiny Banksia flower,
with pistil hooped
over and caught
inside the petal tips



Very
much
enlarged
— a
stamen
tucked
away
inside
a petal
tip

clusters instead of in stiff, sturdy spikes, and they are usually white or creamy in colour — although in Western Australia there are also some pinks and reds.

But of course, as always when looking for relationships among flowers, it's a mistake to judge merely by general appearance. You must go to the individual flowers themselves. And as soon as you do this with a *Hakea*, you see for certain that it does indeed belong to the same family as the *Banksia*.

Here is the same looped style, with the stigma held imprisoned until the petal-tip rolls back. Here again are the four little petals with a stamen attached to the inside of each tip. Here again there are no sepals to be seen. And if, when the flower opens, its petals tend to come apart all the way down instead of only at their tips — well, it's only right that a *Hakea* should be different in *something*.

As with *Banksias*, the fruits of *Hakeas* are hard and woody, with two little winged seeds inside. But they come in all manner of different shapes — some rugged and bulgy, others smooth and oval, still others narrow and pointed like a bird's beak. And again, it seems incredible that such hard, strong seedboxes should come from such tiny flowers.

Probably some of our best-known *Hakeas* are those that we call Needle Bushes, for the very good reason that their leaves are as sharply-pointed as needles — and just as painful if you jab up against them. And, since the leaves of the Needle Bush crowd all over it in dense masses, the plant itself is like an armoury of weapons. Not weapons against you and me, however, but against the heat of the sun.

Look closely at a Needle-Bush leaf, and you will see that it is actually a cylinder, with its underside rolled inward. So that here we have one of Nature's many clever ways of enabling plants to live and flourish in hot, dry places.

It is the habit of plants to transpire — that is, lose moisture — through numbers of tiny pores (or stomates) on the under surfaces of their leaves. So obviously, a plant with large, soft, spreading leaves would very quickly shrivel up and die in a climate with sparse rainfall and a burning-hot sun — whereas a plant with its leaves rolled around, pores inward, would be able to live quite happily. In fact, Needle Bushes sometimes grow big enough to look like small trees.

However, all *Hakeas* are not Needle Bushes. Some of them have quite normal-looking leaves — long, broad and flat — which would ordinarily be at the complete mercy of the sun, only for another little trick, clever and extremely simple. As with *Eucalypts*, the leaves of these *Hakeas* twist sideways on their stems, so that only their edges face directly into the sun — and of course, they don't lose moisture out of their edges.

Flowers like little clust'ring threads
Caught against a bush or "tree",
Long flat leaves — or needle-sharp —
Hakeas are we!

Spikes of massed and fragrant flowers
In the bushland glowing,
Rugged trees with branches odd
This way, that way going,
"Old man" seeding heads — all say:
"Here's a *Banksia* growing!"

Gardening in Limestone Areas

by Pauline Tully

Gardening in the greater part of South Australia means not only coping with a limestone area, but for those in country areas there is the added build-up of alkalinity in the soil from the constant use of bore water over the long summer period which can often last through November to March or April. Although a "good" winter in the south-east of the State, where I lived, can be very wet indeed, the rate of evaporation during the dry months is practically the greatest in Australia. Therefore to combat dehydration it becomes necessary to try and create a moist atmosphere by regular watering and by the end of summer there is a thin crust of yellowish/white salts on the soil surface that can only be dispersed by good Autumn rains.

My garden was grown in a thin layer of terra rosa soil over solid limestone — the stone at varying depths and at one place right on the surface. The site was bare of any flora apart from a few Rough-barked Manna Gums, although we were situated not far from typical sandy-soil heath-like scrub. It seemed sensible to me to start a garden by trying to grow local flora, and it was fortunate (or not so fortunate perhaps) that some of these adjacent bushland areas were about to be bulldozed for future pine forest and agricultural development. There were, therefore, opportunities for me to collect seedlings and small plants, cuttings, etc., and these eventually found their way into my garden.

I cannot emphasise enough the successful use of local flora for a garden of any area — whether limestone or not. It is so important to conserve through cultivation the native plants that belong to your own district. Apart from this, it is after all easier to grow what obviously does well under the conditions offering. In limestone areas, the plants I found easy to grow were most of the *Acacia* family; the "bush peas", which means a multitude of plants such as both bush and climbing varieties of *Hardenbergia*, *Daviesia*, *Templetonia*, *Lotus*, *Indigofera*, *Goodia*, *Eutaxia*, *Kennedya*, *Chorizema* and many others.

The Hakeas; *H. rostrata*, *H. nodosa*, *H. vittata* and *H. rugosa* all grew in the S.-E. of South Australia, and *H. multilineata*, *H. laurina*, *H. saligna* and *H. suaveolans* were happy there.

The finest of the Grevilleas was *G. lavandulacea* — the form which grows along the S.A./Vic. border from Penola to Bordertown, and makes a magnificent display from late Winter onwards.

The Mallee type Eucalypts did well — *E. forrestiana* especially. *E. diversifolia* was included because of its adaptability to all sorts of harsh conditions, and grows in its natural state in the so-called desert country of S.A. as well as along the Coorong where it is subject to salt-laden windy conditions. It will grow anywhere. To give a full and itemised list of plants would take up too much space. It is 10 years since I left my garden in South Australia and came to live in Victoria, and so much more has been gained in knowledge of native plants, that I am sure I would have attempted at least, to try and establish more varieties and species had I the experience since acquired.

During this time, new fertilizers have come onto the market which could probably have a good effect in supplying both trace elements and nutrients lacking in limestone soils. Much more is known too, about native plants of all kinds. One must remember that the Society for Growing Australian Plants was only formed in 1957, and in the 20 years it has been in existence, we have learned and are still learning a great deal year by year.

GARDENING IN LIMESTONE AREAS

As the practice of "liming" certain plants is recommended for some species of western plants, reports of success with a wide range of natives were investigated revealing the following:

Mrs. Joan Lindross, 7 Tiverton Street, Belmont, Vic. submits a list compiled by Mr. Ted Errey of plants flourishing in his limestone area:

PROTEACEAE	<i>Banksia baueri</i> , <i>B. baxteri</i> , <i>B. caleyi</i> , <i>B. canei</i> , <i>B. ericifolia</i> , <i>B. integrifolia</i> , <i>B. lindleyana</i> , <i>B. marginata</i> , <i>B. media</i> , <i>B. nutans</i> , <i>B. occidentalis</i> , <i>B. ornata</i> , <i>B. praemorsa</i> , <i>B. serrata</i> , <i>B. speciosa</i> , <i>B. spinulosa</i> . <i>Dryandra formosa</i> , <i>D. praemorsa</i> . <i>Grevillea alpina</i> , <i>G. aquifolium</i> , <i>G. baueri</i> , <i>G. bipinnatifida</i> , <i>G. oleoides</i> , <i>G. juniperina</i> , <i>G. lavandulacea</i> , <i>G. rosmarinifolia</i> , <i>G. sericea</i> , <i>G. steiglitziana</i> , <i>G. thelemanniana</i> . <i>Hakea laurina</i> .
MIMOSACEAE	<i>Acacia anceps</i> , <i>A. floribunda</i> , <i>A. mitchellii</i> , <i>A. pentadenia</i> , <i>A. prominens</i> , <i>A. spectabilis</i> . <i>Dianella laevis</i> , <i>D. revoluta</i> , <i>D. tasmanica</i> . <i>Anigozanthos flavids</i> .
LILIACEAE	<i>Orthosanthus multiflorus</i> .
HAEMODORACEAE	<i>Cassia australis</i> , <i>C. nemophila</i> .
IRIDACEAE	<i>Goodia lotifolia</i> , <i>Hardenbergia violacea</i> , <i>Indigofera australis</i> , <i>Kennedia prostrata</i> , <i>Pultenaea daphnoides</i> , <i>P. pedunculata</i> , <i>Templetonia retusa</i> .
CAESALPINIACEAE	<i>Boronia heterophylla</i> , <i>Correa alba</i> , <i>C. decumbens</i> , <i>C. Manni</i> , <i>C. reflexa</i> , <i>Eriostemon myoporoides</i> .
FABACEAE	<i>Dodonaea microzyga</i> . <i>Hibiscus huegellii</i> . <i>Thomasia petalocalyx</i> . <i>Hibbertia stricta</i> .
RUTACEAE	<i>Agonis flexuosa</i> , <i>Beaufortia sparsa</i> , <i>Callistemon citrinus</i> , <i>C. linearis</i> , <i>C. macropunctatus</i> , <i>Calothamnus quadrifidus</i> , <i>Calytrix alpestris</i> , <i>C. sullivanii</i> , <i>Chamaelaucium uncinatum</i> . <i>Eucalyptus alpina</i> , <i>E. crenulata</i> , <i>E. erythrocorys</i> , <i>E. leucoxyton rosea</i> , <i>E. macrandra</i> , <i>E. nicholii</i> , <i>E. nutans</i> , <i>E. orbifolia</i> , <i>E. preissiana</i> , <i>E. stoatei</i> , <i>E. subcrenulata</i> , <i>E. tetraptera</i> , <i>E. torquata</i> . <i>Eugenia myrtifolia</i> , <i>Leptospermum nitidum</i> . <i>Melaleuca elliptica</i> , <i>M. hypericifolia</i> , <i>M. nesophila</i> , <i>M. polygaloides</i> , <i>M. pulchella</i> , <i>M. radula</i> , <i>M. wilsonii</i> . <i>Thryptomene calycina</i> , <i>T. saxicola</i> . <i>Notelaea ilgustrina</i> .
SAPINDACEAE	<i>Mazus pumilio</i> .
MALVACEAE	<i>Prostanthera ovalifolia</i> , <i>P. sieberi</i> .
STERCULIACEAE	<i>Eremophila maculata</i> .
DILLENIACEAE	<i>Helichrysum bracteatum</i> , <i>Olearia grandiflora</i> , <i>O. pinnosa</i> .
MYRTACEAE	
OLEACEAE	
SCROPHULARIACEAE	
LAMNACEAE	
MYOPORACEAE	
COMPOSITAE	

Mrs Lindross adds the following to the list: *Grevillea Poorinda* (various), *G. robusta*, *Hakea petiolaris*, *H. victoriae*, *Acacia baileyana*, *A. iteaphylla*, *A. longifolia*, *A. pravissima*, *A. pycnantha*, *A. retinodes*, *A. saligna*, *A. vestita*, *Kennedia rubicunda*, *Dodonaea boroniifolia*, *Eucalyptus rubida*, *E. globulus* ssp. *bicostata*, *E. gomphocephala*, *E. tasmanica*, *E. perriniana*, *Melaleuca armillaris*, *M. linearis*, *M. styphelioides*, *M. violacea*.

A dose of iron chelates, a couple of teaspoons in a bucket of water, watered round the roots about twice a year, corrects a slight yellowing. Mrs. Pauline Tully, Nicholson, 3882, writes:

Your appeal made me remember a list of plants in my garden which was then in the south-east of S.A. near Narracoorte. This garden was grown in a thin layer of terra rosa soil over pure limestone — there was in fact a large limestone cave in the depths below! (*I have omitted those plants already mentioned. Ed.*)

Acacia acinacea, A. armata, A. dodonaeifolia, A. fimbriata, A. mearnsii, A. melanoxylon, A. myrtifolia, A. longifolia var sophorae, A. suaveolens, A. verticillata; Albizzia lophantha; Astroloma conostephioides; Bossiaea prostrata, B. cinerea; Baeckea crassifolia, B. virgata; Billardiera cymosa; Boronia pilosa, B. caerulescens, B. megastigma; Bursaria spinosa; Cassia sturtii; Calytrix tetragona; Clematis microphylla; Callistemon macropunctatus; Dillwynia floribunda; Daviesia ulicina; Gompholobium huegelii; Goodenia humilis; Hakea nodosa, H. multilinea, H. vittata, H. rugosa, H. rostrata, H. suaveolens; Leucopogon virgata; Lotus australis, Melaleuca gibbosa, M. megacephala, M. uncinata; Sambucus gaudichaudiana; Solanum aviculare; Viminaria juncea; Casuarina distyla, C. stricta; Cryptandra tomentosa; Darwinia micropetala; Dampiera rosmarinifolia; Dodonaea cuneata; Eutaxia microphylla; Grevillea ilicifolia; Hardenbergia violacea, H. comptoniana; Hibbertia fasciculata, H. linearis, H. sericea; Isopogon ceratophyllus; Melia; Prostanthera nivea, P. behriana, P. inclsa, Tetratheca cillata.

HOW ARE YOU GROWING WILDFLOWERS?

There is a need for many more reports from readers on their experience with the cultivation of wildflowers. Please write to the Editor. Perhaps you may have a problem or want information on a particular genus of plants! Let us help you in the fun.

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Grow from Seed — 2

A REVIEW OF PROPAGATING METHODS BY THE EDITOR

Proven basic methods of growing plants from seed by the home gardener with no special facilities were described in our last issue. This advice was kept as simple as possible because beginners often get discouraged by the introduction of strange terms, special facilities or complicated procedures. I hope that this article will not discourage them. Read it. Skip the apparently involved sections if necessary, but get the general trend.

You may adopt the various methods used by others, but as one well-known writer often says, "it is commonsense". He does not mean that you should naturally know what to do. He means you should look around you, see what others are doing, and by careful thought and observation evolve the method that suits you best. Most propagators have their own variation of commonly used practices that they have found works for them. I shall try to describe to you their various "secret" (which is ridiculous, as they have all been published before if you know where to look) methods. It is the "commonsense" adoption of their methods to your particular circumstances that will bring you success.

The article in the last issue was slanted to the germination of seed species in the plant family *Myrtaceae*, the subject of that issue, as they are particularly easy to germinate. This issue is primarily devoted to the plant family *Proteaceae*, and as these are very often propagated by seed quite easily, then you are encouraged to grow some plants for your garden. However, while they are so easy to grow from seed by some people who by luck or careful planning do it the right way, others have a lot of difficulty due to very simple errors.

I do not pretend to be an expert, or even one of those successful propagators. I shall review methods already published, under various headings, and request those who can contribute more to send me their comments. (For propagation of ferns refer to Volume 8, page 138.)

Basic Requirements for Germination of Seed

I suggest you first read "The Seed", Vol. 1, Issue 11, page 13—"Germination", Vol. 7—"Germination of Seed", Vol. 2:44. For our next volume I hope to print an article reviewing the latest scientific research on this aspect; is there a writer who will accept this assignment?

First get Your Seed

To collect your own seeds often needs some knowledge of the plant genera and species. Perhaps this is wrong. Careful observation will indicate when seed is ready for harvest. Nature's way of forming seed and protecting it for suitable germination conditions is often devious, certainly with infinite variety. Much more information needs to be published on fruits, seeds, when they are ripe, how to identify the plant from the fruit and seed, etc., so will readers with information on this please contact the Editor?

As this issue features the genera in the plant family *Proteaceae*, the collection of seed from the more common species are described in another article on this subject. For species that drop seed, such as *Eriostemon*, *Grevillea*, etc., see Vol. 1, 4:7. For advice on storage refer to Vol. 1, issue 1, page 3.

The easiest way to get seed is out of a packet. Unfortunately, there are limited supplies, especially of *Proteaceae*, and we would welcome donations from anyone who can collect some.

When you have your seed, do you have seed? Is it viable? Will it grow given perfect conditions? It is not usually easy to tell if seed is viable.

One accurate report (Vol. 6: 257) was 25 per cent viability of *Eriostemon australasius* seed.

With hard seed, such as from wattles and pea-flowered plants, put it in water. If you can sink it, it is probably good. The surface tension between the water surface and the seed coat may cause good seed to float. A non-foaming detergent added to the water will probably rectify this.

Other seed with bulky or fluffy outer coats cannot be proved this way. If there is a hard core, it may be good. Much seed looks good, feels good, but will never germinate, so do not be discouraged by poor results at times.

When to Sow

This will vary with the species and with your climate. As discussed under Dormancy (Vol 2:91) the length of day (or night) can be critical in some cases.

For *Proteaceae*: "Sow seed no earlier than October, or growth is slow and germination yield low, but no later than late February, or too little growing time is left before the cold months in Melbourne" (Vol. 5:356).—*Waratah*: "Pods ripen about April, so plant then." I have been advised to plant W.A. *Banksia* seed in May, after the humid hot weather and give the plants time to get established before the next humid spell in Sydney.

You will see that summer planting in the South, with April to May planting in the North, would appear the best times.

Prior Treatment of Seed

Much has been written already on this subject. It is aimed at first getting the seed ripe for germination and then frustrating nature's way of protecting the precious embryo for survival of the species in the wild.

Reports on after ripening of seed before planting are needed. We have one concerning *Epacris* (Vol. 3:197).

Reports of success following physically removing the outer seed coat or testa appear in past issues, this being used with *Grevillea* (Vol. 2:83, Vol. 3:143). It is easier with large seed. There is one report of good success with *Ptilotus* seed.

The treatment of seed with calcium hypochlorite (common bleaching powder) to partially remove the seed coat prior to planting is described in Vol. 1, Issue 2, page 5. This method could be used much more widely and is effective on small seed as well. It is also a good fungicide and bactericide, and I have seen excellent results with it.

The hot water treatment was described in our last issue. The abrasion of the hard coat (or nicking with a knife) is effective (Vol. 7:96).

The seed coat must also serve other purposes. The experiment reported in Vol. 6, page 259, showed failure to germinate *Eriostemon australasius* when the testa was wholly removed, but when only chipped away at the radicle (large) end, and leaching of the remainder of the coat under running water for two weeks was tried, germination of this extremely difficult seed was successful.

Germination Prior to Planting

Seeds need light (or cycles of light related some think to the period of day or night at a suitable time or season of the year), warmth (or cycles of warmth and cold), and water to encourage the embryo to end its hibernation and start to grow again. It contains all the food it needs to grow the first four leaves and the propagating medium only serves to hold it down and provide a snug bed for the new root. It is fun to provide these germinating conditions and see the new leaves emerge, and the root to thrust out blindly before planting the seed.

Pregermination of seed is especially useful with *Proteaceae*, as the seed is usually large. The various methods of pretreatment of seed will often provide pregermination as well. In your cup of wattle seed, in water that has been hot and now has cooled off, you will see some of the seed growing in the water if left there a week or so.

Methods of pregermination have been mentioned already:—

In a loose, sterile medium (Vol. 1, Issue 1, page 4).

Mix the seed with damp vermiculite . . . place in an ice-cream tray . . . keep in a sunny position and keep damp.

In cotton wool—the cottonwool sandwich (Vol. 1, 12:17).

In damp peat moss in a bottle (Vol. 3, page 69).

In a plastic bag (Vol. 3:68).

In papier-mache egg-cartons (Vol. 8:30).

Prepare Your Seed Boxes, Pots or Containers

Seed is germinated in a wide range of containers. The old method of using seed-boxes (Vol. 6:309) is still used widely, especially by commercial nurserymen and the experienced propagator. You would be well advised to read of the propagating methods of Alec Blombery in Vol. 7, page 96, follow his methods and ignore all the variations mentioned here.

The germination medium may be just coarse sand, which is quite satisfactory. The use of a little peat or sphagnum moss appears to assist germination (Vol. 8:34), as well as help retain moisture. Other growers have their own pet mixture (Vol. 3:252, Vol. 7:321, Vol. 5:356, Vol. 6:309).

I use perlite, as it is sterile and an occasional spray with a fungicide seems to keep it this way (Vol. 6:309 uses vermiculite).

There is evidence that some seed needs the friendly help of a fungi or other organism to assist it to germinate, or to assist it to grow. Soil from around *Boronia* or *Eriostemon* plants is introduced into the mix for germinating Eastern *Rutaceae* (Vol. 7:96). Dried *Banksia* leaves, shredded, are used in a mix to germinate Waratah (Vol. 1, 1:3).

A wide range of propagation containers or boxes are used from a glasshouse with trays, a shade-house, a special hot-box (Vol. 3:107), propagating frames for the home gardener, widely used and recommended (Vol. 2:47), to old buckets (Vol. 3:106).

The glasshouse does not appear to be successful because of humid conditions. The widely used simple method of placing a piece of glass over the pots or boxes has proved very successful, but the glass must be raised shortly after germination to provide fresh-air circulation. The use of trays or pots in the open without glass is preferred by some and appears more successful with some species, especially those that are slow to germinate (Vol. 1, No. 1:4, No. 5:3 and No. 7:11, Vol. 3:69 and Vol. 7:97). The bucket Vol. 3:106 has been very successful with some seed.

Planting the Seed

The seed is best planted with a cover equal to twice the thickness of the seed. Cast the seed on the propagating medium and cover with a thin layer of sand, firming down flat with a flat implement. The covering of seed is varied by many propagators. There seems general agreement that seed can be planted too deep. A lot of seed, especially fleshy fruits, is just rested on the surface. Rodger Elliot does not cover fine seed of *Myrtaceae*, such as *Callistemon* and *Melaleuca*, when using the bog method.

Various methods of seed cover also include:—

A cover of paper over (Vol. 1, 1:3).

A cover of a piece of towelling (Vol. 3:14).

A ½" layer of white gravel, which provides an acid reaction (Vol. 6:309).

A cover of road metal, "easy mulch" or compost (Vol. 3:252).

If you water overhead from a spray, a covering such as the gravel will help to hold the seed down and prevent it getting washed out.

To be continued In the next Issue.

The Genus *Lissanthe* R.Br.

by T. J. Hawkeswood, Glenbrook, N.S.W.

The two species of the genus *Lissanthe* belonging to the plant family *Epacridaceae* are presented.



Colour photography by John Fanning.

LISSANTHE STRIGOSA

A small, prickly shrub to 60 cm high, with white or pink flowers in short axillary racemes crowded at the ends of the branches.

The genus *Lissanthe*, erected in 1810 by Robert Brown, is a small genus consisting of only two species, belonging to the Australian heath family Epacridaceae; one species is endemic to the three eastern mainland Australian States, as well as to South Australia and Tasmania, while the other species is endemic to N.S.W. only.

One of the species, *L. strigosa* (Sm.) R.Br. is quite a common and well-known plant, being figured by Black (1964), Blombery (1967) and Burbidge (1970), and photographed in colour in Cochrane et al (1968) and Rotherham et al (1975). The other species, *L. sapida* R.Br. is not so well-known since it is confined mainly to the lower Blue Mountains and, according to Benthams (1869), was found along the banks of the Grose River, N.S.W.; Beadle et al (1972) record it as being found on the Woronora Plateau, south of Sydney. The material used for most of my study of *Lissanthe sapida* was collected near Knapsack Gully, near Glenbrook, N.S.W.

The characteristic features of the genus are as follows:—

The corolla-tube is hairy inside about or above the middle; the corolla-lobes being glabrous and valvate in bud, spreading or recurving upwards when in full bloom. (It is from the glabrous lobes that *Lissanthe* receives its name; it is from the Greek *lissos*, meaning smooth, and *anthos*, a flower). An hypogynous disc is present; it is cup-shaped, being sinuate or five-toothed. The ovary is five-locular. The drupaceous fruit is ellipsoid to globular in shape, the mesocarp being pulpy, the endocarp being hard and bony and usually five-celled; however there are often fewer cells by abortion (Benthams 1869, Black 1964). The plants are small to medium-sized shrubs. Small flowers are present in *L. strigosa*, but larger flowers are present in *L. sapida*. Two bracteoles and one bract, which do not overlap the calyx, as in many other Epacridaceae genera, are present under each flower, more or less at the base of the pedicel (see diagrams).

Benthams (1869) records the flowers of *L. sapida* as "small", the corolla-tube being "2-2½ lines long", (5-6 mm), and Beadle et al (1972) record the corolla-tube as "4-5 mm". The specimens I have examined in the lower Blue Mountains have had a corolla-tube length of 7½-11 mm. Beadle et al (1972) states that *L. sapida* flowers from April to September; however, I have also found it flowering during February and March.

KEY TO THE SPECIES OF LISSANTHE

- A. Leaves linear-oblong to linear-lanceolate, 10-35mm in length; with recurved margins and a pungent mucronate tip. Flowers few in loose racemes; corolla-tube mostly 9 mm long. Fruit red, 8-10 mm diameter.

Native Cranberry; *L. sapida* R.Br. (1810).

- *A. Leaves linear, rigid, tapering to a pungent point, 4-15 mm long. Flowers numerous, pink to white, in short dense racemes. Fruit palish or white, up to 4 mm in diameter.

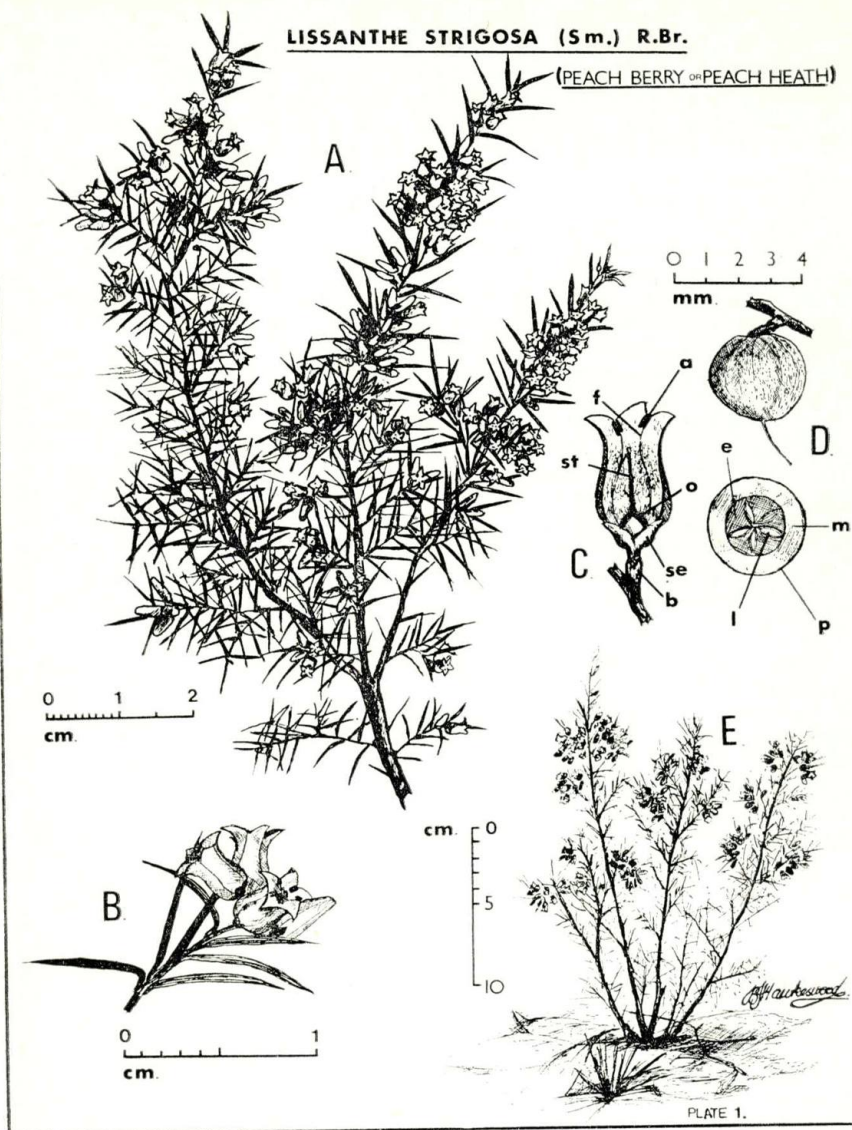
Peach Heath or Peach Berry, *L. strigosa* (Sm.) R.Br. (1810).

LISSANTHE SAPIDA

L. sapida (Native Cranberry), is an erect shrub to 2.5 m in height, having linear-oblong to narrow-lanceolate leaves up to 35 mm in length. The flowers are whitish or with a greenish tinge; the lobes usually coloured pale green in the plants that I have examined. The immature drupaceous fruits are green or green-yellow, becoming bright scarlet red when mature. They measure up to 1 cm in diameter, sometimes more. Willis (1963) states that the fruit resembles the European cranberry in size and colour and that these fruits are edible; I have tried eating them, but they appear to be tasteless; the hard endocarp is not edible and the mesocarp is not thick enough to make the fruits worthwhile eating. The plant flowers from February to September. It is found in N.S.W. only.

LISSANTHE STRIGOSA (Sm.) R.Br.

(PEACH BERRY OR PEACH HEATH)



LISSANTHE STRIGOSA

Sketch by Brian Hawkeswood.

(A to E: Scales as Indicated. C and D to same scale)

- A. Branch of Peach Heath In bud and flower.
- B. Raceme of four flowers.
- C. Half flower diagram, showing anther (a), and anther filament (f), style (st), ovary (o), (not cut), sepal (se), and bracteoles (b).
- D. Fruit and a transverse section showing pericarp (p), mesocarp (m), endocarp (e), and a loculus (l).
- E. Hablt study of Peach Berry.

LISSANTHE SAPIDA R.Br. (1810) — Botanical Description

DC. Prod. VII 742; Bot. Reg. t. 1275; Bot. Mag. t. 3147; *Styphelia sapida* F. Muell. Fragm. VI 42.

Erect, glabrous or minutely pubescent shrubs to 2.5 m in height, mainly 1 m, with spreading branches. Leaves alternate, almost sessile, on very short petioles 1-3 mm long; mainly 7-10 longitudinally veined (veins more prominent on the under surface); oblong lanceolate to linear-lanceolate, 10-35 mm long, 2-5 mm wide, mucronate tip 1 mm long, reddish, brown or black; leaves with recurved margins, shining olive to dark emerald green above, pale on the under surface, glabrous. Inflorescence a loose raceme, 3-5-flowered. Flowers on pedicels 2-3.5 mm long, usually with two small bracts and one bracteole, none of which overlap the calyx. Corolla-tube 7.5-10 mm long, somewhat narrowed at the throat; lobes (five), 2.5-4 mm long equal, straight or curved, glabrous and valvate in bud. Sepals (five), 0.5-1.5 mm in length, very broad and obtuse, or slightly acute, the two outer ones usually thickened or produced at the base. Style about 7-9 mm long, thick, almost as long or longer than the corolla-tube, with small white hairs at the base, terminal on ovary summit and persistent. Corolla-tube ringed with tufts of white hairs about or above the middle. Tube white to pale green, the lobes tinged with darker green. Anthers obtuse, filaments attached to the anther slightly above the middle; the anthers wholly or partially enclosed within the corolla-tube, alternating with the lobes. Filaments whitish, extremely thin, attached to the sides of the corolla-tube. Hypogynous disc slightly toothed. Fruit is drupaceous; ellipsoid to globular in shape; when mature, coloured bright scarlet red and measures 8-12 mm in diameter, 5-locular (or fewer due to abortion); endocarp thick, not separating into pyrenes, mesocarp fleshy or pulpy; pericarp thin and smooth. Flowers Feb.-Sept.

For those who may wish to collect cuttings or seed, of *L. sapida*, from the bush, where possible, the following places have had specimens collected from them:— On hillsides near the Grose River; Mt. Caley, east of Mt. Victoria; banks of the Nepean River near Mulgoa and Silverdale; Emu Plains; Glenbrook; Erskine Creek (south of Glenbrook), on sandstone slopes; Linden; Cataract Falls near Lawson; Kurrajong; Springwood; Valley Heights; Blackheath; Wentworth Falls; Burragorang Mountain; Tahmoor (Bargo River) and Yerrinbool. (In many of the areas above, e.g. Emu Plains, *L. sapida* may have been eliminated due to urbanisation.)

LISSANTHE STRIGOSA

L. strigosa is a small shrub measuring up to about 60 cm high, erect or procumbent, having small, narrow-linear-lanceolate leaves up to about 15 mm in length. Flowers are in short axillary racemes which are crowded at the ends of the branches. The flowers are white, or they may have a pinkish tinge through them. The fruit is a white or pale fleshy drupe about 3-4 mm diameter. Cribb (1975) lists the fruit as edible; being sweet-tasting when ripe. The plant flowers from July to August. It is found in southern Queensland, N.S.W., A.C.T., Victoria, S.A., and Tasmania.

Dried specimens examined in the National Herbarium of N.S.W., and the Herbarium of the University of New England, have been collected from the following places: Qld. — Wallangarra; Toowoomba; Oakey; various areas around Brisbane; N.S.W. — Armidale, on rocky slopes; Glen Innes; Narrabri; Tenterfield; Windsor; Capertee; Cox's River; Glen Davis; Jenolan Caves; Bathurst; most places on the Blue Mountains; Nowra; Canberra. Vic. — the Grampians; Bairnsdale; also found in South Australia and Tasmania.

LISSANTHE SAPIDA R.Br.

(NATIVE CRANBERRY).

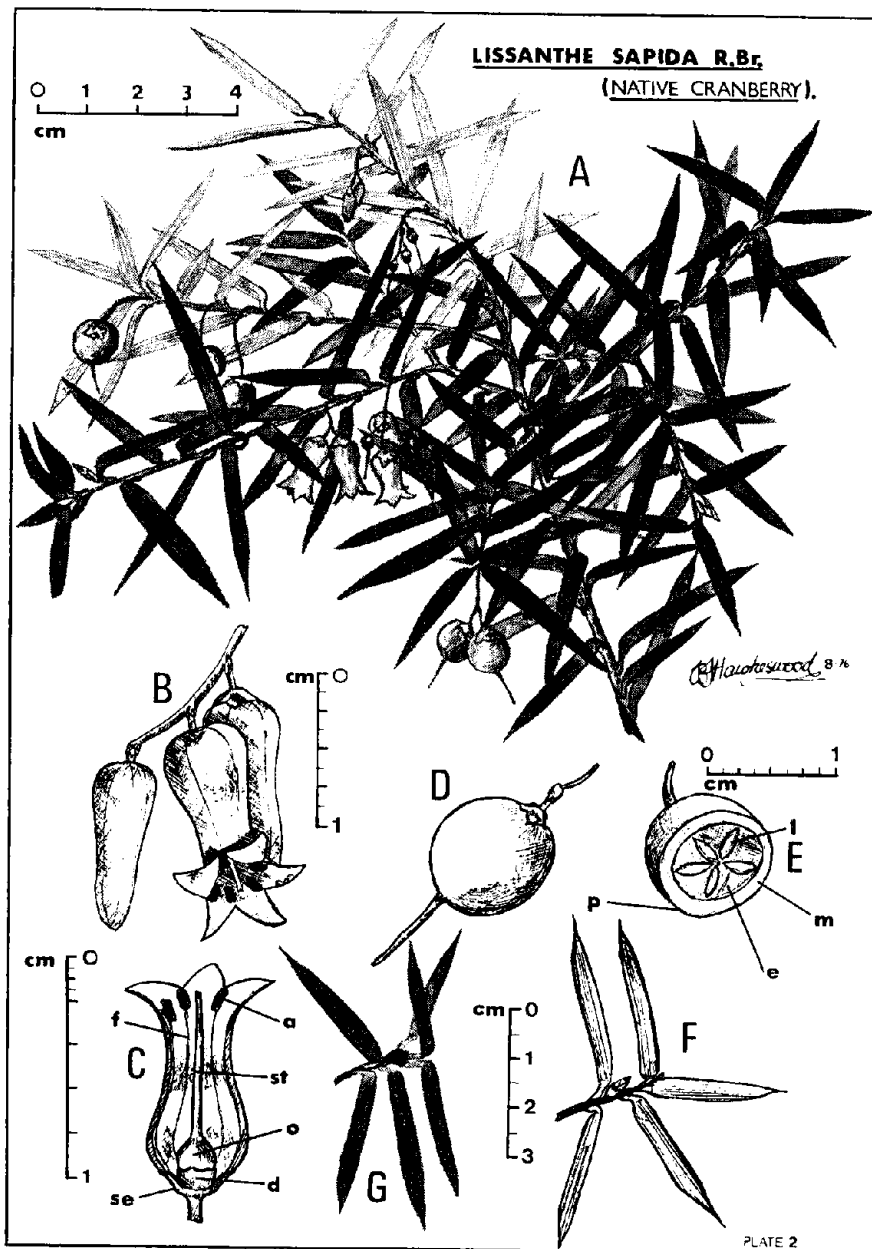


PLATE 2

LISSANTHE SAPIDA

Sketch by Brian Hawkeswood.

- (A to E: scales as indicated; D and E to same scale; F and G to same scale)
- Branch of Native Cranberry in bud, flower and fruit.
 - A loose raceme of three flowers, two in bud.
 - Half flower diagram, showing anther (a), filament (f), style (st), ovary (o), hypogynous disc (d), sepal (se).
 - Fruit with attached style.
 - Transverse section of a fruit showing pericarp (p), mesocarp (m), endocarp (e) and a loculus (l).
 - Undersurface of leaves showing characteristic parallel venation and an axillary bud.
 - Dorsal surface of leaves of Native Cranberry.

LISSANTHE STRIGOSA (Sm.) R.Br. (1810) — Botanical Description

DC. Prod. vii 742; Hook. f. flora. Tasm. 1,247; *Styphelia astrigosa* Sm. Specim. Bot. New. Holl. 48 (1793-95); F. Muell. Fragm. vi 42; *Lissanthe subulata* R.Br. Prod. 540; DC. Prod. vii 742; *L. intermedia* A. Cunn.; *L. rigida* Benth. in Hueg. Enum. 76.

A stiff, much-branched, bushy shrub, sometimes low and spreading, but usually erect and attaining a height of 10-60 cm; the branches glabrous or pubescent. Leaves alternate, narrow linear-lanceolate; rigid, shortly stalked, flat or the margins recurved, mucronate, 4-15 mm long, about 1 mm wide; upper surface glabrous, shining dark green, the under-surface glaucous, 3-5 longitudinally veined, the veins more prominent on the under-surface. Flowers small, in short dense axillary racemes of 1-4 flowers, these crowded at the ends of the branches, sometimes below a short terminal raceme having more numerous flowers. Pedicels short, 0.5-1.5 mm in length, each subtended by a small, obtuse, concave, ovate bract, which has ciliate margins; two ciliate bracteoles are also present at the base of the pedicel. Sepals similar to the bracts and the bracteoles, pinkish, ovate, obtuse, ciliate, 1-1.5 mm in length. Corolla-tube white or pinkish, constricted at the throat, 2-4 mm in length, with short white scattered hairs inside above the middle; lobes shorter than the tube, glabrous or with microscopic papillose hairs, straight or spreading outwards. Stamens with short filaments 1-1.5 mm in length, joined to the top of the corolla-tube; anthers half-exserted. Hypogynous disc shortly 5-lobed. Style much shorter or nearly as long as the corolla-tube, marked by furrowed channels almost to the stigma; pubescent on lower half; stigma small. Ovary 5-locular with a single pendulous ovule in each loculus, pubescent, with dense white papillose hairs; fruit a fleshy white globular baccate drupe, 2-4 mm diameter; style persistent on fruit. Fls. July/Aug.

In the past, another species of plant was included in the genus *Lissanthe*; it was described under the name of *L. montana*, (Hooker 1857, Benth. 1869, Maiden 1916, Curtis 1963). In 1956, J. H. Willis transferred this species to the genus *Leucopogon*, since it resembled *Leucopogon hookeri* F. Muell., in many characteristics. Its new name was described as *Leucopogon montanus* (R.Br.) J. H. Willis (Willis 1956, 1972). In some latest references (e.g. Curtis 1963), *Leucopogon montanus* is still described in the former genus.

L. montanus differs from the two species of *Lissanthe* by having sessile flowers in which the two bracteoles clasp the base of the calyx, a feature not present in *Lissanthe*. The flowers are dioecious (Benth. 1869, Curtis 1963); the flowers becoming unisexual by abortion of pollen or ovules (Curtis 1963); the corolla-tube is glabrous inside above the middle. Willis (1956) was convinced that the corolla-beard, so characteristic of the *Leucopogons*, of *L. montana*, had either failed to develop or was reduced to microscopic proportions. Microscopic evidence has shown that papillate hairs are present on the lobes of the flowers of *Leucopogon montanus*, while only minute papillose hairs are present on *L. strigosa* (Willis 1956). Fortunately the strongest evidence to support the transfer of *L. montanus* to the genus *Leucopogon* came in 1955, when S. Smith-White showed that the haploid chromosome number in the true *Lissanthe* species was 7, while in *L. montana*, the number was 14. The rest of the features of *L. montanus*, as described in such references as Hooker (1857), Benth. (1869) and Curtis (1963), fit the generic characteristics of the genus *Lissanthe*.

LISSANTHE and STYPHELIA

Another point I would like to make of critical interest concerns the confusion of the reference of *Lissanthe* to the genus *Styphelia*. Cochrane et al (1968) features *Lissanthe strigosa* as *Styphelia strigosa*, and should be corrected accordingly to avoid confusion; many overseas workers combine several genera of the Epacridaceae under *Styphelia*, but most botanists in Australia regard these genera as separate; *Styphelia* differs from *Lissanthe* in having an elongated cylindrical corolla-tube, the anthers well-projected beyond the corolla-tube and the style much longer than the corolla-tube.

HORTICULTURAL POTENTIAL

Lissanthe are attractive shrubs very suitable for gardens. The *Epacridaceae* are notorious for being extremely difficult and perhaps impossible in many cases to grow by seed, and I believe that *Lissanthe* is by no means an exception. The fruits of *Lissanthe* ripen and drop to the ground during October to December; in the ground, the mesocarp and the hard endocarp are broken down by soil bacteria, etc., and the seeds are subsequently released into the soil. It would be perhaps a good idea to collect soil from beneath specimens in the field so as to try to obtain seeds which may be soon germinating, for those who may wish to grow the plants by seed. Cuttings are usually easier than seed to grow. The advice of Blombery (1970, 1973) should be noted for the growing of *Lissanthe* by cuttings.

Cuttings should be grown in a cutting medium of sand and peat moss, sand and loam, or the natural soil in which the original plant was growing, with a small covering of humus on the top, i.e. rotting leaves and other vegetative matter. If possible, the prepared mixture should be steam sterilized, but pouring boiling water over the medium, and letting it drain after it has been placed into cutting tubes or small pots, will be sufficient.

It is advisable to obtain cuttings of young tips of branches from the most vigorous plants, or older branches, but material should be less than 5 mm in diameter, since this wood is not as hard as the older wood and will not dry out as quickly. The base of the cutting should be cut at an angle or slant, or have a "heel" that has been carefully torn from the parent branch. The shoots can be left with the terminal bud attached or it can be cut off. Cuttings should be kept moist before planting. After preparation of the soil medium etc., the cuttings may then be placed in water containing Formula 20 hormone solution or dipped in a plant cutting powder, as directed on the respective bottles or packets, which contain the growth regulators. They can be transferred to the cutting medium, and planted about 2-3 cm deep. A moderate supply of water is required. A glasshouse should be used to protect cuttings from winds, beating rains, overexposure to sun, etc. If this is not possible, a sheltered position should be given to these. *L. sapida* is found in dry or wet sclerophyll forests in its range; it appears to prefer a sheltered and shady habitat away from wind and direct sunlight. Good drainage is essential, since it prefers to grow on rocky or sandy slopes, whereas *L. strigosa* inhabits open woodlands or unsheltered areas where it gains the most benefit from the sun.

I have undertaken to grow *Lissanthe* by the above methods etc., and will report on the successes (or failures) in a later issue. From recent reports I have had, other attempts to grow *Lissanthe* by the above methods, either by cuttings or seed, have been unsuccessful, but I feel that if perseverance and tender care prevail, good results will be achieved. I believe that *Lissanthe sapida* is an uncommon plant even with its own limited distribution and that it may face extermination in the future, so any reports of successful growing of *Lissanthe* will be greatly appreciated, by myself and other growers interested in the cultivation and preservation of these attractive shrubs.

ACKNOWLEDGEMENTS

I would like to thank Professor N. C. W. Beadle and Mr. J. B. Williams of the Botany Department, University of New England for checking the manuscript and giving kind remarks regarding corrections; also I would like to thank Dr. L. A. S. Johnson of the National Herbarium of N.S.W. for allowing me to examine specimens for this study.

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CLASSIFICATION OF THE EUCALYPTUS

You will notice a code of letters against each species opposite (MABEJ, MABCC, etc.). As there are so many species and there is so much confusion in their naming, the leading authorities, Prof. L. D. Pryor and Dr. L. A. S. Johnson, have prepared a booklet — "A Classification of the Eucalypts". This has been reprinted recently and is available by mail from the Editor, Australian Plants, for \$4.50 plus 80c postage. Further details will be in the next issue.



Photography by F. W. Humphreys.

EUCALYPTUS OLDFIELDII

A beautiful western *Eucalyptus* growing to 4 m.

FOURTEEN NEW EUCALYPTUS FROM WESTERN AUSTRALIA

M. I. H. Brooker — CSIRO Division of Forest Research, Canberra, A.C.T.

In the past few years many new *Eucalyptus* species have been discovered or recognised in Western Australia. This has been made possible largely by increased accessibility to remote sites and to a lesser extent by a closer examination of known areas and the use of more refined taxonomic methods.

As might be expected, most of these species are very restricted in distribution. They are all small trees or mallees and are fairly inconspicuous with the exception of the fine timber tree, *E. brevistylis*, which was confused for some years with red tingle (*E. jacksonii*). Few are of ornamental interest. Notable are *E. pendens* with its slender stems and drooping canopies and *E. aquilina* with its large, beautifully-sculptured fruits. Others like the shrubby *E. prominens* and the white-barked trees *E. fraseri* and *E. leucophloia* may be useful as ornamentals in arid areas.

All of these new species so far published belong in the two largest subgenera of the most recent classification of *Eucalyptus* (Pryor and Johnson 1971)*. Their taxonomic positions in this system are indicated by the letters at the end of the line in the following digests. The leaflet number of the Forest Tree Series, published by the Forestry and Timber Bureau and latterly by the CSIRO Division of Forest Research (1974-1977) is given in brackets after the common name. Original descriptions are indicated in the References.

***Eucalyptus acies* — Woolburnup mallee (194) MABEJ**

Eucalyptus acies is a smooth-stemmed mallee to 2.5 m tall with yellowish, markedly quadrangular branchlets. The adult leaves are opposite to subopposite, lanceolate to broad lanceolate, up to 15 x 3.5 cm, rigid with yellow midribs. The umbels are axillary, 7-flowered; peduncles flat and down-turned; buds pedicellate, up to 1 x 1 cm, clavate and ribbed; fruit hemispherical to obconical, up to 1.5 x 1.5 cm with a prominent broad disc; valves 3-4, not prominent.

Woolburnup mallee has a restricted distribution in the Fitzgerald National Park and has been collected only on Thumb Peak, Middle Mount Barren and Woolburnup where it grows among dense shrubbery on Proterozoic quartzite rocks.

It is not closely related to any other species and is classified in a subseries with *E. calcicola* (Hamelin Bay mallee) and *E. ligulata* (Lucky Bay mallee).

***Eucalyptus aquilina* — Mt. Le Grand mallee (181) MABCC**

Eucalyptus aquilina is a smooth-barked, multi-stemmed mallee to 5 m tall. The adult leaves alternate on the branchlets and are lanceolate or falcate, up to 13 x 2.5 cm, rather thick and slightly glossy. The umbels are axillary, 3-flowered; peduncles flat and finally downturned; buds sessile, turbinate never strongly ribbed, up to 3.5 x 3.5 cm, opercula hemispherical to low conical; fruit obconical, up to 4 x 5 cm, disc broad, rugose, red-brown and shining when fresh, extending over the 5, 6 or 7 valves as raised, hooked lobes.

Mt. Le Grand mallee has a very restricted distribution and is known only from two populations between Mt. Le Grand and Frenchman Peak. It grows in dense clusters on hillslopes near creeks and in creek beds with *E. doratoxylon* (spearwood) and *E. ligulata* (Lucky Bay mallee).

It is clearly related to *E. coronata* from which it differs in the smooth buds and fruit, non-beaked opercula and bigger lobes to the disc. It occurs well to the east of known occurrences of *E. coronata*.

Eucalyptus balladoniensis is a few-stemmed mallee to 4 m tall. The bark is held on the lower parts of the stem but above, it decorticates in long strips to leave a smooth surface. The adult leaves alternate on the branchlets, and are lanceolate, up to 13 x 2.5 cm. The umbels are axillary, 7-flowered; peduncles terete or slightly flattened, erect; the buds up to 2 x 1 cm with opercula prominently beaked; fruit hemispherical, up to 1.2 x 1.2 cm, with a broad, incurved disc and 4 exserted valves, hollowed at the back.

Balladonia mallee has only been collected northwest of Balladonia on the Eyre Highway and between Balladonia and Zanthus. It grows on plains and gentle slopes in open-scrub with *E. transcontinentalis* (redwood), *E. platycorys* (Boorabbin mallee) and *E. fraseri* (Balladonia gum). The understorey is usually spinifex, bluebush and saltbush.

It is not closely related to any other species but its bisected cotyledons and smooth, grey elliptical seed place it at least in the Bisectaria near perhaps the OLEOSAE and the MACROCARPAE.

Eucalyptus brevistylis — Rates tingle (153)

MAE:A

Eucalyptus brevistylis a large tree to 40 m tall with brown, thick, fibrous, longitudinally fissured bark to the small limbs. The adult leaves alternate on the branchlets, and are lanceolate or falcate, asymmetrical at the base, strongly discolorous, up to 10 x 3 cm. The seedling and coppice leaves are unique for species in the area as they are cordiform and petiolate. The inflorescences are axillary or in more or less terminal clusters of umbels with 11 or 13 flowers; peduncles slender, erect; buds ovoid to clavate, up to 0.3 x 0.3 cm, with hemispherical opercula; fruit truncate-ovoid, prominently wrinkled, up to 1 x 0.9 cm; disc inward-sloping; valves 3, sunken and obscure.

Rates tingle has a restricted distribution east and northeast of Walpole. It grows on plains or gentle slopes on deep yellow podsols in tall, dense forest with *E. marginata* (jarrah), *E. calophylla* (marri) and *E. megacarpa* (bullich).

It is not closely related to any other species but belongs broadly in a group with *E. jacksonii* (red tingle) from which it differs in the short operculum, small style, rugose fruit, yellow wood, and petiolate, cordiform seedling leaves. The wood is similar to that of the unrelated *E. guilfoylei* (yellow tingle).

Eucalyptus calcicola — Hamelin Bay mallee (154)

MABEN

Eucalyptus calcicola is a small, smooth-stemmed mallee to 2.5 m tall. The adult leaves alternate on the branchlets, are lanceolate or falcate, up to 11 x 3 cm. The umbels are axillary, 7-flowered; peduncles angular or flattened; buds double-conic, coarsely ribbed, up to 1.5 x 1 cm, opercula beaked or conical; fruit obconical or cup-shaped, more or less sessile, strongly ribbed, up to 1.5 x 1.6 cm, often retained in dense clusters on old wood; disc prominent, wide and slightly raised; valves 4, sunken.

Hamelin Bay mallee has a remarkably restricted distribution on the westerly aspects of some massive calcareous dunes near Hamelin Bay west of the karri forests and near to stands of stunted *E. calophylla* (marri) and *E. megacarpa* (bullich). It was discovered by the well-known Western Australian naturalist Harry Butler.

Its natural affinities are obscure and is probably closest to *E. ligulata* (Lucky Bay mallee) from which it differs in the more coarsely-ribbed buds and fruits, shorter buds and particularly in the shining, green, pointed seedling leaves.

Eucalyptus deflexa is a small, smooth-barked multi-stemmed mallee to 3 m tall. The adult leaves alternate on the branchlets and are small, lanceolate, narrow-lanceolate or slightly falcate, up to 10 x 1 cm, yellowish-green and glossy. The umbels are 3-flowered, peduncles slender, long and down-turned; buds cylindrical or ovoid with short opercula up to 1.2 x 0.5 cm; fruit on long pedicels, ovoid, up to 1.2 x 0.9 cm; disc steeply depressed; valves 3, 4 or 5, deeply sunken. Flowers may be yellow or pink.

Lake King mallee has a distribution in the scrub north of Ravensthorpe, particularly between Lake King and the Johnston Lakes. It grows on flats and low rises in open-scrub with *E. flocktoniae* (merrit), *E. pileata* (capped mallee), *E. eremophila* (tall sand mallee) and *E. foecunda* (narrow-leaved mallee).

In its floral morphology it does not resemble any other species although the reniform cotyledons, inflected stamens, coarsely-pitted seed and glandular pith place it with the mallees of the *E. griffithsii* — *E. rugosa* group.

Eucalyptus effusa — Rough-barked gimlet (202)

SIK:I

Eucalyptus effusa is a small, straggly, few-stemmed mallee up to 4 m tall. The stem bark is not shed but partly decorticates in long strips. On the smaller branches it sheds to leave a smooth surface. The adult leaves alternate on the branchlets and are narrow-lanceolate up to 10 x 1.5 cm. The umbels are 7-flowered; peduncles are short, slightly flattened or angular, widening towards the top; buds cylindroid, up to 0.9 x 0.4 cm, opercula being longer than the base; fruit cupshaped or obconical, up to 0.7 x 0.6 cm; disc narrow; valves 3 or 4, barely exerted.

Rough-barked gimlet has a restricted distribution between the Fraser Range and Balladonia. It grows in small stands in tall shrubland or tall open-shrubland on gentle slopes and plains. The soil is highly calcareous and often supports an understorey of spinifex (*Triodia*).

It is in the gimlet group of species being close to *E. salubris* (gimlet), *E. campaspe* (silver-topped gimlet) and *E. diptera* (two-winged gimlet) from which it differs, however, is lacking the characteristic fluted stems and in retaining its outer bark.

Eucalyptus exilis — Boyagin mallee (155)

MADAF

Eucalyptus exilis is a smooth-barked mallee to 6 m tall with slender, straggling stems to 6 cm diameter. The adult leaves alternate or are sometimes subopposite, shortly petiolate, ovate-lanceolate, up to 7 x 1.2 cm, often narrowing, abruptly to a short point. The young branchlets are glaucous. The umbels are axillary, up to 11-flowered; peduncles slightly flattened; buds clavate to ovoid, up to 0.8 x 0.5 cm; operculum hemispherical or broadly conical; fruit ovoid or truncate-globular; up to 1.5 x 1.4 cm; disc inward-sloping; valves 4 obscure.

Boyagin mallee is distributed in the Mundaring Weir catchment, the Boyagin Rock Reserve and the Wickpin Reserve. It grows on plains and moderate slopes of poor lateritic soils in open scrub with *E. accedens*, *E. drummondii* and dense sclerophyllous shrubbery.

It is closely allied to *E. sepulcralis* (weeping gum) and *E. pendens* (Badgingarra mallee) from which it is easily distinguishable in the field by its erect and non-pendulous canopy. It also has smaller buds, leaves and fruit than these other two species.

***Eucalyptus fraseri* — Balladonia gum**

SLE:J

Eucalyptus fraserii is a tree to 20 m tall with smooth, whitish or whitish-grey bark. The adult leaves alternate on the branchlets and are narrow to broad-lanceolate, up to 15 x 2.5 cm. The umbels are axillary, 7-flowered; peduncles usually short and stout, erect; buds sessile, elongate-ovoid, up to 1.5 x 0.5 cm; opercula ribbed; fruit obconical or cupshaped, up to 1.2 x 0.8 cm; disc broad, level or inward-sloping; valves 4 to rim level.

Balladonia gum occurs from the Fraser Range eastwards towards Balladonia and Mt. Ragged. It grows in low woodland on soils over limestone with *E. transcontinentalis* (redwood) and *E. flocktoniae* (merrit) both of which it resembles in habit.

It belongs in a large group of mallees and is close to *E. conglobata* (Port Lincoln mallee) from which it differs in the tall, erect tree habit and in the buds and fruit which taper at the base and are not completely sessile as in *E. conglobata*.

***Eucalyptus insularis* — Twin Peak Island mallee (184)**

MADEM

Eucalyptus insularis has two distinct forms depending on the locality. It occurs on North Twin Peak Island on the Recherche Archipelago as a stout mallee to 8 m tall and near Cape Le Grand as a dense-canopied, slender-stemmed, shrub to 2 m tall. The adult leaves alternate on the branchlets, and are small, narrow-lanceolate or lanceolate up to 7.5 x 0.8 cm, often narrowing to a conspicuous slender hook. The umbels are axillary and multi-flowered; peduncles slender and turned down; buds clavate, up to 0.6 x 0.3 cm, opercula hemispherical, fruit truncate-ovoid, up to 0.8 x 0.6 cm; disc inward-sloping, red-brown and shining when fresh; valves 3, deeply sunken.

Twin Peak Island mallee is known only from North Twin Peak Island and near Cape Le Grand. On the island it grows amongst dense shrubbery of similar height including *Acacia heteroclita* with *E. lehmannii* (bushy yate) nearby. Near Cape Le Grand it grows in more open conditions at the western end of a large granite rock again with *E. lehmannii* nearby. In both localities it grows at the base of low rocky cliffs.

It does not resemble any other species although it clearly belongs with the western group of *Monocalyptus* species.

***Eucalyptus leucophloia* — Migum (203)**

SNACIB

Eucalyptus leucophloia is a small, straggly tree to 10 m tall with smooth, white, powdery bark often black-spotted. Foliage, buds, fruits and branchlets can be glaucous. The adult leaves alternate on the branchlets and are lanceolate, up to 10 x 2 cm. Many individual trees are mature while the canopy is in the intermediate stage when the leaves are opposite. The umbels are axillary or are clustered towards the ends of branchlets, 7- or 11-flowered; peduncles slender, short; buds ovoid or double conical, up to 0.9 x 0.5 cm; opercula hemispherical, conical or slightly beaked; fruit hemispherical or cupular, up to 0.8 x 0.6 cm; disc obscure; valves 3, broadly based and usually strongly exerted or sometimes smaller and only slightly exerted.

Migum is widely distributed. It occurs from the Pilbara region of Western Australia eastwards across the continent to western Queensland. It grows in low open-woodland commonly on low stony hills with a variety of other eucalypts such as *E. terminalis* (inland bloodwood), *E. argillacea* (northern grey box) and *E. papuana* (ghost gum).

It is close to *E. brevifolia* (northern white gum) with which it was once included. *E. brevifolia* has a restricted northwestern Australia distribution and differs clearly in the broad disc of the fruit.

Eucalyptus ligulata — Lucky Bay mallee (182)

MABEL

Eucalyptus ligulata is a small, multi-stemmed mallee to 3 m tall with smooth bark. The umbels are axillary, 7-, 11-, or 13-flowered; peduncles flattened, erect; buds double-conic, ribbed, up to 1.5 x 0.6 cm; opercula pointed, wider than the base; fruit cupshaped to truncate-ovoid, shallowly ribbed, up to 1.5 x 1.4 cm; with a red-brown, wide disc; valves 3, sunken.

Lucky Bay mallee is known only from Haul Off Rocks and the Cape Le Grand area where it is very common around the base of Frenchman Peak and at Lucky Bay. It grows in closed or open-scrub with *E. aquilina* (Cape Le Grand mallee), *E. doratoxylon* (spearwood), *E. tetragona* (tallerack), *E. angulosa* (ridge-fruited mallee) and *E. uncinata* (hook-leaf mallee).

Its natural affinities are not clear but is probably close to *E. calcicola* (Hamelin Bay mallee) from which it differs in the blunt-ended, non-glossy seedling leaves, and the more elongate, less coarsely-ribbed fruits.

Eucalyptus pendens — Badgingarra mallee (183)

MADAD

Eucalyptus pendens is a remarkable, smooth-stemmed, whipstick mallee to 5 m tall with the canopy always finally drooping. The young branchlets are shiny red beneath a white glaucous wax layer. The adult leaves alternate on the branchlets and are lanceolate, tapering to a fine point, up to 12 x 2 cm. The umbels are axillary, 7-, 11- or 13-flowered; peduncles oval or flattened in section, up to 4 cm long; buds clavate, up to 1.1 x 0.8 cm; opercula hemispherical, apiculate; fruit truncate-ovoid, wrinkled, up to 2 x 2 cm; disc reddish brown, inward-sloping; valves 4 or 5, sunken.

Badgingarra mallee occurs in a few sparse stands in the sandplain scrub near Badgingarra. The mallees emerge well above the dominant, sclerophyllous shrubbery and are conspicuous on the skylines. There are no eucalypts in association although *E. totiana* (prickly bark) and *E. lane-poolei* (salmonbark wandoo) grow nearby.

It is closely allied to *E. sepulcralis* (weeping gum) from which it differs in the smaller buds and fruit, and to *E. exilis* (Boyagin mallee) which has smaller leaves and an erect canopy.

Eucalyptus prominens — Cape Range mallee (204)

SII:G

Eucalyptus prominens is a few-stemmed mallee or shrub to 3 m tall with smooth bark or sometimes there is a stocking of non-decorticated bark. The adult leaves alternate on the branchlets and are narrow-lanceolate to lanceolate, up to 13 x 2 cm. The umbels are axillary, 7-flowered; peduncles flattened, up to 1.5 cm long; buds clavate, up to 1.3 x 1 cm; opercula hemispherical; fruit obconical, up to 1.2 x 1.3 cm; disc narrow, inward-sloping; valves 4 or 5, deltoid, exerted.

Cape Range mallee occurs only in the Exmouth Gulf region and is common on the Cape Range where it grows in tall open-shrubland on slopes with outcropping limestone and is associated with *E. terminalis* (inland bloodwood) and a form of *E. oleosa* (red mallee).

It is closely allied to *E. trivalvis* (desert mallee) from which it differs in the larger buds and fruit, the obconical shape to the fruit, and particularly the exerted 4 or 5 valves.

REFERENCES

- Brooker, M.I.H. (1972) — Four new taxa of *Eucalyptus* from Western Australia. *Nuytsia* 1, 242-253 (*E. acies*, *E. pendens*).
- Brooker, M. I. H. (1974) — Six new species of *Eucalyptus* from Western Australia. *Nuytsia* 1, 297-314 (*E. aquilina*, *E. brevistylis*, *E. calcicola*, *E. exilis*, *E. insularis*, *E. ligulata*).
- Brooker, M. I. H. (1976) — Six new taxa of *Eucalyptus* from Western Australia. *Nuytsia* 2, 103-117 (*E. balladoniensis*, *E. deflexa*, *E. effusa*, *E. leucophloia*, *E. prominens*).
- Brooker, M.I.H. (1976) — Two new combinations in *Eucalyptus* from Western Australia. *Aust. For. Res.* 7, 65-67 (*E. fraseri*).
- Hall, N. and Brooker, M.I.H. (1974-1977) — Forest Tree Series Leaflet Nos. 153, 154, 155, 164, 181, 182, 183, 184 (AGPS Canberra), 194, 200, 201, 202, 203, 204 (CSIRO, Melbourne).
- Pryor, L.D. and Johnson, L. A. S. (1971) — 'A Classification of the Eucalypts' (Aust. Nat. Univ., Canberra).
- White, B. J. (1971) — Tingle stand. Forest Notes, Forests Department, W. Aust. 9, 36-8 (*E. brevistylis*).

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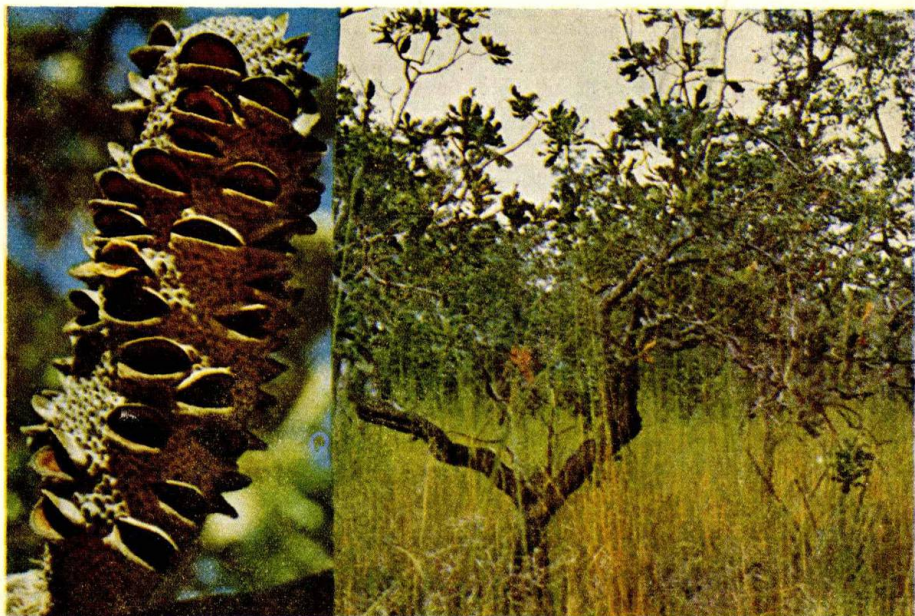
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Banksia of the North



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BANKSIA DENTATA

TOP LEFT: The woody fruiting cone of *Banksia dentata*.
TOP RIGHT: *Banksia dentata* growing amongst annual grasses at the edge of a swamp in the McMinns area
BOTTOM: The dense cylindrical flowering spike of *Banksia dentata*.