

Australian Plants

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Australian Proteaceae for the Garden

As this plant family contains so many unique plants of horticultural value, that are found only in Australia, this issue is once again devoted to Proteaceae. While the first articles describe those fabulous *Grevillea*, it is to other members of the family that I wish to bring your attention. It is here that action is needed by readers to investigate requirements for their cultivation and preservation for the world's stock of horticultural treasure in the future.

Grow the beautiful *Grevillea* as recommended by Australia's leading authority on this subject, Bill Molyneux, but help us at the frontier of horticultural endeavour as requested on page 319: "Australian Proteaceae—A Horticultural Frontier".

CONTENTS OF THIS ISSUE

- "Grevillea in Horticulture", by W. Molyneux — Page 287.
- "Seven New Species of *Grevillea*", by A. S. George — 299.
- "The Plant Family Proteaceae", by L. A. S. Johnson and B. G. Briggs — Page 303.
- "Australian Proteaceae — A Horticultural Frontier" — Editor's Notes — Page 311.
- "Cultivation of Proteaceae" — Notes by the Editor — Page 319.
- "Conditions for Cultivation of Australian Plants", by R. L. Specht — Page 312.
- "A Native Garden", by W. H. Payne and R. Powell — Page 314.
- "Santalum Fruit" — Domestication of the Quandong", by Grant and Buttrose — Page 316.
- "Franklandia", by Ken Newby — Page 321.
- "Persoonia", by W. Cane — Page 323.
- "Spartothamnella, the Genus", by Munir Ahmad Abid — Page 323.
- "Scientific Books on Plant Life" — Page 326.
- "Publications by Botanic Gardens & State Herbaria" — Page 327.

COVER PLATE *Grevillea dielsiana*

by Erica Crane

A single-stemmed, light grey barked, well branched, spreading shrub that under preferred conditions can become quite dense. Most specimens in gardens do not grow dense, but are attractive and open when not in flower. In late winter the large pendulous flowers, to 6 cm long, show well on the bush. A flowering bush is shown in full colour and glory in West Australian Plants for Horticulture, Part 2, a book you should have. Available from the Editor for \$7.50, plus 50c postage.

A new species *Grevillea ripicola* is described on page 302, which is allied to *G. dielsiana*, except that the lobes of the leaves are linear-lanceolate and flat and the flower segments are hairy in the throat.

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Grevillea in Horticulture

From notes taken during an address by W. MOLYNEUX
to a Society meeting in Sydney

Grevillea belongs to the family Proteaceae and is included in the sub-family Grevilleoidea. This group includes many genera, some of the best known being *Telopea*, *Hakea*, *Banksia*, *Macadamia* and *Lambertia*. They are characterised by having flowers in pairs, with each pair of flowers subtended by a bract which is usually deciduous at the time of flowering. In Australia there are approximately 250 species of *Grevillea*, with a number as yet undescribed. A large percentage of these occur in the south-western corner of Australia. There are 50 species in N.S.W., 35 species in Victoria and 40 species in Queensland. Tasmania has one species, *Grevillea australis*, which also occurs on the alpine country of Victoria and N.S.W. In Tasmania seven forms have been accorded varietal rank.

Grevillea is represented outside Australia in New Caledonia 3 spp. and in the Celebes, Indonesia. The Australian species *Grevillea glauca* and *G. pinnatifida* also occur in New Guinea, together with the endemic *G. papuana*.

It has been suggested that *Grevillea* first made its appearance on the floral stage during the late Cretaceous period, which is something like 80 million years ago. Even the botanists find it very hard to define the stages of development of *Grevillea*. Its closest affinity is to *Hakea*, and to a lesser degree *Finschia*, which does not occur in Australia.

Grevillea species are mostly confined to sclerophyll forests and heaths, only a few occurring in desert situations or in rainforests.

Grevillea and *Hakea* appear to have evolved in close association with each other. They sometimes have strong similarities in foliage, and in those instances can best be distinguished by the structure of the fruit, which is known as a follicle. *Grevillea* usually has a little follicle, which opens when the seed is ripe. In *Hakea* the fruit is a hard, woody capsule which stays on the bush and only opens after it is picked or a fire goes through the area. The two exceptions to this are *Grevillea candicans* and *G. annulifera*, which each have a round nut.

The botanists have subdivided the genus into groups, and the species show marked variation between the groups. There is at the moment a complete revision of this genus being undertaken, but at this stage we must accept the scheme proposed by Benthham in "Flora Australiensis," Vol. 5, 1870.

The section *Grevillea* contains such species as *Grevillea macrostylis*, *G. tripartita*, *G. nudiflora*, *G. platypoda* and *G. pectinata*. There is still a diversity in foliage, with very narrow lobing, very broad lobing, an extreme diversity in flower size and colour, style size and plant habit. This variation has resulted from interactions between the plants' ancestors and the environment. I have found that this group of plants is very hardy under a wide range of cultivation conditions.

Grevillea lavandulacea—Another principally Victorian *Grevillea*, possibly with the greatest horticultural material. The finest forms are again from the Grampians area.

"Black Range" form—An open, upright shrub with small, rigid foliage. The flowers are a clear colour—light purple to dark red.



Photography by D. Woolcock

GREVILLEA PLATYPODA

Grevillea platypoda (above) is closely allied to *G. infundibularis*, a new species described on page 300, and to *G. patentiloba*, which has longer styles and more divided leaves with narrower lobes. Some of the other species in this group are *G. macrostylis*, *G. plurijuga* (illustrated on page 296), *G. pectinata* and *G. oncogyne*.

GREVILLEA LAVANDULACEA

The colour plate opposite shows one form (and colour form) of this very beautiful shrub. The picture of the bush is not meant to show much detail, but illustrates quite vividly how this particular form will add a blaze of colour to your garden. Bill Molyneux has this to say of the forms:

"Billywing" form—Found in seasonally wet areas, it is a compact plant to 0.6 m, with small pink to red, strikingly beautiful flowers.

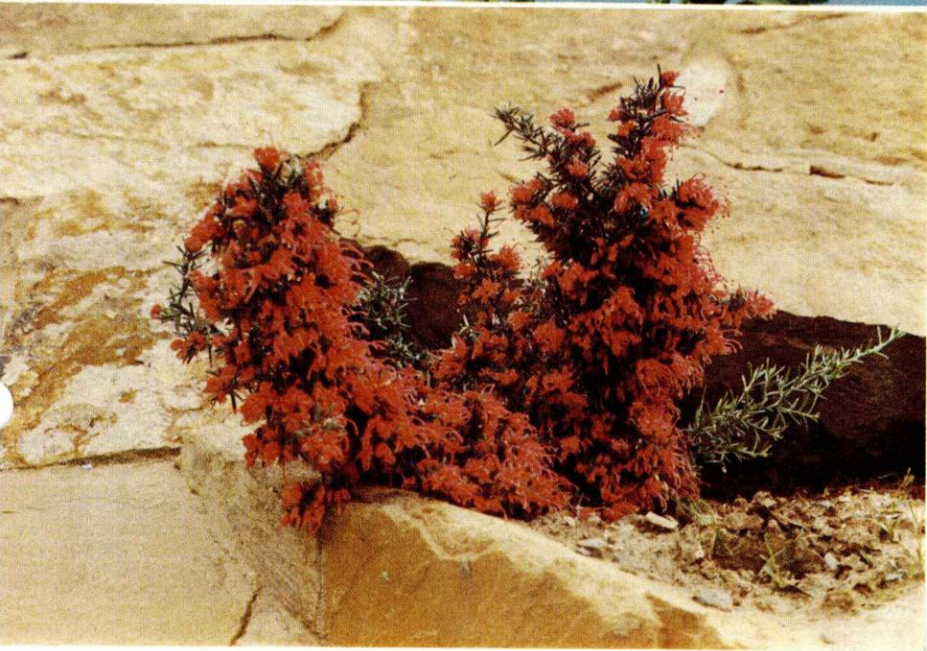
Cascading form—A form very similar to the above. Has a beautiful cascading habit to 2 m and red/pink flowers. The foliage is softer, the flowers being similar.

Penola form from S.A.—A feature of this plant is the greyish foliage. The flowers are pink. It grows to 1.5 m.

Tanunda form from Tanunda, S.A.—The plant, to 1 m, has very green leaves and pink flowers.

Comment by D. Macgillivray, Botanist, National Herbarium, Sydney.

In reply to the query from the Editor, "Australian Plants", concerning the probable future status of the many forms of *Grevillea lavandulacea*, it seems that *G. muricata* from the western part of Kangaroo Island, S.A., often referred to as a form of *G. lavandulacea*, will remain a distinct species, but the many forms, including a plant at present known as *G. rogersii*, will remain part of *G. lavandulacea*. Naturally this could be subject to alteration on completion of the present review.



Photography by M. B. Williams (top)

GREVILLEA LAVANDULACEA

The section *Manglesia* seems to be one of the most characteristically "West Australian" groups of this genus. It is characterised by small, dense clusters of white or cream flowers with very small styles dilated in the centre. They are often highly perfumed. This group is not well adapted to pollination by birds. In this group I have noted that ants are seed-dispersing agents. I have seen ants appearing to sit on the seed follicles waiting for them to open, then remove the seeds and take them to their nests. They do not appear to eat the seed as, after rain, it is not unusual to see a forest of *Grevillea* seedlings sprout up from the ants' nest.

This group includes plants that are fairly well known: *G. tridentifera*, *G. glabrata*, *G. triloba*, *G. paniculata*, *G. vestita* and *G. biternata*. Although the group displays a wide variety of leaf forms, the floral structure is very stable.

It is interesting to note the variation in leaf form of *Grevillea*. In Queensland a large percentage of species have a large pinnate, fern-like leaf, with most plants being large shrubs or small trees. In N.S.W. there appears a dominance of simple leaves, either linear, obovate or lanceolate type leaves. In Victoria we have a large number with holly-like leaves. In South Australia they again have simple leaves in most cases, while in W.A. you find a complete range, including simple leaves and holly-type leaves, but the very narrow divaricate type of leaf is quite common.

Potential for Horticulture

Some 150 of the 250 named species have been tried in horticulture. Many of these will adapt to a wide range of soil conditions, while some are very limited. I have grown all the Victorian species and had success with all but two, which are desert ones from the north-west of the State. These are *Grevillea pterosperma* and *G. huegelii*. They grow on low rainfall and very deep sand conditions in W.A. and S.A. as well. A third species grows with them, in Vic. and S.A., *G. ilicifolia*, but it extends its range to the Grampians and the edge of the Little Desert. In cultivation it grows best in well-worked soil over clay conditions.

This inability to grow some species of *Grevillea* in Victoria extends to some N.S.W. species, especially in the sandy soils of the bayside areas near Melbourne. Talking to people in Sydney, I find that they are also having difficulty in growing a number of N.S.W. plants in the light sandy soil areas. It is interesting to note that some of N.S.W. species, such as *Grevillea caleyi*, *G. laurifolia*, *G. acanthifolia* and *G. x gaudichaudii*, will not grow well in these light, low-nutrient soils, yet plants such as *G. sericea*, *G. speciosa* and *G. longifolia* grow extremely well. For the former group you need to build up the soils with peat moss or humus and fertilize fairly heavily with a nitrogenous fertilizer such as blood and bone, or with "Osmocote" sparingly.

Of the Queensland species of *Grevillea* tried under cultivation in Victoria, the only one I have had real success with is *G. banksii*, which we found very frost tender. However, in shady conditions it grows very well. Other very desirable species, such as *G. pteridifolia*, do not do well; it is too cold and wet for them in Victoria.

Of the W.A. species of *Grevillea*, there is a long list of very desirable garden shrubs. The sum of my experience is that the ones with a wide range of growing conditions will adapt quite satisfactorily, whereas those with a very limited range have proved very hard to establish. Also the ones that grow in deep sand, the northern sand-plain grevilleas of W.A., are very difficult to establish, whereas those that come from shallow soils are much more adaptable and will adapt to either shallow or deep soils.

Choose Your Plants Wisely

It is amazing the number of customers who come to the nursery and advise that their plants have died for no reason at all. There is always a reason, and it is usually wrong growing conditions. We put a lot of work into our catalogue to group the plants and help people in their selection. If people are determined to attempt unsuitable species for their conditions, then they must accept a high mortality rate.

We have found that a lot of W.A. plants suffer root damage during winter rains and that this is not evident until summertime, when the plant is under stress. The plant is able to manage over cooler conditions, but when summer comes it cannot survive. In many instances we have found that the plant has virtually drowned, or damaged roots cannot cope with high summer transpiration losses.

That Deadly Fungus

A common cause of death is a fungus disease known as *Phytophthora cinnamomi*. This is a root pathogen that attacks the feeder roots of a plant and at the moment there is no known cure. The nurseryman has a duty here to supply a disease-free plant, and we apply very strict controls in sterilization of soils and nursery hygiene. With *Phytophthora* you can take it in soil from a nursery and, when planted in the garden, it can wipe out your garden within a week.

As a gardener you can get minimum control by using sterilized soil or by using a chemical control. We use Coban as a soil drench, very expensive and very effective for potted plants. Dexon is another commercial product available. These give only a temporary cover. The best thing is not to get the fungal disease in the first place by carefully selecting where you obtain your plants and your soil.

The disease is, however, very widespread, being found in most forested areas in Australia. It has been spread by mud on vehicle tyres and even on shoes following a tramp through the bush. Although there are reports indicating that it has been spread by airborne spore, it usually spreads, and does so quite rapidly, along the water table. Introduced to a garden, all shrubs "downstream" on the water table are quickly infected—its progress "upstream", or across, is very slow. Good drainage is the most effective control.

Signs of disease is overnight collapse—healthy plants one day and dead the next day. Unfortunately you cannot detect the damage by the disease until the plant is dead. Pull up the dead plant and you will find that the roots have died back to stumps, and all the little feeder roots have gone.

One indicator is by growing *Banksia* bushes nearby; the foliage yellows in the early stages, although this could happen due to some nutrient deficiencies. A simple test of the soil for the disease is to take a sample at 20 cm depth, put it into a container with water and stand a pear in the muddy water to a depth of 4 cm. If the disease is present, a brown ring, like a bruise, will develop at water level.

Plants that come from dry, well-drained areas are the most susceptible, and plants from moist gullies are the least susceptible.

Some hardy and attractive *Grevillea* are:

Grevillea from South-eastern Australia

Grevillea confertifolia—This species is found only in the Grampians. One form from the creeks grows to 1 m, arching out with its clusters of red-pink spider flowers the other is prostrate. A prostrate form comes from the plateau on top of the Grampians. Both are hardy in the garden. This plant is closely related to *G. sericea*, the "Pink Spider Flower" from N.S.W.



Photography by Peter Althofer

GREVILLEA RIVULARIS

Described as a newly named species in Issue 67:318, this shrub, to 2 m high, was previously known as *Grevillea* 'Carrington Falls'. The pungently pointed, deeply divided leaves, 3-6 cm long and about the same in width, do not hide the bright red glabrous flowers and make it an excellent background or screen/shelter shrub as recommended by Bill Molyneux on page 298.

GREVILLEA ALPINA (opposite)

Bill Molyneux records the following forms of this beautiful shrub:

The best forms known to me:

"Goldfields"—Generally small soft foliage with a rounded spreading habit; flower colour white, yellow, green, pink, red, orange and lilac.

The Mt. Ida (20 km east of Bendigo) form has red and yellow woolly flowers and is the densest-growing goldfields form, to 1 m.

The Mt. Slide (near Lilydale) form is red and cream and is more upright, to 1.5 m.

The Pylong (near Seymour) form is also red and cream and can reach a height of 2 m.

The St. Arnaud (west of Bendigo) form has red to pink flowers, but rarely grows above 1 m.

Grampians area—The forms found in the Grampians have larger dark green leaves.

"Grampians"—A form of upright habit to 1.6 m, with red and yellow flowers.

"McDonald Park"—A lower-growing form to 0.8 m, also with red and yellow flowers and narrow foliage. This is not a true *G. alpina*, but of hybrid origin.

"Whoo Forest" (near Nagambie) form—Larger leaves with cream and green flowers.

"Morri Morri" State Forest form found on the eastern fringes of the Wimmera. A shrub to 1.5 m, rounded in habit, with large pink to lilac flowers.

Tooberac form which occurs in a limited area just to the East of Mt. Ida. Small soft grey foliage and elongated bunches of orange/red flowers. 60 cm high x 40 cm.



GREVILLEA ALPINA

Grevillea barklyana—The Victorian Gippsland form is from deep wet gullies, and in these conditions can grow to 10 m or more. In garden conditions it will grow to 4 m, throwing its skirts out across the ground. A real beauty, with long pinky toothbrush-type flowers. The birds love them. The foliage is quite variable, some with entire leaves, some with one or two lobes and some with 8-10 lobes. It is always an interesting plant, even in leaf colour. The N.S.W. form from Jervis Bay does not grow as large, is more open, with a deeper-colour flower. It has flowers for most of the year.

Grevillea victoriae—A variable species with many attractive forms. Unfortunately it does not always show its flowers to advantage in the garden. The typical alpine form has very dark ovate leaves with rusty-red flowers. In Gippsland there is a form that grows on dry hillsides near Lake Mountain. Its leaves are a mid-green and the flowers pink to red.

The third Victorian form is known as *var. leptoneura* and is found in East Gippsland. The drier area of occurrence are on the Genoa River and above W. Tree. Plants have been found with pink, orange, or red flowers—all on the one bush. It seems very adaptable and is the best one for cultivation.

Grevillea miqueliana—Found in Victoria and as far north as Tuross Falls in N.S.W. There are two forms, one on the Walhalla on dry hillsides and the other on the side of Mt. Wellington in very wet conditions. They are very adaptable plants. The leaves and flowers are similar to *G. victoriae*, but the leaves are much larger and much softer. Flower colour varies from red-orange to red-yellow. The Mt. Wellington form grows to just under 3 m and is very dense. The Walhalla form could grow a little higher, but it is much more open in habit.

Grevillea oleoides—The form from the Sutherland-Waterfall area of N.S.W. grows very well in Victoria. My plant is 3 m high, upright and dense, with a mass of bright red flowers.

Grevillea dimorpha—A very variable shrub from the Grampians, with leaves 10-12 cm long by 5 cm wide to 15-20 cm long and 1/4 cm wide. Massed plantings give a good display. Very adaptable in gardens. The flowers appear on all woods all over the plant, making ideal drifts of colour. This species is very close to *G. oleoides*, differing it seems by the hairs on the back of the leaves, in *G. dimorpha* the hairs are "rusty", comparatively coarse and stout, whereas with *Grevillea oleoides* they are fine. The style of the flower of *G. dimorpha* is also shorter.

Grevillea parviflora—A diverse species in Berowra, N.S.W., it is prostrate with fine foliage and white flowers. At Waterfall, N.S.W., it is tall with coarser foliage and pink and white flowers. It is similar to *G. sericea*, the "Pink Spider Flower", differing in that the foliage is more rigid, the leaves are more revolute, and the hairs on the back of the leaves are rusty rather than soft and silky. The flowers are smaller and the style shorter. In the Grampians it is tall and becomes progressively smaller as you move across Victoria. The form from the Brisbane Ranges, north of Geelong, is an adaptable, delicate, sweet little plant. It is such a low, shrubby plant you can barely see it in the grass.

Grevillea repens—One of the many "holly-leaved" species of Victoria, this plant is prostrate, often covering areas to 3 m across. It grows in wet situations in its westerly occurrence s.w. of Daylesford—while south of Ringlake, the conditions under which it grows are much harsher. A good plant for banks or as a ground-cover undershrub. The flower colour can vary from pink to red in large open racemes.

Grevillea aquifolium—Holly-leaved *Grevillea*. As well as prostrate forms there are those that become a shrub to 2 m. A very fine-leaved form is known as *var. attenuata*. Reference has been made to the many "holly-leaved" species of *Grevillea* in Victoria. As a quick reference these are *G. sp.nov.* Mt. Cole growing to 1.5 m, with pillar-box red flowers; *G. sp.nov.* Enfield, south of Ballarat, which may be prostrate to 3 m across or occasionally upright to .75 m, the flowers of orange/red being bicolour, and *G. willisii* from near

Omeo and adjacent areas, that grows to 2.5 m x 3 m which has grey foliage and has terminal inflorescences of cream/white flowers.

NOTE: There are many "Holly-leaved" *Grevillea* in Victoria. Readers are referred to page 222 of Issue No. 73, where the author describes two new species and mentions other species.

Grevillea alpina and *Grevillea lavandulacea*. These are two species of which Victoria may be especially proud. Both have many forms, all being beautiful small shrubs, spectacular when in flower. They are illustrated in colour on pages 289 and 293, and with the captions I have mentioned what I consider are the best forms.

Western Grevillea

Of the many Western Australian *Grevillea* I will mention just a few:

Grevillea plurijuga—Found near Esperance, this beautiful dense shrub, often to 2 m, has ferny grey foliage. It throws up long leafless stalks over a metre above the foliage to display its long racemes of pink flowers. It will grow in Melbourne in well-drained conditions. The character of holding its flowers on long leafless stalks above the bush is common with a number of western *Grevillea*, among which are *G. pectinata*, *G. eriostachya*, *G. leucopteris* and *G. annulifera*. Unfortunately I have not had much success with these in Melbourne, although *G. leucopteris* appears hardier.

These spectacular flowers are illustrated—*G. plurijuga* on the next page, *G. eriostachya* in No. 21 issue, page 1, and *G. annulifera*, 29:9.

Grevillea dielsiana—A plant with very divaricately lobed leaves from the northern sandplain is one of the few from these conditions that does grow in Victoria. Unfortunately it does not bush up well, nor really prosper, but the large waxy flowers show clearly. There are colour variations of yellow, orange, pink and red. Illustrated on the front cover.

Grevillea candicans—A stout shrub from the northern sandplain with white cylindrical inflorescences and hard globose fruits.

Grevillea paradoxa—A shrub to 2 m, the leaves having narrow, divaricate lobes. The flowers are grouped in a spike-like inflorescence that instead of opening from the branch outwards, as with most other *Grevilleas*, opens from the end inwards.

Grevillea hookerana—There are many forms. One commonly grown is probably a sterile hybrid. The type form possibly comes from an area west of Albany, W.A. A lovely plant 2-2½ m, with branches arching upwards, carrying very large deep-red "toothbrush" racemes of flowers. The fine divided foliage is very soft to touch. An excellent background plant and great for attracting birds. It requires a well-drained situation. Colour pl. 56:333.

Grevillea tripartita—One form grows in sandy conditions in W.A., and another in heavy moist soil. A good background plant, rigid, with large groups of flowers held well above the foliage with long stalks. A good bird attractor. It can form a dense thicket to 3 m if not pruned.

Grevillea macrostylis—Very similar to *G. tripartita*, except for a small botanical difference in the flower. Generally the leaf segments are broader, but forms often have narrowed leaf segments, and forms of *G. tripartita* often have broad leaf segments.

(a) Background Shrubs for Screen/Shelter

	Habit	Flw Colour	Flw Time
<i>G. tripartita</i>	erect/sparse	red/yellow	Spring/other times
<i>G. barklyana</i> (Vic. form)	dense	pink	Spring/Summer
<i>G. longifolia</i>	spreading	pink	Spring
<i>G. asplenifolia</i>	spreading	deep pink	most of year
<i>G. johnsonii</i>	upright/dense	pink	Winter/Spring
<i>G. glabrata</i>	intricate/ spreading	white	Spring/Summer
<i>G. hookerana</i>	spreading	red	Spring/Summer
<i>G. juniperina</i>	upright/dense	red	Spring/Summer

(continued on page 298)



Photography by H. A. Morrison

GREVILLEA PLURIJUGA

(above)

Another very beautiful *Grevillea* recommended for planting by Bill Molyneux. He describes on page 295. A dense shrub often to two metres it throws up long leafless stalks over a metre above the foliage to display its long racemes of flowers.

Photography by A. S. George

GREVILLEA INVOLVERATA

(opposite top)

One of the species of *Grevillea* recently described and named by Alex George. There are seven new species described in an article commencing on page 299, this plant being adequately described on page 301. It is a low spreading shrub, with attractive foliage dotted with red flowers standing up proudly in late winter.

Photography by B. Ballingal

GREVILLEA SARISSA

(opposite bottom)

A NEW WESTERN AUSTRALIAN GREVILLEA



Photography by A. S. George

GREVILLEA INVOLUCRATA (top) **GREVILLEA SARISSA** (bottom).

Background Shrubs for Screen/Shelter—cont'd

	Habit	Flw. Colour	Flw. Time
<i>G. endlicherana</i>	upright/soft grey	pink/white	most of year
<i>G. aquifolium</i>	intricate/ spreading	red/pink	Spring/Autumn
<i>G. shiressii</i>	upright/dense	green/blue	Summer/Autumn
<i>G. rivularis</i>	intricate div. foliage	pink/inky blue	Summer/Autumn

(b) Medium Shrubs

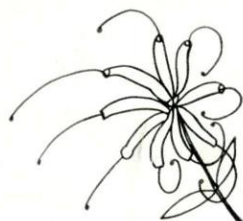
<i>G. stenomera</i>	dense/soft grey	pink	most of year
<i>G. victoriae</i>			
var. <i>tenuinervis</i>	dense/spr.	red	Summer/Spring
<i>G. linearifolia</i>	open/weeping	white	Spring
<i>G. miqueliana</i>			
(Mt. Wellington)	dense/dark	red/yellow	Winter/Summer
<i>G. oleoides</i>	upright	red	Spring/Summer
<i>G. 'Poorinda</i>			
Constance'	dense/spr.	orange	most of year
<i>G. speciosa</i>	dense/shrubby	red/pink	Spring/Summer
<i>G. 'Clearview</i>			
Robin'	dense/soft grey	red	Winter/Spring
<i>G. jephcottii</i>	upright/dark	cream/green	Spring
<i>G. rosmarinifolia</i>	upright/dense	yellow	Autumn/Spring
<i>G. sericea</i>	open	pink/mauve	all year

(c) Small Shrubs

<i>G. dimorpha</i>	spreading/ variation in foliage	red	Winter/Spring
<i>G. glabella</i>	dense/grey fol.	pink	Autumn/Spring
<i>G. parviflora</i>	spr./soft grey	white/pink	Spring
<i>G. alpina</i>	many forms	orange, red, yellow, white, pink	Winter/Spring
<i>G. aspera</i>	open	red/yellow/ green/pink	Winter/Spring
<i>G. baueri</i>	spreading	red/cream	mainly Spring
<i>G. pilulifera</i>	clump	cream/yellow/red	Autumn/Winter
<i>G. steigltziana</i>	scrambling/ div. holly fol.	red/green	Winter/Spring
<i>G. confertifolia</i>	spreading	wine	Spring
<i>G. concinna</i>	scrambling	red	Spring/Summer
<i>G. intricata</i>	intricate	cream	Spring
<i>G. lavandulacea</i>	shrubby/ many forms	pink/red	Winter/Spring
<i>G. singuliflora</i>	spreading	green/blue	Spring/Summer

(d) Ground Cover and Trailing Plants

<i>G. rogersii</i>	spawling/ small fol.	red	Spring/Summer
<i>G. confertifolia</i>	spreading/dense	wine	Spring
<i>G. repens</i>	prostrate	red	Summer
<i>G. x gaudichaudi</i>	prostrate	red	Spring/Summer
<i>G. thelemanniana</i>	trailing/ soft grey	red	Spring/Summer/ Autumn
<i>G. thelemanniana</i>	trailing/green	red	Spring/Autumn
<i>G. sp. Enfield</i>	spreading	bicolour/ red/yellow	Spring
<i>G. brownii</i>	open/spreading	red/yellow	Winter/Spring
<i>G. tridentifera</i>	dense/spreading	white	Winter/Spring
<i>G. acanthifolia</i>	dense/spreading	pink	Spring/Summer



Seven new Species of *Grevillea*

Seven New Species of Grevillea described by A. S. George in Nuytsia, Vol. 1 No. 4, issued by Dept. of Agr., W.A., in 1974

Grevillea costata C. A. Gardn. ex A. S. George — Section Lissostylis

Allied to *Grevillea inconspicua* Diels, from which it differs in the spreading habit; the thicker, pungent leaves, nerveless above; the longer pedicels; and the ribbed fruit.

A shrub to 1 m with spreading branches, silky-pubescent with appressed, medi-fixed hairs. *Branchlets* angular-striate when young, reddish. *Leaves* linear, pungent, very shortly petiolate, 1.5-4 cm long, margins closely revolute, the upper-surface appressed-pubescent but at length glabrous. *Flowers* in small, terminal or axillary racemes, the peduncle 2-10 mm long, pubescent. *Bracts* filiform, ferruginous-pubescent, very early caducous. *Pedicels* slender, 6-10 mm long sparsely appressed-pubescent. *Perianth* white, narrow, 3-4 mm long without the limb, appressed-pubescent outside, inside densely hirsute around the ovary, less so above; *limb* reflexed, pubescent outside, glabrous inside. *Torus* straight, gland small. *Style* 8-9 mm long; *stipe* 1-2 mm long; *pollen presenter* $\pm$ orbicular, thick but with a rather thin undulate margin, the stigmatic groove on a prominent central cone; a few glands on the style just below the pollen presenter. *Fruit* swollen, 12-15 mm long, prominently 7-10-ribbed, the ribs sometimes irregular. *Seeds* oblong, 9-10 mm long, thick, with incurved margins.

Distribution: Western Australia near lower central coast, along or near the lower Murchison River, growing in rocky soil.

The specific epithet refers to the ribbed fruit.

Grevillea fistulosa A. S. George — Section Plagiopoda

Allied to *Grevillea drummondii* Meisn. from which it differs in the indumentum; the longer leaves, white-tomentose below, with recurved or loosely revolute margins; the perianth segments red, 3-nerved, glabrous inside; the torus less oblique; the style terete, more hirsute; and the orbicular stigma.

An erect shrub of 1-2 m with an *indumentum* of hairs which are forked at the base, the new growth densely ferruginous. *Branchlets* angular-striate, becoming terete, densely tomentose at first, at length almost glabrous. *Leaves* oblanceolate, obtuse with a broad, hard mucro, mostly 4-7 cm long, narrowed into a petiole of less than 5 mm; sometimes flat with recurved margins but usually the margins inrolled giving the leaf a hollow, tubular aspect; midrib prominent above and below, with a lateral nerve just inside each margin; upper surface hirsute at first but later glabrous and finely scabrous; lower surface remaining densely tomentose with matted hairs. *Flowers* in axillary, sub-umbellate racemes on very short peduncles, the rhachis densely hirsute. *Bracts* linear, acute, 3-4 mm long, abaxial surface tomentose, adaxial surface glabrous within, soon caducous. *Pedicels* 5-8 mm long, hirsute. *Perianth* 6-7 mm long, red, slightly swollen below middle, loosely hirsute, the limb globular, recurved, more densely hirsute, the segments 3-nerved, glabrous within. *Style* 6-7 mm long, thick, $\pm$ terete, hirsute, the torus oblique; *stipe* $\pm$ 1 mm long. *Pollen presenter* orbicular, lateral and vertical, shortly hirsute in the centre of the dorsal side, the stigmatic



Photography by A. S. George

GREVILLEA OLIVACEA

area a small cone just below the centre on the ventral side. *Fruit* fusiform, closely tomentose, 15-20 mm long. *Seed* elliptic but the margins tightly inrolled, very narrowly winged, 8 mm long, base acute.

Distribution: Endemic in the Fitzgerald River National Park on the south coast of Western Australia. Usually occurs in dense scrub in rocky gullies on the hills.

The specific epithet refers to the tube-like appearance of the leaves caused by the recurved margins.

Grevillea infundibularis A. S. George — Section *Leiogyne*

Allied to *Grevillea platypoda* F. Muell., from which it differs in the smaller habit; the leaves flabelliform, dentate, almost sessile, glabrous; and the small, simple, terminal inflorescences.

Grevillea infundibularis is a smaller, more sprawling plant than *G. platypoda*, with dentate, funnel-like leaves (more or less clasping the stem) and the flowers, also smaller, are bright red, not pinkish-red and yellow as shown in the colour plate of *G. platypoda* on page 288. Another similar species, *G. patentiloba*, has much-divided leaves and narrowly revolute segments (more like *G. wilsonii*) and larger pink flowers.

A *sprawling shrub*, occasionally up to 1 m tall, appressed-pubescent when young, becoming glabrous apart from the flowers, or the branches sometimes spreading-hirsute. *Leaves* hemispherical-flabelliform, almost sessile, when fresh concave and stem-clasping so as to appear funnel-like, mostly 10-25 mm long x 20-35 mm wide, dentate with mucronate teeth, a prominent nerve to each tooth, the nerve-like margins slightly recurved. *Flowers* red, in small terminal racemes, rarely axillary. *Rhachis* and *pedicels* appressed-pubescent with medifixed hairs; *pedicels* 5-8 mm long. *Perianth* 7-9 mm long without limb, broad at base, sparsely pubescent outside, inside densely hirsute below, less so above; limb prominent, recurved, pubescent outside, glabrous inside. *Torus* straight, gland $\pm$ horizontal, lobed, rather thin. *Style* 17-18 mm long,

slender, glabrous; stipe 1 mm long; ovary bilobed; *pollen presenter* lateral and vertical, orbicular, the stigmatic groove small, central. *Fruit* broadly fusiform but abruptly narrowed at each end, 13-14 mm long, thick-walled, somewhat rugose, with a ridge on each side. *Seeds* not seen.

Distribution: Known so far from only two peaks in the Fitzgerald River National Park on the south coast of Western Australia. Growing with scrub among quartzite boulders.

The specific epithet refers to the funnel-like aspect of the leaves in the fresh state.

***Grevillea involucrea* A. S. George — Section Plagiopoda**

Allied to *Grevillea fulgens* C. A. Gardn. from which it differs in the shorter pinnatisect leaves with 5-13 lobes; the few-flowered inflorescence; the persistent involucre; the bracts almost or quite glabrous; the glabrous pedicels; the perianth glabrous outside, densely hirsute inside in the lower half; and the more slender, less hirsute style.

A *spreading shrub* to 50 cm tall x 2 m broad. *Branches* pubescent with both appressed medifixed hairs and short erect glandular hairs. *Leaves* pinnatisect, 1-3 cm long, divided almost to the midrib into 5-13 linear pungent lobes 4-8 mm long, appressed-pubescent but becoming glabrous, the margins tightly revolute but the midrib prominent below. *Inflorescence* terminal or axillary, of 1-3 flowers, the short peduncles with several bracts forming a persistent involucre. *Bracts* cuneate-obovate, acute, 4-8 mm long (those subtending the flowers the larger), glabrous or with a few appressed hairs outside below the apex, deep pink. *Pedicels* slender but thickened under the torus, 6-10 mm long, glabrous. *Perianth* 10-12 mm long without the limb, broad at base, thick, glabrous outside hirsute inside in the lower half, the limb tightly revolute, glabrous. *Torus* oblique, gland widely concave. *Style* $\pm$ 2 cm long, curved; stipe 1-2 cm long, glabrous anteriorly, hirsute posteriorly; ovary densely white-hirsute; style ferruginous-hirsute with basifixed hairs; *pollen presenter* lateral and vertical, orbicular, thick, the stigmatic groove central, scarcely raised. *Fruit* not seen.

Distribution: Known from two localities in southern South-Western Australia, between Hyden and Lake Margenta, where it grows in shallow sand over laterite on open heath.

The specific epithet refers to the involucre of bracts about the inflorescence.

***Grevillea olivacea* A. S. George — Section Leiogyne**

Allied to *Grevillea obtusifolia* Meisn. from which it differs in the taller, erect habit; the larger leaves white-pubescent below; the rachis and pedicels densely pubescent; and the perianth pubescent outside and glabrous inside except for a ring of hairs about the ovary.

A colour plate of *G. obtusifolia* is on page 292 of our No. 67 issue. *G. olivacea* differs from this in being a large, handsome shrub with a broad crown, the leaves dark green above, whitish below. The larger pubescent flowers are on the bush usually for at least three months.

A *shrub* to 4 m, the branches appressed-pubescent becoming glabrous. *Leaves* narrow-elliptic to oblanceolate, rarely with 1 or 2 small lobes near apex, 3-5 cm long, obtuse, narrowed into a petiole up to 1 cm long, the margins recurved to loosely revolute, upper surface green, appressed-pubescent at first but soon glabrous, lower surface appressed-white-pubescent; midrib evident on both sides with faint penninervation. *Flowers* red in short terminal and axillary racemes, the rachis and pedicels densely pubescent. *Pedicels* 4-5 mm long. *Perianth* 7-8 mm long (excluding limb), pubescent outside, glabrous inside except for a ring of dense hairs around the ovary, the limb erect in young bud, recurved before anthesis, densely pubescent outside, glabrous inside. *Torus* straight, gland prominent. *Style* 25 mm long, slender, glabrous, the stipe 4-5 mm long; *pollen presenter* oblique, orbicular, with a prominent stigmatic cone. *Fruit* $\pm$ cylindrical but pouched at base, stipe lateral, apex abruptly tapered into persistent style, 11-13 mm long,

glabrous, somewhat rugose. *Seeds* elliptic but supervolute, 8 mm long, the margins narrowly winged.

Distribution: Western Australia, near west coast between Dongara and Jurien Bay; growing in calcareous soil among scrub.

The specific epithet refers to the leaf colour which resembles that of olive leaves (*Olea europaea* L.).

Grevillea ripicola A. S. George — Section Calothyrsus

Allied to *Grevillea dielsiana* C. A. Gardn., from which it differs in the lobes of the leaves linear-lanceolate, flat; and the perianth segments pubescent in the throat with reflexed hairs and shortly pubescent on the margins.

There is a colour plate of *G. dielsiana* on the front cover.

A densely branched *shrub* to 3 m tall, young growth pubescent, otherwise glabrous apart from the bracts and the inner surface of the perianth. *Leaves* divided divaricately into 3-5 linear-lanceolate lobes, the lower ones again divided into 2-5 lobes, all 3-nerved, pungent, flat with slightly recurved margins; the whole leaf up to 6 cm long x 8 cm broad, the lobes 1-3 cm long. *Flowers* pink becoming red, with green limb and pollen presenter, in terminal racemes on short peduncles. *Bracts* ovate about 0.5 mm long, pubescent in the upper part and on the margins, very early caducous. *Pedicels* reflexed, 4-5 mm long. *Perianth* 8-10 mm long, slightly broader in lower half, the limb reflexed; glabrous outside, inside pubescent in the throat with reflexed hairs and on the margins with shorter, spreading hairs. *Torus* somewhat oblique; *gland* thick. *Style* 30-35 mm long, slender; *stipe* 3 mm long; *pollen presenter* lateral, very oblique, $\pm$ orbicular, the stigmatic area a small central umbo. *Fruit* 16-18 mm long, smooth, style persistent. *Seeds* oblong, slightly crescentic, grooved on inner face.

Distribution: South-Western Australia: around Collie, 160 km S. of Perth. Grows along river banks in Jarrah-Marri forest.

The specific epithet refers to the habitat, i.e. growing on river banks.

Grevillea scapigera A. S. George — Section Lissostylis

Allied to *Grevillea eryngioides* Benth., from which it differs in the sprawling habit; the smaller, bipinnatifid leaves with narrower lobes, long-petiolate; the simple inflorescence on a shorter peduncle glabrous except for the hirsute inner surface of the perianth; the longer style, long-stipitate; and the narrower fruit and seeds.

A *shrub*, the stems prostrate or slightly ascending, appressed-pubescent. *Leaves* erect, 3-9 cm long on slender petioles, bipinnatifid, at first pubescent but soon glabrous; lobes cuneate to lanceolate, flat, pungent. *Flowers* in dense racemes on leaf-opposed erect peduncles to 30 cm high, simple or rarely branched. *Rachis* glabrous. *Bracts* linear, 3.5-4.5 mm long, ciliate, caducous. *Pedicels* slender, 3-5 mm long, glabrous. *Perianth* pale yellow, narrow, 4-5 mm long, revolute under the limb, glabrous except for spreading hairs inside in the lower half. *Torus* straight. *Style* about 18 mm long, slender, minutely papillose; *stipe* 4-5 mm long; *pollen presenter* lateral, vertical, obovate with thin undulate margins, the stigmatic groove central, slightly raised. *Fruit* 1-1.5 cm long, tuberculate. *Seeds* navicular, smooth, outer surface convex, inner slightly so, with narrow membranous borders.

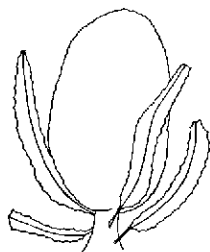
Distribution: Western Australia: central South-West, between Brookton and Hyden, growing on sandplains.

The specific epithet refers to the form of the inflorescence.

ACACIAS OF NEW SOUTH WALES—by Inez Armitage

Announcing the publication of a new book that has long been needed. A book produced in clear, simple language of the wattles of N.S.W. All species are illustrated by line drawings that will enable you to identify the wattles growing naturally anywhere in N.S.W. Illustrated further by 54 colourplates, this 200 page book will be of exceptional value at the introductory price of \$7.50, post free. Orders will be received for dispatch by mail to your home during August, 1978.

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The Plant Family Proteaceae

by L. A. S. Johnson and B. G. Briggs*

*These notes were adapted from a paper presented to the Linnean Society of London on 6th December, 1973, and published in that Society's Proceedings, February, 1975, under the title: "On the Proteaceae—the evolution and classification of a southern family". The paper dealt with some historical aspects and discussed at length the evolution of the family and its distribution on a world-wide basis.

Following a scientific study of the characteristics of the large number of plants in the family Proteaceae, and a review of the fossil record, the authors have attempted a reconstruction of an ancestor (termed "Proto-Proteaceae") such as would have existed almost 100 million years ago. This ancestor was probably an evergreen tree of dense rainforest. From this have evolved the diverse forms of Proteaceous plants, many of which are grown today.

Figures 1 & 2 display the most likely phylogeny and summarise the classification into genera, subtribes, tribes and subfamilies. This review indicates a number of changes at generic level.

Presented here are excerpts from those sections of the paper that deal with the relationships of the genera as they concern the Australian flora.

New Australian Genera

Seventy-five genera are now recognised in place of 62. The principal change, as it affects the Australian flora, is to the genus *Persoonia*, which the authors divide into four genera:

Persoonia, retaining most species in E. Australia, with five species in S.W. Australia.

Toronia, a new genus with only one species in New Zealand.

Acidonia, endemic to S.W. Australia.

Pycnonia, species with short styles and zygomorphic flowers, chiefly in S.W. Australia, but with one species ranging across Northern Australia.

SUBFAMILIES, TRIBES AND SUBTRIBES

Persoonioideae

The subfamily Persoonioideae is established with two tribes: Persoonieae and Bellendeneae. The latter contains only *Bellendena*, which is unique in its presumably reduced diploid complement of five moderately large chromosomes and in several morphological features, including the totally free filaments (primitive), absence of floral bracts (advanced) and retention of some endosperm in the seeds. See pages 320 (colour plate) and 323.

Proteoideae

The subfamily Proteoideae is re-defined to include those genera characterised by a combination of (i) a complement of small chromosomes at the tetraploid or higher level (including dysploid derivatives), (ii) flowers not in grevilleoid pairs, (iii) ovules two or (more usually) one, (iv) indehiscent drupaceous or more usually dry fruits, (v) a single wingless and rather small seed; of these all except (ii) are advanced characters. The three major groups in the subfamily are treated as tribes. All differ in circumscription from tribes recognised under the same names in the past.

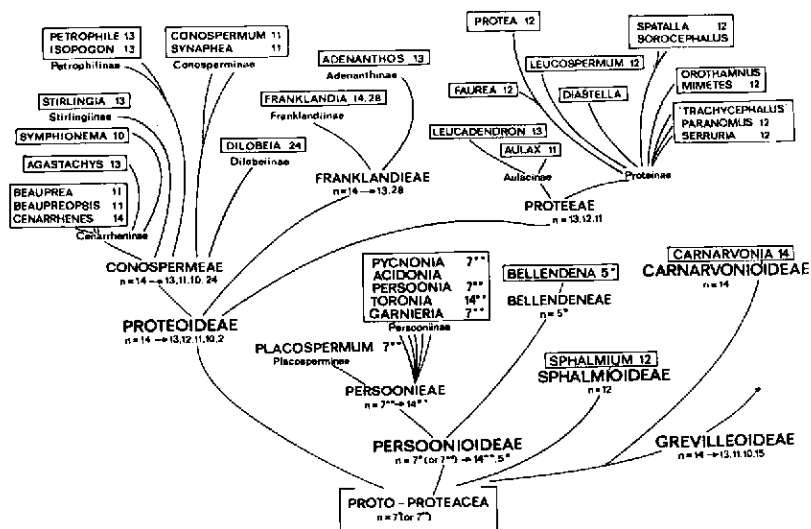


FIG. 1. Inferred phylogenetic relationships in the Proteaceae and classificatory scheme of the family, excluding details of the Grevilleoideae. Haploid chromosome numbers are included; moderately and very large chromosomes are indicated by one or two asterisks respectively. The non-Australian genera are *Toronia*, *Garnieria*, *Beauprea*, *Beaupreopsis*, *Dilobeia* and all members of the Proteaceae. The remaining 17 genera are wholly or partly Australian.

Tribe Conospermeae comprises five subtribes, the members of which were formerly distributed amongst Persooniidae and Proteaceae:

(i) Subtribe Cenarrheninae is an assemblage of relict genera which all retain many primitive characters and were included in the then rather vaguely defined Persooniidae, but which differ strikingly in chromosomes from the Persooniidae. Previously *Symphionema* was considered as allied to *Bellendena*, chiefly because its chromosome number is a multiple of five; but there is little particular resemblance between these genera, and on morphological and cytological grounds we now see *Symphionema* as related to *Cenarrhenes* and *Agastachys*, with its $n = 10$ small chromosomes representing a reduction from $n = 14$, as found in *Cenarrhenes*, but probably as a separate event from the reduction to $n = 11$ found in *Beauprea* and *Beaupreopsis*.

(ii) Subtribe Dilobeinae, with only the monotypic Madagascan *Dilobeia* Thou., appears to represent an early offshoot with some specialisation in pseudodichotomous leaf-shape and dioecious flowers.

(iii) Subtribe Stirlingiinae contains only the small S.W. Australian genus *Stirlingia*.

(iv) Subtribe Petrophilineae comprises two genera: the closely related *Isopogon* and *Petrophile*, each with many species in extra-tropical Australia. The well-defined subtribe is specialised in the cone-like infructescences and the clearly phylogenetically independent modification of the style as a pollen-presenter different in type from others in the family. See the colour plate on page 332.

(v) Subtribe Conosperminae consists of the highly specialised and successful *Conospermum* and the equally specialised but less diverse *Synaphea*. Both show perianth zygomorphy, partial sterilisation of the androecium and unusual pollination mechanisms.

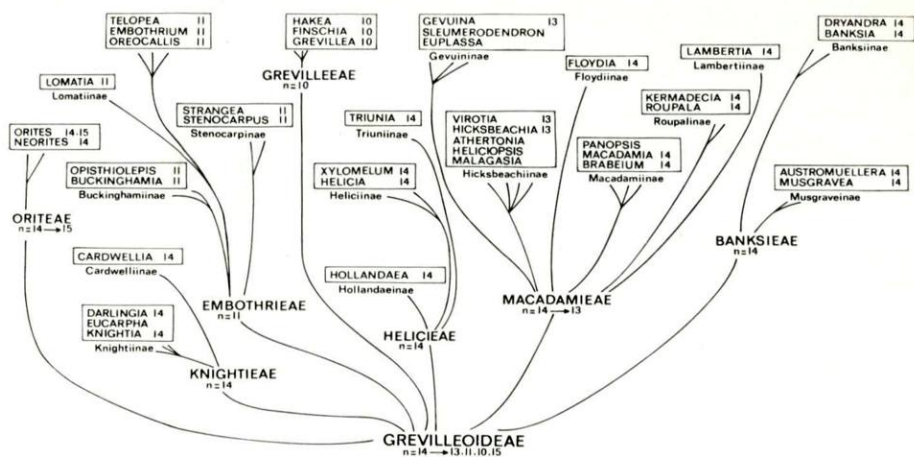


FIG. 2. Inferred phylogenetic relationships in the Grevilleoideae and classificatory scheme of the subfamily. The non-Australian genera are *Knightia*, *Eucarpha*, *Embothrium*, *Finschia*, *Euplassa*, *Sleumerodendron*, *Helicopsis*, *Malagasias*, *Panopsis*, *Brabeum*, *Kermadecia* and *Roupala*. The remaining 28 genera are wholly or partly Australian.

Tribe Franklandieae has traditionally been restricted to *Franklandia*, with two species in S.W. Australia. This is at first sight so bizarre that botanists familiar only with better known Proteaceae sometimes doubt that it belongs to the family. Such an impression is heightened by its unusually large, spherical pollen grains, which look quite un-Proteaceous on superficial inspection. Analysis of the characters of *Franklandia* shows, however, that in all essentials of vegetative and reproductive structures it follows not only the family pattern, but that of the Proteoideae, and its chromosome size and number ($n = 14$ and 28 respectively in the two species) also support its inclusion in the subfamily. We place it in a unigeneric subtribe Franklandiinae because of its peculiarities, but have enlarged the Franklandieae to embrace a second unigeneric subtribe Adenanthinae. *Adenanthos* has generally been placed in the variously defined Proteae and has not previously been associated with *Franklandia*; but if one discounts the exaggerated "floral tube" of the latter, the two genera can be seen to share features which distinguish them from both Conospermeae and Proteae *sensu stricto*. Both have thin, broad and more or less elongated and connate hypogynous glands, which are adnate at the base to the partly connate tepals, although to a much greater degree in *Franklandia* than in *Adenanthos*. They are alone in the family in possessing cavities in the leaves (again, more conspicuous in *Franklandia*). These are lined with a one-layered epithelium from which, in *Franklandia*, pluricellular uniseriate hairs arise and extend into the cavity.

Franklandia has pseudodichotomous leaves with terete segments, and in those species of *Adenanthos* with divided terete leaves there is a distinct tendency for the middle segment to be shortened, so that they are, in a sense, on the way to pseudodichotomy. The inflorescence is reduced in *Adenanthos*, as is the chromosome number of $n = 13$. Further study of the apparently strikingly different pollen grains may yet reveal finer features of similarity. See the colour plate on page 321.

Tribe Proteae is now re-defined to comprise two subtribes:

(i) Subtribe Aulacinae consists of the dioecious genera *Leucadendron* and *Aulax*. These stand apart cytologically and morphologically from the remainder of the African genera which make up the Proteae.

(ii) The large subtribe *Proteinae* with 11 genera is coherent in the chromosome number of $n = 12$, and in that no genus stands very far apart from at least some of the others, but it encompasses a wide range of ecological and habit types. The inflorescences and flowers are variously adapted to insect and bird pollinators, and the inflorescences range from simple racemes or spikes (*Faurea*) to capitula with or without showy involucre (*Protea*, *Leucospermum*, *Diastella*, *Serruria*), and in some genera are reduced to small capitula aggregated in spike-like or occasionally head-like conflorescences (*Mimetes*, *Orothamnus*, *Paranomus*, "*Trachycephalus*", *Sorocephalus*, *Spatalla*). In advanced species of *Spatalla* the unit inflorescences are single-flowered by reduction.

Sphalmioideae

This subfamily contains only the monotypic *Sphalmium*. This N.E. Australian genus can hardly be placed among the *Persoonioideae*, from which it differs in chromosome size and in the combination of fruit- and seed-types. It is clearly excluded by the follicular fruits and winged seeds from the *Proteeae*, and although it shows some similarities to *Grevilleoideae* in the follicles and in wood anatomy, it differs fundamentally in the simple inflorescences with flowers singly in the axils of the bracts and in showing no approach to the paired flowers or pseudo-racemose conflorescences of that subfamily. The two seeds are unique in being pendulous from a false dissepiment formed by enlargement and concrescence of the initially free funicles of the sub-basal anatropous ovules. The two-branched hairs parallel those of certain *Grevilleoideae*, but this feature appears to have been of multiple secondary origin within the latter subfamily. *Sphalmium* has evidently had a long and not very successful evolutionary history since its divergence somewhere near the base of the "line" which led to the *Grevilleoideae*.

Carnarvonioideae

Another unigeneric subfamily, *Carnarvonioideae*, from the same region, must also have diverged early from the pre-*Grevilleoids*.

Its peculiar inflorescence-type, which shows some aggregation into a loose conflorescence, has not attained the paired-flower condition. The reduction to two ovules must have occurred independently of similar reductions in some tribes of *Grevilleoideae* and the absence (presumed loss) of the floral glands also distinguishes *Carnarvonia* from all *Grevilleoids* except some advanced species of *Grevillea*. The curious partly digitate, partly pinnate and partly first-degree, partly second-degree division of the leaves is unique in the family.

Grevilleoideae

The subfamily *Grevilleoideae* (now that *Carnarvonia* is excluded) is, we believe, a monophyletic group marked by its characteristic flower-pairs. This condition is apparently derived from a branching system in which the lateral inflorescences have become reduced, in the ancestral *Grevilleoid* line, to an axis (*peduncle*) bearing two bracteate pedicellate flowers. It has undergone subsequent modification and further reduction in some of the tribes and genera, often correlated with zygomorphy and other derived and adaptive floral conditions. Secondarily single flowers are found in some species of a few genera. The "pseudoracemes" of bracteate flower-pairs are *conflorescences* in our terminology, the flower-pair being *uniflorescences*. Otherwise, the ancestral *Grevilleoids* must have retained most of the primitive character-states of "*Proto-Proteaceae*", since these are variously exhibited amongst the living genera, but presumably had small chromosomes at the tetraploid level of $n = 14$. Follicular fruits and flattened winged seeds occur in all the tribes (in rainforest genera as well as those of more xeric habitats), but the derived condition of more or less indehiscent fruits and large wingless seeds has arisen independently at least four times in three tribes, always in genera inhabiting moist closed forests. There are no very small fruits, such

as are found in most Proteoideae, or drupes with the *Parsoonia* or *Cenarrhenes-Beauprea* type of pericarp structure; the ovule number, primitively numerous, is never less than two, and a single seed is found only in indehiscent-fruited genera and in *Strangea*.

The 40 genera are now grouped in seven tribes, five of which are divided into subtribes. This results from the establishment of two new tribes, Knightieae and Helicieae, and the inclusion of Musgraveae in the amplified Banksieae.

Tribe Oriteae contains only two genera. Both retain primitive floral structure but have lost the peduncle and floral bracts, while *Orites* has some vegetatively advanced species. The recently described *Neorites*, with numerous ovules, supports the segregation of Oriteae from Macadamieae.

Tribe Knightieae also retains primitive features, including the peduncle (miscalled "fused pedicels" by many authors), pluriovulate condition and the rainforest-tree habit. As well as subtribe Knightiinae, with the three small relict genera *Knightia*, *Eucarpa* and *Darlingia*, we have included the unigeneric *Cardwellinae* as a probable early offshoot from this line, although *Cardwellia* shows considerable advancement in its strongly zygomorphic flowers.

The tribe Embothriaceae stands, as in our former treatment, as a group marked by the reduction of chromosome number to $n = 11$ and the loss of peduncles and individual floral bracts, but retaining several ovules as the basic state. *Embothrium* is extremely close to both *Oreocallis* R. Br. and *Telopea* R. Br. in many characters, including fine details of the pollen grains, although the grains of *Embothrium* have only two pores, in contrast to the three-porate pollen of the other genera.

The Embothriaceae fall into four subtribes: (i) *Stenocarpinae*, standing apart from the other subtribes in the outer seed-wing, developed from the proximal part of the funicle, as well as the unique inner seed-wing apparently developed from the inner integument; it is possibly worthy of tribal rank (*Stenocarpus* with the closely allied but more xeromorphic and one-seeded *Strangea*); (ii) *Buckinghamiinae* (the N.E. Queensland rainforest relicts *Buckinghamia* and *Opisthiolopis*, which are very distinct in appearance, but nevertheless share many characters); (iii) *Lomatiinae* (the eastern Australian and South American *Lomatia*) differing from Embothriinae in flower-pair orientation, pericarp anatomy, the seed-wing being entirely internal to the raphe, and from Buckinghamiinae in the diagonal floral orientation; (iv) *Embothriinae* (*Oreocallis*, *Embothrium*, *Telopea*), markedly ornithophilous and found on both sides of the South Pacific Ocean.

Tribe Grevilleae, although it has only the three genera *Grevillea*, *Finschia* and *Hakea*, rivals the African Proteaceae in its successful specific radiation, especially in *Grevillea* with over 250 species. Marked by loss of peduncles and floral bracts, by diagonally-orientated zygomorphic flowers, two-branched terminal cells of the trichomes, reduction to two lateral hemitropous ovules and reduction of the chromosome number to $n = 10$, it is a very close-knit and well-defined group of the Australasian region, ranging from tropical lowland rainforest to every other extreme of habitat found in the family, including truly arid regions not penetrated by other Proteaceae.

Tribe Helicieae retains peduncles and floral bracts, unreduced tetraploid chromosome number of $n = 14$ and, in the basic state, numerous ovules, but has lost the divided pre-adult leaf-state which is retained in the inferred latest common ancestors of all the other Grevilleoidean tribes. The subtribe *Hollandaeinae* contains only the N.E. Australian relict *Hollandaea* and has the most primitive features, but has presumably lost the seed-wing still retained in *Xylomelum*. *Hollandaea* is unique in combining numerous ovules and follicular fruits (both primitive) with thick wingless seeds (advanced). Subtribe *Heliciinae* groups the two well-distinguished and ecologically diverse but clearly related genera *Helicia* (indehiscent or tardily dehiscent fruits with thick wingless seeds; many species chiefly in closed communities, i.e. rain-

forest *sensu lato*, from Australia to S. and E. Asia) and *Xylomelum* (dehiscent, woody, fire-resistant fruits with thin winged seeds; five species in open communities in Australia). Subtribe *Triuniinae* is set up for the newly recognised and rather isolated *Triunia*, which, on foliage and hair-type as well as to some extent on ovules and fruits, seems to be best retained in the tribe despite its zygomorphic flowers.

Tribe *Macadamieae*, as now restricted, is still a rather varied group, chiefly marked by the two more-or-less pendulous and orthotropous ovules; but present studies indicate that the genera comprised in it are likely to have a common ancestral stem separate from those leading to other groups, although a basal *Macadamieae* would not be very different from the ancestors of, say, *Helicieae* or *Banksieae*. The basic chromosome number for the tribe is clearly the unreduced tetraploid $n = 14$, but we have now found $n = 13$ in members of the subtribes *Hicksbeachiinae* and *Gevuininae*.

Subtribe *Hicksbeachiinae* ranges from Madagascar to New Caledonia and four of its five essentially rainforest relict genera (*Malagasiasia*, *Heliciopsis*, *Athertonia*, *Hicksbeachia*, *Virotia*) are recently or newly established. Subtribe *Gevuininae* (*Euplassa*, *Gevuina*, *Sleumerodendron*) spans the South Pacific Ocean. It is chiefly distinguished from the *Hicksbeachiinae* by floral zygomorphy, thus its taxonomic status recognises it as a monophyletic grade with inferred ancestors that would fit into the *Hicksbeachiinae*. Both subtribes have indehiscent fruits with large seeds and divided pre-adult (or adult) leaves (early stages unknown in *Malagasiasia*), and there is a tendency to have a pair of opposite, more or less trilobed leaves immediately succeeding the cotyledons.

Subtribe *Floydiinae* consists of the newly segregated monotypic genus *Floydia*, which differs from the *Hicksbeachiinae* and *Gevuininae* in its simple pre-adult leaves, different fruit shape and texture, branched terminal cells of the hairs and the absence of floral bracts; it is distinguished from the other *Macadamieae* subtribes by the retention of peduncles and the hair-type, and appears unique in the tribe in possessing a phellogen and cork in the fruit.

Subtribe *Macdamiinae* comprises the three very similar genera *Brabejum* (monotypic in southern Africa), *Macadamia* (Australia to E. Malesia) and *Panopsis* (well developed in tropical America).

Subtribe *Roupalinae* groups the species-rich tropical American *Roupala* with *Kermadecia*, which, as now clearly defined, is endemic in New Caledonia. *Kermadecia* is more advanced in its zygomorphy (diagonal and therefore non-homologous with the anteroposterior condition in *Gevuininae*) and indehiscent fruits with wingless seeds, but there is much resemblance between the genera in leaf form and venation, as well as in indumentum and floral characters. Like the *Floydiinae*, *Macdamiinae* and *Lambertiinae*, they have the unreduced $n = 14$.

Subtribe *Lambertiinae* consists only of *Lambertia*. It has been claimed that the flowers are not in grevilleoid pairs in *Lambertia*. Our studies show that quite definite flower-pairs occur, with each pair subtended by a common bract of the innermost series of the "involucre", all of the bracts being whorled in the same phyllotactic series as the leaves. The only exception is the terminal flower (to which the confluence is reduced in two of the nine species), which is indeed a unique characteristic of the genus; this flower terminates the growth of the confluence axis and lacks either a pair- or a flower-bract.

Tribe *Banksieae* is now enlarged to embrace two subtribes: *Musgraveinae* (two relict endemics of N.E. Australian rainforests, *Musgravea* and *Austromuelleria*) and *Banksiinae* (*Banksia* and *Dryandra*), held together by leaf-venation, presence (except in the almost glabrous *Austromuelleria*) of trichomes with very long thin terminal cells (as well as those of more usual form) and biporate pollen grains. The confluences with both unit-influence (pair) bract and floral bract preserved (this condition secondarily modified

or partly lost in *Dryandra*), are readily derivable from a common source, and so are the flowers. The tribe retains thin elongate separate hypogynous glands (reduced to three in Musgraveinae) and follicular fruits with two winged seeds. Banksiinae, with dense spike-like or head-like confluences, an interseminal false dissepiment formed from the outer integuments and vascular tissue in the wood rays, possess more advanced features and have proliferated greatly in sclerophyllous communities, with considerable secondary evolutionary modification. The unreduced $n = 14$, however, has been maintained throughout.

B. GENERA NEWLY RECOGNISED

Lengthy descriptions are not given; the following is mainly translated from the Latin diagnoses given in the original paper to validate the names. Further species names under these genera will be published later in the journal "Telopea".

Toronia L. Johnson & B. Briggs

Distinguished amongst the Persoonieae by the following:

Inflorescences racemose with flowers in the axils of bracts (not foliage leaves); perianth very slightly curved but not saccate; tepal-margins incurved; anther-connective without an appendage; ovary sessile; the short style not reaching to the top of the anthers, thick and straight with a broad, more or less oblique stigma; ovules 2; seed 1. Chromosomes very large, $n = 14$.

The name is derived from the epithet *toru*, of Maori origin, and the ending *-onia* to suggest the affinity with *Persoonia*.

One species in New Zealand, *Toronia toru*.

Acidonia L. Johnson & B. Briggs

Distinguished amongst the Persoonieae by the following:

Flowers single or clustered in leaf-axils, or more rarely in elongated racemes; perianth straight, tepal margins not incurved; anther-connective always produced into a short to elongated terminal appendage; ovary more or less stipitate; the long style reaching to the top of the main part of the anthers, straight or curved near the base; stigma small, often but not always oblique; ovules 2 or 1; seed 1. Chromosomes unknown.

Type species: *Acidonia microcarpa*. Basionym: *Persoonia microcarpa*.

The name is derived from Greek *akis*, *akidos*, a point (alluding to the connective appendage) and *-onia*, as above. The genus corresponds with *Persoonia* sect. *Acranthera* Benthams, but is not nomenclaturally based upon it.

Endemic in S.W. Australia, with some 13 species.

Pycnonia L. Johnson & B. Briggs

Distinguished amongst the Persoonieae by the following:

Inflorescences racemose or the flowers in the axils of bracts in the subterminal parts of the branchlets; perianth more or less curved, anterior tepal swollen or saccate towards the middle, tepal-margins not incurved; anther-connective always produced into a short or elongated terminal appendage; ovary not or rarely stipitate; the short style not reaching the main part of the anthers, thick and strongly curved with the small stigmatic apex pressed into the protuberance of the anterior tepal (in bud); ovules 2; seed 1. Chromosomes very large, $n = 7$, so far as is known.

Type species: *Pycnonia teretifolia*. Basionym: *Persoonia teretifolia*.

The name is derived from Greek *pyknos*, thick (referring to the style) and *-onia*, as above. The genus corresponds with *Persoonia* sect. *Pycnostylis* Meisn. This section was adopted also by Benthams.

Six species endemic in S.W. Australia and one widespread in northern Australia.

Triunia L. Johnson & B. Briggs

Differs from *Helicia* in its flowers with a markedly zygomorphic perianth, anatomical details of the fruit and 'whorled' leaves.

Replaced synonym: *Helicia* sect. *Macadamiopsis* Sleumer in *Blumea*, 8: 8 (1955).

Type species: *Triunia youngiana*. Basionym: *Helicia youngiana*.

The name is derived from Latin *tri-*, three-, and *unus*, one (alluding to the perianth in which three tepals are coherent to a higher level than the fourth).

Three species in tropical and subtropical eastern Australia.

Malagasias L. Johnson & B. Briggs

Distinguished amongst the Persoonieae by the following:

Adult leaves simple and entire; conflorescences single in the upper axils; flowers hermaphrodite, small; perianth-limb scarcely distinct from the tube, tepals not strongly spirally twisted after flowering; pollen-presenter little developed, more or less spindle-shaped. Chromosomes unknown.

Type species: *Malagasias alticola*. Basionym: *Macadamia alticola*.

The name is derived from that of the Malagasy people and Republic. One species in Madagascar.

Athertonias L. Johnson & B. Briggs

Distinguished amongst the Hicksbeachiinae by the following.

Pre-adult leaves coarsely lobed, adult leaves simple and entire; conflorescences single, terminating leafy branchlets; flowers hermaphrodite, moderately large; the swollen perianth-limb markedly distinct in the bud from the narrow tube, tepals not strongly spirally twisted after flowering; pollen-presenter club-shaped; fruits black at maturity. Chromosomes unknown.

Type species: *Athertonias diversifolia*. Basionym: *Helicia diversifolia* (*Hicksbeachia diversifolia*).

The name is derived from the Atherton Tableland, which is in turn named after John Atherton (1837-1913), a pioneer pastoralist in the district, where it is endemic.

One species in N.E. Queensland.

Virotia L. Johnson & B. Briggs

Distinguished amongst the Hicksbeachiinae by the following.

Pre-adult leaves variously lobed or probably sometimes simple and entire, adult leaves simple and entire; conflorescences single, axillary; flowers hermaphrodite, elongate; perianth-limb more or less distinct from the tube, tepals spirally twisted after flowering; hypogynous glands (nectaries) usually more or less fused; pollen-presenter spindle-shaped. Chromosome number, $n = 13$ as far as is known.

Type species: *Virotia leptophylla*. Basionym: *Kermadecia leptophylla* (*Macadamia leptophylla*).

Six species endemic in New Caledonia, together with one N.E. Queensland species ("*Helicia heyana*") tentatively assigned to *Virotia* in the absence of fruits. Named after New Caledonian botanist Robert Virost.

Floydia L. Johnson & B. Briggs

Distinguished amongst the Macadamieae by the following.

Leaves alternate, the pre-adult and adult leaves simple, entire; peduncles ("common stalks" of the flower pairs) developed but *individual* floral bracts none (pair-bracts are present); flowers straight and not zygomorphic; filaments adnate to the tepals for most of their length; hypogynous glands (nectaries) separate; pollen-presenter more or less club shaped; fruit indehiscent, globose;

exocarp corky; seed 1, thick, the testa neither thickened nor very hard. Chromosome number, $n = 14$.

Type species: *Floydia praealta*. Basionym: *Helicia praealta* (*Macadamia praealta*).

Australian Proteaceae for Horticulture

A Horticultural Frontier introduced by THE EDITOR

Plants grouped in the plant family of Proteaceae have considerable value in horticulture. While many hundreds of species have already been widely used, there are still more that should be given their place in the landscapes of tomorrow. The article on page 303 by Dr. L. A. S. Johnson, Director of The Botanic Gardens, Sydney, and B. L. Briggs, Senior Botanist of the National Herbarium, Sydney, places the many genera in perspective. Referring to figure 1 of this paper the plants in their subfamilies are grouped as given below. References are given for past issues of "Australian Plants". We are especially concerned with trials and recording of information concerning the successful cultivation of these unique plants. Will readers please advise the Editor of their experiences in the cultivation of species in Proteoideae and Persoonioideae so that we can present a further report?

Conospermeae

Cenarrheninae

Cenarrhenes. One species in Tasmania *C. nitida*, Issue 32: p. 154.
Agastachys. One sp. in Tasm. *A. adorata*, 39:108P, 46:68, 54:55.

Stirlingiinae

Stirlingia. Six species in the south-west—who has grown them?

Petrophilinae

Petrophile and *Isopogon*—see page 332.

Conosperminae

Conospermum. Much more information needed. 40:166, 27:304P.
Synaphea. More information required. *S. reticulata* 50:246.

Franklandiinae

Franklandia. Most unique plants. See page 321.

Adenanthos. An issue is planned and reports, notes, articles, slides and prints are needed. 23:103, 27:335, 46:67.

Persoonioideae

Persoonieae

Placospermum. One species in the N.E. *P. coriaceum* 35:316.
Pycnonia, *Acidonia* and *Persoonia*—see page 323.

Bellendeneae

Bellendenia. One species in Tasm. *B. montana* 23:105.

Sphalmioideae—*Sphalmium* and Carnarvonioideae—*Carnarvonia*. Each genus has one species in the north-east. There are a number of genera with only a few species in the rainforest and fringes in the north-east. Reports on these are especially desired.

Grevilleoideae

These are as shown in figure 2 of the previous article. Reports are needed for inclusion in a review of this subfamily.

See page 287 for comments on propagation and cultivation.

Conditions for Cultivation of Australian Plants

by R. L. Specht, Prof. of Botany, University of Queensland

Soils form the usual substrate in which vascular plants anchor themselves by their roots and from which the plant derives its water and plant nutrients. A great number of different soils are found throughout the continent of Australia — shallow, deep, stony, sandy, loamy, clayey, peaty, calcareous, non-calcareous, saline, non-saline. Many of these soil types occupy considerable areas of landscape and on them distinctive floras have developed. For example:

1. Samphire (or salt marsh) plants and mangroves are confined to saline soils.
2. Calicicole (limestone loving) plants are seen growing on highly calcareous soils.
3. Heath plants (also a component of dry sclerophyll forest) are found on very infertile, non-calcareous soils, often deep sands, sandstone soils or leached lateritic (ironstone) soils.
4. A rich flora of grasses and herbs tends to grow on more fertile, sometimes calcareous, soils (often loamy or clayey in texture).
5. The best development of rain-forest vegetation in Eastern Australia tends to be on deep volcanic soils — non-calcareous and of medium fertility.
6. Swampy peats tend to be very infertile and support a vegetation dominated by heathy plants or sedges.

These Australian floras are very distinctive and may be found from the high rainfall zone of the coast, into the arid inland. With increasing aridity, the plant communities become more open, with increasing areas of bare ground between the plants; the component species tend to change, but each major soil type carries from high to low rainfall a suite of plant communities strikingly similar to each other in their physiological reactions, e.g. heathlands in the high rainfall belt give way to *Dodonaea* — *Eremophila* — *Cassia* shrublands in inland Australia on the same infertile soil.

It means, therefore, that if native plants are to be grown successfully, we must be aware of the nutritional limits of each group of species and adapt our cultural practices to conform to these limits.

Let us look at some studies made on heathland species — a group of very attractive plants found growing on very infertile soils. *Banksia*, *Grevillea*, *Telopea*, *Melaleuca*, *Leptospermum*, *Thryptomene*, *Boronia*, *Eriostemon*, and many others are characteristic of this group of plants. In the high rainfall belt of eastern and southern Australia there are many localities where infertile soils supporting heath plants abut fertile soils supporting a grass-herb vegetation. In fact it often takes only a few paces to walk across these boundaries between soil types — from one vegetation type to another. Why is one group of plants on one soil type and not on the other? It is clear from experiment that the infertile soil is too poor to support the growth of grasses and herbs which, without fertilizer, struggle for existence on these soils. But can the heath plants on the infertile soils grow on the more fertile soils or on their own soils when fertilizer is applied to them?

Many attempts have been made to grow these heath plants on the richer soil — and many successes have been claimed. But are they really successes? Field and laboratory experiments have now been conducted in South Australia, Victoria, New South Wales and Queensland. Much more research needs to be done, but some clear points are emerging from the research already conducted.

1. Certain of the heath plants are pioneer, short-lived species which grow vigorously on the ashes of a bush fire. These species are more akin to

* Professor Specht, Head of the Department of Botany, University of Queensland, gave this address at the *Conference on Growing Native Plants* organised by the University of New England and held at Burrendong. Published in the proceedings of the conference, this article has been reprinted from *Burrendong Arboretum Brigge*, No. 40, October, 1977.

those found on the richer soils; they can only survive on the infertile soils if the fertility of the soil is regularly replenished by the ashes of other plants. Some, like the wattle, pea and sheoak families, supplement this momentary increase in fertility by fixing gaseous nitrogen from the air. Successful cultivation of these plants is often achieved.

2. In contrast with the pioneer species, the long-lived heath plants struggle in the early stages of their growth. They are deprived of nutrient by their pioneer neighbours intermixed with them. If for some reason they are placed in a soil of higher fertility, a number of things could happen:
 - (i) The seedlings tend to be very sensitive to the higher nutrient level — "osmotic-burning" of the roots may occur; nutrient-imbalance (more phosphate, too little nitrate, or vice-versa) may result; root-rotting fungi, stimulated by the increased fertility, may invade the roots; the seedlings may become more frost sensitive.
 - (ii) If the seedling survives all these hazards, most respond by growing more rapidly than usual. Herein lies another danger — the tender young shoots, which may in many cases appear through the summer, are sensitive to the harsh rays of the sun during this season. The young leaves tend to lose water faster than the roots can extract it from the soil. The problem is often exacerbated by the invasion of root fungi (encouraged by the higher nutrient level) which block the passage of water into the plant. Quite suddenly the plants die — almost overnight — with little or no warning. No matter what one does, the end result is inevitable.
 - (iii) If the heath plant survives, it certainly grows bigger, brighter and better. It often produces a wealth of flowers, many more than its struggling, unfertilized brothers and sisters. But disaster is at hand — old age appears to catch up with the fertilized plant, many years before its unfertilized relatives.

What can we learn from the results of these experiments? If attempting to grow heath plants, firstly ascertain whether they belong to the category "pioneer" or "long-lived". If "pioneer", most can germinate and establish in moderately rich soil. If "long-lived", the seedlings will often fail to survive in moderately rich soil — germinate them and establish them in infertile sands and don't be tempted to add any fertilizer. When the "long-lived" heath plants are well established in their pots, it should then be possible to transplant into richer soil or, better, into sandy soil to which a weak well-balanced fertilizer dressing has been applied. A sandy soil is preferable because root-rotting fungi appear to be less active in this soil medium.

No matter how successful one may be in establishing the seedling heath plant, the worst must be expected. The "pioneer" plants are normally short-lived. The unfertilized "long-lived" plant, though looking a picture whilst it is alive, may suddenly die due to drought, root-rot, or just "premature" old-age, induced by the fertilizer.

Considerable success, provided we do not expect them to live too long, can be achieved in growing heath plants. Research focussed on root-rot and premature ageing in fertilized heath plants should enable us to solve or reduce these problems in the future. Judicious pruning, removal of competing plants and appropriate watering techniques appear to prolong the life of ageing native plants in the garden environment.

The problems of growing native plants characteristic of other soil types — saline, calcareous, swampy, rain forest vegetation, are not as well defined as those for heathland plants. The best advice is to reproduce the soil environment characteristic of each group of plants as closely as possible. But there is considerable room for experimentation. For instance, it is possible to grow some mangrove species in soil regularly saturated with fresh water, not salt water. Do not be afraid to experiment; the essential point is to document your techniques and results carefully so that others can learn from your experience. Your contribution to the conservation of our Australian flora could be quite valuable.

A Native Garden

Introduction by The Editor

Just what is a native garden? I mean a garden that looks native, a piece of the wild. Most people with them protest that it is not just a garden containing wildflowers even if it is exclusively Australian plants. What they have sought to achieve is a small natural haven for animals (including humans) and birds, in which the plants intermingle as a natural community. How do you create such a natural retreat?

In her books "Bush Gardens" and "More About Bush Gardens", Betty Maloney, with her feel for nature and her gift with presentation, has tried to show readers how they can create their own bush garden. But is this what people strive for when they seek to grow a native garden? For Betty, leaf and limb are as important as flower, in fact more so. It is the relationship of shade, texture, shape and colour of leaves, the twist of branches, the lay of a log and litter of the floor, among many other things that creates the setting, the presence of a bush garden.

Flowers? Of course there are flowers, but these do not dominate or signal the purpose of the setting. When in season, they are decoration, like a delicate picture, a bonus to a setting that is already complete.

In attempting a natural native garden, many people hope for a bush garden, abundant with wildflowers, all in a small space. I fear they will be disappointed. Such a project is a four dimensional art form in itself. The fourth dimension is the creative talent and the work that goes to create and maintain it. But! Like a painting it is what you see and feel that matters.

However, there are many techniques that could be adapted and with this in view, we have a reader who would like to exchange notes on one technique. Robert Powell writes:

"I am trying to encourage people to grow more natural gardens — in fact as natural as possible — by reproducing in the garden the actual community of plants which could grow naturally on the site, and leaving those plants to their own growth and reproduction. Nature could then be enjoyed to the fullest. I would like to collaborate with people with gardens modelled on their local plant communities."

Interested readers could write to R. Powell, 1 La Grande St., Innaloo, W.A. 6018.

I would disagree with Robert on some aspects. I feel that careful pruning and manipulation would produce a more pleasing "natural" setting. Careful maintenance and even the cunning concealment of pots would allow more flexibility and presentation by changing potted plants in season, etc. Many will disagree and maybe I am wrong. Robert Powell is sure I am wrong because when the above was sent for approval he replied as follows:

"Your mention of pruning shows that the difference between us is one not of degree but of kind. I love nature and it is nature I want in my garden. I had to plant the plants there (since my block was cleared long since) but now I want them to call the tune while I simply observe what they do.

You view gardening as an art; you know how you want your plants to look and you prune them — however lightly — to make them conform with your ideals. Your scheme for moving plants in and out of the garden in pots takes the artistic approach further. I am interested in a *community* of plants; your movable plants are like itinerant workers in a country town — they can scarcely affect, or be affected by, the community in which they briefly find themselves. Your pot plants will not develop sinuous curves to grow through the gaps in a neighbouring shrub; they will not provide shelter for seedlings. They will not interact with their neighbours as they would in nature. Moreover, like children from a broken home, they will not show a normal development; you will not see in them the natural reactions of a natural plant to the seasons, to age, etc.

Society's emphasis teaches us to be active in the garden. This, I am sure, robs us of most of the garden's pleasures. Not only does tampering destroy nature (e.g., pruning destroys the plant's natural growth habit; watering destroys its seasonal behaviour; spraying destroys natural food chains and the insects' effects on plants) but such an approach doesn't allow us to find time or develop the right attitude to enjoy nature. (Admittedly, plants may need some watering during their first summer in the garden and thereafter a small amount of weeding is often necessary; but that can be the limit of our activities.)"—Robert Powell.

So now we have two Native Garden schemes, one contrived, and one natural. Or are they so different? If the "contrived" one looks unnatural then the creator has failed. The suggestion about the use of potted plants was just that, a suggestion. I do not use them, who has the time! But I wonder how natural "natural" one can achieve with the outward pressures of any local scene.

However in some situations a natural self-evolving garden could be created. Why not write to Robert and try one?—Editor.

Notes on Cultivation

Readers are invited to write to the Editor outlining their experiences in cultivation. These reports may be developed into articles or extracts presented as notes such as that above.

GREVILLEA THELEMANNIANA

(A note from A. Thomas, 20 Hunter Street, Euroa, Victoria, 3666)

Grevillea thelemanniana is a wonder ground cover plant. I have used it to cover up the butt of a lombardy poplar which I had razed almost to ground level. I surrounded the butt with stones, allowing a depth of 8 cm of soil over the top of the old butt. The *Grevillea* has more than covered the area and flowers very well.

I have found that species of *Grevillea* and *Hakea* do very well in this north-east of Victoria.

EDITOR'S NOTE: *Grevillea thelemanniana* is indeed an excellent plant and ideal for the beginner. There are a number of forms, the one with greyish leaves appearing the best for flower, with less foliage. There is also a small upright form that flowers very well. A colour plate in our No. 29 issue, on page 5, illustrates the plant. For good references in past issues refer to Issue 46:66, 48:150, 50:243, and 55:146.

Grevillea from Seed

(My experience, by Pat Stanley, Canisius College, Pymble, N.S.W.)

A friend sent me a sprig of unopened seed capsules of *Grevillea banksii*. As the seeds were released quickly, I planted the green seed immediately on 9th March, 1978. On 26th March the seed began to germinate. Most, if not all, seeds germinated within a few days. It would seem that "green" seed germinates easily, without any treatment. The medium should be kept damp, "wet"?, during this period.

CORRECTIONS

Inevitably some errors creep in. Two major ones that must be corrected concern credits for photography.

Hakea cucullata—both photographs in Issue 72, pages 148-149. Excellent photography by Dr. Byron Lamont.

Grevillea aspera—front cover of No. 73 Issue. A superb photograph by Betty Ballingal of a flower growing on a plant flowering well at Brookvale Park, Queensland.

Santalum Fruit

DOMESTICATION OF THE QUANDONG, *SANTALUM ACUMINATUM* (R.Br.) A.DC.

by W. J. R. Grant and M. S. Buttrose — CSIRO, Division of Horticultural Research, G.P.O. Box 350, Adelaide, South Australia, 5001

The macadamia nut (*Macadamia integrifolia* Maiden and Betcher, and *M. tetraphylla* L. Johnson) is often quoted as the only fruit of an indigenous Australian plant which is of economic importance. There are a number of other fruits which are edible (Cribb and Cribb, 1974) but their quality precludes their being economically significant in their wild form. One of these is the quandong or native peach, *Santalum acuminatum* (R.Br.) A.DC. This plant with its fruits was familiar to early settlers over the whole southern half of the continent, and trees are still found from south central Queensland to northern Victoria, across South Australia and across the southern half of Western Australia. The thin flesh of the ripe fruit has a characteristic acidity and astringency, although sweetness can vary, and is still prized by many country people for jam, pies and stewed fruit dish. Less attention is given to the fresh fruit and to the kernel, both of which are edible. The tree itself is especially attractive when carrying ripe fruit.

Almost all present-day commercially produced fruits have originated as small, thin fleshed wild fruits, and over many centuries have been improved by selection of outstanding specimens and by breeding. The quandong is worth improving as an edible fruit for the following reasons. The plant will grow and fruit in semi-arid, as well as better-watered areas of southern Australia. As water for irrigation becomes scarcer and of lower quality due to salinity, the production of a fresh fruit without irrigation in dry areas could become more important. The flesh of the quandong is nutritionally valuable due to a high content of vitamin C (approximately double that of oranges for equal fresh weights), while the kernel is a rich food with approximately 25% protein and 70% oil. As well, the flavour and astringency of the fruit are attractive to many people.

Variation in growth and fruit characteristics exist. Before starting a selection and breeding programme we have had to understand and overcome some of the obstacles in establishing plants. In his book, Blombery (1973) states that quandong seeds can be categorized as "frequently difficult to germinate" and Lord (1972) comments that the quandong is "difficult of cultivation". In an article in this journal, Curtis (1974) contended that germination and cultivation is not difficult provided that the stone is nicked, a host plant supplied and adequate watering undertaken. Our recommendations, after trying a number of different techniques, at the present time are as follows.

Germination

Seeds will germinate within a couple of months of removing from ripe fruit, but germination is better with one-year-old seeds and possibly still better with yet older seeds. Crack the stone in a steel vice and remove the kernel. The brown parchment-like layer which normally still covers the actual kernel is also cracked by hand or knife and split off. Take a small clean plastic bag (e.g. 15 cm by 18 cm) and place inside it two handfuls of moist vermiculite or fresh clean woodshavings. Vermiculite can be purchased from nursery suppliers, but for many people woodshavings (or coarse sawdust) will be easier to obtain. If possible, the medium should be sterilised. Both can be pasteurised in a moist state by heating to 60°C for half an hour in an oven. When filling the bag, the vermiculite or shavings must not be so wet that water can drain out, but just moist to the feel (approximately 40 ml boiled water per half-filled bag as described above). This bag is good both



Photography by E. A. Lawton, C.S.I.R.O.

SANTALUM ACUMINATUM

—leaves, whole fruit, seeds and kernel.

for seed germination and harmful fungal growth, so care must be taken to keep the bag sterile, e.g. hands must be thoroughly washed before removing seed. Any rotting seed must be removed. Kernels should preferably be surface sterilised before being placed in the bag. Firstly, immerse the kernels for 30 minutes in household chlorinated bleach (e.g. White King) diluted to one-tenth strength and to which has been added 10 drops of detergent per litre of solution. Then drain off the bleach solution and wash three times in cold boiled water. Finally, dust the kernels with a general purpose fungicide, e.g. Captan, Thiram or Zineb, and place within the vermiculite inside the bag. Clip the bag shut to prevent moisture loss. The bag must now be held in a cool place out of the light. The optimum temperature for germination appears to be between 16° and 20°C (61° to 68°F). Germination is very poor at 25°C and still worse at 30°C. We inspect the bags once each week and remove germinated seeds. These are readily seen because of the thick white root which often appears against the clear polythene. The first seeds usually germinate at three weeks, the last ones may take several months. With this technique we are achieving about 80% germination.

Planting

In common with other members of the Santalaceae the quandong is a root parasite. When a quandong root comes in contact with a root of some other plant a pad-like growth proliferates from the quandong and partly surrounds the host root at that point. Root tissues from the quandong invade the host and a direct root connection is established. It is not known what the quandong requires from a host, nor whether it requires a host for its whole life span, although we are studying these questions. The host range appears to be wide — *Eucalyptus*, *Acacia* and *Casuarina* to mention a few natives, also any backyard fruit tree or shrub, and perennial grasses

and even annual plants. With our interest in establishing orchard plantations, we are experimenting with kikuyu grass and lucerne as host plants. These could be kept mown or grazed.

We commonly take a germinated seed with 5 cm (2 inches) long root and plant into a 15 cm (6 inch) pot or polybag with potting soil. Probably any well drained sandy soil would be suitable. Some lucerne seeds or a slip of kikuyu are planted into the same container and the pot kept well watered. Regularly each fortnight we apply a commercial soluble fertiliser (Aquisol, Thrive, etc.) and at monthly intervals a small supplement of super-phosphate and of iron chelate (a level teaspoon of each/gallon/month) until the plants are ready for field planting. Hirano and Lyon (1977) have had encouraging results using iron chelate with some other *Santalum* species. Late autumn or winter are probably the best times for transplanting to a permanent site. Plants must be watered in well at planting, and there must be adequate water until the roots grow out well. For the home gardener freshly germinated seeds can be planted directly into position adjacent to a suitable established host plant, preferably in late autumn. Seedlings must be protected against snails and in country areas against rabbits. A tree that grows vigorously will flower in its third year and have its first few fruit by four years old.

Many people are disappointed that small quandong "seedlings" that they find adjacent to established trees will not transplant. One reason is that many of these small plants are actually root suckers, and in digging them out they are deprived of an adequate root system. Another common fallacy is that quandongs do not need a host because there is not another plant within, say, 50 metres of an old tree. Although it has not yet been proved that a host is absolutely essential, such observations certainly do not provide this proof because there is bound to be some plant life near the quandong, perhaps some *Triodia* or other perennial (or annual) grass, or else some very small woody perennials. In addition, it must not be forgotten that roots can grow very long distances, and after all, if a host root grows 25 metres and a quandong also 25 metres there could be parasitism with two trees 50 metres apart.

To summarise, there are six important steps to success:

1. Crack the stone in a vice and remove the remaining parchment cover from the kernel.
2. Sterilise the seeds with bleach and fungicide.
3. Prepare a moist sterile germination mixture in clean plastic bags.
4. Place seed in bag at optimum temperature (16-20°C).
5. Remove germinated seed when the root is approximately 5 cm (2 inches) long and plant either directly in the ground near a host or in a pot with a host.
6. Water and nourish the plants regularly and protect from snails whilst seedlings are succulent.

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Send to the Editor, 860 Henry Lawson Drive, Picnic Point, N.S.W. 2213

Cultivation of Proteaceae

Notes by THE EDITOR

to assist Readers in Propagation and Cultivation

Propagation of Proteaceae

Much has been written about the propagation from seed of species of *Grevillea*, *Hakea* and *Banksia*, and readers are referred to past issues. The article on "Santalum Fruit" has been included in this issue as a suggested method of seed germination for Proteaceae. See also 71:122, 72:165, 73:206, 208.

Propagation by cuttings is usually quite successful. Many methods have been described in past issues, references for this volume being pages 102, 250 and 167.

Cultivation of Proteaceae

Articles in Volume 9 have been carefully selected to guide readers with this complex problem. Many are so easy to grow, and results are spectacular. Others have proved disappointing and it is often the experts who have failed. While I hope that you will read the following articles carefully, do not be discouraged by the wealth of learned advice. I still stick with the original advice—good healthy garden conditions above and below ground will yield excellent, even spectacular, results. Refer to:

"Conditions for Cultivation of Australian Plants", by R. L. Specht, on page 312, where it will be noted that while good results can be expected, often plants are short-lived. They often are in the bush as well, so if you get two or three good years be appreciative of this and replant.

"Why Can't We Grow all the Western Australian Plants in the East?", by Jim Webb (71:109); and "West Australian Banksias in Canberra", by J. Gotham and G. Butler (71:113), that raises the question of the level of calcium in the soil. This is the subject of further serious study—see Study Group below.

"Proteoid Roots", by Dr. Byron Lamont, on page 72:161, where the beneficial association of soil micro-organisms produces dense bunches of rootlets in conditions of low levels of inorganic nutrients and moist soil.

"Microbial Interactions in Soil and Healthy Plant Growth", by A. M. Smith (73:209), which is in the forefront of agricultural research and could be the most significant breakthrough in the problems associated with the cultivation of Proteaceae.

The Study Groups in Proteaceae

Study Groups comprise people with all levels of competence who are interested in the cultivation of a particular group of plants. Advice, seed, etc., are freely available; such that even the most inexperienced beginner is welcome and needed. But! What is needed is patience, persistence and a genuine desire to help and record results over a lengthy period. If interested contact the following:

Calcium Nutrition Study Group—P.O. Box 207, Civic Square, A.C.T., 2608.
Membership is \$1.00 and keen types are welcome.

Grevillea Study Group—Merv. Hodge, 25 Burford Street, Moorooka, Qld., 4105.
Membership is \$1.00 for this active, well-organised group of growers.

Banksia Study Group—Trevor Blake, 12 Little John Court, Vermont, 3133.



Photography by J. Glass

PERSOONIA SAUNDERSIANA

Refer to page 323, where reference is made to proposed changes to the genus *Pycnonia*.

FRANKLANDIA

by Ken Newbey, School of Environmental and Life Sciences, Murdoch University, W.A.



Photography by Erica Crane

FRANKLANDIA FUCIFOLIA

PAGE 321—Vol. 9

Franklandia belongs to the family PROTEACEAE (*Banksia*, *Hakea*, *Conospermum*, etc.), and is the only genus in the tribe FRANKLANDIEAE. The two known species are confined in south-western Australia. *Franklandia* is not an obvious member of Proteaceae; having a narrow floral tube dividing into 4 regular petals which reflex with maturity. The single seed is inverted conical with a pappus (long fine hairs radiating from the margin), and on a long stalk.

Reproduction is by suckering from the root stock after fire or mechanical damage, e.g. roadside grading. Plants are few-flowered. During my field work, which has included many burnt areas, seedlings have never been sighted.

The horticultural potential of both species is limited to ornamental and dried arrangements, due to the unusual foliage and flowers. Neither species has an accepted common name.

The glabrous leaves and branches suggest propagation by cutting should be possible. The few seeds produced are shed annually and difficult to collect. Root stock division may be worthy of investigation. I have not noted this genus in cultivation.

***Franklandia fucifolia* R. Br.**

Woody shrub 40-60 cm high, upright-spreading to spreading, open, scattered foliage on the upper half; divided just below ground level into 2 or 3 major rigid branches; secondary branching sparse; branchlets none. Recent mature branches, leaves and flowers covered with scattered, very small warts. Bark on the old wood rough from flaking, dull medium to brownish grey; mature wood without flakes. Leaves compound, 8-14 cm long, 2-3 cm across, forked 2, 3 or 4 times, segments terete, about 1.5 mm diameter, roughish, flexible, dull medium green. Flowers glabrous, outer surface dull light reddish brown, axillary, single, upright, scattered, opening as the new growth matures. Floral tube (including pedicel) 30-35 mm long, 1.5 mm diameter; petals narrow, 9-10 mm long, inner surface dull medium yellow; anthers linear, attached to inner floral tube surface and not protruding. Seed 1.5 mm long, 1.5 mm diameter, dull light blueish grey; stalk 8-9 mm long, narrow, glabrous, bright darkish brown; pappus (bristles) fine, 8-9 mm long, spreading, dull light creamish. The flowering period depends on the length of the growing season: normally April to November. Individual plants flower for long periods.

The species is widespread from Albany to Cape Arid, and inland to about 457 m isohvet (up to 150 km), but never common. Furthest west record is Dinninup, near Boyup Brook. Occurs in open-heath on well-drained, deep white sand, but never in areas under marine influence.

Humidity is generally low to moderate. Average maximum temperature hottest month 24-27°C; Average minimum temperature coldest month 5-8°C; Highest temperature recorded 45°C; Lowest temperature recorded -2°C; Annual rainfall 457-635 mm.

***Franklandia triaristata* Benth.**

Differs from *F. fucifolia* in greater height (60-140 cm), foliage more slender, flowers much larger with outer surface pink. Occurs in the Bunbury-Busselton area, which has a higher annual rainfall (890-1020 mm) and generally higher humidity. Field experience and W.A. Herbarium specimens indicate that the distributions of both species do not overlap.

Plants should be grown in well-drained deep sand to sandy loam in sunny situations where the humidity is generally moderate or less.

Persoonia

By W. CANE, Box 19, Maffra, Victoria, 3860

One group of plants in the family Proteaceae that deserves more attention is the genus *Persoonia*. As recorded in the article earlier in this issue, the group of plants formerly comprising the genus *Persoonia* in Australia has been divided into three genera. As my comments are applicable to all in this group they shall apply to the three genera as a whole.

The colour plate, on page 320, of a plant known as *Persoonia saundersiana* (to be transferred to the genus *Pycnonia* in the future, see page 309) shows how the bright yellow flowers contrast and show out well against the green foliage.

Very few species of *Persoonia* are grown in the garden. No doubt the reason is that not much is known of reliable methods of propagation from seed or cuttings. Some are hardy. There is so much in the genus to appeal from the horticultural angle, as many are quite spectacular in flower, while others have beautiful foliage throughout the year. In fact the foliage of some is quite unique and excellent for landscaping and foliage contrast. The leaves vary from being hair-like and graceful to others which have leaves several centimetres wide.

Persoonia vary considerably in growth habit, from vigorous, dense ground cover plants, to shrubs less than 1 m in height, to graceful trees. I am "hooked" on them and would like to hear from anyone who knows of various species, and especially those who can provide me with seed for my research.

The Genus *Spartothamnella*

Summary by The Editor of a Revision by Munir, Ahmad Abid as published in the Journal of the Adelaide Botanic Gardens, Vol. Pt. 1

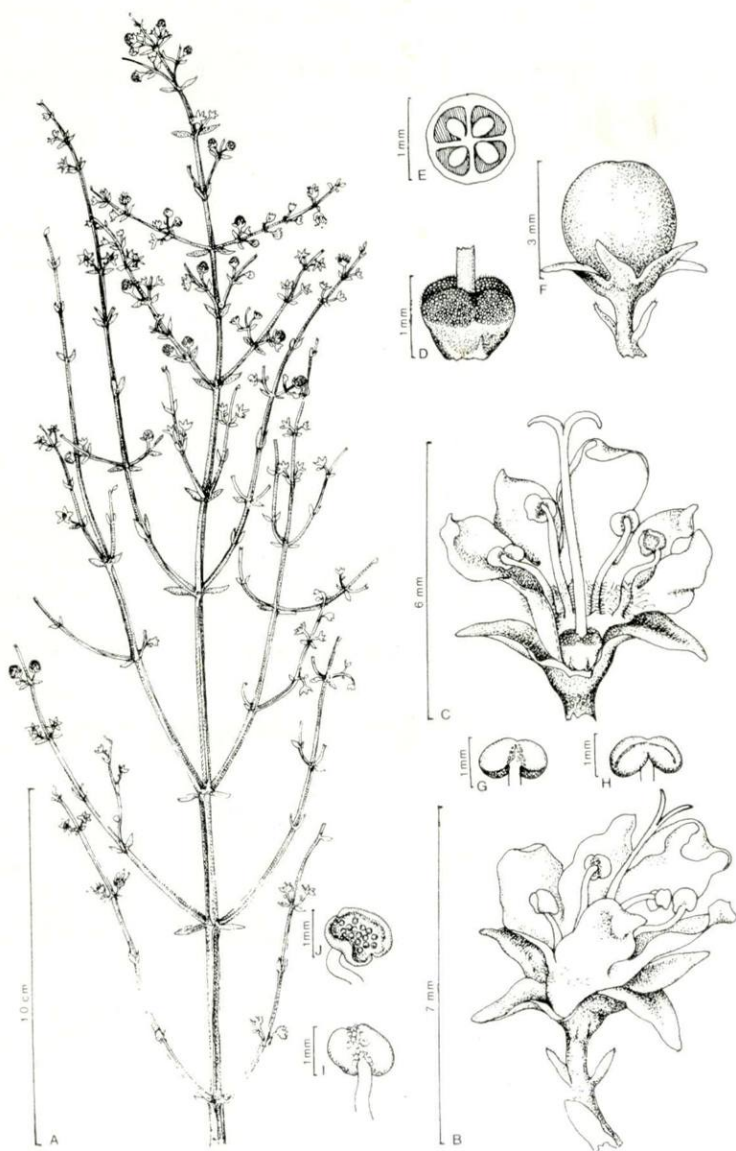
Spartothamnella is a small genus of three species which, in the field, are scrappy wiry looking plants. The flowers are almost insignificant and it seems the plants have little horticultural value. The author has retained the genus in the family *Chloanthaceae* but recognises some affinity with the families *Myoporaceae* and *Verbenaceae*.

1. (a) Plant pubescent with branched hairs, flowers sessile

As a reference it would appear sufficient to reproduce a sketch showing the details of one species and the following key:

- calyx longer than corolla 1. *S. puberula*.
(b) Plant glabrous or grey-puberulous in young plant with simple hairs; flowers pedicellate; calyx shorter than corolla 2.
2. (a) Plant glabrous, stem acutely 4-angled, longitudinally striate; pedicel and calyx glabrous 2. *S. juneae*.
(b) Plant grey-puberulous when young, later glabrescent; stem obtusely 4-angled, non striate; pedicel and calyx grey-puberulous 3. *S. teucriflora*.

Information on "The Journal of The Adelaide Botanic Gardens" is given on page 327.



Spartothamnella juncea (A. Cunn. ex Walp.) (C. Burgess s.n.: CBG 009500). A. flowering twig; B. flower with bract and bracteoles; C. flower with calyx and corolla vertically cut open showing androecium and gynaecium; D. ovary; E. T.S. ovary; F. fruit with persistent calyx; G. back view of undehiscent anther; H. front view of undehiscent anther; I. back view of dehiscent anther; J. front view of dehiscent anther, showing the single chamber formed by the confluent anther-lobes at the apex.

Sketch reprinted from The Journal of The Adelaide Botanic Gardens by permission.



An
unnamed
species
of
Prostanthera
to be
found at
Ryalston
N.S.W.

THE CRADLE OF INCENSE

The Genus Prostanthera, by GEORGE W. ALTHOFER

This book is undoubtedly a major contribution to the Flora of Australia. Plants of the genus *Prostanthera*, known generally as the Australian Mint-bush, are grown world wide for their beautiful bushes, abundant flowering, and the mint smell of their crushed leaves.

This book has a magic that is missed by most books on wildflowers. Written by a leading authority on the Australian Flora and its cultivation, certainly the authority on *Prostanthera*, the clinical presentation of description of plants so necessary when there are so many species is tempered by the narrative of a bush wanderer and poet.

In fact the book is presented along two parallel themes. On each right page the author describes in narrative form, his exploration of the bush and the spectacle that holds him in wonder as he comes upon yet another species of free flowing mint-bush. On the left hand page opposite the native is a colour plate or sketch of the species "discovered" together with a simple but adequate description.

Many new species are described and illustrated in colour. The colour presentation is exceptional bearing in mind that the photography is by amateurs and often of very rare species not seen by many, even professional botanists, in the past.

As with our other publications, new recordings and information will be supplied in Australian Plants to up-date your book, but the wealth of information in the book is such that it can never be presented in our normal issues. You must get a copy of this valuable book, fully bound with a hard cover and colourful glossy dust jacket. We would have liked to sell it cheaper but even on a non-profit basis, the income is needed to produce more books of this outstanding quality.

Why "The Cradle of Incense" for the title? Why not read the book and find out.

Available from The Editor for \$12.00.

SCIENTIFIC BOOKS ON PLANT LIFE

Fortunately for the future of mankind, there is considerable research on plant life, its evolution, its propagation, its healthy growth, selective breeding, and the sensible control of pests and diseases. There will be some readers who wish to learn more about these developments and the basics of plant biology. A summary of books produced over the last year is included below. You may be able to borrow them from your local library (they will in turn borrow them from specialist libraries), or you can buy a copy through your local bookshop, or the bookshop of your nearest University, or direct from D.A. Book Depot Pty. Ltd., 11 Station St., Mitcham, Victoria, 3132. (Enquire first by mail.)

PLANT DISEASE — AN ADVANCED TREATISE — Vol. 1, How Disease Is Managed. — Edited by Horstall and Cowling from Academic Press, U.S.A. — Price in U.S.A. \$29.00.

This five volume treatise is intended for the advanced researcher in plant pathology. The chapters such as "Mechanism Of Action Of Fungicides" are authoritative but quite readable, making this book a must for people really interested in the control of plant disease problems.

POLLINATION MECHANISMS, REPRODUCTION AND PLANT BREEDING by Frankel and Galun — Price \$29.40 from your bookseller.

This book presents an integrated botanical, genetic and breeding-methodological treatment of the reproductive biology of mainly angiosperms for the student and the specialist plant breeder.

BIOLOGICAL INSECT PEST SUPPRESSION by Coppel and Mertins. — Price \$35.30 from your bookseller.

This covers the knowledge to date of methods of suppression of insect populations by the action of their indigenous and introduced natural enemies. The realisation that the continued use of chemical solutions to eradicate a creature that appears to compete with our desires for plants, be it for food or environment, may ultimately threaten our own health, is at last being appreciated. All creatures, except man who manages quite capably to exterminate himself, are controlled by other creatures and this book approaches pest control from this way. For instance, not only are biological methods of control of nematodes considered but the use of nematodes as a control of other pests is studied. Essentially a reference book for the student, but of value to anyone interested in this vital subject.

INCOMPATIBILITY IN ANGIOSPERMS by de Nettancourt — Price \$27.50.

A review for students of the huge body of accumulated data on the physiology, biochemistry, ultra-structure, cytology, genetics and evolution of incompatibility in angiosperms. An excellent technical reference for all serious plant breeders.

AN INTRODUCTION TO ENVIRONMENTAL BIOPHYSICS by G. S. Campbell. — Price \$9.90 from your bookseller.

The physical micro-environment in which living organisms reside is defined and the exchange processes between them in relation to mass and heat transfer evaluated in mathematical terms. A student's book.

AN INTRODUCTION TO PLANT ANATOMY — by Eames & MacDaniels. Published by McGraw-Hill, U.S.A. The Australian price is not known.

This book is an elementary text and not presented as a research reference. While it is technical in nature, and presents clearly the knowledge of man to date, a serious study privately would provide a good grounding for the better understanding of plants. 428 pages, 23 x 15 cm.

MORPHOLOGY OF THE ANGIOSPERMS — by A. J. Eames. Published by McGraw-Hill, U.S.A. The Australian price is not known.

The present knowledge of man on the various parts of seed-bearing plants (Angiosperms) is presented for advanced students and teachers. The detailed studies of the plant body, the flower, the reproductive parts, the seed, etc., are clearly presented. 518 pages, 23 x 15 cm.

PROGRESS IN BOTANY—39 — Edited by Herausgeber. Price in Australia from your University Bookshop or D.A. Book Depot \$50.50.

A review of recent scientific research in the areas of Morphology, Physiology, Genetics, Taxonomy and Geo botany by leading scientists from universities in Germany. 304 pages, 24 x 16 cm.

NEW NATURAL PRODUCTS AND PLANT DRUGS WITH PHARMACOLOGICAL, BIOLOGICAL OR THERAPEUTICAL ACTIVITY — Edited by Wagner & Wolff. Price in Australia from your University Bookshop or D.A. Book Depot \$34.50.

Produced in the "Proceedings in Life Sciences" series by Springer-Verlag, this is a report of the "Proceedings of the First International Congress on Medicinal Plant Research, Section A," held in the University of Munich, Germany, in September, 1976. 286 pages, 24 x 16 cm, with 152 figures.

PLANT GROWTH REGULATION — Edited by P. E. Pilet. Available from your bookseller at \$32.40 or D.A. Book Depot, Mitcham, Victoria.

Proceedings of the 9th International Conference on Plant Growth Substances text of addresses by the world's leading specialists under the chapter headings of: 1. The Wall of Growing Cell—2. Hormones, Membranes—3. Hormone Analysis—4. Auxins and Root Growth Inhibitors—5. Gibberellins and Cytokinins—6. Ethylene and Other Regulators—7. Gravity and Light Effects—8. Hormonal Control. 304 pages, 24 x 17 cm.

PLANT TISSUE CULTURE AND ITS BIO-TECHNOLOGICAL APPLICATION — Edited by Barz, Reinhard and Zenk. Available from booksellers for \$44.50.

Proceedings of the First International Congress on Medicinal Plant Research, Section B. The possibility of growing plant cells like micro-organisms is the subject of discussion by the world's leading research scientists. 420 pages, 24 x 17 cm.

LIPIDS AND LIPID POLYMERS IN HIGHER PLANTS — Edited by Tovini and Lichtenhaler. Papers presented at a symposium at the Botanical Institute of the University of Karlsruhe. The emphasis by the world's leading research scientists in this field is on biosynthesis, distribution, function and physiology of the various higher plant lipids and their role in biomembranes and epidermal cell walls. 306 pages, 24 x 17 cm.

More scientific books on page 328.

PUBLICATIONS BY BOTANIC GARDENS & STATE HERBARIA

South Australia

THE JOURNAL OF THE ADELAIDE BOTANIC GARDENS. Available only from The Director, Botanic Gardens, Adelaide, S.A. Price \$4.50. This is a new medium for the publication of papers on both the Australian flora and on horticultural botany. Taxonomic papers on Australian vascular plants will occupy the largest number of pages. The first issue reviews the general *Spartothamnella* and *Wrixonia*. Short papers on the South Australian and Northern Territory flora will be published, a summary of the family Lythraceae in the N.T. being in the first issue. Under the heading "Plant Portraits" a series of line drawings and accompanying descriptions and notes will illustrate species insufficiently illustrated in the literature. Illustrations of *Bulbophyllum formosum*, *Diplocaulobium dichrotropis* and *Ceratostylis acutifolia* are in the first issue with botanical descriptions. The journal will appear at irregular intervals. The subscription will vary according to the size of the issue, the first issue of 68 pages costing \$4.50.

Queensland

"AUSTROBAILEYA" is the title of the new journal published by the Queensland Herbarium, Dept. of Primary Industries, Brisbane, Queensland. This has replaced "Contributions from the Queensland Herbarium". It is published in a limited number of copies and is intended for the professional plant taxonomist, not being readily available for the general reader. Vol. 1, No. 1, officially publishes the names of new species in the Queensland flora and reviews the taxonomic position of some genera. However, it is proposed to publish a summary of this scientific research in future issues of "Australian Plants" so that the general public will be fully informed of the valuable work being carried out by Queensland botanists.

"WILDFLOWERS OF SOUTH-EASTERN QUEENSLAND". A series of delightfully written little books by Beryl A. Lebler, available from the Department of Primary Industries, William Street, Brisbane, 4000, for \$2.50 including postage. Volume 1 has 102 pages (24 x 18 cm) and is styled for the layman/wildflower lover, with botanical detail very well presented.

New South Wales

"TELOPEA" is the title of the journal published by the National Herbarium, Botanic Gardens, Sydney. As announced on page 314 of Volume 8, this is a similar publication presented in scientific terms. Vol. 1, No. 2, reviews "The Lindsaeid Ferns of the Old World VII," discusses the "Changing Dominance of an Algal Species," and describes a new genus of composites known as *Actites*. This new genus of herbs is described further in this issue.

Victoria

"MUELLERIA" is published by the National Herbarium, Botanic Gardens, Melbourne. Of interest in the Vol. 3, No. 4, issue is a new species of *Lastreopsis*, *L. grayi*, a fern from the rainforests of the Atherton Tablelands in N.E. Queensland. Its closest ally is yet another new species to be described shortly in "Telopea" above, so further details will be given then.

Western Australia

"NUYTSIA" is published by the W.A. Herbarium of the Department of Agriculture, Western Australia. As with the other publications above, they are a report of scientific research and have a restricted circulation. Future issues of "Australian Plants" will carry articles based on the reports in this publication.

Australian Capital Territory—Canberra

"GROWING NATIVE PLANTS" is published by the Canberra Botanic Gardens and is presented in a popular manner for wide general public use. A major objective of the Gardens is to undertake basic scientific research into the propagation and cultivation requirements of the Australian flora and to grow a wide range of this flora in the Canberra Botanic Gardens. Conscious of their responsibility to disseminate the results of this research to the horticultural trade as quickly and simply as possible, their journal is written in layman terms and is well illustrated in colour. The most recent issue, Vol. 8, 1978, carries articles on winter colour, tissue culture, and many others. Copies are obtainable from the Botanic Gardens or from any Australian Government Publishing Service office.

Australian Government—C.S.I.R.O.

"BRUNONIA". A record of botanical work at a scientific research level. This is published under the guidance of Dr. H.J. Eichler, Director of the Herbarium Australiense of the C.S.I.R.O., Canberra. Annual subscription is \$10.00, payable to the Editor.

MORE SCIENTIFIC BOOKS ON PLANT LIFE

MEIOTIC CONFIGURATIONS by Dr. J. Sybenga, Agricultural University, Netherlands. Price \$26.60. Not available from the Editor. A source of information for estimating genetic parameters for geneticists and plant animal breeders. 250 pages, 24 cm x 16 cm.

INTERCELLULAR COMMUNICATION IN PLANTS — STUDIES ON PLASMODESMATA. By various authors in the Department of Developmental Biology, Australian National University Research School of Biological Sciences and others. Price \$28.10. Not available from the Editor. The book summarises and integrates a field of study in its entirety: the nature of plasmodesmata and the part these intercellular connections play in the life of the plant. 386 pages, 24 cm x 16 cm.

ENCYCLOPAEDIA OF PLANT PHYSIOLOGY (New Series).

Volume 1—Transport in Plants I—Presents Phloem Transport in chapters headed "Structural Considerations", "Nature of Substances", "Assessment of Evidence", "Possible Mechanisms", "Phloem Loading", by 20 eminent scientists in 536 pages, 24 cm x 16 cm. Price \$58.50. (Not available from Editor.)

Volume 2—Transport in Plants II—Part A—Cells. Presented under "Theoretical and Biophysical Approaches", "Particular Cell Systems" and "Regulation, Metabolism and Transport". Price \$50.00.

Part B—Tissues and Organs—Presented under "Pathways of Transport in Tissues", "Particular Tissue Systems" and "Control and Regulation of Transport in Tissues". Price \$53.90.

BIOLOGY OF PLANTS by Raven, Evert, Curtis. Price in Australia unknown (\$15.95 in U.S.). Not available from Editor. This 684-page (28 cm x 21 cm) book is presented in completely revised form by the authors, who are obviously competent tutors. This would be the best book I have seen for use by someone who wishes to study plants at home in a serious way. It is very simply and clearly written, well illustrated and complete in the scientific sense. With this in mind, the chapters speak for themselves: The Plant Cell—Photosynthesis . . . —Genetics and Evolution—Diversity of Plants—The Plant Body . . . —Growth Regulation—Ecology.

PHYSIOLOGICAL PLANT PATHOLOGY — Edited by Heitefuss & Williams. Volume 4 of a new series of Encyclopedia of Plant Physiology available only from your bookseller for \$87.30.

This large 890 page book maintains the high standard of the series with papers by 37 of the world's researchers. The intention is to bring to the attention of researchers and students the present state of our knowledge in all aspects of plant pathology. By understanding the complex phenomena of diseases in plants it is hoped to substitute the use of chemical sprays by maintaining a careful ecological balance of nature.

GLOSSARY OF GENETICS & SYTOGENICS — by Rieger, Michaelis & Green. Available only from your bookseller for \$16.20.

A 647 page (14 x 20 cm) soft covered reference to all scientific words, terms and meanings used in connection with the above subject. An essential reference for students.

MODERN METHODS IN FOREST GENETICS — by Miksche. Available only from your bookseller for \$26.10.

This volume contains papers developed from courses on the above subject at the IUFRO Bio-chemical Genetics Workshop at Univ. of Göttingen, Germany, in 1973.

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Notes and Colour Slides Required

An issue is in preparation on plants in the family Lamiaceae. This includes such widely grown plants as *Prostanthera* (for which no further information is required now), *Westringia*, *Hemigenia*, *Hemiandra* and *Plectranthus*. Please help with notes on cultivation experience and colour slides or prints. Other genera in the family for which this assistance is also required are: *Scutellaria*, *Mentha*, *Epimiri*, *Ocimum*, *Basilicum*, *Ajuga*, *Teucrium*, *Eichlerago*, *Wrixonia* and *Microcorys*.

An issue is also in preparation on Myoporaceae, which comprises the genera *Myoporum* and *Eremophila*.

Notes and slides are still required on *Phebalium* and *Eriostemon*. Why not let us know how well you grow these excellent garden plants?



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(SUBFAMILY PROTEOIDEAE)



Photography by J. Glass

PETROPHILE DRUMMONDII

A small upright shrub, of less than 1 m in height, that makes a showy garden plant. It is ideal for rockeries.

An article about the family Proteaceae, on page 303, describes how the many plants in the family are grouped in subfamilies, and then tribes, and then genera. The above plant comes in the subfamily Proteoideae and then the tribe Conospermeae. It can be grouped in a subtribe Petrophillinae with plants in the genus *Isopogon* because of the close resemblance to each other. For those interested in these beautiful garden plants that are our wildflowers you are referred to articles in previous issues, and especially the colour plates of *Isopogon cuneatus* 26:288, *I. formosus* 54:53, *I. scabriusculus* 67:333 and *Petrophile biloba* 44:348.