

Australian Plants

Registered by Australia Post

Publication No. N86 1592

March, 1984

Vol. 12 No. 99

\$1.50



The Australian Flora — Our Natural Asset

An increasing number of Australians are becoming aware of the natural beauty of their homeland. It abounds in magnificent landscapes of stark or rugged beauty to quite tranquil scenes. Few can comprehend the ravages man has brought upon this land and the many beautiful habitats with their flora, that have been destroyed for the survival of man, for the creature comforts of the human race or probably more frequently, from ignorance.

Although it supports the "last ditch" efforts of the sincere conservationists, this publication has been produced for twenty five years with the appreciation that people are also important. Australians deserve to enjoy the standard of living and freedom of thought and action that is their way of life. One of the most precious assets is the environment for pleasant living and an essential part of the natural environment is the Australian Flora.

How to help Australians preserve and observe, to appreciate and to savour/study nature's unique blessings is the objective of this publication. Cultivation of the flora in the home setting, in streets, parks and gardens, and in reserves is just one approach to the whole problem. The last 97 issues and the article opposite will assist readers to cultivate the flora. The task is greater than this. We are only beginning to learn.

We have accomplished much. We were not directly responsible for national projects in research including the National Botanic Gardens and the growing number of practical study and display areas, or for the start on the publication of the Australian Flora series, but our members were and we are confident that, being such a large and active group, we set the climate for national effort at the government level.

We are, however, responsible for the Australian Flora Foundation and its success, and your personal support is crucial. See page 277.

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COVER PLATE

Photography by Neil Marriott

A wildflower garden created on a mound of (see pp.242) featuring from front to rear: *Helipterum roseum* from the dry centre, a "white paper daisy" with a bright yellow centre (many forms in various shades of pink to red are available but every garden needs patches of white to complement the other coloured flowers); *Lechenaultia biloba* from Western Australia with its unique blue flowers produced in profusion; *Eriostemon australasius*, a magnificent shrub of the Sydney sandstone area. The background from left to right is an *Eremophila*, emu bush of the desert, ready to burst into bloom; *Conostylis robustum*, a small well rounded yellow flowered plant ideal for rockeries; *Eremophila nivea* with mauve flowers as a backdrop to the smallest of the Kangaroo Paw family, *Anigozanthos humilis* and the red *Lechenaultia*, *L. formosa*.

How can such a colourful garden be created? See the article opposite.

AUSTRALIAN PLANTS No. 98 issue of Volume 12, comprising issues 93-100
International Series Index ISSN 0005-0008. A National publication in 15000 copies.
Published by The Society for Growing Australian Plants N.S.W. Ltd. see last page.
Available to members or by subscription of \$A6.50, including postage to your address.
Send to the Editor, 860 Henry Lawson Drive, Picnic Point, N.S.W. 2213.
Publication date of previous issue. No. 97 was 27th Jan., 1984.



Wildflower Gardening

Low Maintenance Gardening —
With particular reference to Dry or
Seasonally Dry Inland Areas

by Neil R. Marriott, White Gums Nursery, Stawell, Victoria.

REASONS FOR DEVELOPING LOW MAINTENANCE GARDENS

- A. Necessity — lack of water.
- B. Time saving factor — allows more time for leisure time activities, e.g., sport, planting more gardens!
- C. Growing evidence that plants grown with minimal artificial watering, fertilizing, etc. have greater life-spans.

GARDEN MAINTENANCE consists primarily of:

1. Watering (summer)
2. Drainage (winter)
3. Fertilizing
4. Weeding
5. Pruning
6. Pest control

Let us look at these in detail now and see how by proper planning and preparation of a garden, each one can be greatly reduced:

1. WATERING — can be greatly reduced by:

a. Soil Preparation:

- i, Deep ripping and/or thorough cultivation to allow deep root penetration.
- ii, Fallowing — ideally for 6 months or longer really does improve results, although most gardeners cannot wait this long. Therefore plan ahead. Fallowing tends to enable plants to get more nutrients out of the soil and become established more rapidly.
- iii, Improving soil structure — addition of gypsum, compost and possibly gravel is essential for growing many of our smaller plant species such as *Leschenaultia*, *Verticordia*, the smaller *Grevillea* and *Eremophila*, etc., as it creates an open, free draining soil which allows for thorough feeder root development, and at the same time allows the soil to retain more moisture in dry periods.

b. Mulching: reduces watering by:

- i, breaking the capillary action of rising soil moisture; therefore the soil remains moist for longer as evaporation is greatly reduced.
- ii, reducing soil temperature; evaporation increases with increase in soil temperature.

Mulches can be either *organic*, e.g. compost, leaf-litter, pinebark, peanut shells, wood chips, etc. or *inorganic*, e.g. washed river sand, gravel, crushed rock, etc. Both have their advantages, with cost and local availability being the major consideration for most people. However organic mulches do increase the effects of frost on plants, and this must be borne in mind if you live in a frosty area.

c. Wind Protection:

Winds can be extremely drying, especially hot northerlies. Therefore adequate windbreaks are important. These are most effective if they do not completely block the wind, but *slow* it. This is why dense cyprus hedges are not as effective as windbreaks of native species such as *Casuarina*,



Melaleuca huegelii △

▽ *Hypocalymma angustifolium*





A Wildflower Garden (above)

Photography by Neil Marriott

A garden on a mound of (see pp.242) created in a bare paddock and featuring from left to right in the background, *Grevillea pectinata* (red to pink), *Grevillea pilosa* yet to burst into bloom, and *Eremophila nivea*, the grey bush with pink flowers; and in front, *Hemiandra pungens*, the ground cover normally with abundant white flowers yet to appear; *Verticordia huegelii* (brown/pink) with *Verticordia picta* covered in intricate pink flowers; *Lechenaultia formosa* (deep red); *Conostylis candicans* (yellow); *Lechenaultia biloba* (blue); *Conostylis aurea* (yellow) in front of *Dampiera teres* (mauve/pink) and *Rulingia hermannifolia*, the ground cover in the foreground.

Melaleuca huegelii (top left)

Photography by C. L. Wheeler

As demonstrated in the cover plate, a well presented garden needs patches of white flowers to feature the other colours. When this can be achieved by such a spectacular hardy shrub as *Melaleuca huegelii*, it is especially rewarding. A shrub that can be contained to one metre as shown, or grown to two metres, this plant is ideal for a damp situation (reasonably drained), or for good garden conditions.

Hypocalymma angustifolium (Bottom left)

Photography by Ray Page

A small hardy shrub with white flowers ageing to pink, this plant should be a feature of every small garden or rockery. A vigorous shrub in the garden situation could grow more than one metre but it can be pruned and contained to any shape and size.

Low Maintenance Gardening — continued

Eucalyptus, *Melaleuca*, etc. These should ideally be planted three rows deep to provide foliage from ground to tree tops. A quick break can be made with shade cloth while your windbreak trees are becoming established.

d. Shade for less hardy species:

By selecting a location which is shaded from the hot midday and afternoon sun many plants from more temperate climates can be kept going over the dry summer periods.

e. Selection of drought hardy species:

Careful selection of species is important. Many *Grevillea*, *Hakea* and *Acacia* and most *Eremophila* for example are extremely drought hardy and once established require little additional water.

2. POOR DRAINAGE — can be improved by:

- a. **Improving soil structure** — adding gypsum and gravel makes soil more friable and free-draining.
- b. **Forming up gardens** into raised beds — Mounds — sleeper, log or rock gardens.
- c. **Digging out** and lowering footpaths and drainage lines — garden thus becomes raised in relation to lowered water table.
- d. **Installation of an underground drainage system** — “aggy” pipes or more easily PVC slotted drainage pipes such as “agflow”.

It may seem rather strange to talk about drainage problems in an article about dry inland areas, but the soils of much of Australia's inland are often heavy clays and loams which can become rapidly waterlogged during wet weather. Many plants which succumb in summer with all the symptoms of lack of water are often found, on closer examination to have a largely decayed root system due to poor drainage in winter. Good drainage is one of the most important considerations for successful cultivation of Australian plants in all areas.

3. FERTILIZING

Fertilizing is generally beneficial for most natives. However it must be carried out with caution; under, rather than over fertilize.

One of the easiest and most natural methods of fertilizing is by way of mulches such as leaf litter, twigs, seed pods, etc., which gradually break down and improve the fertility of the soil, providing a rich humus layer on the top of the soil. As they break down, these type of mulches need “topping up” every year or two. The easiest way of doing this is by returning garden clippings and prunings back to the garden surface after chopping up with clippers or an electric mulcher.

True Blood and Bone and slow release pelleted fertilizers such as ‘Osmocote’ are the next best method of fertilizing IF NECESSARY, i.e. if growing too slowly, etc. These should be applied to the surface of the ground, raked in and well watered. They are normally applied in spring or autumn.

Wildflower Gardening

Editorial Policy

Has anyone noticed that Neil Marriott has not given a recommended soil mixture for his mounded or sleeper gardens. He lives in a low rainfall area in Victoria that can get hot as well as dry but also gets biting, plant-flattening winds. You will also note he grows plants from the east and the west in the one garden, many of them very difficult plants. He wants people to grow wildflowers in similar gardens throughout our vast land following the simple procedures defined here.

On page 258 he has an article on one of his special loves *Eremophila*.

Our No. 93 Issue featured gardening in dry areas; No. 94 featured cultivation in containers; No. 95, native gardens in suburban situations; No. 96, gardening in Tasmania and cold climates; No. 97, gardening in Atherton and the tropical north; now Neil Marriott seeks to speak to everyone, everywhere.

4. WEEDING — can be reduced by:

a. Fallowing —

Most weed seeds in soil will germinate during autumn-winter fallowing. These can then be turned back into the soil. This has the double effect of reducing weeds and increasing soil humus at the same time.

b. Spraying —

Perennial weeds such as couch-grass, oxalis, sorrel, etc. can be eliminated for good by spraying with a NON-RESIDUAL, systemic weedicide such as "Roundup" ("Zero"). This is best done when garden is fallow or very carefully between established plants.

Wash off immediately any spray that gets on to your plants, or better still cover small plants with tins, buckets, etc. before spraying. A weedicide "wiper" is often more suitable for use amongst established plants.

c. Mulching —

A good thick mulch will greatly reduce weeds by

- i. Blocking any remaining soil-borne seed from coming up from below.
- ii. Preventing weeds from getting roots down into soil. Weeds which do germinate in the mulch are easy to pull out as their roots cannot gain a firm hold.

5. PRUNING

Most natives are improved by careful pruning, however for most species it need not be an annual chore. If from an early stage your plants are regularly tip-pruned as you wander around the garden, little pruning with secateurs, saws, etc. should ever be needed. Exceptions include *Callistemon*.

Location and spacing are important aspects to keep in mind when planting, otherwise much unnecessary pruning back may become necessary as plants mature. Make sure you know a plant's mature size and light requirements before you plant it.

6. PEST CONTROL

Insect pests such as caterpillars and scale can be problems in the early stages of your garden. However if you have planted plenty of bird-attracting species such as *Grevillea*, *Hakea*, *Eremophila*, *Eucalyptus*, etc., the pests will soon be kept largely under control by the birds as they move into your garden. Ensure that there is a good water supply in your garden for the birds and they will often become permanent residents.

Pest outbreaks not controlled by the birds are best dealt with by picking off by hand and squashing. DON'T USE INSECTICIDES as you will surely finish up killing the birds! Environmentally safe sprays such as pyrethrum, garlic, and eucalyptus sprays of course are quite safe for both the birds and yourself, but you will find that as your garden reaches a natural balance with the local environment your need for these sprays will all but disappear.

CONCLUSION

Garden maintenance for most people is an ongoing and fairly constant problem; traditional gardeners spend hours watering their precious lawns and gardens over our long hot summers; hacking into their gardens and carting loads of beautiful clippings to the tip in autumn; and bringing back loads of manure in the spring. They spend a small fortune on replacement plants that die in their gardens, and on a host of deadly sprays and the like which kill off the birdlife and create a constant imbalance with the environment. There is always some problem arising and they finish up hating their garden.

Native plant growers are in the fortunate situation where, by creating a low maintenance garden they can "have their garden and enjoy it too". ■



Scaevola stricta △

▽ *Lechenaultia tubiflora*





A Wildflower Garden (above)

Photography by Neil Marriott

A mounded garden featuring *Dampiera cuneata* (mauve/blue) in the front with *Phebalium bullatum*, the yellow flowered shrub of unique beauty when examined closely, and *Prostanthera hirtula*, a prostrate form and one of the many very floriferous species of Australian Mint Bush.

Scaevola stricta (top left)

Photography by Brian Crafter

Our previous issue (No. 95) showed a close-up photograph of *Dampiera diversifolia*, a similar prostrate plant to *Dampiera cuneata* so well grown above. A feature of the well flowered shrubs in the plant family Goodeniaceae is the rewarding sprawling often suckering habit that shows its flowers so well as with *Scaevola stricta* above. Ideal for the rockery or for the garden border.

Lechenaultia tubiflora (bottom left)

Photography by Brian Crafter

How fascinating? Sitting on the ground with small tubular flowers to 3 cm high, this plant is a gem. Neil Marriott sent a slide of the form he grows in his garden as described and photographed in this issue. The flowers are a clear white tube topped by red, not brown/maroon as shown opposite. As the red/white form is featured in a colour plate in a previous issue it seemed preferable to show the different colour form on this occasion.

Pimelea

THE EASTERN MAINLAND SPECIES

by Susan Threlfall

Pimelea belongs to the family Thymelaeaceae, to which belong garden exotics such as *Daphne*, *Dais* and *Edgeworthia*.

There are over 80 species, 37 of which occur in eastern mainland Australia. Although largely Australian, the genus also occurs in New Zealand, Timor and New Guinea.

Many species, although botanically quite distinct, are similar in appearance and while many are very attractive, others would have little to offer in a garden.

Pimelea is distinguished from other members of the Thymelaeaceae by having only two stamens in each flower. The flowers are arranged in heads, spikes or clusters. When in heads the flowers are often borne on a dome shaped receptacle formed by the thickened end of the stem. In Section *Thecanthes*, however, the receptacle has become cup shaped and the flowers are inside it. See fig. 1. The inflorescence is usually surrounded by modified leaves known as involucre bracts. The flowers are tubular and have four spreading lobes. The two stamens are inserted in the mouth of the perianth and usually exceed it as shown in fig. 2. The ovary has a single glabrous style. The fruit is a nut or occasionally drupaceous.

The genus is divided into several sections consisting of species having certain characters in common.

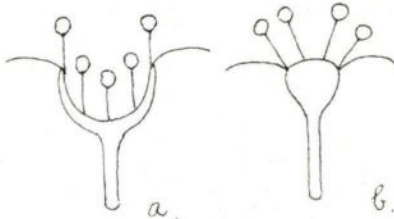


Figure 1

(a) Flowers on flattened stalks within a cup-shaped receptacle surmounted by free involucre bracts (modified leaves shown at the lip of the receptacle). Found only in the two species of Section *Thecanthes*.

(b) Flowers of all other species are attached to a dome-shaped receptacle.

Section *Thecanthes*

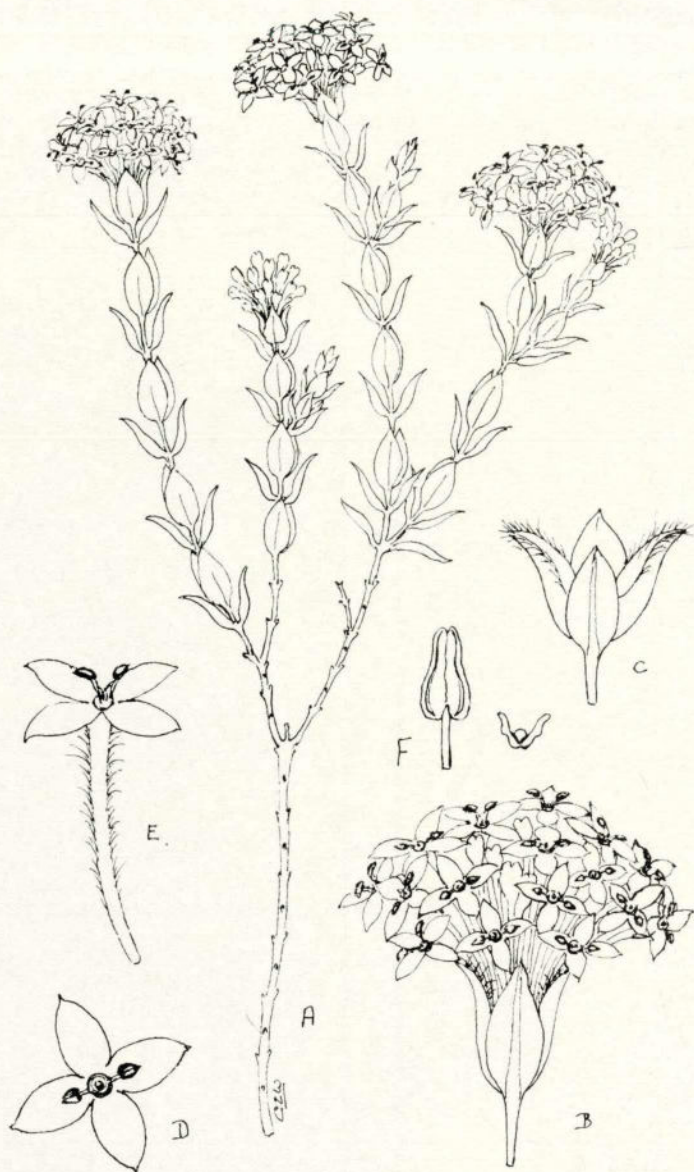
A group of species in which the flowers are borne on flattened stalks within a cup shaped receptacle surmounted by 4 free involucre bracts. The two species in this section occur in tropical Australia.

Pimelea cornucopiae is an erect annual herb up to 0.5 m high and entirely glabrous. The flowers are white and 8.5-10.5 mm in length. Found in woodlands and fcrests on a variety of soils in Qld. Also N.T.

Pimelea sanguinea is a much-branched annual herb up to 0.15 m high and entirely glabrous. The flowers are blood red and 4.5-6.0 mm in length. At times, the inner surface of the bracts dries to a deep red. Found in a variety of forests and grasslands in Qld. Also N.T. & W.A.

Section *Calyptrostegia*

In these species the flowers are grouped together on a dome-shaped receptacle to form heads. All are shrubs with glabrous leaves and well-differentiated involucre bracts. See Figure 2 opposite.



Pimelea glauca

Figure 2

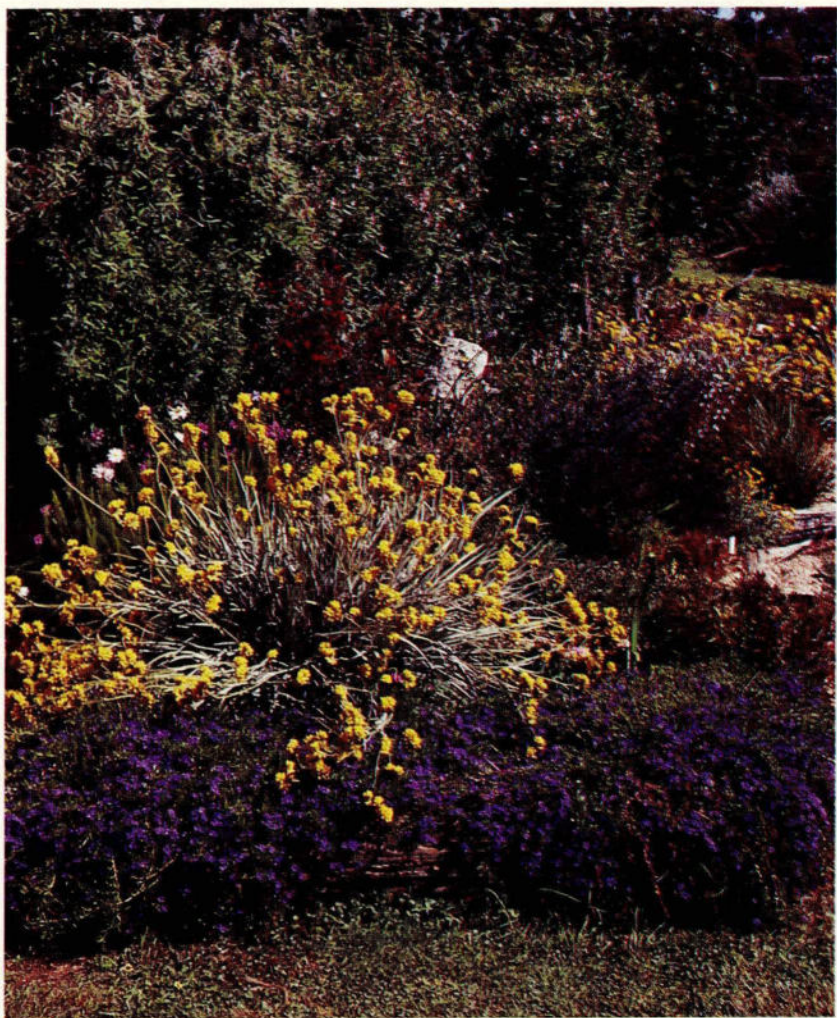
An erect shrub up to one metre high belonging to Section Calyptröstegia. Detail A shows a flowering branch full size, the leaves and bracts being a bluish-green. The flowers are grouped together on a dome-shaped receptacle to form a flower head as enlarged in (B), cupped in the leaf-like bracts. The involucre bracts of this species (C) are fringed on the inner pair as shown. The white flowers (E) have two stamens and a single glabrous style. The stamens have two anther cells back to back on a narrow connective when dehiscent, as in (F). A widespread species found in forests and grasslands usually on clayey soils except in South Australia where it is common on coastal heaths and dunes on sandy soils. Qld., N.S.W., Vic. and S.A.



Pimelea alpina △

▽ *Pimelea linifolia*





A Wildflower Garden

Photography by Neil Marriott

A raised garden formed by timber sleepers, gracing Neil Marriott's home. In the foreground is *Dampiera diversifolia* (mauve/purple), in front of *Conostylis aureus*. You will observe *Helipterum roseum* on the left of the path with a red flowered *Grevillea* behind. A perfect shrub to provide a blaze of white flowers to highlight the other colours, would have been a *Pimelea*.

Pimelea alpina

Photography by Lois Sourry

A shrub that will vary from an erect upright shrub to 0.3m high, to a prostrate bush or a mat on the ground depending on exposure at high altitudes. The flowers are reddish-pink, as above, or white, grouped together on a dome-shaped receptacle as shown in Figure 2 for another species in the same section *Calyptrostegia*.

Pimelea linifolia

Photography by W. H. Payne

This is a very widespread species and to the bush Rambler of the east, the typical *Pimelea* everyone has seen and admired. It has many forms usually erect in the bush underscrub, to a small plant as photographed here growing on a roadside on the N.S.W. south coast.

Species of *Pimelea* in Section Calyptrastegia are distinguished by:

- A. Bracts conspicuous, enclosing the flowers.
- B. Flower heads on main stems; pedicels bearing long hairs *P. macrostegia*
- B*. Flower heads on short side branches; pedicels glabrous *P. bracteata*
- A*. Bracts not much wider than the leaves, not enclosing the flowers.
- C. Shrubs up to 3.0 m high; leaves up to 3.0 cm wide *P. ligustrina*
- C*. Shrubs up to 1.5 m high; leaves up to 1.0 cm wide.
- D. Bracts 9-11, green with pale cream markings on base and midrib *P. treyvaudii*
- D*. Bracts 4 or rarely 8, green or bluish.
- E. Leaves bluish; inner bracts fringed on the margins; flowers glabrous at the base *P. glauca*
- E*. Leaves green; bracts and flowers otherwise.
- F. Stems bearing short hairs except when old *P. humilis*
- F*. Stems glabrous.
- G. Leaves up to 11.0 mm long, crowded at the ends of the branches. Flowers 5-18 per head. Alpine regions *P. alpina*
- G*. Leaves up to 39.0 mm long, not crowded; flowers 7-60 per head. Widespread at lower altitudes *P. linifolia*

Pimelea alpina is an erect or prostrate shrub up to 0.3 m high which sometimes forms mats up to 0.5 m across. The leaves are crowded together and restricted to the ends of the branches. The flowers are reddish-pink or white. Found only at high altitudes in woodlands, heaths and tussock grasslands. N.S.W. & Vic.

Pimelea bracteata is an erect shrub up to 2.0 m high, restricted to wet heaths and creek banks at high altitudes in the Southern Tablelands of N.S.W. Glabrous, pale yellow flowers are borne in nodding heads on short side branches. The bracts are very conspicuous and often tinged with purple or red. N.S.W.

Pimelea glauca is described with the sketch in Figure 2.

Pimelea humilis is an erect or straggling shrub up to 0.5 m high. The wiry stems are covered with short fine hairs which become fewer with age. Flowers are creamy white. Found in dry sclerophyll forests and heath on sandy soils. N.S.W., Vic., & S.A.

Pimelea ligustrina is a tall shrub up to 3.0 m high with leaves up to 8.0 cm long and 3.0 cm wide and large showy heads of creamy white flowers. Found in open forests and wet sclerophyll forests in gullies. Qld., N.S.W., Vic. & S.A. The subspecies are:

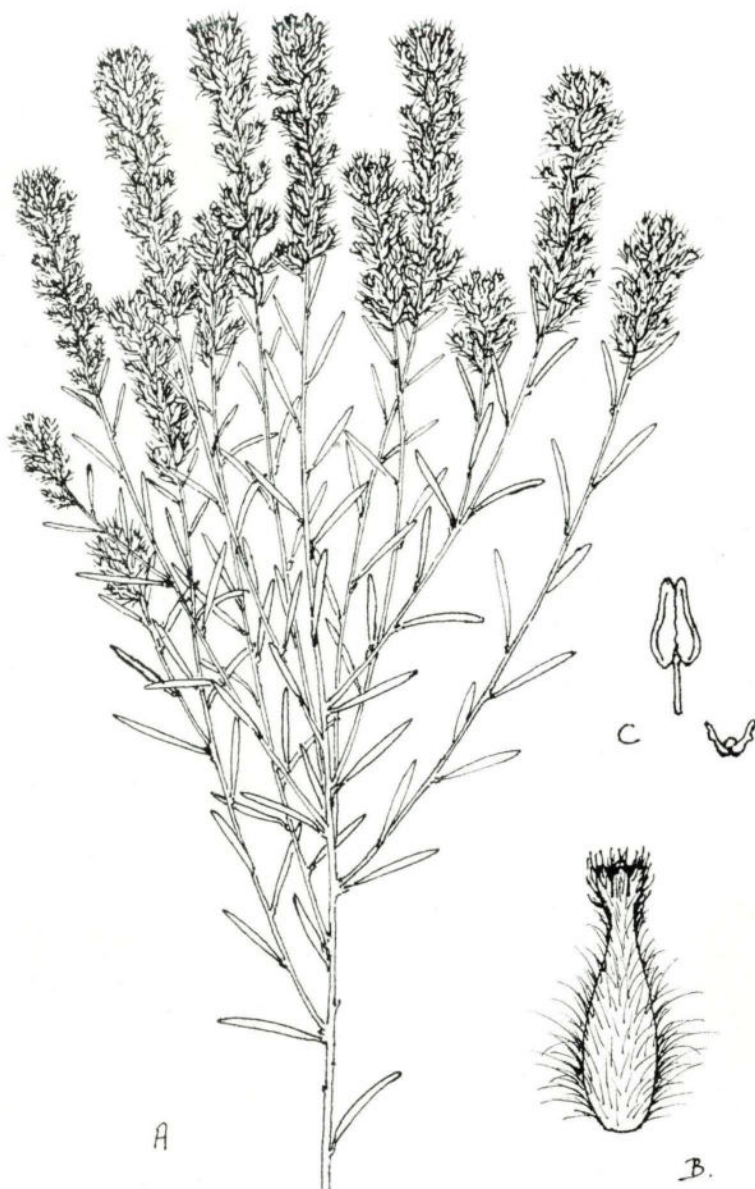
- ssp. *ciliata*, with fringed, reddish brown bracts is found in open forests, woodlands and heaths above altitudes of 1500 m. N.S.W. & Vic.
- ssp. *hypericina* differs from ssp. *ligustrina* in that the bracts appear white due to a covering of short silky hairs. N.S.W.

Pimelea linifolia is an extremely widespread and variable species. It can be erect, prostrate or occasionally clump forming and up to 1.5 m high. The flowers are white or sometimes pink. Common in a wide variety of situations. Qld., N.S.W., Vic. & S.A. There are 4 subspecies:

- ssp. *linoides*, a luxuriant shrub up to 2.5 m high which occurs mainly in the Blue Mountains of N.S.W.
- ssp. *caesia*, a small blue-grey shrub similar to *P. glauca* except that the bracts are not fringed and the flower is hairy to the base. N.S.W. & Vic.
- ssp. *collina* differs from ssp. *linifolia* in that the leaves and bracts have obvious intra-marginal veins and the perianth bears silky hairs. It is generally found in damper situations than ssp. *linifolia*. Qld, N.S.W.

Pimelea macrostegia is an erect shrub up to 1.5 m high restricted to Kangaroo Island. The nodding flower heads are enclosed by large bracts occasionally tinged with purple. The pale yellow flowers are covered outside with long dense silky hairs but become glabrous with age. Found in sandy scrubs. S.A.

Pimelea treyvaudii is an erect or sprawling shrub up to 0.6 m high. The white flowers are in heads surrounded by 9-11 narrow sessile bracts. These bracts are coarsely fringed, at least near the base and often have pale cream markings. Found in dry sclerophyll forests. N.S.W. & Vic.



Pimelea trichostachya

Figure 3

This species belongs to the section *Choristachys*. There are many individual flowers in spikes, compact when young but elongating as the flowers develop. The plant grows to 0.75 m high, the sketch (A) above being drawn full size. The flower spikes have a similar habit to that shown for *Pimelea decora* on the next page. Each flower (B, shown enlarged) is yellow and densely covered outside with long patent hairs becoming appressed on the lobes. The stamen (c) has two anther cells back to back when dehiscent. A head of flowers may reach 4.5 to 5.5 cm in length. The plant is found on sandy soils overlaying clay in Qld., N.S.W., Vic., S.A., W.A. & N.T.



Pimelea decora △

▽ *Pimelea punicea*



Section Choristachys

In these species the flowers are borne in spikes which are compact when young but elongate as the flowers develop. In most species the involucre is absent although a pair of leaves gives the appearance of bracts while the spike is compact. See Fig. 3 for key features.

- A. Stem and leaves entirely glabrous.
 - B. Woody shrub; flowers white *P. spicata*
 - B*. Herbs woody at the base; flowers red
 - C. Bracts 9-12; mature spikes up to 13.0 cm long *P. haematostachya*
 - C*. Bracts 5-6; mature spikes up to 22.5 cm long *P. decora*
- A*. Stems and leaves not glabrous.
 - D. Flowers bearing long brown hairs *P. williamsonii*
 - D*. Flowers never bearing brown hairs.
 - E. Plants bearing coarse shining hairs which may become dull with age *P. sericostachya*
 - E*. Plants bearing hairs which are never shining.
 - F. Spikes dense, up to 2.0 cm long at maturity *P. simplex*
 - F*. Spikes with widely spaced flowers, over 10.0 cm long at maturity.
 - G. Flowers bearing short pointing forward hairs *P. elongata*
 - G*. Flowers bearing long spreading hairs *P. trichostachya*

Pimelea decora is a many stemmed perennial up to 1.0 m high and is mainly herbaceous although woody at the base. Blood red flowers fading to yellow at the base are borne on spikes up to 22.5 cm long at maturity. Involucral bracts are present although deciduous and become papery and chaff-coloured with age. Found in grasslands on black soils. Qld.

Pimelea elongata grows up to 0.5 m high and is mainly herbaceous although woody at the base. The flowers are widely spaced on spikes which are up to 15.0 cm long at maturity. They are yellow green, 3.5-5.0 mm long and densely covered outside with short pointing forward hairs which become appressed on the perianth lobes. Grows on heavy textured soils with a sandy upper layer. Qld., N.S.W. & S.A.

Pimelea haematostachya is similar to *P. decora* except that the leaves are narrower and the flowers shorter. Mature spikes in this species reach only 13.0 cm in length. Found in grasslands on heavy textured soils. Qld.

Pimelea sericostachya is an erect herb up to 0.6 m high and slightly woody at the base. The stems, leaves and flowers bear shining, often coarse appressed hairs. The white flowers are arranged in spikes up to 9.0 cm long at maturity. Found in open forests on sandy soils. Qld. There are two subspecies, ssp. *amabilis* having the more robust and shining appearance.

Pimelea simplex grows up to 0.5 m high and is mainly herbaceous although woody at the base. The flowers are greenish yellow to white, 4.0-7.5 mm long and borne on dense spikes which either remain compact at maturity or elongate to up to 1.8 cm in length. There are two subspecies:

- ssp. *simplex* occurs in N.S.W., Vic. & S.A. on red loams with underlying clay.
- ssp. *continua* occurs on soils of heavy texture in Qld., NSW. & S.A.

Pimelea spicata is a slender, erect or decumbent shrub up to 0.5 m high. White flowers are borne on dainty spikes up to 3.8 cm long at maturity. Confined to coastal N.S.W. around Sydney and Shellharbour.

Pimelea trichostachya grows up to 0.75 m high and is mainly herbaceous although woody at the base. See Fig. 3 for details.

Pimelea williamsonii is a bushy shrub up to 0.3 m high. White flowers 3.5-5.0 mm long are borne on spikes which are up to 6.5 cm long at maturity. Long brown hairs cover the perianth. Vic & S.A.

Pimelea decora

Photographed in the wild to show the natural habitat and appearance of this species. I have grown the plant in my garden in Sydney as reported in No. 24 Issue that also carries a close-up colour plate of a flower head as shown here in Fig. 3. The flowers are in spikes, elongating as the new flowers develop — Editor.

Pimelea punicea

Photography by F. D. Hockings
Found in the Northern Territory, top end. This species is an erect fleshy annual to 50 cm high. An attractive herb cultivated from seed. Who will supply notes on other species from the centre?

Section Dithalamia

Dioecious shrubs (i.e. having male and female flowers on separate plants) in which the flowers are borne in heads with a well differentiated involucre. The female flower is continued only shortly if at all above the ovary. See Fig. 4.

- A. Flowers axillary *P. axiflora*
- A*. Flowerheads terminal.
- B. Stems glabrous.
- C. Pedicels glabrous *P. pauciflora*
- C*. Pedicels hairy.
- D. Pedicels bearing long coarse hairs; flowers glabrous *P. serpyllifolia*
- D*. Pedicels bearing short fine hairs.
- E. Perianth glabrous or nearly so; male flowers up to 24 per head *P. neo-anglica*
- E*. Perianth bearing short curly hairs; male flowers up to 100 per head *P. microcephala*
- B*. Stems bearing short hairs.
- F. Leaves up to 3.0 mm wide; flowers 1.25-3.5 mm long *P. hewardiana*
- F*. Leaves up to 10.0 mm wide; flowers 3.5-9.0 mm long.
- G. Leaves up to 33.0 mm long; pedicels bearing short hairs; flowers white *P. petrophila*
- G*. Leaves up to 10.0 mm long; pedicels bearing long hairs; flowers white or yellow. *P. flava*.

Pimelea axiflora has heads of 2-10 white flowers borne on very short peduncles in the axils of leaves. There are two subspecies:

ssp. *axiflora* is a shrub up to 3.0 m high with narrow leaves 10.0-74.0 mm long. Found in wet and dry sclerophyll forests and open scrub usually along creek banks or in damp places. N.S.W. & Vic.

ssp. *alpina* is a shrub up to 1.0 m high with coriaceous leaves 4.5-18.0 mm long. Found in heath, woodland and open forests at high altitudes. N.S.W. & Vic.

Pimelea flava is an erect shrub up to 2.0 m high although sometimes stunted in exposed conditions. See Fig. 4 for details of plant and flower. The leaves vary from very thin to thick and coriaceous. The stems are covered with short fine white appressed hairs and are often completely hidden by the leaves. The flowers are white or yellow, and covered outside with long fine white hairs except for the base. There are two subspecies:

ssp. *flava* grows up to 2.0 m high. The involucre bracts are often markedly bigger than the leaves which are elliptical, obovate or orbicular. Yellow flowers occur in heads of 15-42. Found in a wide range of situations on light forest soils and frequently in damp rocky places. Vic. & S.A.

ssp. *dichotoma* is a shrub 1.0 m high bearing narrow-elliptical to elliptical leaves and white flowers in heads of 9-28. Found on light soils in mallees and usually in drier situations than ssp. *flava*. N.S.W., Vic. & S.A.

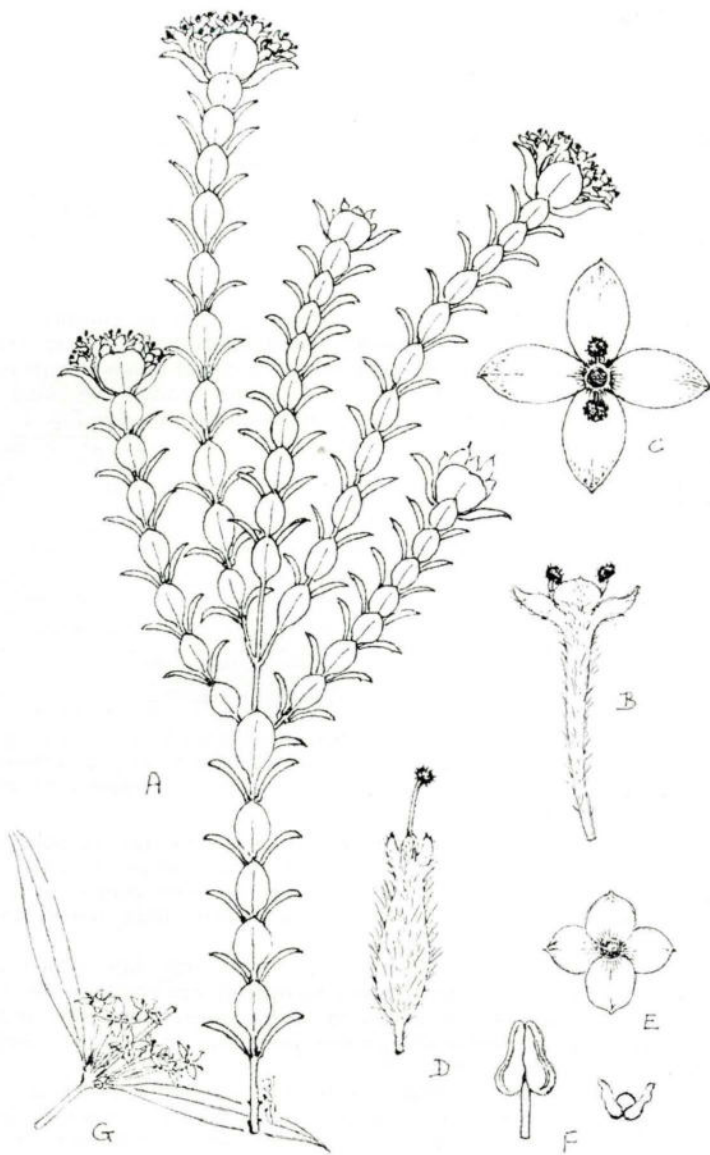
Pimelea hewardiana is a small divaricate shrub up to 0.6 m high. The flower heads are terminal but are sometimes borne in the forks of branches. The small yellow flowers, 1.25-3.5 mm long, are covered outside with short coarse hairs and occur in heads of 7-37 flowers. Found in mallee, scrubs or gullies usually in rocky positions. Vic.

Pimelea microcephala is an erect open shrub up to 4.0 m high, with leaves 7.0-44.0 mm long. The greenish yellow flowers are covered with short fine curly hairs. There are 7-12 per head on female plants and over 100 on males. The fruit is red. Found in open forest and mallee usually on sandy soils. Qld., N.S.W., Vic. & S.A. Also W.A. & N.T.

ssp. *glabra*, in which the leaves are glaucous and the male flowers shorter and fewer in number, occurs on granite soils in the mountains of Central Australia.

Pimelea neo-anglica is an erect open shrub up to 3.0 m high with leaves 4.0-48.0 mm long. The greenish yellow flowers are glabrous or with very few short scattered hairs and occur in heads of 3-7 on female plants and 4-24 on males. The fruit is red. Found in open forest. Qld. & N.S.W.

Pimelea pauciflora is an erect open shrub up to 3.0 m high with leaves 4.0-20.0 mm long. The greenish yellow flowers are glabrous and occur in heads of 3-7 on female plants and 4-9 on males. The fruit is red. Found, often forming thickets, in open forest, woodland and scrub. N.S.W. & Vic.



Pimelea flava (with *P. axiflora*, detail G)

Figure 4

This erect shrub sometimes to two metres belongs to the Section Dithalamia and being dioecious, the male and female flowers are on separate plants. The flowers are borne in heads cupped by bracts large leaves, distinct and larger than the normal leaves. The flowering branch of *Pimelea flava* (A) is shown full size with the flower heads at the end of branches. This differs from *Pimelea axiflora*, detail (G), where the flowers are grouped where the leaves join the stem. The male flowers (B) and (C) shown enlarged, have two stamens from a long slender tube (perianth) formed by the four petals. The female flowers (D) and (E) have smaller petals in a shorter tube (perianth), with the single style. The stamens (F) have two anther cells back to back on a narrow connective when dehiscent.

Pimelea petrophila is an erect shrub up to 1.0 m high with narrow-elliptical to elliptical leaves. The stems are covered with short fine appressed hairs. The white flowers are covered outside with short hairs becoming coarser towards the base and occur in heads of 18-53. S.A.

Pimelea serpyllifolia is a dense shrub up to 1.5 m high which may be prostrate or stunted in exposed situations. The leaves are crowded on the stems and up to 13.0 mm long. The flower heads are borne on very short side branches and may at times appear axillary. The yellow flowers are glabrous and occur in heads of 2-10 on female plants and 2-17 on males. Found in scrubs and woodlands on calcareous soils and frequently occurs just behind the fore-dune. N.S.W., Vic. & S.A. Also W.A.

Section Epallage

Shrubs in which the flowers are borne in heads or clusters, at times with a poorly differentiated involucre. These species differ from those in other sections in that the anther cells are on a broad dorsal connective and parallel on the inner face when dehiscent. In the species described earlier the anther cells are back to back on a narrow connective. See Fig. 5.

- A. Dioecious shrub; leaves covered with silky hairs *P. penicillaris*
- A*. Flowers bisexual; leaves otherwise.
- B. Stems and leaves glabrous *P. stricta*
- B*. Stems and leaves at least with scattered hairs.
- C. Flowers solitary or in clusters of 2-5 in the axil of leaves *P. umbratica*
- C*. Flowers in terminal heads, although sometimes appearing lateral.
- D. Involucral bracts well differentiated; flowers in heads on a dome shaped receptacle.
- E. Leaves up to 8.5 cm long; bracts 3-6; flowers 3-15 per head — *P. phylloides*
- E*. Leaves up to 15.0 cm long; bracts 6-22; flowers 25-100 per head *P. octophylla*
- D*. Involucral bracts poorly differentiated; flowers clustered in heads.
- F. Flowers 2 in each head; creeping plant *P. biflora*
- F*. Flowers usually more than 2 per head; erect plants.
- G. Peduncles up to 5.5 cm long; involucre absent *P. strigosa*
- G*. Peduncles up to 1.0 cm long; involucre present *P. curviflora* & *P. latifolia*

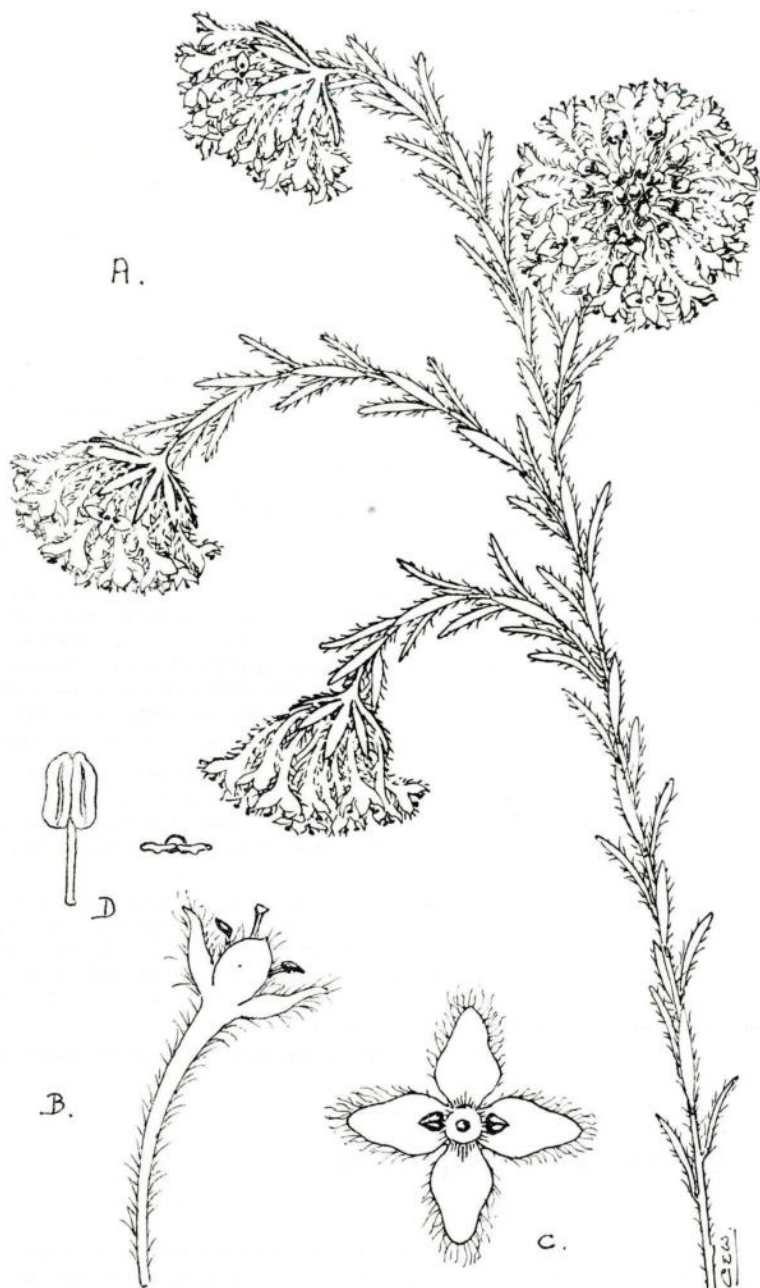
Pimelea biflora is a creeping prostrate, mat-forming shrub bearing heads of dark wine red flowers. Each head has two flowers and is subtended by 2 bracts. Found in alpine and sub-alpine forests and grasslands often in damp ground. N.S.W. & Vic.

Pimelea curviflora and *P. latifolia* are two extremely variable species which can be divided into many subspecies and varieties. In both species the flowers are clustered in heads with poorly differentiated (or at times absent) involucre. There is no receptacle, the pedicels being merely clustered together on the end of the peduncle.

Pimelea curviflora is a shrub up to 1.5 m high with leaves bearing appressed to loosely appressed (or rarely spreading), hairs on the lower surface. The flowers are dark red or yellow to yellow green, often with red lobes although those of ssp. *micrantha* appear white due to a dense covering of hair. Qld., N.S.W., Vic. & S.A.

Pimelea latifolia is a shrub up to 3.0 m high with leaves bearing slightly tangled spreading hairs although at times the hairs may be coarser or appressed. The flowers are white or greenish yellow often with red lobes. Qld. & N.S.W.

Pimelea octophylla is an erect shrub up to 1.0 m high with red-brown stems bearing long fine white hairs. See Fig. 5 for details of plant and flower. The leaves may be covered with long fine straggling hairs or coarse forward-pointing ones or almost glabrous except for the margins. Up to 150 cream to pale yellow flowers are borne in heads subtended by 6-22 bracts. There are four subspecies distinguished by the distribution of hairs on the bracts and flowers. Found in heath and dry sclerophyll forests usually on sandy soils. N.S.W., Vic. & S.A.



Pimelea octophylla

Figure 5

Belonging to the Section Epallage, this erect shrub to one metre high has flowers in heads or clusters with a poorly differentiated involucre (i.e. the distinction between the leaves and the flowerhead-cupping bracts is not clear). The flowering branch (A) is shown full size, one of the many flowers in the flowerhead being shown enlarged in (B) and (C). Two stamens are shown and one further enlarged (D) is shown with two anther cells side by side when dehiscent, a characteristic feature of all species in Section Epallage.

Pimelea penicillaris is an erect dioecious shrub up to 2.0 m high. The stems are covered with velvety hairs and the leaves with silky hairs. The brown bracts are covered with silky hairs and fringed on the margins. The yellow flowers are covered outside with long fine hairs and borne in heads of 25-70 flowers on female plants and 50 to over 100 on males. Grows on sandy soils. Qld., N.S.W., S.A. & N.T.

Pimelea phyllicoides is a many branched shrub rarely more than 0.5 m high. The leaves are glabrous or bear a few long hairs on the lower surface. White flowers are grouped together on a dome-shaped receptacle in heads of 3-18 flowers. Found in dry sclerophyll forests and heaths usually on sandy soils. Vic. & S.A.

Pimelea stricta is an erect wiry shrub up to 1.5 m high with yellow-green leaves. Heads of creamy white flowers are subtended by 4 acuminate bracts. Found on sandhills or on light sandy soils in open woodland or mallee. N.S.W., Vic. & S.A.

Pimelea strigosa is an erect shrub up to 2.0 m high. Heads of 7-19 flowers are borne on peduncles up to 4.0 cm long and involucre bracts are absent. The flowers are yellow, at times tinged with red, and covered outside with glistening hairs. Found in woodlands and pasture lands often near watercourses. Qld. & N.S.W.

Pimelea umbratica is a densely branched shrub up to 1.0 m high bearing thick, dull green leaves which are covered to varying degrees with short fine hairs and crowded at the ends of the branches. Solitary flowers or clusters of 2-5 are borne in the axils of the leaves and there are no involucre bracts. The flowers are white, covered outside with short fine white hairs and may be male, female or bisexual. Found in woodlands on stony soils. Qld.

There are two species which do not fit into any of the sections described.

Pimelea drupacea is a Tasmanian species which has been found on the mainland only at Sealers Cove, Victoria. It is an erect shrub to 2.0 m high with dark green leaves. White flowers are borne in heads which are terminal or occur in the axils of upper leaves. The fruit is black and succulent. Found in damp woodlands. Vic.

Pimelea venosa is an erect shrub with the stems covered with coarse spreading hairs. The leaves are crowded on the ends of the branches and densely fringed with coarse hairs. The main veins are obvious on the lower surface and are mid brown in colour. The flowers are white and borne in terminal heads on short side branches or rarely in clusters in the leaf axils. Known only from Bolivia and Bluff Mountain in N.S.W.

These descriptions are taken from more detailed descriptions published in *Brunonia* 5: 113-201 (1982). ■

To Grow *Eremophila*

by Neil Marriott, "White Gums Nursery" Stawell, Vic.

The name *Eremophila* comes from two Greek words EREMOS — a desert, and PHILOS — love of; hence the name *Eremophila* gives us a clue as to their habitat and their cultural requirements:— Desert loving.

Under cultivation, nearly all species require very good drainage, but interestingly enough, they generally do far better on heavy loams than light sandy soils. Nearly all species occur naturally on loams, either gravelly or sandy; even those few that do grow naturally on sand, generally have their roots into loams one or two feet below the sand.

Best results are obtained by building up beds of loam containing gravel for EXCELLENT CROWN DRAINAGE. The amount of build-up is dependant upon the natural rainfall and drainage of your area, but I have built-up big mounds over 1 m high with spectacular results. *Eremophila* that I have had trouble with in my normal garden beds (formed up into about 30cm high mounds) have grown magnificently, and easy to grow species have rapidly developed for a spectacular showing.

The second major requirement for successful cultivation is FULL SUN; this keeps the foliage dry, preventing mildew, etc., damaging the foliage (a major problem in the wetter coastal areas, especially for most of the showy grey, woolly-leaved species). Even in full sun some species in shade during wet winters could fail.

Nearly all species benefit from regular pruning, in fact vigorous species such as *E. denticulata*, *E. calorhabdos*, etc., will soon become tall and leggy specimens without it. This is best done by regularly nipping out the tips of each branch as you wander around your garden. However, heavier annual pruning can be quite successfully carried out and is best done immediately after flowering to prevent the plant wasting energy producing masses of fruits.

Even with full sun and excellent drainage, some species can still prove to be rather difficult to grow, and I have found that one method of overcoming this is to plant your *Eremophila* at the base of a large shrub or tree, ensuring that this in no way reduces the sunshine getting to the plant. Using this method, or similar, such as growing your *Eremophila* under the eaves of your house, you can considerably extend the range of climatic conditions under which these desert lovers can be grown.

Obviously one cannot expect to be able to grow all *Eremophila* species in your garden, where the soil and air moisture content is far higher than that found naturally in desert regions and where the sun's heat and intensity is far lower. Therefore it is sensible to start off by growing the Temperate Region species first, progressing to Semi-arid and Arid Region species as your skills in cultivating them develop.

The following list is of those species that I have found to be most hardy in my region (i.e. approx. 500 mm rainfall annually with a gravelly loam soil).

- Eremophila alternifolia* — 2x2 m, pink flowers
- E. bignoniiflora* — 3x3 m, white flowers
- E. biserrata* — Dense mat, green flowers, bird attraction
- E. calorhabdos* — Upright 2x1 m, spectacular pink flowers
- E. christophori* — 1.5x1 m, mauve flowers for many months
- E. decipiens* — 1x1 m, red flowers, bird attractor
- E. densiflora* — .3x1.5 m, massed violet flowers
- E. denticulata* — Vigorous, 2x2 m, red flowers, bird attractor
- E. drummondii* (sometimes sold as *E. dempsteri*) — 1x1 m, violet flowers
- E. glabra* (many forms incl. excellent prostrate mats)
- E. laanii* — 1.5x1.5 m, pink and white flower forms
- E. ionantha* — 1x1 m, fine foliage, lilac flowers
- E. longifolia* — 3x3 m, suckers, dull red flowers
- E. nivea*, often called *E. margarethae* — 1.5x1.5 m, beautiful silver foliage
- E. maculata* — 2x2 m, many forms, hardy, red, pink, yellow flowers
- E. polyclada* — 2x2 m, stands winter wet, large white flowers
- E. racemosa* (syn. *E. "bicolor"*) — 1.5x1.5 m, vigorous, two-tone pink flowers
- E. subfloccosa* — 1x1 m, green flowers, silver foliage
- E. verticillata* — .3x1 m, strong smelling foliage, small mauve flowers
- E. youngii* — 2x2 m, pink/red flowers

The Eco-Garden—2

by Coralie Whitby

The Need For Many Leaves

Forests are in equilibrium — without interference, some have existed unchanged for thousands of years, some for millions. They keep control of their pests, recycle all their nutrients, retain their soil and control their water relations. The new gardening method, eco-gardening, aims to reproduce this kind of equilibrium in a garden. In particular, the permanent part of an eco-garden is modelled on the forest gully, where, because of the changed micro-climate, not all the plants of the forest proper can grow and some new species appear.

Natural forest needs a leaf area eight to ten times ground area, because it has to feed its many pests and yet have enough leaves over to feed itself. One of the most important ways in which a forest grows the number of leaves it needs is by arranging its vegetation in successive layers. In eco-gardens, the dominants and sub-dominants are introduced plants (grown for their special use, beauty or interest), while the lower vegetation layers are formed of plants actually indigenous to the garden site. The upper vegetation layers replace the eucalypts and tall wattles of the local, natural forest or woodland.

Part of a native eco-garden designed for Gembrook, Victoria is given below. Its two upper layers consist of Australian trees and shrubs not necessarily native to the area. The lower two layers are formed of plants indigenous to the dry sclerophyll forest of Gembrook. Leaf area is increased by having successive vegetation layers, and by using so many indigenous plants — plants from the same natural community can tolerate close spacing. Several of the species listed are legumes — these provide a permanent source of fixed nitrogen. Plants use nitrogen to make the protein for their cells, so legumes increase the leaf area of all the plants in the eco-garden. All the litter the garden produces is recycled in situ, as in the forest: this conserves soil structure, nutrients and moisture, also thereby conserving leaf area.

Vegetation layers in a native eco-garden at Gembrook

Row 1 — Dominants (Introduced natives) — 1. *Eucalyptus erythronema*, 2. *Eucalyptus steedmanii*.

Row 2 — Sub-dominants (Introduced natives) — 3. *Leptospermum juniperinum*, 4. *Callistemon citrinus* "Harkness", 5. *Acacia spectabilis*.

Row 3 — Indigenous understorey — 6. *Correa reflexa*, 7. *Banksia spinulosa*, 8. *Dampiera stricta*, 9. *Bauera rubioides*, 10. *Gahnia clarkei*, 11. *Pultenaea daphnoides*, 12. *Acacia myrtifolia*, 13. *Spiridium parvifolium*, 14. *Amperea xiphioclada*, 15. *Helichrysum dendroideum*.

Row 4 — Indigenous groundcover — 16. *Platylobium formosum*, 17. *Haloragis tetragyna*, 18. *Viola hederacea*, 19. *Hydrocotyle laxiflora*, 20. *Goodenia lanata*, 21. *Hibbertia pedunculata*, 22. *Acaena anserinifolia*, 23. *Platylobium formosum*.

The thick growth of indigenous plants provides completely natural homes for birds, spiders and other predatory animals native to your area, so the trees and shrubs are grown for beauty will have natural control of their pests.

Part 2* of a series by Coralie Whitby, Author of "Eco-gardening: the Six Priorities".

Part 1 of this series was presented in the No. 92 Issue of Australian Plants. "Eco-gardening — the Six Priorities" is a book that presents a theory that could be so pertinent to the successful cultivation of the Australian Flora, that the basis for the theory was briefly presented in Part I. It has created so much interest that Coralie has been requested to present a series of articles defining the six priorities that support her theory. Book available from Editor for \$12.00. ■

The Eco-garden And The Need For Many Leaves — The Editor Summarises

In an Eco-garden the leaves should not be concentrated at a particular height above the ground so as to obstruct the sunlight to lower levels, but should be spread throughout the different layers right down to the ground. A native eco-garden may be of many types, from one that resembles a forest with trees and shrubs competing naturally, to one where the structure is carefully controlled in the fashion of a more formal garden. The plants chosen and their care is the subject of further articles in this series.

The Native Eco-Garden — Practice and Theory⁽²⁾

The following are questions by the Editor, in correspondence and answers by Coralie Whitby.

"Has the figure of a leaf area 10 times ground area been determined by someone?"

Yes. Hogetsu in Japan summarised the literature in a table which is also given on p.376 of Odum, "Fundamentals of Ecology" 3rd edition. See also p.48 of Odum. The figure of 8-10 applies in the case of mature broad-leaved evergreen forest.

"Would the same rate apply to all balanced gardens with a range of vegetation up to small trees?"

A field of soybeans has a leaf to ground area ratio of 4 to 1, and bamboo 5 to 1, but these vegetations are not stable. I think to achieve a dynamic equilibrium in a garden the figure has to be higher than these, as suggested in my book.

"Developed forests have very little flora on the forest floor, and what is there is often leggy and not floriferous. How can you achieve an eco-garden with light tree cover and floriferous plants below?"

My own mature dry sclerophyll forest is not as you describe. The Country Fire Authority here says it has not been burnt in living memory, so it may be progressing towards greater stability. It contains some wet sclerophyll forest elements. In my forest after heavy rains much of the old understorey vegetation lies down on the forest floor, and seedlings of many species come up between the dead branches and leaves. Virtually all species are regenerating under the forest canopy (except the legumes, and these are regenerating in open areas without the help of fire). The seedlings flower even in their first season, giving delightful carpets of mixed *Viola hederacea*, *Bauera rubioides* and *Hibbertia pedunculata* in flower between well-spaced trees. The old, leggy shrubs are riots of bloom every year — these include *Acacia*, *Hakea*, *Banksia*, *Melaleuca*, *Prostanthera lasiantha*, *Leptospermum juniperinum* and *Spyridium parvifolium*. The *Hibbertia* as it ages climbs to eight feet or more — a fine spectacle in yellow in its season. The Japanese love old shrubs and trees — surely there can be nothing ugly about a shrub which is aging naturally? I think many of our forests have been subjected to rough treatment in the past — my own forest is lovely at all seasons.

"The implication is that only forest-type flora can be grown — plants that have adjusted to the savage root competition of large trees. Is this right?"

I do not think one is as limited as that. Whatever your local natural understorey is, you grow that. There will not be any big trees grown in the garden itself, so the understorey species will not have their fierce competition. They do not require the competition for their survival, though they can cope if it is there — at Wilson's Promontory for instance, much of the forest understorey is able to grow out in the open as a heath, and it is the same on my block.

Small trees and tall shrubs from other parts of Australia that are introduced into the eco-garden could in general come from any formation, though they may need an adjusted garden environment for healthy growth. If their environment is adjusted, the understorey around the introduced species will have to be selected for its ability to survive in the new conditions. For instance, my understorey species have had to be selected for their ability to grow at neutral pH. If you live at the seaside your understorey will be composed of salt-tolerant species; then the introduced dominants will need careful selection because of the salt winds. Your local understorey on a beach site might contain *Atriplex*, *Bursaria*, *Rhaqodia*, *Leucopogon*, Cushion Bush and *Correa alba*. The natural dominants could be coastal tea-tree and coastal wattle. The species you select to replace these dominants will have to be able to withstand the gross environmental conditions, salt and high winds. In this last case, neither the understorey nor the introduced plants will be forest flora.

"Root competition would appear to be the major problem. How can this be controlled?"

The place where there are most roots would be forest soil, because of the close growth and the presence of tall trees. In an eco-garden there might be less root competition, without the tall trees. Jarrah roots go down 60 feet, whereas shrubs have far shallower root systems than this, particularly where there is a good rainfall; in a garden ALL the plants will have shallow root systems if there is hard-pan or if water is applied little and often just to the soil surface.

You can encourage deep rooting of dominants, by removing hard-pan or breaking up the compacted clay layer to a good depth below them before planting. Dominants will quickly exploit the deep, loose soil if water is then applied thoroughly once a week or else through a drip system, to wet the deep soil. Understorey species will have shorter roots if they are planted above hard-pan; or if their branches are lightly pruned after flowering; or if the topsoil is kept moist by a thick mulch. These methods will ensure a stratified root-system in an eco-garden.

Mycorrhizal roots of all species would have to come into the litter and topsoil of course, to get at recycled nutrients — management here would involve initially ensuring a sufficiently fertile topsoil and adequate litter to satisfy the needs of all the plants.

In an eco-garden one is aiming at a stratified root-system (like that of forests) for soil conservation and full exploitation of soil resources. Loose soil is not stable even under litter — soil needs dense roots to conserve it and to control salt. ■

Tristania

by Peter G. Wilson, School of Botany, University of New South Wales
Kensington 2033

In a recent review of *Tristania* (Wilson & Waterhouse, 1982) it was shown that the Australian species previously referred to this genus really formed five very distinct groups, each of which should be considered a separate genus. Furthermore, it is clear that at least some of these genera are not closely related to the others and that the presence of staminal bundles (or "fascicles") is only a superficial similarity and is not indicative of a natural grouping. When *Tristania* was divided in accordance with the rules of nomenclature, it was not possible to retain the name *Tristania* for either of the two species well-known amongst horticulturists, *Tristania conferta* and *Tristania laurina*. This may be considered unfortunate but, on the other hand, the names for the two genera that will include these species (*Lophostemon* and *Tristaniopsis*) have been in existence for over a century, and it is proper to acknowledge the significant contribution of the authors that first described these genera.

The history of *Tristania* starts in 1812 when the English botanist Robert Brown described the genus and included the three species *T. neriifolia*, *T. laurina* and *T. conferta*. As early as 1830, the Austrian H. W. Schott, better known for his work on the Araceae, created the genus *Lophostemon* to include two cultivated "species" of *Tristania* (at least one of which was Brush Box) which he rightly considered to be distinct from *Tristania neriifolia*. In 1863, two French botanists A. T. Brongniart and A. Gris, working on the New Caledonian flora, described a new genus *Tristaniopsis* to include a number of New Caledonian species that are clearly related to the Australian *T. laurina*, and backed up their argument with a very thorough enumeration of the many differences between their species and *Tristania neriifolia*. The degree of difference between these new genera and *T. neriifolia* is very great, and the conclusions of Schott on the one hand and Brongniart and Gris on the other are completely justified; it is, therefore, regrettable that George Bentham, in the *Flora Australiensis*, decided to adopt a very cautious attitude to these generic splits and so delayed these name changes until the present.

Key to the genera

- | | |
|--|-----------------------|
| 1. Top of capsule not projecting well beyond the calyx | 2 |
| 1. Top of capsule projecting well beyond the calyx | 3 |
| 2. Leaves opposite; oil ducts absent | <i>Tristania</i> |
| 2. Leaves alternate and crowded in false whorls at the ends of branchlets;
oil ducts present, exudate milky | <i>Lophostemon</i> |
| 3. Seeds numerous, winged (except in <i>Tristaniopsis exilliflora</i>) | 4 |
| 3. Seeds few, globular | <i>Ristantia</i> |
| 4. Top of capsule rounded; ducts absent | <i>Tristaniopsis</i> |
| 4. Top of capsule conical; ducts present, exudate yellow | <i>Welchiodendron</i> |

Tristania R. Br.

This genus is now restricted to a single species, *T. neriifolia* (Sims) R. Br., which is indigenous to the Sydney region where it is found along creeks on Hawkesbury Sandstone.

Leaves opposite (figure 1); flowers yellow, the stamens erect, each fascicle made up of 3 or 4 stamens fused only towards the base, the style is set into a pit on the top of the ovary; the fruit is thin-walled capsule the top of which does not project beyond the calyx (figure 4e); the seeds are 1-2mm long and more or less linear; the cotyledons are flat, lying face to face.

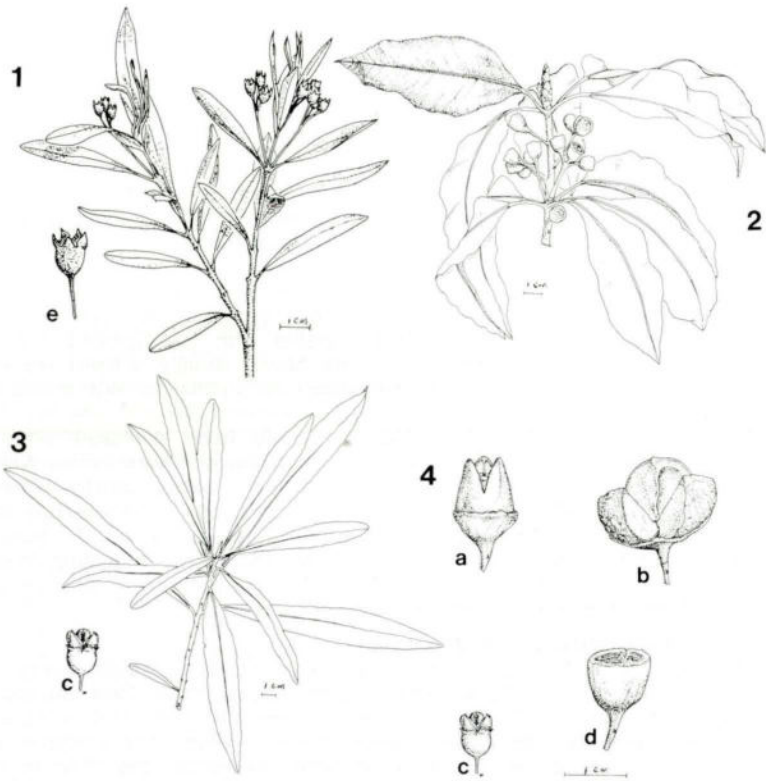


Figure 1 — *Tristania neriifolia* at half full size showing opposite leaves and its fruit (e).
 2 — *Lophostemon confertus*, formerly *Tristania conferta* at one quarter full size, showing false whorls of leaves (apparently grouped together around the stem) and an expanding bra — covered bud. The fruit is shown in (d) below to full size.
 3 — *Tristaniopsis laurina* at one quarter full size has alternate leaves, the fruit of *T. collina* is shown in detail C at full size.

Tristania neriifolia has more affinity with the northern Queensland species known as *Metrosideros queenslandica* than with any of the other species previously referred to *Tristania*. It is not often grown in gardens but should form a well-shaped shrub or small tree under cultivation.

***Lophostemon* Schott**

A genus of four species, *L. confertus*, *L. suaveolens*, *L. grandiflorus* (with two subspecies), and *L. lactifluus*, found in northern and eastern Australia, with *L. suaveolens* extending to southern New Guinea.

Leaves alternate and crowded into false whorls at the ends of the branchlets around bract-covered resting buds (figure 2); the stems and petioles contain ducts that release a viscous milky exudate when broken; flowers white or cream, the stamens numerous, fused into bushy fascicles that lie on top of the petals, the style is not set into the top of the ovary; the fruit is a capsule the top of which does not project, or barely projects, beyond the calyx (figure 4d); the seeds are narrow; the cotyledons partly enclose one another.

The genus *Lophostemon* is particularly distinct from *Tristania* in having false whorls of leaves and oil ducts in the tissues; these features reveal its affinity with Turpentine (*Syncarpia*) which shares them. The revival of the generic name *Lophostemon* will remind many that the name "*Lophostemon australe*" was widely used by nurserymen to describe Brush Box from late last century until well into the first half of this century.

***Tristaniopsis* Brongn. and Gris**

A genus of around 30 species of which three, *T. laurina*, *T. collina* (newly described) and *T. exiliflora*, occur in eastern Australia; other species occur in New Caledonia, New Guinea, the Philippines, and through south-east Asia to Burma and Thailand.

Leaves alternate (figure 3); flowers yellow (white in some non-Australian species); the stamens usually in short bushy fascicles; the style not set into the top of the ovary; the fruit a capsule with the rounded summit exerted beyond the calyx (figure 4c); the seeds usually winged (except in *T. exiliflora*); the cotyledons partly enclosing one another, or one enclosing the other.

The new species, *T. collina*, has previously been confused with *T. laurina* but differs in having fibrous rather than smooth bark (when found as a tree); more numerous oil dots in the leaf; leaves usually without hairs on the undersurface; leaves often drawn out into a narrow tip; and petals roundish rather than elliptical. The new species, unlike *T. laurina*, is rarely found beside streams and has been known as "Mountain Water Gum" because it is more often found at higher altitudes; it also occurs as mallee-form shrubs on drier or exposed ridges.

***Welchiodendron* Wilson and Waterhouse**

This new genus has only one species, *W. longivalve*, which occurs on Cape York Peninsula, the Torres Strait islands and southern New Guinea.

Leaves alternate; the stems and petioles contain ducts that release a clear, yellow, oily exudate when broken; flowers yellow, the stamens are numerous, fused into broad fascicles opposite the petals, the style is not set into the top of the ovary; the fruit is a capsule with the conical summit exerted beyond the calyx (figure 4a); the seeds are winged; the cotyledons partly enclose one another, or one encloses the other.

This genus is superficially similar to *Tristaniopsis* but the presence of oil ducts with the same configuration as in *Lophostemon* and marked differences in fruit structure and seed arrangement, indicate a fundamental difference.

***Ristantia* Wilson and Waterhouse**

This new genus has three species but only one, *R. pachysperma*, has been described so far. The genus is endemic to Queensland where the species are restricted to small, isolated areas.

Leaves alternate; flowers small and white, stamens in groups (except in one species), not fused the style is not set into the top of the ovary; the fruit is a thick-valved, woody capsule with the summit exerted beyond the calyx (figure 4b); the seeds are relatively large and globular; the cotyledons are rolled, not enclosing one another.

The following key may serve to highlight the differences between the genera and can be used to distinguish them. It should be noted that the three best-known genera can be identified on the basis of leaf arrangement alone, without needing capsules.

ACKNOWLEDGEMENT:

I am particularly indebted to Steve Francis for providing the illustrations.

REFERENCE:

Wilson, P. G. and Waterhouse, J. T. (1982). A review of the genus *Tristania* R. Br. (Myrtaceae): a heterogeneous assemblage of five genera. *Aust. J. Bot.* 30: 413-446.

Barringtonia

The genus *Barringtonia* J. R. & G. Forster in Australia
by R. J. Henderson, Queensland Herbarium, Brisbane

The family Lecythidaceae, consisting of some 450 species, is represented in Australia by five species from the genera *Planchonia* and *Barringtonia*. Attributes of this extensive pantropical family have been discussed by T. J. Hawkeswood in Australian Plants 88 (September 1981) where he elaborated in detail on Australia's only representative of *Planchonia*, *P. careya*.

It should be noted that many botanists and others, including ones from Australia, prefer to treat the above genera as belonging to a separate family, *Barringtoniaceae*, restricting *Lecythidaceae* to include only strictly tropical American genera. There are merits in either view.

Barringtonia differs from *Planchonia* principally in having but one seed per fruit and this seed developed from one of the four to 26 ovules that occur only at the apex of the ovary. Also its flowers, which are borne in usually large numbers on terminal or axillary racemes or spikes, have all but the inner row of stamens bearing anthers.

The name commemorates the Honorable Daines Barrington (1727-1800), English jurist, antiquary and botanist, a friend of Sir Joseph Banks and John and George Forster who described the genus.

Barringtonia consists of about 40 species dispersed in tropical and sub-tropical regions of East Africa, Madagascar, Southern Asia, Malaysia and Australia and tropical islands of the western Pacific Ocean. One species (*B. asiatica*) is in cultivation in Hawaii, the West Indies and tropical islands of the Atlantic Ocean. Four species are native to Australia.

Australian representatives are trees or shrubs with large spirally arranged leaves. Flowers are borne in usually long racemes or spikes at or near the tips of the branches or on the stems. The flowers usually have four white to red or pale yellow petals and numerous conspicuous white to purple stamens. The fruit is fleshy-fibrous, from pyramid-shaped to spindle- or even pear-shaped, sometimes strongly angled or even winged, each containing a single seed which always remains enclosed within it.

A key to Australian species of *Barringtonia*.

- | | |
|---|----------------------|
| 1. Calyx with lobes free, the margins softly hairy | <i>B. acutangula</i> |
| Calyx with lobes fused, tearing into smooth-margined segments or with the top falling off as a little cup | 2 |
| 2. All flowers sessile (without a stalk): calyx top falling as a cup | <i>B. calyptrata</i> |
| Flowers usually pedicellate (stalked): calyx rupturing into persistent segments | 3 |
| 3. Staminal filaments 2.2-4 cm long | <i>B. racemosa</i> |
| Staminal filaments 8-15 cm long | <i>B. asiatica</i> |

Barringtonia acutangula (L.) Gaertner

Freshwater Mangrove

("acutangula" referring to the acute angles or wings on the fruit)

Shrub or tree to 25 m. Bark grey to brown, intricately furrowed. Leaf blades sometimes hairy beneath, papery, oblong, 5-16 cm long and 2-6 cm wide; stalk up to 1.5 cm long. Racemes up to 75-flowered, and 0.75 m long. Flower stalks up to 13 mm. Buds about 5 mm long. Calyx of tube about 0.5 mm and semicircular, hair-fringed lobes to 3.5 mm long. Petals to 12 mm long and 7 mm wide, red, pink or white. Stamens in three whorls; filaments 0.3-2 cm long from a tube up to 4.5 mm long, deep pink to dark red. Fruit egg-shaped but angular, up to 6 cm long; seed egg-shaped up to 4 cm long. The wood is soft, without heartwood and is relatively durable. This species extends in the tropics from Afghanistan in the west to as far east as north-eastern

Australia. In Australia it is known from tropical parts of Western Australia, the Northern Territory and Queensland, where it commonly occurs on banks of streams. Plants flower and fruit throughout the year but the main flowering is in April and May.

The bark has been used widely, including by Aborigines in north Queensland, as an effective fish poison. The wood has been used for boat-building, in heavy construction and cabinet-making.

Many common names are applied to this plant throughout its range. In Australia, Freshwater Mangrove is widespread because of its almost exclusive occurrence on banks of watercourses, and Itchy Tree has been used for it in the Northern Territory. Malanan and Danba are names given it by Aborigines in Western Australia.

***Barringtonia asiatica* (L.) Kurz**

("asiatica" referring to where the first plants of the species were found)

Tree to 30 m. Bark dark brown to grey, fissured. Leaf blades hairless, rather tough, obovate-oblong, 20-40 cm long and 10-20 cm wide; stalk about 5 mm long. Racemes usually up to 10-flowered, up to 20 cm long. Flower stalks 4-8 cm. Buds 2-4 cm long. Calyx expanding and rupturing to two unequal lobes 3-4 cm long and 2-3 cm wide and a tube about 3 mm long. Petals 5.5-8.5 cm long, white. Stamens in six whorls; filaments 8-15 cm long from a tube up to 6 mm long, white becoming pink, red or purple at the end. Fruit more or less pyramid-shaped, up to 11 cm long; seed oblong, about 4 cm long and 3 cm wide, somewhat four-angled. The wood is pale coloured, tough but not durable. This plant occurs widely in the tropics from Madagascar to the western Pacific. In Australia it is found in Cape York Peninsula and on Torres Strait islands. Plants usually grow along the coast and the characteristic fruit is common in northern beach litter. It flowers and fruits throughout the year with flushes of blooms in May and August.

Fruit, bark and pounded seed are used as a fish poison by various peoples and some use bark, fruit or leaves to alleviate headache or treat sores or "bad dreams".

The species has several common names throughout its range, e.g. Butun throughout Indonesia and Vutu or Futu in the Pacific, but no distinctive name in Australia.

***Barringtonia calyptrata* (R.Br. ex Miers) R.Br. ex F. M. Bailey**

Corned-beef Wood

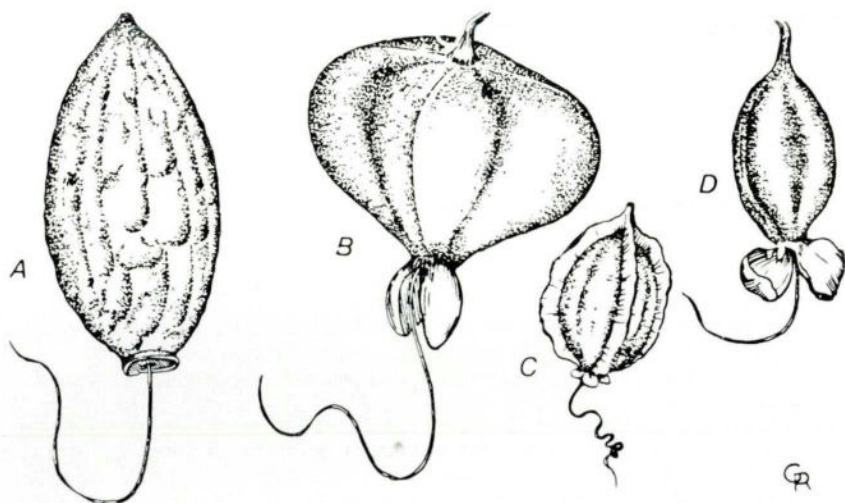
("calyptrata" referring to the little cap (calyptra) falling from the opening bud)

Tree to 30 m. Bark dark brown or grey, thick and flaky. Leaf blades hairless, tough, obovate-oblong, 16-30 cm long and 4-13 cm broad; stalk 5-35 mm long. Spikes many-flowered, to 40 cm long, on old stems. Buds 7-12 mm long. Top of the expanding calyx usually falling off as a conical cup 3-8 mm long. Petals 10-27 mm long, white to pale yellow. Stamens in 4-7 whorls; filaments 0.2-4 cm long from a tube up to 1 cm long, white. Fruit egg-shaped to spindle-shaped, up to 9.5 cm long; seed ellipsoidal, about 2 cm long. Wood soft, pale but comparatively dense.

This plant is found in the Aru Isles, Papua New Guinea and north-eastern Queensland in Australia. It usually grows along near-coastal streams. Plants flower from May to November but mainly in September and October.

Infusions of leaves and bark are reportedly used internally by New Guinean peoples for treatment of chest pains and fever.

The common name Corned-beef Wood is derived from the smell of the timber. Outside Australia the plant is known under several native names.



Barringtonia

Fruits of Australian *Barringtonia* species. A. — *B. calyptrata* x 0.6, B. — *B. asiatica* x 0.3, C. — *B. acutangula* x 0.6, D. — *B. racemosa* x 0.6. The thread-like styles usually fall off before the fruits drop.

***Barringtonia racemosa* (L.) Sprengel**

("racemosa" referring to the spectacular, many-flowered racemes)

Tree to 27 m. Bark greyish, yellowish or brown, mostly smooth. Leaf blades hairless, papery, broadest above the middle, 13-42 cm long and 4-16 cm wide; stalk 2-15 mm long. Racemes many-flowered, up to 1 m long. Flower stalks to 25 mm long. Buds 6-9 mm long. Calyx rupturing to 2-5 lobes 7-15 mm long from a tube 2-5 mm long. Petals 15-25 mm long, white or tinged with red or yellow. Stamens in 5-6 whorls; filaments 10-40 mm long, white or pink below. Fruit egg-shaped but more or less four-angled, up to 9 cm long; seed 2-4 cm long. Wood white and soft.

Trees of this species are found throughout the tropics from East Africa to the western Pacific. In Australia the species is known only from north-eastern Queensland, in lowland rainforests, around coastal swamps or in tidal areas behind mangroves. It flowers and fruits throughout the year with flushes of blooms in May and September.

Roots, seeds and bark are used in folk medicine in India and Malaysia and the bark was used medicinally by north Queensland Aborigines. Bark and fruit are reportedly used widely as fish poison and leaves to some extent as food. In some areas ornamental plantings are used as windbreaks or hedges.

In addition to these native species, other species may be found in Queensland. *Barringtonia neo-caledonica* Vieill, from New Caledonia, has been grown as a park tree about Brisbane in years gone by.

REFERENCE:

- R. J. Henderson, *Lecythidaceae*, *Flora of Australia* 8:1-6 (1982). Volume 8, *Flora of Australia*.
J. P. D. Payson, A. Monograph of the Genus *Barringtonia* (Lecythidaceae), *Blumea* 15:157-263 (1968).

Waratah

Propagation of *Telopea* by J. Twyford
The Secret of Successful
Propagation Revealed!

During the 1950s I overcame Waratah seedling failure using the following method.

1. A nursery bed was constructed with a coarse sand layer, containing leaf mould from a plant of the Proteaceae family e.g. *Banksia*.
2. Metal 14 cm long tubes, real tubes, open ended, were filled with coarse sand, and peat moss mix.
3. A Waratah seed was pushed into this, then sprinkled with fine *Banksia* mould. The optimum sowing time is October for Sydney climates, for advancing the plants on in late winter.
4. The scheme is that any tube is in direct contact with all others via the sandy bed, the whole a homogeneous mass. Proliferation of mycorrhizal association of seedling, and fungus was the aim, by providing the likely environment.
5. A cover of shade cloth provided necessary cover during heat of the day. This was rolled up at night to oppose 'damping off' fungi.
6. Seedlings from fresh seed appeared within a month of sowing. Applications of Aquasol, and weak solutions of condy's crystals were given alternately. The potassium permanganate, sufficient to just colour water was expected to act as a fungicide, and supply necessary manganese. This chemical did not appear to affect the helpful fungus!
7. Apart from broad classifications, understanding fungi is one for the experts. The mycelium on roots of *Grevillea*, *Telopea* and *Hakea*, appears to be similar.
8. The Waratah seedling bed produced better results each season. The seedlings when advanced into large containers grew on with vigour, if optimum growing conditions were provided.
9. Many vascular plants require a symbiotic fungi association to survive: The expensive truffle edible fungus of Beech Forests in Europe is a good example. Conversely the Waratah is the desired bi-product of our efforts to grow its fungal partner. Horticulture is the practical application of scientific studies mixed with an appreciation of nature's way.
10. The description of Waratah propagation in the 1950s, above emphasised the determination to provide the optimum environment for the Waratah's symbiotic fungal partner; the ever-awareness of maintaining two plants as one.
11. Contrary to most plant species, Waratahs survive planting out best as advanced plants. The development of the ligno-tuber is a factor of most importance. Healthy tubed seedlings were transferred to large containers of sand and peat. These were grown on in semi-shade, until several years old.
12. Plants thrived, and flowered, along a well-drained water course, sloping down a southerly valley. Good quality brown loam of desired "crumb structure" retained permanent hygroscopic moisture. Plant roots nestled among cool ferns, and fungi. From this position the tall flowering canes could reach up into the open environment, where they could signal their generic name; *Telopea* [seen from afar].
13. Although our Nursery property at Thornleigh N.S.W. provided an ideal setting for *Telopea* production, planting sites had to be carefully chosen to avoid impervious clay.
14. The obsession with providing optimum conditions for the helpful fungi seemed to succeed, and could help growers even in these enlightened times.

Dryandra—2

For Horticulture

by Tony Cavanagh

Dryandra species, closely related to *Banksia*, are ideal for horticulture both for foliage, flowering, cut flowers or dried arrangements. In No. 92 issue I introduced the genus in part one of this series of articles in which I listed all currently described species. It is now proposed to describe and illustrate all species in more detail.



Dryandra ashbyi (above, Details on page 271)

Photography by Joe Glass

Dryandra fraseri R.Br

Specimens were collected by Charles Fraser in the vicinity of the Swan River in 1827 and the species was named by Brown in the supplement to the *Prodromus* of 1830. The plant was introduced to Europe in 1840, probably from seed sent by James Drummond, and was grown, but not apparently flowered, at Cambridge Botanic Gardens and also at the San Donato gardens of Prince de Demidoff near Florence.

Dryandra fraseri is a sprawling, prostrate sometimes slightly erect shrub usually up to 1.5m across and from 20 to 50cm high. Leaves are narrow, 5-10cm long by about 1.5cm wide, divided to the mid-rib into widely spaced lobes which are rigid and pungent pointed to about 5-8mm, margins revolute. Upper surface is either bright or dull green, under surface shows a prominent yellow-brown mid-rib while lobes are whitish-green with very fine white 'down' present. Flowerheads are variable in size, 2-4cm in diameter, terminal or on very short side branches, closely surrounded by floral leaves longer than the flowers. Colour orange-yellow or bright yellow, contrasting attractively with the dark brown or black felted bracts at the base of the flower head; style to 3.5-4cm. Flowers in autumn-winter.

Once established, *D. fraseri* is one of the hardiest *Dryandra* and does well in full sun or semi-shade locations. In common with some other *Dryandra* species, its sometimes tends to die out in the centre of the bush so that older plants may look untidy. Pruning may assist in maintaining the plant's shape and appearance otherwise it can be replaced.

Dryandra fraseri grows easily from seed, germinating in about 5 weeks and gives few troubles. It is also one of the species which is relatively easy to propagate from cuttings taken between March and June.

Dryandra fraseri is widespread in Western Australia and several forms exist, some apparently tending to grade into the closely allied *D. ashbyi*. The common form has fine, dull blue-green leaves with orange-yellow flowerheads. What was thought to be a particularly attractive variant with larger bright green leaves, yellow stems and larger, bright yellow flowerheads with strongly contrasting black bracts at the base is now known to be *Dryandra ashbyi*. Both plants, however, are quite prickly on account of the stiff, sharp pointed leaves.

Dryandra ashbyi B. L. Burt

I believed *D. ashbyi* to be a yellow flowered form of *D. fraseri*. Both Keith and Pat Alcock have seen similar plants in Western Australia as far south as the Wongan Hills and like me have referred to them as 'yellow flowered *fraseri*'. They regarded *D. ashbyi* as being a larger bush, with distinct blue-grey foliage and wide sinuses between the needle-like leaf lobes — my plant has greener foliage, is almost procumbent and the leaf sinuses are only slightly wider than those of *D. fraseri*. Samples of common *D. fraseri* and my *D. ashbyi* were examined by Mr Steve Forbes, botanist at the National Herbarium, Melbourne and compared against information given in Dr Burt's original description of *D. ashbyi*. The two keyed out (quite clearly in my opinion) as being two distinct species and agreed, particularly as regards differences in flower parts, with the descriptions in Burt's article.

From various sources and my own observations I have compiled the following comparison of the two:

FEATURE:	<i>D. ashbyi</i>	<i>D. fraseri</i>
Size:	Generally a small spreading shrub but can reach 2-2.5m	Semi-prostrate to scrambling up to 1m high
Appearance:	A stiff, rigid bush with a tendency to grow upright	A softer, more graceful spreading plant, often with long arching branches
Branches, branchlets:	Yellow, smooth, glabrous	Dark grey, rough, new growth often with dense matt of hairs
Leaf colour, size and shape:	Blue-green to dark green, 4-6cm long with widely spaced pungent segments up to 1.5cm long	Greyish green, 5-10cm long with shorter (0.6-1cm) closely spaced, needle-like segments
Flower heads:	About 3-4cm in diameter, bright yellow, outer bracts black/dark brown	Similar in size or slightly smaller, but heads in bud distinctly pink, changing with age to a dull orange, outer bracts dark brown.
Flower parts:	Perianth greenish, perianth tube glabrous	Perianth rose pink, perianth tube densely hairy.
Occurrence:	Irwin district, gravelly hills	Avon, Darling and Stirling Districts, gravel heath

Dryandra ashbyi is apparently uncommon in cultivation. It is a hardy plant in an open, well drained site growing well in sand or gravel. It frequently flowers before two years of age, during late autumn and winter, the flower heads being packed along the branches or on short side stems. It propagates readily from seed or cuttings, cuttings taken in February-May giving good results. We have several plants at Cranbourne and others up to 15 years old are known in cultivation.

The history of *D. ashbyi* is interesting as it is the only *Dryandra* species to be described from cultivated material. It was described in 1939 by B. L. Burtt of Kew Botanic Gardens from cultivated plants grown at Blackwood (near Adelaide) by the early Australian plant pioneer, Edwin Ashby. Ashby had obtained his plant from near the town of Yuna, some 50km northeast of Geraldton, Western Australia. However, in 1901, the German botanist Ludwig Diels had collected two specimens, which he had called *D. fraseri*, from near Geraldton and at Minginew (about 35km east of Dongara). He described the plant as "... a blue-green dwarf shrub, very thorny". A rather nice drawing of one of these specimens with the caption "... eine Charakter — Species in Distrikt Irwin" was later to appear on page 316 on Volume 7 of Engler and Pruden's classic work "Die Vegetation der Erde" and is reproduced below. Burtt considered that both of Diels' specimens were closer to *D. ashbyi* than to *D. fraseri*, so obviously there are possibilities for intermediates or even hybrids between the two species. ■

Studies in *Dryandra*

The *Dryandra* Study Group has been operating now for ten years under the leadership of Tony Cavanagh with competent assistance by Alf. Salkin, and more recently, Keith Alcock, 59 Gordon Avenue, Montrose, Victoria, 3765. The eleven newsletters have been reprinted and attractively bound and are available from Keith, by mail, for \$9.00 including postage. They contain a wealth of information comprising study group members, reports and data based on ten years study.

You may like to join the Study Group as well for an annual fee of \$2.00. What a bargain for a fascinating interest by mail, free advice and seed, a potter with seedlings and flurries of activity in the garden.



Dryandra fraseri

Photography by F. W. Humphreys

Other Study Groups And Plant Research

Study groups as listed in previous issues. The purpose of study groups is to provide a means whereby people from all parts of Australia may engage in an interesting activity, by mail. Most have an annual fee of \$2.00 to cover postage costs. The members in the groups have various skills but most are untrained gardeners or bush lovers who want to know more or who would like to engage in a worthwhile activity at their convenience without attending meetings.

Research? One scientist described their efforts as "mickey mouse research" and perhaps this is an apt description. Scientific research is the objective of The Australian Flora Foundation and we have been able to establish a link between the two levels. Study groups do not pretend to carry out scientific research but with guidance from the Australian Flora Foundation, they can accomplish much at the gardening level and still enjoy gardening. See page 277 for the work of the Australian Flora Foundation.

Tuberous, Cormous And Bulbous Plants

by Pate and Dixon

Although confined to Western Australian plants this book is a reference of exceptional value to the range of plants covered by the title. Although a number of colour plates are included, the book is a record of a detailed study by two scientists, presented in a way that a layman can easily follow and understand. I had deferred its introduction as I had hoped one of the authors would have found the time to use it as a basis for an issue of Australian Plants but this was not possible. The authors have grouped the entire western flora — that part that we laymen lump together as growing from bulbs, corms or tubers, into categories that examine the below ground growing characteristics of the plants. This leads to a better understanding of these plants and the cultural conditions they require. One of the books that wildflower enthusiasts should not be without. Available from the Editor — Australian Plants for \$42.00 including postage.



Bossiaea foliosa photographed by C. Totterdell

Seed Germination of *Bossiaea Foliosa*

by E. A. James,
Department of Agriculture, Victoria Horticultural Research Institute,
P.O. Box 174, Ferntree Gully 3156.

Bossiaea foliosa commonly known as Leafy Bossiaea is a small, compact shrub common to the Victorian alpine regions. It is an erect and often wiry shrub to about 1 m high and has small orbicular leaves crowded along opposite sides of narrow branchlets. The flowers are yellow and prolific, appearing in early summer or autumn depending on habitat. Flowers are followed by round, flattened pods (5-10 mm long) which are covered in short brown hairs. Although 'pea-flowered' native plants are generally not in great demand by the native plant enthusiast, the interesting foliage and mass flowering of *B. foliosa* make it a plant which should be more widely grown. Local provenances of seed should also be used in revegetation programmes in alpine areas.

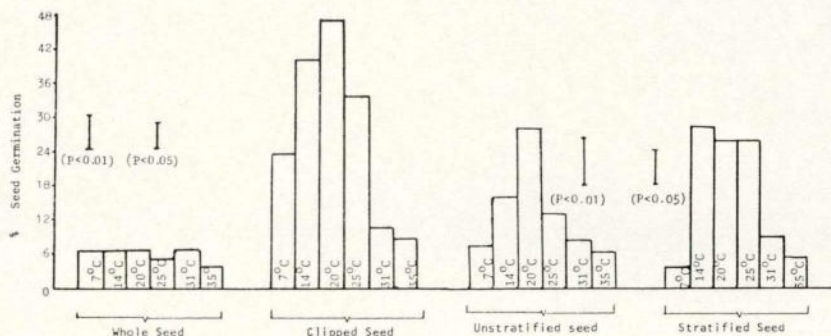
Field collected *Bossiaea foliosa* seed is variable in both size and colour. This suggests that some seeds are 'hard' with a waxy seed coat which would prevent imbibition and germination. In addition, several Australian alpine plants including *Eucalyptus pauciflora* and *Banksia canei* require a period of cold to break seed dormancy (stratification) (Pryor, 1954; Grose, 1954; Salkin and Hallam, 1978).

This study was designed to determine both the degree of hard-seededness in *Bossiaea foliosa* and whether the seeds require stratification to break dormancy.

Seed of *Bossiaea foliosa* was collected at random from 35 plants from a population at 1620 m above sea level at the Rocky Valley Borrow Pit near Falls Creek, Victoria. These seeds were stored for 4 months to allow for any after-ripening effects (Boden, 1957).

Three lots of 10 seeds each were germinated on moist filter paper on a thermogradient plate (Fox and Thompson, 1971) at each of six different temperatures (7°C, 14°C, 20°C, 25°C, 31°C or 35°C).

To determine the degree of hard-seededness this experiment was conducted using both untreated seeds and seeds which had part of the testa removed with nail clippers (Clemens *et al.*, 1977). The experiment was repeated using seed which had been stratified for seven weeks on moist filter paper in closed petri dishes at 4°C $\pm$ 0.5°C.



Results and Discussion

I found that clipping the testa of both unstratified and stratified seed increased germination significantly over a range of temperatures (Fig. 1).

Temperatures between 14 and 25°C significantly increased germination in clipped seed but were ineffective in increasing germination of whole seed. This suggests that the effect of clipping the seed coat was to remove the dormancy imposed by a hard-seed coat and enable imbibition (absorption of water) to occur.

Germination is considered to begin with imbibition and end when the radicle emerges from the seed (Mott and Groves, 1981). However, after imbibition occurs, the emergence of the radicle can be influenced by conditions which affect metabolic processes in the seed. When temperatures were between 14 and 25°C, conditions were optimal for the physiological processes of germination which result in the emergence of the radicle. Therefore, the highest germination percentages occurred over the temperature range.

Lower temperatures delayed germination in the whole seed but did not affect the overall percentage at the end of the 7 weeks. Temperatures above 30°C reduced germination in clipped seed but did not affect whole seed. This may have been due to a lethal effect on the seed (Mott and Groves, 1981) by denaturation of enzymes involved in the physiological processes of germination. In whole dormant seeds, metabolic processes are not activated so they are not disrupted by temperatures above optimum.

In no treatment was there a significant difference in total seed germination between stratified and unstratified seed (Fig. 1) although stratification tended to increase germination rate. In general, at temperatures between 14 and 25°C, clipped seed germinated within 3 weeks of imbibition and was not affected by stratification. Whole seed germinated sporadically over a 10-week period unless stratified, after which most germination occurred in weeks 4 to 6 but continued for over 10 weeks.

These results appear to be in conflict with those of Pryor (1954) who found that stratification was effective in increasing germination in *Bossiaea foliosa* seed collected from 1300 m (seeds for this study were from 1620 m) from 0% to 30% after an 8-week cold period. Seed provenances, altitudes of source populations and storage conditions may be responsible for this wide variation in germination response between the two studies.

The best germination percentage obtained was about 48% for clipped seed at 20°C. This is considerably lower than for some other legumes studied (mainly acacias) where germination percentages of around 80% are common (Farrell and Ashton, 1977; Clemens *et al.*, 1977) although the final germination in acacias does seem to be affected by the origin of the seed (Farrell and Ashton, 1977).

Native species in the family Fabaceae appear to have hard seed mechanisms similar to those in exotic legumes. Hard-seededness may be reduced as storage time increases or if seed is subject to alternating temperatures (Mott and Groves, 1981). Variation in hard-seededness and thus ease of germination (Main, 1981) is interpreted as a method for maintaining a stock of seed in the soil. *Bossiaea foliosa* seed variation, therefore, could be considered an adaptation to the stressful and unpredictable alpine habitat. The germination strategies of alpine native plants have not been widely studied so there may be factors operating in the germination of *Bossiaea foliosa* which have not been considered here.

My work suggests that scarification of the seed, rather than a cold treatment, would be effective in increasing total germination. However, the origin of the seed and storage conditions may influence the magnitude of the response.

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Boronia heterophylla

Photography by D. Richards

At the Horticultural Research Institute, of the Department of Agriculture, Knoxfield, Victoria, various methods of improving branching and flowering of Australian plants are under investigation. One promising method involves the application of hormones that are usually produced by the plants themselves. A synthetic hormone called BAP (a cytokinin) applied to the leaves of *B. heterophylla* has produced the effect shown above. In February, 6-month-old plants were sprayed with BAP at 100 ppm twice a week for 3 weeks. The control plants were not treated. Plants, grown in containers in a pine bark: coarse sand: brown coal mix were over-wintered in a polyhouse. Flower buds were visible on all plants in mid-June and were fully opened in late September-early October. Control plants produced the most flowers and were in full-bloom 2 to 3 weeks earlier than treated plants. This is evident in the photograph which was taken in mid-October when flowers on control plants had already faded. The major effect of BAP was to produce profuse lateral shoot development shortly after treatment. These numerous short laterals developed flowers along their length giving the plant a compact, bushy flowering habit. The use of BAP and a number of other growth manipulation chemicals is a continuing interest of the Horticultural Research Institute with the aim of recommending improved branching techniques to the nursery trade and to horticulturalists.

The Australian Flora Foundation

Dr Dennis West,
Horticultural Research Inst.,
Knoxfield, Dept. of Agri., Victoria

At a time when, already, the survival of many species of the Australian flora is in jeopardy, there is a need for a non-government body of concerned people which can initiate and co-ordinate efforts of those interested in the conservation and husbandry of Australian native plants.

The Australian Flora Foundation can fill this need and we welcome its establishment and offer our support for its successful operation. A list of projects for research could be:

Seed Germination Physiology of Australian Plants for Ornamental Horticulture

Many Australian plant species, especially from families Mimosoideae, Myrtaceae and Proteaceae, which are being developed for ornamental horticulture, must be seed propagated. Methods of promoting germination could be based upon the results of physiological studies needing to be determined.

Development of Post-harvest Handling Methods for Ornamentals

There is a considerable potential in marketing Australian native flowers on overseas markets. Post-harvest handling methods involving temperature, water, humidity, chemical treatments and packaging methods are critical for optimum quality of flowers and need study of the best combinations of these factors for both the local and export markets.

Methods of Vegetative Propagation of Selected Plants

For species with horticultural potential there is a need for further study of the grafting of *Banksia* and *Hakea* species onto rootstocks.

Research is needed on selection of superior forms of many plants such as eucalypt species for street and park use.

The Australian Flora Foundation — Plant Research

The above notes are taken from the annual report of the foundation and are a summary from an address by Dr Dennis West at the annual meeting. Readers, yes any individual, are invited to the next annual meeting to be held at Canberra on 19th, 20th and 21st of October, 1984, based on the National Botanic Gardens, Canberra. Further details in a future issue but plan to attend and have a pleasant, hosted weekend. Buses will be leaving from Adelaide, Melbourne and Sydney to pick up en route — Editor

Your Research Foundation

The Australian Flora Foundation? Not a government organisation; not a part of the Society or any other organisation, but an independent research promotional organisation at your disposal and requiring your support. There is no justification for complaints that "we need scientific research to help us grow *Banksia* or *Telopea* or *Verticordia* or any other aspect relative to the ultimate survival of this magnificent flora of ours or its horticultural application". You have only to write to *your own research foundation*, c/- Botanic Gardens, Adelaide, South Australia, to initiate a study. Requests will hopefully be specific such as "if western *Banksia* can be grown when grafted onto an eastern *Banksia* rootstock, can it be assumed that the limiting factors are below ground and not related to above ground climatic conditions, or is the problem area at the point of entry to the ground?". These types of queries will eventually lead to research and the development of a control.

Hopefully readers will not leave action to "others". Your research organisation needs your help. The new generation of scientists are keenly aware that some research should seek to resolve current problems and that the general public should be informed of the valuable work being carried out by public institutions.

Money! Yes, funds are needed. Your financial support of any amount. The membership is generally restricted to those who want to take an active part in the work and is \$5.00 per annum. Individuals may be a research sponsor for the sum of \$25.00 annually. If just one tenth of our readers donated \$25.00 for one year we would have adequate funds for a number of research projects immediately. The foundation is seeking to promote projects that involve a minimum of outlay in cash terms but that can take advantage of the huge resources available to its active members through the facilities available to them. Hence your \$25.00 will be well spent with a probability of a significant return in results.

Send donations to The Secretary, The Australian Flora Foundation, Botanic Gardens, Adelaide, South Australia.

Eucalypts of South-eastern Australia

A Field Guide — Vol. 1

by M. I. H. Brooker and D. A. Kleinig

This will become a much valued handbook for the bush walker, in fact everyone interested in the unique Eucalyptus trees that are the principal tree on our landscape. At last we have a well illustrated book designed for the layman. The group of trees known as *Eucalyptus* is a very large one of over 500 species. This book describes and illustrates 242 species in such a manner that anyone could identify a species in a particular area.

This huge task is accomplished by presenting a series of keys for many areas using characters that can be identified by reference to excellent detailed photographs and sketches. In fact a short study of this part of the book provides a wealth of knowledge of interest. But do plant keys leave you cold?

You can identify the tree of interest by simply studying the pages of colour plates of each of the 242 species that show; a map with the area of occurrence; details of buds and fruit; a mature tree; and the trunk of the tree, all in colour.

Presumably there will be similar volumes in the future for the other areas of Australia. Excellent value at \$40.00, this 287 page book is available from the Editor, Australian Plants, post free.

Verticordia

Studies in propagation of *Verticordia nitens*
by P. A. Watkins and R. W. Shepherd,
Division of Horticulture, Western
Australian Dept. of Agriculture

Seed of most *Verticordia* species displays low viabilities and germination is often unsuccessful. Vegetative propagation from cuttings is therefore necessary.

Cuttings were taken in June from the basal and top (flower producing) growth of plants. Cuttings were obtained with and without heels and dipped for 10 seconds in Indole butyric acid (IBA) solutions with concentrations of 0.500 ppm, 1.000 ppm, 2.000 ppm, 2.500 ppm and 5.000 ppm IBA. Following treatment cuttings were placed in a well-draining sterile medium and kept under mist. Root development was assessed after five weeks. Ten cuttings for each treatment were used.

IBA ppm	% rooted by different types of cuttings			
	Top tip	Top heel	Base tip	Base heel
0	50	20	40	10
500	40	10	30	10
1000	40	20		10
2000			40	10
2500				80
5000				40

Good rooting of tip cuttings from both the basal (base) and flower producing (top) parts of the plant were achieved with no IBA treatments. IBA treatments tended to have little effect on rooting. However, only concentrations up to 2.000 ppm were assessed and higher concentrations may have given better results. Poor rooting of heel cuttings was obtained with no IBA treatment and a ten-second dip in 2.500 ppm IBA increased basal heel cuttings from 10 to 80 percent when compared with the control.

This preliminary study suggests that both heel and tip cuttings of *V. nitens* can be successfully used for propagation, provided the heel cuttings are treated with IBA. The use of both types of cutting ensures that all parts of the plant can be used for propagation with no wastage of material. However, it should be noted that cuttings taken from the flowering part of the plant develop into plants which produce very short flowering stalks for at least the first year. Cuttings taken from the basal part of the plant will develop into plants which produce long flowering stalks. The former type of plant has little value for cut flower production initially. ■

Endemic Plants of the Porongurup Ranges

By Greg Keighery, Kings Park and Botanic Garden, Perth, W.A.

The Porongurup Range (34° 42'S, 117° 53'E.) is an isolated range of granite hills (maximum elevation 655m) located between Albany and the Stirling Ranges in Western Australia. Most of the range (2,300ha) is now National Park, though the surrounding countryside has been largely cleared.

There are four endemic taxa—*Hibbertia bracteosa* and *Villarsia calthifolia* (Abbot*, 1982), *Brachysema subcordatum* and an undescribed subspecies of *Apium prostratum*.

All four taxa listed here have very restricted ranges within the small Porongurup National Park, and two (*Hibbertia bracteosa* and *Villarsia calthifolia*) are already gazetted rare flora. From the studies reported here, it appears that both these species should prove highly amenable to cultivation, which should help increase public awareness of them and hence increase their chances of survival.

***Apium prostratum* undescribed subspecies.**

Only known from a single collection made in the range in 1867 by one researcher suggests it is either a new species of *Apium* or an undescribed subspecies of *Apium prostratum*. I have not yet relocated this taxon.

***Hibbertia bracteosa* Turcz. (Dilleniaceae)**

Occurs on granite rocks, in crevices above 400m contour, throughout the range. The species spreads via rhizomatous suckers along these crevices. It is a soft wooded shrub to approximately 1m tall, bearing large green alternate rounded leaves, clasping the stem, up to 5cm long. The large flowers are yellow, solitary, 3-4cm across, erect on slender pedicels 2-3cm long. The stamens are numerous, all around the ovary, and are bright yellow. Flowering September to December.

This species is without doubt one of the most attractive members of this large genus. The large yellow flowers are scentless and are pollinated by pollen-collecting flies and bees. Abundant seed is formed in natural populations, approaching 90% fruit set. Cuttings have proved easy to strike at Kings Park, and this rare species could be widely cultivated.

***Villarsia calthifolia* F. Muell.**

Occurs on granite rocks, in crevices and soil pockets throughout the range, and Abbott records it as occurring just below the 300m contour in Karri forest in Mira Flores estate.

It is a robust perennial herb, with a tuberous rootstock. The leaves are reniform to oval, with dentate margins to 15cm diameter on 15cm petioles. The inflorescence is from 50-90 cm tall, bearing numerous yellow flowers, ca. 1cm wide. Flowering October to December (rarely September).

A magnificent species, the best of the genus. Sets abundant seed, but has not yet been cultivated.

***Brachysema subcordatum* Benth.**

Occurs on granite rocks, crevices and run off aprons throughout the range, above the 400m contour. It is an erect dense shrub, dark green, to 1.5m. Apparently may sucker as it occurs in dense clumps. Leaves are crowded, opposite or in whorls, entire, ovate, with undulate margins, 2-4cm long. Flowers dark red, axillary, solitary or several on a short common peduncle, 10-15mm long. Calyx $\pm$ 10mm long, silky tomentose, green. Standard small erect, wings as long as keel. Flowers September to December, see colour plate.

*Abbott, I. (1982) "The Vascular Flora of the Porongurup Range, South-Western Australia." West. Aust. Herbarium Res. Notes 7 : 1-16.



At the Porongurups *Brachysema subcordatum* (above) is visited by nectar-seeking birds (New Holland Honeyeater and Brown Honeyeater). Abundant fruit is set, and cuttings (semi-hardwood) have struck readily. ■

Eremosyne

by Greg Keighery, Kings Park and Botanic Garden

Eremosyne Endl. is a monotypic genus, endemic to southern Western Australia. The genus, though closely related to the Saxifragaceae (and originally placed as the tribe Eremosyneae of this family), is generally considered to form a separate family: the Eremosynaceae. As such, it is one of the two flowering plant families endemic to this region (the other being the Cephalotaceae — consisting of *Cephalotus follicularis*: the Albany Pitcher Plant).

Eremosyne petinata Endl. occurs naturally between Margaret River and Denmark, in the high rainfall zone of southern Western Australia, occurring most frequently in dense populations after hot fires on a variety of soils (sands, loam, clay or moss swards).

The species is a small, erect spreading, much branched annual herb, to 15 cm. The plant is sparingly hairy all over with the largest leaves basal, entire or lobed, becoming smaller and forming bracts as one progresses up the

flowering stems. The flowers are small, borne in dense terminal inflorescences. The calyx is united briefly and covered by a slightly rusty coloured indumentum. The petals are white inside, pink outside, giving pink buds, and are also tubular at the base. The ovary is largely superior, two locular, with one ovule per loculus. Seeds are erect, top shaped with a copious endosperm.

Wild populations flower between September and December, but peak in October and November. I have grown plants from seed sown in April or May, in a freely draining mix. Plants were kept in pots with occasional waterings of liquid fertilizer during the winter and early spring while they were growing. Damping off proved a problem for small seedlings. Plants can be kept in shade, but prefer a dappled sunny situation (in Perth).

This is a delightful (perhaps mainly because of its unique botanical position) small annual for pot culture. ■

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Fairhill Nurseries — Fairhill Rd., Yandina, 4561. Tel. (071) 46-7193, P.O. Box 100. Large range of trees, shrubs, ground covers, climbers, ferns, palms and orchids for the sub-tropical and tropical east coast. Extensive display gardens 8.30 a.m. to 5 p.m. anyday. New comprehensive catalogue now available \$2.00 posted.

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Cranebrook Native Nursery — R23 Cranebrook Road, Cranebrook, N.S.W. Tel. (047) 77-4256. Four miles north of Penrith, between Tadmore and Taylor Roads. Open 10.00 a.m.-8 p.m. Closed Sundays.

Denovans Nursery — 188 Marco Ave., Panania, 2213. Tel. 77-8891.

Sydney Wildflower Nursery — (part of the Forest Native Nursery Group) — 9 Namba Road, Duffy's Forest. Tel. (02) 450-1785. We specialise in a wide range of native plants. Catalogue \$4.50 posted. Open 7 days.

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H. Grant — 2 Sandra Pl., Dubbo, 2830. West N.S.W. a speciality. Two stamps for a catalogue posted.

Growing Grevillea

Reprinted by permission from
Growing Grevilleas by Don Burke

Grevilleas are easy plants to grow. Most shrubby types will reach maturity in about two or three years and require only minimal care.

In general, grevilleas need full sun to perform well although some (e.g. *G. robusta* and *shiresii*) will grow in part shade. No grevillea so far tested will grow in heavy shade.

The majority of grevilleas like a light, well-drained soil, many preferring sandy soil types. In general, the spider-flowering and toothbrush-flowering species like well-drained soils and dislike summer humidity; whereas the tropical brush-flowering types are more tolerant of heavier soils and of summer humidity.

First generation hybrids of the toothbrush- and spider-flowering groups are much hardier in warm, humid areas than their parent species. For this reason, people in, say, Sydney and Brisbane should avoid pure species of these two groups and plant the hybrids instead. (See list of species and hybrids.)

Species which are native to southern Australia usually do best in a more Mediterranean climate: i.e. warm, dry summers and cool, moist winters. The advantage, for instance of the Poorinda hybrids is that their climatic tolerances are far wider than their parent species.

Grevilleas demand to be kept in active, vigorous growth: as soon as the growth slows down, pathogens and insects will attack the plant and it may die. The grevillea evolutionary pattern is one of fast turnover: grow quickly, flower like mad, set and shed masses of seed: after which the individual plant is expendable.

Soils

Grevilleas like well drained and well aerated soils. Some species are more tolerant of heavy, clay soil types, but in general drainage must be good.

Clay soils have a bad name amongst the general public, but they don't deserve it. For the most part, clay soils are good garden soils, usually being rich in nutrients and holding water well during dry periods. If your garden has poorly drained clay soils, surface drainage (such as the contouring of the soil to shed water), forking over, and the addition of gypsum will all help. Gypsum helps clay soils to form internal cracks which aid drainage.

The addition of organic matter such as compost, leaf mulch or peat moss will also help to improve drainage and aeration in clay soils. It may sound crazy, but large trees also assist with drainage: they suck up moisture very efficiently during wet periods. So much so that certain gum trees are used for swamp drainage in various areas, notably Israel. ■

Growing Grevillea

by Don Burke — \$10.00 including postage from Editor

Just a small book of 80 pages with a limited amount of colour, this book is of value to those who want to grow more *Grevillea* to provide all year flowering, to attract the birds, to give pleasure in the garden, or, to grow in pots. The book is based on a series of articles and talks that Don gives and it reflects his aggressive, practical, competent manner. A feature is the reporting on unusual grafting practices.

Growing Natives In Containers

by Alec Blombery — \$10.00 including postage from Editor

As with all his other books on growing wildflowers, over the last 20 years, Alec has adopted a very practical approach to this subject. It is unfortunate that many of our more spectacular wildflowers can only be grown in containers but at least Alec describes here how this is done with rewarding results. Turn disadvantages of limited space into the pleasure that can be obtained from a mobile potted garden.

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

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PUBLISHED BY THE SOCIETY FOR GROWING AUSTRALIAN PLANTS N.S.W. LTD.

Managing Editor: W. H. Payne, assisted by Ray Page, P. D. Leak, B. Kennedy, P. Owens, J. Aston. Do not telephone or call private home. Enquiries by mail only.

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Brachyscome latisquamea

Photography by F. D. Hockings

Brachyscome/Helipterum Study Group

by Maureen Schaumann

This study group should be of interest to many readers as *Brachyscome* species are easy to grow from seed or cuttings, are small dainty plants and rewarding in flower as shown above. *Helipterum* species are also very showy and easy to grow. Write to the leader, Maureen Schaumann, 88 Albany Drive, Mulgrave, Victoria 3170, enclosing two dollars and you will be rewarded with advice and sufficient material to get you started.

For those who do not wish to participate, help is needed in the collection of species and seed in the field. An interested botanist is also required to help species identification and other specialist advice. Who will help?