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Are You A Beginner? Are You Confused?

Possibly you have only recently become aware of the unique flora of Australia. Perhaps you are in the position I was in many years ago, a new home and a sudden urge to plant natives. In those days before SGAP, there was very little reference material so we tried what we thought was obvious. Many wildflower garden writers for years pushed the same flat-tyred barrow, "study the conditions in nature and reproduce them". It is not possible to reproduce nature's conditions and we lost our plants trying.

Are things any easier now? You can go to SGAP meetings. Nobody produces a magic formula, an easy sure-fired way to grow natives. Do not be put off by the knowledgeable talk by apparent experts. Botanical names slide off the tongue and occasionally a well grown plant appears. It is mostly all a front. Most of those present know little more than you do, a raw beginner. Do not be put off but join in the good fellowship of the meeting and meet some nice people. Occasionally you will get some valuable advice. You are all learning together.

All the accumulated knowledge of the last 30 years is contained in past issues of Australian Plants and there is no substitute, no book or series of books, that has adequately summarised it. If you want to learn more, the purchase of previous issues in bound volumes is the best investment you can make.

This is the best advice you can get but it is expensive and will land you into a lot of work, sifting through apparently conflicting information. Over the next few issues of Australian Plants I will use this column to help the beginner.

Meanwhile, enjoy this issue. The *Lechenaultia* are beautiful plants. Excellent pot plants, that with some understanding, can be grown in the garden, see page 114. The yellow pea-flowered plants will also give great pleasure.

Eucalyptus, our "gum" trees can be very ornamental, see page 125 for our national project. The few that occur outside Australia are described on page 121.

The fact is that the reliable use of our most spectacular wildflowers is still in the pioneering stage. We are still learning ourselves, but please join us in our floral adventure.

Editor

COVER PLATE

Lechenaultia formosa, an orange upright form. See page 96 for other colour forms.

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Lechenaultia

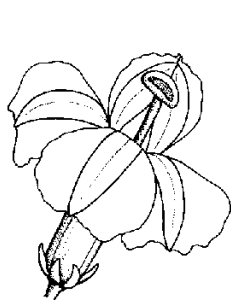
by David Morrison, Department of Applied Biology,
New South Wales Institute of Technology.

Lechenaultia is a genus of 25 species of the plant family Goodeniaceae. All of the species occur in Australia, with most of them restricted to south-western Western Australia. Several species, notably *Lechenaultia formosa* and *L. biloba*, have excited considerable horticultural interest, not the least for the range of vivid colours presented by the flowers, which are some of the most attractive in this country. *Lechenaultia biloba*, in particular, was well known in cultivation in Europe early last century, as some forms possess flowers of a deep blue almost unknown elsewhere in the plant kingdom. This engendered the name 'The Floor of the Sky', as the flowers seem to bring the bluest skies down to carpet the earth.

Lechenaultia are principally plants of the sandy soils of the south-western corner of Western Australia, where 19 of the species are endemic. However, a number of species occur elsewhere, with two species (*L. lutescens* and *L. striata*) in arid western central Australia, one (*L. divaricata*) in arid eastern central Australia, one (*L. filiformis*) widespread across tropical northern Australia and extending to the southern coast of New Guinea, and one (*L. ovata*) restricted to the Kakadu region.

Most of the species are small perennial sub-shrubs or herbs, with only *Lechenaultia acutiloba*, *L. divaricata*, and *L. linarioides* becoming shrubs over one metre high. The plants are widespread but never prominent components of the vegetation. Eight of the species are considered to be rare and endangered (*L. acutiloba*, *L. chlorantha*, *L. juncea*, *L. laricina*, *L. longiloba*, *L. ovata*, *L. pulvinaris*, and *L. superba*).

SECTION LECHENAULTIA



L. formosa



L. tubiflora



L. longiloba

The genus is made up of three distinct groups of species. Firstly, there are those species that have red, yellow or light olive-green flowers, with the petals held erect and forming a tube, with a straight style. This type of flower is typical of plants that are pollinated by birds, and these species all produce nectar in the flowers, which is the reward that the birds are seeking when they probe the flowers. This group is known as section *Lechenaultia* of the genus, and it includes most of the horticultural favourites, such as *L. formosa*, *L. laricina*, *L. macrantha*, and *L. superba*. These are shown in colour on the next page.



Lechenaultia superba (above)

Photography by Ivan Halliday

An erect shrub to 70 cm high this flora gem has been gazetted as rare and endangered. The flowers, 17-23 mm long, may be yellow to orange to red. Three of the petals are spread outwards at the top of the tube with the other two erect.

Lechenaultia formosa (opposite, top)

Photography by Neil Marriott

There are many colour forms of this very showy plant. This pink form is shown growing in a tub. The yellow flowered form on the cover is growing in a hanging basket. This plant and its cultivation has been featured in colour in its many colour forms in previous issues of Australian Plants together with detailed instructions on its cultivation. Page 310 of our No. 107 issue shows two other colour forms growing in hanging baskets with advice on cultivation.

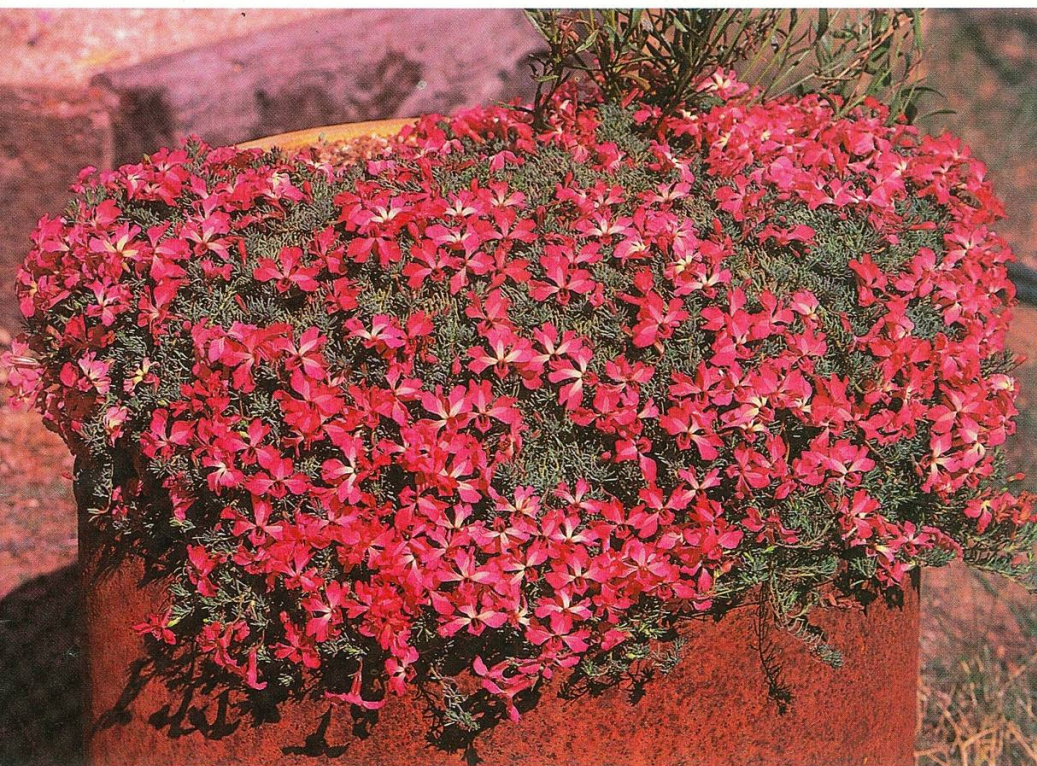
Lechenaultia longiloba (opposite, bottom)

Photography by John Simmons

This photograph shows the character of the group of species in the section *Lechenaultia*, the petals being held erect forming a tube with the straight style inside. *Lechenaultia longiloba* is a low scrambling plant that often suckers. The flowers are up to 35 mm long, often pale yellow or green but usually attractively suffused with pink to red on the edges sometimes to the extent of being all red as shown opposite.

The Section *Lechenaultia*

The species in this group are listed in the last section of the key to species on page 99. In addition to the three above, *L. acutiloba* is pictured on page 104, *L. linarioides* has been pictured before and space will not permit the inclusion of the superb colour slides I have, in this issue. We need slides of *L. chlorantha*.



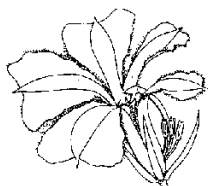
Lechenaultia formosa, a pink form △

▽ *Lechenaultia longiloba*



The other two groups are insect-pollinated, having more open (non-tubular) flowers that are usually blue, do not produce nectar, and have a curved style. One of these groups has flowers with wings on all five of the petals, which makes them look very similar to *Dampiera* flowers. This group (known as section *Patentes*) includes *L. biloba* and *L. floribunda*. The other group (known as section *Latouria*) has flowers with wings on only three of the five petals, and includes a range of species, of which only *L. heteromera* is relatively common in cultivation.

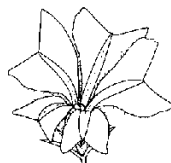
SECTION PATENTES



L. floribunda



L. expansa



L. biloba

SECTION LATOURIA



L. filliformis



L. brevifolia



L. divaricata

The correct spelling of the name *Lechenaultia* has apparently caused some confusion for horticulturalists, although most people seem to be accepting the botanically-correct version. The genus was first described by Robert Brown, who was the botanist with Matthew Flinders when he circumnavigated Australia in the *Investigator*. Brown named the genus after a French botanist and traveller, Jean-Baptiste Louis-Claude-Theodore Leschenault de la Tour, who visited Australia as part of Nicolas Baudin's voyage of exploration in search of la Perouse. The two botanists met at a bay near Victor Harbour in South Australia, when the two expeditions took shelter there. Flinders named the bay Encounter Bay to commemorate his meeting with the French expedition.

Being an educated man, Brown quite naturally (I feel) expected that his new friend would spell his name in the modern French manner, using 'ch', rather than spelling it with the Germanic or Old French 'sch'. Brown therefore consistently spelt the name without the 's', and so we must follow suit under the current rules of botanical nomenclature. If it is any consolation, botanists consistently used Brown's spelling of the name for about 30 years after the name was published, before they started spelling it as Leschenault would have done. This new spelling was used for the next 100 years or so, before the original was re-instated.

Before proceeding to describe the various species, a simplified botanical key to assist the non-botanist to identify each species is given opposite. Please do not let the apparent technical presentation deter you. The characters used are readily identifiable and a layman may easily use it, try it.

Key to the species

- 1 Petals not erect, with the flowers open on one side
 - 2 Wings present on all five petals
 - 3 Wings on all five petals equally wide
 - 4 Leaves and sepals hairy *L. pulvinaris*
 - 4* Leaves and sepals not hairy
 - 5 Style > 11 mm long *L. stenosepala*
 - 5* Style < 9 mm long
 - 6 Wings on petals > 2 mm wide *L. biloba*
 - 6* Wings on petals < 2 mm wide *L. expansa*
 - 3* Wings on two of the petals narrower than on the other three petals
 - 7 Leaves, sepals and ovaries covered with small translucent bumps (papillae) *L. papillata*
 - 7* Leaves, sepals and ovaries without papillae *L. floribunda*
- 2* Wings present on only three of the five petals
 - 8 One of the sepals distinctly longer than the other four sepals
 - 9 Leaves > 12 mm long *L. filiformis*
 - 9* Leaves < 10 mm long *L. ovata*
 - 8* All five of the sepals the same length
 - 10 Sepals < 2.5 mm long *L. subcymosa*
 - 10* Sepals > 3 mm long
 - 11 Leaves rare on the flowering stems and crowded on the non-flowering stems
 - 12 Petals dark blue *L. brevifolia*
 - 12* Petals pale blue, yellow or cream
 - 13 Ovules > 15 pairs per ovary *L. striata*
 - 13* Ovules < 8 pairs per ovary *L. juncea*
 - 11* Leaves equally common on the flowering and non-flowering stems
 - 14 Leaves membranous *L. divaricata*
 - 14* Leaves not membranous
 - 15 Leaves < 9 mm long *L. heteromera*
 - 15* Leaves > 10 mm long *L. lutescens*
- 1* Petals erect and forming a cylindrical tube
 - 16 Inside of petals hairy throughout *L. linarioides*
 - 16* Inside of petals hairy only in a tuft at the base
 - 17 Stems with rough bark (except on new growth)
 - 18 Leaves rigid *L. tubiflora*
 - 18* Leaves fleshy
 - 19 Petals bluish-green or greenish-yellow
 - 20 Leaves < 6 mm long *L. acutioba*
 - 20* Leaves > 6 mm long *L. chlorantha*
 - 19* Petals red, orange or yellow
 - 21 Leaves > 11 mm long *L. superba*
 - 21* Leaves < 11 mm long
 - 22 Two of the petals erect above the tube and joined along the adjacent margins *L. formosa*
 - 22* Two of the petals erect above the tube but not joined *L. laricina*
 - 17* Stems with rough bark only near the base of the plant
 - 23 Stems, leaves and sepals hairy *L. hirsuta*
 - 23* Stems, leaves and sepals not hairy
 - 24 Wings on petals < 3 mm wide *L. longiloba*
 - 24* Wings on petals > 4 mm wide *L. macrantha*



Lechenaultia pulvinaris (above)

Photography by K. Gallagher

The echidna-like habit of this spiky cushion-like sub-shrub to 15 cm high, covered with a mass of blue-purple flowers makes it an attractive horticultural plant. See page 112.

Lechenaultia expansa (opposite, top)

Photography by David Morrison

This sub-shrub can grow to 60 cm high. The pale blue-purple flowers cover the plant making it an attractive plant for the garden. See page 106.

Lechenaultia tubiflora (opposite, bottom)

Photography by Neil Marriott

No treatment of *Lechenaultia* is complete without a photograph of this unique plant. The range of flower colour is impressive from white to yellow to red. If white or yellow, they are often suffused with orange, red (as opposite) or blue around the top. It is usually a spiky cushion-like shrub to 15 cm high but there are erect forms to 70 cm. The flowers are tubular (to 17 mm long), unlike the other two pictured here but the growth habit is similar to them.

The Blue *Lechenaultia*

It seems incredible that the most spectacular of all the *Lechenaultia*, *L. biloba*, is not included in the colour plates. This world famous clear blue flower has been featured in many issues and we refer you to the cover plate of our No. 100 issue where a garden scene is highlighted by the dazzling blue flowers of *L. biloba*. Other species in the section *Patentes* are *L. stenosepla* (colour plate on page 108), *L. papillata* and *L. floribunda* for which we require good colour slides.



Lechenaultia expansa △

▽ *Lechenaultia tubiflora*



***Lechenaultia acutiloba* Benth.**Wingless *Lechenaultia*

A hemispherical much-branched shrub that can grow to 1 m high and 1.5 m diameter, often suckering. The leaves are crowded, fleshy, terete, and 3-5 mm long. The flowers are tubular, about 21-25 mm long, on ovaries 5-7 mm long. They are greenish-yellow, sometimes turning blue towards the tips of the petals, and cover the plant when in full flower. Three of the petals are curved downwards at the top of the tube, while the other two are erect and curve so that the tips cross each other behind the style. All of the petals are wingless, which is unique within the genus. Colour plate on page 104.

This species only occurs in south-western Australia on the coastal sandplain between the towns of Ravensthorpe and Ongerup, where it usually grows in damp soil along river banks or around the edges of swamps. It is thus geographically localised and restricted to a very specific habitat. It flowers from about mid September to late December. This species was first collected by George Maxwell in 1863 near the Young River.

It is grown in cultivation, but it needs to be more widely grown to ensure its continued survival.

***Lechenaultia biloba* Lindley**Blue *Lechenaultia*

A moderately-branched sub-shrub or small shrub that can grow to about 90 cm high and 60 cm in diameter, and that may sucker. The leaves are crowded, fleshy, terete, and usually about 6-11 mm long. The flowers are open, and vary in colour from brilliant dark blue through pale blue to creamy white, but even the blue ones usually have a white centre. The flowers vary considerably in size, from about 14 to 20 mm long, on ovaries 11-18 mm long, and they cover the plant when in full flower. The wings on all of the petals are very large, being up to 6 mm wide, making the flowers the largest of the blue-flowered species.

This species is widespread in south-western Australia from Three Springs to Cape Leeuwin and inland to Lake King, being more common in the western part of the range. It occurs in sand or sandy loam in a variety of heaths, scrubs, woodlands and forests. Flowering is usually from early August to mid November. It was probably first collected near Perth by James Drummond in 1837, but was also collected in the same year by Georgiana Molloy further south near Augusta.

This is one of the most common *lechenaultias* in cultivation, and is one of Western Australia's best known wildflowers. Due to the wide variety of flower colours and sizes a number of horticultural varieties have been named e.g. Alba, Blue Peter, Giant, Myall, Pale Blue, Suckering, White Flash.

***Lechenaultia brevifolia* D. Morrison**

A tufted sparsely-branched sub-shrub that can grow to 40 cm high and 50 cm diameter, often suckering. The leaves are crowded on short stems and at the base of the flowering stems, fleshy, terete, and 2-3 mm long. The flowers are grouped at the top of almost leafless stems, open, 13-18 mm long, on ovaries 7-12 mm long. They are dark blue with a white centre, and have wings on only three of the five petals. The habit and flowers are similar to those of *L. juncea* and *L. striata*, but the petals are a much darker blue. Colour plate on page 108.

This species is common in the drier parts of inland south-western Australia between Southern Cross and Mount Ragged. It is found in red or yellow sand, in heath or scrub, and it flowers from late October to early December.

This species was collected quite a few times last century, but was then not re-discovered until relatively recently. The first collection was by Ernest Giles in 1875 near Victoria Spring on his expedition from Adelaide to Perth, and then by Muir in 1880 and Merrill in 1889. Richard Helms collected it twice in 1891 on the Elder Exploring Expedition, while P. A. Gwynne collected it once on the same trip. All of these specimens were sent to Ferdinand von Mueller in Melbourne, who seems to have considered them as being merely a variety of *L. heterocmera*. The species was then re-discovered in 1960 by Alex George, and it was finally described in 1986.

It is not known in cultivation, but it would make a striking specimen, as its flowers are similar to those of *L. biloba* in colour and stand up exposed on the flowering stems.

***Lechenaultia chlorantha* F. Muell.**

A diffuse much-branched sub-shrub that can grow to 30 cm high and 30 cm diameter, often suckering. The leaves are crowded, fleshy, linear to terete, and about 7-13 mm long. The flowers are tubular, about 21-25 mm long, on ovaries 7-10 mm long that are often curved downwards. They are pale bluish-green, sometimes with a dull orange patch in the middle, and cover the plant when in full flower. Three of the petals are curved downwards at the top of the tube, with the other two erect and joined along the adjacent margin. The flowers are very similar to those of *L. formosa*, but are larger and of a different colour.

This species only occurs near the mouth of the Murchison River in south-western Australia, and it is currently known from only one small population. The plants flower during August and September. The species was first collected by Augustus Oldfield at the end of the 1850's.

This species is in cultivation, but obviously it needs to be more widely grown if its future is to be assured. The plants have the prostrate habit of *L. formosa* and a similar flower, but the pale green flower apparently makes them less appealing as horticultural specimens.

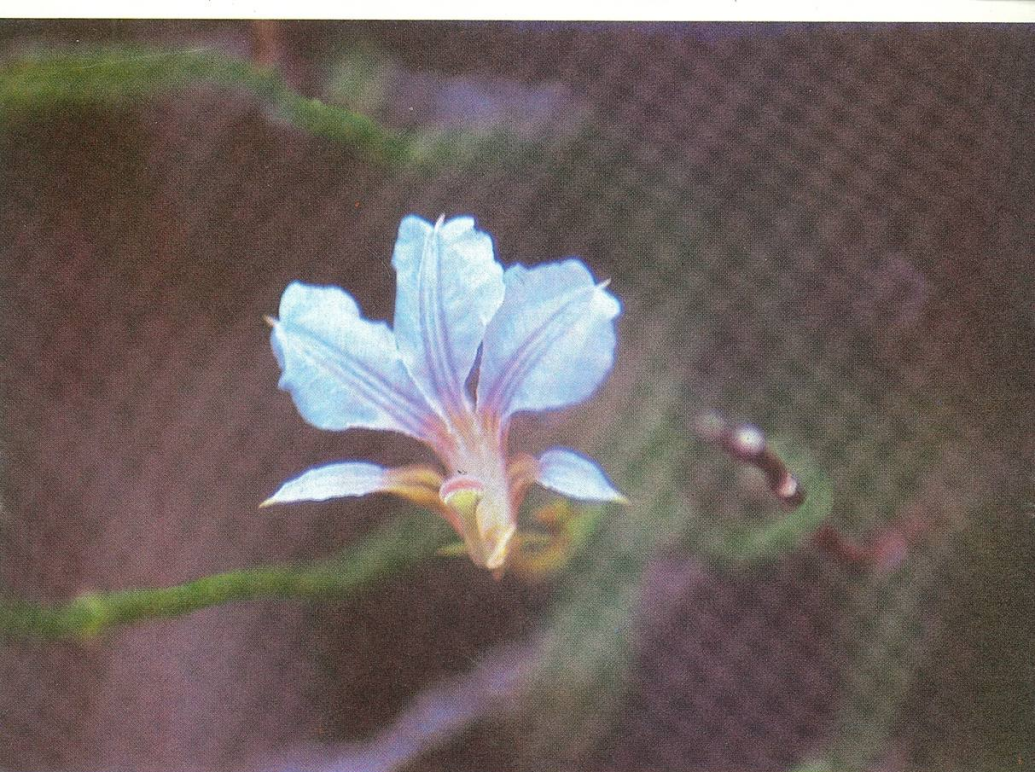
***Lechenaultia divaricata* F. Muell.**

Tangled Lechenaultia

A divaricate much-branched shrub that can grow to 1 m high and 1 m diameter. The leaves are scattered over the plant, membranous, triangular, and less than 2 mm long. The flowers are open, 13-20 mm long, on ovaries 4-7 mm long. They have wings on only three of the five petals, vary from yellow through pale yellow to creamy white, and are scattered over the plant. The fruiting capsule is very distinctive, looking like a very short beaded necklace.

This species is widespread throughout the eastern arid and semi-arid areas of central Australia, occurring in South Australia, the Northern Territory, Queensland and New South Wales. It grows on sand dunes and floodplains, in grassland or open mulga. It flowers sporadically throughout the year. It was first collected by Dr Wheeler near Cooper's Creek.

This species is not known in cultivation; but it apparently has a high drought tolerance and therefore may do well in dry areas.



Lechenaultia juncea △

▽ *Lechenaultia acutiloba*





Lechenaultia striata △

▽ *Lechenaultia heteromera*



***Lechenaultia expansa* R. Br.**

A virgate moderately-branched sub-shrub that can grow to 60 cm high and 90 cm diameter. The leaves are crowded, fleshy, terete, and about 6-10 mm long. The flowers are open, 9-11 mm long, on ovaries 3-7 mm long. They are pale blue-purple, and cover the plant when in full flower. All of the petals have wings up to 2 mm wide. This species is often confused with *L. floribunda*, but the flowers are smaller and have a more densely-branched flowering habit. Also, *L. expansa* has longer leaves, and the wings on the petals are usually all the same size.

L. expansa grows along the coast of south-western Australia between Perth and Albany, where it usually occurs around the edges of swamps or in other damp areas. It flowers from late October to mid January. It was first collected by Robert Brown near Albany in 1801. See the colour plate on page 100.

This species is very uncommon in cultivation.

***Lechenaultia filiformis* R. Br.**

A grass-like sparsely-branched herb that can grow to 40 cm high and 40 cm diameter, and that probably grows annually from a rootstock. The leaves are not crowded on the plant, somewhat fleshy, linear, and vary from 12 to 24 mm long. The flowers are more-or-less open, as three of the petals spread outwards, while the other two are erect and strongly coherent along the adjacent margins by interlocking hairs. The erect petals are usually without wings. The flower colour varies from deep blue through purple and pale blue to creamy white, and they are often white or pale yellow in the centre or on the edges of the wings. The flowers are scattered over the plant, and vary greatly in size, usually from 11 to 18 mm long, on ovaries 20-30 mm long, with the smaller flowers in the eastern part of the distributional range and the larger flowers in the west. The flower shape is very unusual within the genus.

This species is widespread in the tropical areas of Australia, ranging from the Kimberleys in Western Australia through Arnhem Land in the Northern Territory to Cape York in Queensland, and extending to the south-eastern coast and off-shore islands of New Guinea. It is found in a wide variety of habitats, and flowers sporadically, perhaps only after rain.

This species was first collected by Joseph Banks and Daniel Solander at Endeavour River in 1770, and they tentatively called it *Lobelia filiformis*. It was later collected in the Gulf of Carpentaria by Robert Brown in 1802, who used the earlier specific name but described a new genus for it.

It is not known in cultivation.

***Lechenaultia floribunda* Benth.**

Free-flowering *Lechenaultia*

A moderately-branched sub-shrub or small shrub that can grow to 90 cm high and 100 cm diameter. The leaves are crowded, fleshy, terete, and 4-7 mm long. The flowers are open, 11-15 mm long, on ovaries 6-8 mm long. They vary from pale blue through pale mauve to almost creamy white, usually white or pale yellow in the centre, and cover the plant when in full flower. There are wings on all of the petals, but they are distinctly smaller on two of the petals compared to the other three. The more northern plants have smaller flowers and larger leaves than the southern plants. The flowers are smaller than those of *L. biloba* and the petals are a much paler blue.

This species occurs along the south-western Australian coast between Perth and Kalbarri, where it occurs in sand or loamy sand in heath, scrub or woodland. It flowers from late August to mid December. It was first collected by Karl von Hugel near Perth in 1833.

This species is not particularly common in cultivation, but at least one horticultural variety has been named (Forget-me-not). The large number of flowers per plant make this a very desirable species.

***Lechenaultia formosa* R. Br.**

Red *Lechenaultia*

This is either a prostrate sub-shrub up to 15 cm high and 30 cm diameter, often suckering, or an erect small shrub to 40 cm high and 40 cm diameter. The leaves are crowded, fleshy, terete, and 4-9 mm long. The flowers are tubular, vary from scarlet through pink and orange-red to pale orange, often being more reddish on the lobes than in the centre, and cover the plant when in full flower. The flowers vary considerably in size, from 15 to 21 mm long, on ovaries 7-12 mm long that often curve downwards. Three of the petals are curved downwards at the top of the tube, while the other two are erect and joined along the adjacent margins with just the tips free. The flower shape and nodding ovaries are very distinctive within the genus. Colour plates on pages 93 and 97.

The smaller-flowered more erect plants are confined to the coast between Albany and Cape Le Grande in south-western Australia, while the larger flowered prostrate plants are common throughout south-western Australia between Coorow and Israelite Bay, with outliers in the sandy soils of Point Culver, Eyre and Eucla. The plants occur in sandy and clayey soils, in heath, scrub, mallee and woodland. Flowering occurs sporadically throughout the year, but is most prolific from early August to late October. This species was first collected by Robert Brown while he was at Lucky Bay east of Esperance in 1802.

This is one of the most common lechenaultias in cultivation, and due to the variety of habits and flower colours and sizes, a number of horticultural varieties have been named e.g. Aurea, Beaumaris Red, Brilliancy, Captain Blood, Cardinal, Columbine, Golden Glow, Princess Pink, Scarlet O'Hara, Tango, Wallflower.

***Lechenaultia heteromera* Benth.**

Claw *Lechenaultia*
Hook-leaf *Lechenaultia*

A virgate moderately-branched sub-shrub that can grow to about 60 cm high and 80 cm diameter. The leaves are usually not crowded, somewhat fleshy, linear, curved downwards, and 4-6 mm long. The flowers are open, about 14-19 mm long, on ovaries 10-14 mm long. They are pale blue, with wings on only three of the five petals, and are scattered over the plant. The thick recurved leaves are unique within the genus. Colour plate on page 105.

This species occurs along the coast of south-western Australia between Starvation Boat Harbour and West Mount Barren, where it occurs in deep white sand in heath, scrub or woodland. Flowering is from late August to late November. It was probably first collected by James Drummond in 1848.

It is not common in cultivation, presumably because its open sparse habit and pale flowers are not horticulturally appealing.



Lechenaultia stenosepala △

▽ *Lechenaultia brevifolia*



***Lechenaultia hirsuta* F. Muell.**

Hairy Lechenaultia

A straggling sparsely-branched herb or sub-shrub that can grow to 50 cm high and 100 cm diameter. The leaves are not crowded, somewhat fleshy, linear, and 17-27 mm long. The flowers are tubular, about 29-36 mm long, on ovaries 17-26 mm long. They are scarlet, or sometimes orange-red in the middle, and are scattered over the plant. Three of the petals are spread outward at the top of the tube, with the other two erect. The plants are almost completely hairy, which is unique within the genus. See page 56 of Issue No. 94 for a colour plate.

This species occurs in the sandplains of south-western Australia between the towns of Kalbarri and Badgingarra, where it occurs in sand in heath. The flowering time is from early September to mid December. It was first collected by James Drummond between 1850 and 1851.

This species is not common in cultivation, but could be a very good ground cover due to its sprawling habit and bright red flowers.

***Lechenaultia juncea* E. Pritzel**

Reedy Lechenaultia

A grass-like sparsely-branched herb that can grow to 50 cm high and 70 cm diameter. The leaves are crowded on short stems and at the base of the flowering stems, fleshy, terete, and 8-16 mm long. The flowers are grouped at the top of almost leafless stems, open, 14-18 mm long, on ovaries 11-19 mm long. They have wings on only three of the five petals, and are pale blue, with the edges of the petals often outlined in a darker blue. The flowers and habit are very similar to those of *L. striata*.

This species is restricted to a small area between the towns of Three Springs and Gunyidi in south-western Australia, where it is now known from only a few roadside verges and fields in farmland. Flowering is usually from late November (sometimes earlier) to mid December. It was first collected by Ludwig Diels near Northampton and Ernst Pritzel near Watheroo in 1901.

It is not known in cultivation, but certainly needs to be if its future is to be assured.

***Lechenaultia laricina* Lindley**

Scarlet Lechenaultia

This is a diffuse much-branched small shrub that grows to about 70 cm high and 80 cm diameter, often suckering. The leaves are crowded, somewhat fleshy, terete, and about 5-11 mm long. The flowers are tubular, about 19-23 mm long, on ovaries 6-9 mm long. They vary from scarlet to orange-red, with usually more orange in the centre, and cover the plant when in full flower. Three of the petals curve downwards at the top of the tube, with the other two erect. The flowers are very similar to those of *L. longiloba* and *L. superba*, but the habit is much more bushy.

This species has in the past been confused with several other species, and wrong identifications were often made. This has suggested that this species was more widespread than it actually was. However, it was apparently once common in the small area between Meenaar, Meckering and Northam in south-western Australia, but it is now known from only two populations in farmland. Flowering is from late October to late December. It was first collected by James Drummond in 1837.

It is relatively frequent in cultivation, and this is essential to its continued survival.

***Lechenaultia linarioides* DC.**

Yellow *Lechenaultia*

An intricately-tangled much-branched sub-shrub that can grow to 1 m high and 1.5 m diameter, often suckering, with the branches ascending from the base but curved downwards near the tips. The leaves are scattered on the stems and branches but are crowded on the branchlets, somewhat fleshy, linear to terete, and 8-12 mm long. The flowers are tubular, 16-22 mm long, on ovaries 9-12 mm long. They are yellow on two of the petals and deep pink to purplish-red on the other three, and cover the plant when in full flower. The flowers may become redder with age. Three of the petals curve downwards at the top of the tube, with the other two erect and enclosing the tip of the style. The arcuate branches are unique within the genus.

This species is widespread along the south-western Australian coast between Perth and Kalbarri, and it also occurs in the Shark Bay area. It grows in sand, usually over limestone, in heath, scrub or rarely woodland. Flowering occurs sporadically throughout the year, but it is most profuse between early August and early December. It was first collected by James Drummond near Perth in 1837.

The species is not common in cultivation, but deserves to be from the distinctive bushy habit and brightly coloured flowers.

***Lechenaultia ionglloba* F. Muell.**

Irwin *Lechenaultia*

A procumbent sparsely-branched herb or sub-shrub that can grow to 30 cm high and 30 cm diameter, often suckering. The leaves are not very crowded, somewhat fleshy, linear to terete, and vary from 10 to 26 mm long. The flowers are tubular, 25-35 mm long, on ovaries 15-20 mm long. They are pale yellow or green and usually suffused with deep pink or red towards the edges, so that some flowers are completely red, and are scattered over the plant. Three of the petals are spread outwards at the top of the tube, and the other two are erect. The flowers are very similar to those of *L. laricina* and *L. superba*, but the habit is much more prostrate. The flower is shown in close-up in the colour plate on page 97 and the way these flowers are attractively presented, on page 57 of Issue No. 94.

This is a rare species, being restricted to a small area between Mullewa and Dongara in south-western Australia, where it grows in sand in heath. It is now most common along roadsides. Flowering is usually from late July to early October, but it sometimes continues sporadically until early December. It was first collected by James Drummond between 1850 and 1851.

It is not known to be in wide cultivation, but it needs to be to ensure its survival, and it would seem to be an ideal subject due to its large bright flowers.

***Lechenaultia lutescens* D. Morrison and R. Carolin**

A virgate moderately-branched herb or sub-shrub that can grow to 30 cm high and 30 cm diameter. The leaves are not crowded, rigid, linear, and usually 14-21 mm long. The flowers are open, 16-22 mm long, on ovaries 7-11 mm long. They vary from orange-yellow through (usually) pale yellow to creamy white, and

are scattered over the plant. Only three of the five petals have wings. The flowers and habit are similar to those of *L. heteromera*, but the petals are yellowish rather than bluish.

This species is widespread in the western arid and semi-arid areas of central Australia, occurring in Western Australia and the Northern Territory. It grows in sand or around the edge of lateritic breakaways, in grassland or open scrub. Flowering apparently occurs sporadically, perhaps only after rain. This species was not first collected until 1966, when Alex George found it at three different places along the northern edge of the Great Victoria Desert. It was described in 1986.

It is not known in cultivation, but may do well in dry areas.

***Lechenaultia macrantha* K. Krause**

Wreath *Lechenaultia*

A procumbent sparsely-branched sub-shrub that can grow to 15 cm high and 90 cm diameter, growing annually from a rootstock. The leaves are crowded, somewhat fleshy, linear, usually 25-45 cm long, and all erect. The flowers are tubular, 25-35 mm long, on ovaries 17-23 mm long. They are yellow, often suffused with deep pink or red, especially on the wings. Three of the petals spread outward at the top of the tube, with the other two erect. The flowers are massed around the perimeter of the prostrate plant, so that the plants look exactly like a wreath lying on the ground. This habit is very distinctive, and it can look quite spectacular, as the plants usually occur grouped together in open patches in the vegetation. The plants die back over summer, and then grow again during autumn. A colour plate in Issue 94, page 58, shows this to perfection.

This species occurs in south-western Australia between Talling Peak and Coorow, with a few outlying populations further north. It grows in sandy or red gravelly soil, and flowers from mid August to late October. It was first collected by Max Koch, who found it near Jibberding in 1905.

It is not common in cultivation, but the unusual flowering habit suggests that it should be.

***Lechenaultia ovata* D. Morrison**

A grass-like sparsely-branched herb that can grow to 15 cm high and 15 cm diameter, and that probably grows annually from a rootstock. The leaves are not crowded, somewhat fleshy, up to 7-10 mm long, and are unique within the genus in being ovate rather than terete or linear. The flowers are more-or-less open, as three of the petals spread outwards, while the other two are erect and strongly coherent along the adjacent margins by interlocking hairs. The erect petals are usually without wings, and the flowers are white, about 8-10 mm long, on ovaries 17-24 mm long, and are scattered over the plant. The plants are very similar to *L. filiformis*, but the flowers and leaves are smaller and the leaves are a different shape.

This species is known from only one population near Kakadu National Park in the Northern Territory, where it was found in 1973 by Lyn Craven. It was described in 1987.

***Lechenaultia papillata* D. Morrison**

A moderately-branched sub-shrub or small shrub that can grow to 45 cm high and 40 cm diameter. The leaves are crowded, somewhat fleshy, terete, and 2-3 mm long. The flowers are open, 11-14 mm long, on ovaries 5-8 mm long. They are pale blue, with the wings on two of the petals being distinctly smaller than those on the other three, and cover the plant when in full flower. The leaves, sepals, and ovaries are covered with small translucent bumps, which is unique within the genus.

This species occurs in the drier parts of inland south-western Australia between Newdegate and Mount Ragged. It is found in sand or gravel, usually in heath, scrub or mallee, and flowers from late October to late November. It was first collected in 1964, when it was collected independently by John Beard, Charles Gardner and Frank Lullfitz at three different localities. It grows in the same area as *L. brevifolia*, which was not frequently visited until recently, and was finally described in 1986.

It is not known in cultivation, but is similar to *L. floribunda* in appearance and may do better in drier areas.

***Lechenaultia pulvinaris* C. Gardner**

Cushion Lechenaultia

A spiky cushion-like much-branched sub-shrub that can grow to 15 cm high and 30 cm diameter, often with the stems underground. The leaves are crowded, rigid, linear to narrow triangular, 4-9 mm long, and hairy. The flowers are open, 9-11 mm long, on ovaries 5-6 mm long. They are pale blue or purple around the edge and pale yellow in the middle, and cover the plant when in full flower. All of the petals have wings up to 1 mm wide. The habit is almost identical to that of *L. tubiflora*, while the flowers are similar to those of *L. expansa*.

This species is known from a couple of disjunct areas south-east of Perth, where it occurs principally in open areas around the edges of a number of conservation reserves, although it appears to become absent as the vegetation becomes denser with age. It flowers from mid October to early December.

This species was first collected in 1893 by Michael Cronin, and the specimen was sent to Ferdinand von Mueller in Melbourne. He intended describing it as a new species (*L. croniniana*), but it remained undescribed when he died in 1896, as did many of the specimens sent to him after 1880. The species was then not re-discovered until Charles Gardner found it in 1961, and he described it three years later. See the colour plate on page 100.

It is not common in cultivation, but deserves to be so as the echidna-like habit and mass of blue-purple flowers are very attractive. The species has been gazetted as rare flora, and it cannot be collected without a special permit.

***Lechenaultia stenosepala* E. Pritzel**

Narrow-sepaled Lechenaultia

A diffuse sparsely-branched herb or sub-shrub that can grow to 40 cm high and 70 cm diameter, often suckering. The leaves are crowded on short stems and scattered on the flowering stems, fleshy or somewhat rigid, linear, and about 7-13 mm long. The flowers are open, and vary from blue through pale blue to creamy white, the midrib and edges often outlined in a darker blue, and the

flowers sometimes have yellow spots in the middle. All of the petals have wings up to 2 mm wide. The flowers cover the plant when in full flower, and vary in size from 13 to 19 mm long, on ovaries 9-18 mm long, with the larger flowers and leaves occurring on plants in the northern part of the distribution. The habit is similar to that of *L. juncea* and *L. striata*, but the flowers are more like those of *L. expansa*. The colour plate on page 108 is of a white flowered young plant.

This species is common in south-western Australia between the towns of Three Springs and Gingin, where it occurs in sand or sandy gravel in heaths. Flowering is from early October to mid December. It was first collected by Ludwig Diels near Dandaragan in 1901.

It is not known in cultivation.

***Lechenaultia striata* F. Muell.**

Striate-stemmed Lechenaultia

A virgate sparsely-branched sub-shrub that can grow to 60 cm high and 60 cm diameter. The leaves are crowded on short stems and at the base of the flowering stems, fleshy, terete, and 10-21 mm long. The flowers are grouped at the top of almost leafless flowering stems, open, 14-18 mm long, on ovaries 12-16 mm long. They vary from pale blue through pale yellow to creamy white, and only three of the five petals have wings. The flowers and habit are very similar to those of *L. juncea*.

This species is widespread in the western arid and semi-arid areas of central Australia, occurring in Western Australia, the Northern Territory and South Australia. It grows on the upper half of deep red sand dunes in grassland or scrub. Flowering is sporadic, and may occur only after rain. It was first collected by Ernest Giles near the Olgas on his second expedition into the area between 1873 and 1874.

It is not known in cultivation.

***Lechenaultia subcymosa* C. Gardner and A. S. George**

Wide-branching Lechenaultia

A divaricate sparsely-branched herb or sub-shrub that can grow to 30 cm high and 30 cm diameter. The leaves are crowded on short leafy stems, rigid, linear, and 7-11 mm long. The flowers are grouped on almost leafless stems, open, 14-19 mm long, on ovaries 7-14 mm long. They vary from pale mauve to creamy white. Only three of the five petals have wings. The flowers are very similar to those of *L. juncea* and *L. striata*, but the divaricate habit is distinctive.

This species occurs in Western Australia on North West Cape and on the islands and coastline of Shark Bay. It grows in sand or loam over limestone, in shrubland. Flowering apparently occurs sporadically (perhaps only shortly after a fire), but it is concentrated from late July to early October. It was not first collected until 1961, when Alex George found it south of Learmonth.

It is not known in cultivation.

***Lechenaultia superba* F. Muell.**

Barrens Lechenaultia

An erect moderately-branched shrub that can grow to 70 cm high and 50 cm diameter. The leaves are crowded at the ends of the branches, often being lost

on the lower parts, fleshy, linear to terete, and 11-22 mm long. The flowers are tubular, 17-23 mm long, on ovaries 8-10 mm long. They are yellow, often suffused with orange or red, so that some flowers are completely red, and are scattered over the plant. Three of the petals are spread outwards at the top of the tube, with the other two erect. The flowers are very similar to those of *L. laricina* and *L. longiloba*, but the habit is much more erect.

This rare species is confined to the eastern end of the Barrens range in south-western Australia, where it occurs on rocky quartzite hillsides in thick scrub. Flowering is usually from September to October, but it has been noted at other times. It was first collected in 1863 by George Maxwell.

This species is not widely cultivated, but probably should be, as the erect stems and bright flowers make a most attractive display. The species has been gazetted as rare flora, and cannot be collected without a special permit.

***Lechenaultia tubiflora* R. Br.**

Heath *Lechenaultia*

This is either a spiky cushion-like sub-shrub up to 15 cm high and 30 cm diameter, often with the stems underground, or an erect small shrub to 70 cm high and 60 cm diameter. The leaves are crowded, rigid, linear to triangular, and 7-11 mm long. The flowers are tubular, 13-17 mm long, on ovaries 3-6 mm long, with all of the petals held erect. The flowers vary from bright red through pale yellow and pale greenish-cream to creamy white, and if they are yellow or white then they are often suffused with orange, red or blue around the top. They cover the plant when in full flower. The habit and thin tubular flowers are a unique combination within the genus.

The larger shrubby plants with erect stems have greenish-cream flowers, and are confined to the south-western Australian coast between Albany and Cape Le Grande, while the prostrate plants are common throughout south-western Australia between Coorow and Israelite Bay. The plants are found in sandy heaths and woodlands, especially in open areas. Flowering occurs sporadically throughout spring and summer, but it is most profuse from late September to early December. It was first collected by Robert Brown when he collected near Albany in 1801.

This species is not common in cultivation, but it deserves to be, as the echidna-like habit and range of bright multi-coloured flowers are very attractive. ■

Growing *Lechenaultia*

Editor summarises

All *Lechenaultia* are ideal for pot culture. Opposite we provide the latest research results on a suitable potting media. Even this may be a little heavy for a beginner. The simplest way is to go out and buy a good potting mix, pot up your plant and enjoy the splendour of it. In our No. 107 issue we describe and illustrate how to grow these plants in hanging baskets.

To grow them in the ground, emulate the pot culture technique. For clay soils, form a mound of sandy soil, plant and watch the plant flourish. You will need to water to get established preferably by sinking in a tin without a bottom, adjacent to the plant and filling the tin with water each day. For people with sandy soil, form a mound of good garden loam and water as described above. Full sun is essential. ■

Potting Media — 2*

by E. James and D. V. Beardsell

Research work at the Horticultural Research Institute, Knoxfield, Vic., has led to the following suggestions for potting media and fertilizer programmes. Good results will only be obtained with changes to the potting media if the individual characteristics and requirements of the materials used are understood. It should be remembered that altering ingredients or their ratios in the potting media may necessitate changes to other nursery procedures such as the quantity of base fertilizer to be used and the frequency of watering and liquid feeding. We suggest that growers contemplating changes to their media first experiment on a small scale to test the suitability of such changes to their own conditions of management.

GROWING MEDIA

The following media contain very little if any soil. This is because the use of soil-less media minimizes the spread of soil-borne pathogens. In addition, soil-less media can often be obtained readily and at a consistent quality. Growing media are listed in Table 1. These media have given good results at the Horticultural Research Institute, Knoxfield, for a wide range of plant species. For specific species or production practices, minor alterations to these basic mixtures may be applicable.

1. Potting medium

8 parts pinebark (6 mm and less): 3 parts coarse, washed river sand: 1 part lignapeat (or good quality loamy soil).

For epiphytes, very long term crops and plants which require extra drainage, add 1-2 parts perlite or 1-2 parts rice hulls. However, some extra nitrogen may be required if using excessive amounts of rice hulls. To increase the waterholding capacity and reduce aeration, add more lignapeat or loamy soil (including *good* quality sandy loam).

2. Cutting media

(a) Mist propagation: Suitable media are

- i) 2-3 parts coarse, washed river sand: 1 part German peat moss
- ii) 1 part coarse sand: 1 part peat moss: 1 part perlite
- iii) 1 part peat moss: 2-3 parts polystyrene

(b) Propagation without misting: A suitable medium is 1-2 parts coarse sand: 1 part peat moss: 1 part vermiculite.

3. Seedling Medium

A suitable mix is

2 parts coarse sand: 1 part peat moss: 1 part vermiculite.

*Part 1 of this series is in our No. 109 issue and describes the characteristics desirable in a potting media. It will be noted that the series is really intended for the commercial nurseryman as most gardeners do not have these materials readily available. There are many good potting mixes on the market and this will give a guide to selection. However, there are many important factors to be understood, such as fertilisation. Trade names are included for the benefit of the reader and do not infer any endorsement or preferential treatment of the products listed by the Victorian Department of Agriculture and Rural Affairs.

FERTILIZER PROGRAMMES

Soil-less media provide few nutrients so all of the plant's requirements must be added as fertilizers. In formulating fertilizer programmes it is assumed that the chosen potting medium provides sufficient water and air for plants. Essential elements other than carbon (C), hydrogen (H) and oxygen (O) are usually grouped into major and trace elements depending on the quantity required by plants. Major elements are nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg), sulphur (S) and iron (Fe). Iron is normally considered to be a trace element but is listed here as major because it needs to be supplied to most containerized plants in fairly large quantities. Minor or trace elements are boron (B), copper (Cu), zinc (Zn), molybdenum (Mo) and manganese (Mn).

A number of native Australian plants have evolved in conditions of low soil phosphorus. They are unable to cope with normal amounts of phosphorus supplied in complete fertilizers or in superphosphate. Most of them occur in the family Proteaceae which includes *Grevillea*, *Banksia*, *Hakea*, *Dryandra*, *Adenanthos*, *Isopogon* and also South African species such as *Protea*, *Leucodendron* and *Leucospermum*. Species sensitive to P can also be found in the Australian members of the family Fabaceae. For P sensitive species, a special low phosphorus fertilizer is required.

The most common deficiencies of plants in containers are nitrogen, iron and oxygen. The most commonly encountered toxicities are ammonium and phosphorus but toxic salting may also be caused by a massive overdose of almost any fertilizers. It is important to remember that regular watering will help to avoid the latter condition. Also, some problems attributed to nutrition may, in fact, be caused by pests, diseases, poor light, low temperatures or spray damage.

There are four main ways of supplying fertilizers to container plants.

These are:

1. In the basic mixture
2. As a top-dressing of solid fertilizer
3. As a liquid fertilizer
4. As a foliar spray

FERTILIZER IN THE BASIC MIXTURE

Plants are often grown from a seedling or struck cutting to a saleable size using no more fertilizer than is contained in the basic mixture. This is possible through the use of solid fertilizers with regulated release rates which can adequately supply nutrients for periods from six weeks to 12 months.

The problem facing the grower is to select the fertilizers with release rates to suit the particular plants being grown. Phosphorus should be avoided for native plants, especially those in the family Proteaceae although some Myrtaceous species may respond to low levels of phosphorus. The following basic fertilizer rates have been successfully used.

1. Seedlings

(annuals and bedding plants with a crop life of 6-8 weeks)
0.5 kg/m³ Micromax

- 2.0 kg/m³ Osmocote 17:1.6:8.7 (8-9 month)
- 2.0 kg/m³ Dolomitic lime

This mixture allows early rapid growth followed by a period of hardening-off. However, many native plants respond to liquid feeding soon after germination.

2. Cuttings

- 2.0 kg/m³ Osmocote 17:1.6:8.7 (8-9 months)
- Grow species with and without fertilizer to determine preference.

3. Short-term Crops — with a crop life of 3-5 months.

- 0.5 kg/m³ Ammonium nitrate
- 1.0 kg/m³ Osmocote 14:6.1:11.6 (3-4 month)* or Nutricote 16:4.4:8.3
- 2.0 kg/m³ Osmocote 17:1.6:8.7 (8-9 month) or Nutricote 16:4.4:8.3
- 2.0 kg/m³ Dolomitic lime
- 0.5 kg/m³ Micromax
- 0.2 kg/m³ Sequestrene 138 Iron Chelate

*Note: this fertilizer has a high release rate for phosphorus.

4. Medium-term Crops (crop life of 6-10 months)

- 1.0 kg/m³ Osmocote 14:6.1:11.6 (3-4 month) or Nutricote 16:4.4:8.3
- 3.0 kg/m³ Osmocote 18:4.8:8.3 (8-9 month) or Nutricote 16:4.4:8.3
- 2.0 kg/m³ Dolomitic lime
- 0.5 kg/m³ Micromax
- 0.7 kg/m³ Osmocote coated iron or GU49 iron oxide

5. Long-term Crops (native palms, conifers, slow growing indoor plants) — with a crop life of 12-15 months

- 1.0 kg/m³ Osmocote 14:6.1:11.6 (3-4 month) or Nutricote 16:4.4:8.3
- 1.0 kg/m³ Osmocote 18:4.8:8.3 or Nutricote 16:4.4:8.3
- 2.0 kg/m³ Osmocote 17:4.3:8.2 (12-14 month)
- 2.0 kg/m³ Dolomitic lime
- 0.5 kg/m³ Micromax
- 0.7 kg/m³ Osmocote coated iron or GU49 iron oxide

6. Phosphorus Sensitive Plants (e.g., family Proteaceae and heathland plants, also *Acacia suaveolens*, *A. stricta*, *A. baileyana*, *Pultenaea pedunculata*, *Brachysema* spp.)

- 3.0 kg/m³ Osmocote 17:1.6:8.7 (8-9 month)
- 2.0 kg/m³ Dolomitic lime
- 0.5 kg/m³ Micromax
- 0.7 kg/m³ Osmocote coated iron or GU49 iron oxide

Note: kg/m³ = g/litre

- 12.5 cm (5" pot) = 0.8 litre
- 15 cm (6" pot) = 1.2 litre depending on manufacturer
- 20 cm (8" pot) = 4.3 litre
- 25 cm (10" pot) = 7.0 litre

FERTILIZER AS A TOP-DRESSING

Plants can vary considerably in their requirements for fertilizers. This can present problems for the grower who produces a large range of species. It may not be possible to produce optimum growth over the whole range using a single base mix unless some form of top-dressing is used.

The basic fertilizer should be designed to produce close to optimum growth for plants with moderate fertilizer requirements but not to injure those with low requirements. The plants with high requirements can then be selectively top-dressed at one of the following suggested rates.

1. 2.0 g/litre Osmocote 22.5:0:0 (especially for phosphorus sensitive plants). Provides only N.
2. 2.0 g/litre Osmocote 18:4:8:3. Provides N, P and K.
3. 1.0 g/litre Isobutylidene diurea (I.B.D.U. slow release nitrogen. Care should be taken on species thought to be ammonium sensitive).
I.B.D.U. can be used in the basic mix but preferably at no more than 1 kg/m³.

For iron deficiency, use 1.0 g/litre Osmocote coated iron.

FERTILIZER AS A LIQUID FEED

Liquid fertilizing, as normally practised in Australia, is used to supplement the fertilizers in the basic mixture. Sometimes the complete programme is supplied via the whole irrigation system, but this does not allow much flexibility in the management of plants with varying nutrient requirements. A grower with a wide range of species would be better served with a diluter which can be attached to irrigation outlets so that individual groups of plants can be fed.

There are a number of commercial products in powder or liquid form which can be used to make up complete solutions for liquid fertilizing. Often, however, only nitrogen and potassium (no phosphorus) are needed. The following formulation can be used to supply those elements. Iron may also be included if required. Native plants grown from seed often respond to liquid feeding soon after germination because of the small nutrient reserves in small seeds.

Example of a suitable N.P.K. plus iron liquid fertilizer.

- 1.0 g/litre Ammonium nitrate
- 0.5 g/litre Potassium sulphate
- 0.1 g/litre Mono-ammonium phosphate (*Delete* for phosphorus-sensitive plants)
- 0.2 g/litre Sequestrene 138 Iron chelate (*Delete* if not required)

Many commercial preparations contain high levels of ammonium. It is preferable to have approximately equal amounts of ammonium and nitrate.

FERTILIZER AS A FOLIAR SPRAY

Plants can take up nutrients through their leaves. However, they are more efficient at taking the nutrients through their roots. Foliar sprays should therefore only be used for supplementary feeding to correct specific nutrient deficiencies. It may also be found that foliar sprays are only effective on certain species.

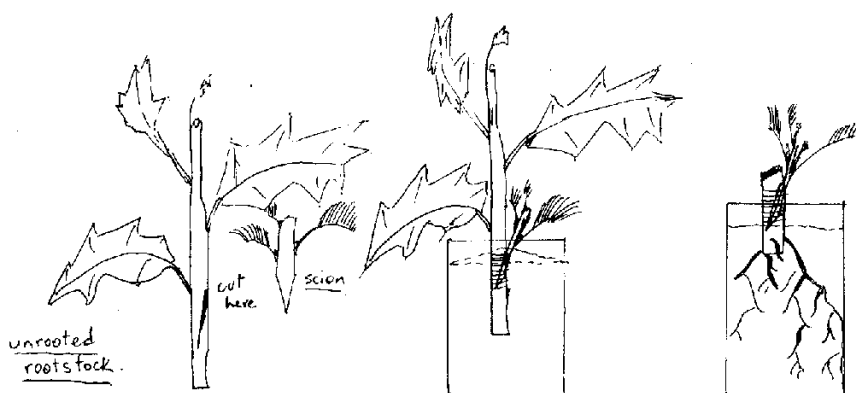
SUMMING UP

Most plants are fairly adaptable and will tolerate variations in nutrient levels on either side of the optimum. In general, provided that plants are supplied with all the major and minor nutrients in sensible proportions they will grow satisfactorily. For top quality plants, each individual grower may have to make minor adjustments to fertilizer programmes to suit particular conditions and species. Most importantly, if changing any aspect of production, it is essential to overhaul the system as a whole to ensure that it remains an integrated management for the production of quality plants. ■

THE CUTTING GRAFT

By Don Burke

Commercially, the method that has the most promise is called the Cutting Graft. This involves joining two pieces of plant material and striking them as a joint cutting. There are two methods: the *side graft* and the *top Cleft (Top Wedge)*. The *side graft* is in my opinion by far the best. With this method, you take a cutting of say *Grevillea robusta* and make a 1-2 cm cut downwards into the stem. This cut should not be deeper than half way through the stem. A piece of the other plant of the same diameter as the *G. robusta* is trimmed to a wedge shape and inserted into the cut; the union is then secured with a packing tape. (I use bits of tape cut to about 3-5 mm x 20 mm long). Since the stems of both pieces of wood used in the graft are of the same diameter, aligning the cambium is not necessary. Just fit the pieces together cleanly. This is quick and easy, requiring no skill.



The Y-shaped result is then placed in a sand peat cutting mix with the fork of the Y (the graft) submerged in the mix. This should be done under the mist in a glasshouse. When the plant has rooted, it is potted on, at which time the undesired top is cut off and the graft union is exposed to the air (i.e. the plant is potted about 1 cm higher than before). If roots have emerged from the top plant, these can be rubbed off at this stage also. From this point on the composite plant is treated like any ordinary cutting grown plant. ■

Experiences With *Grevillea* Cutting Grafts

By Tom and Pip Gibian

These comments apply to cutting grafts only. Our experiences with cutting grafts are strictly experimental as yet. However, our confidence (and competence) in the technique are increasing with time and practice. The technique called the side cutting graft is clearly superior to the top wedge. This is mainly due to the fact that the scion does not dry out provided the Y-shaped graft is placed so the fork of the Y is in the sand peat propagating mix. Conversely, with top wedge cutting graft, we found that the scion consistently wilted and died, even in the misting igloo. Perhaps we need a bell jar over these type of grafts.

We have tried the following *Grevillea* rootstocks:

G. robusta: Too slow and difficult to strike.

G. barklyana: strikes fairly quickly, stem size good, especially for larger species. Main drawback is that it is fungus prone.

Grevillea 'Canberra Gem': Has small stems which are fiddly and prickly. Otherwise it has easily been the best stock for smaller stemmed species such as *G. alpina* varieties and *G. lavandulacea*. It strikes quickly, is fairly fungus resistant and forms a vigorous mat of roots.

Grevillea 'Poorinda Royal Mantle': Is rather slow to strike, but otherwise fulfils criteria adequately. Again, too little experience for comment by us.

Our success rate does not as yet compare favourably with approach grafting (using two living plants). However we are seriously considering propagating our future *G. alpina* varieties and some *G. lavandulacea* varieties as side cutting grafts on *Grevillea* 'Canberra Gem'.

Death of the graft due to inadequate hardening, mainly in hot weather seems the main problem. *Graduated hardening of grafts is essential*, much more so than ordinary cuttings. December, January and February are difficult months.

Scion may strike with or without the rootstock. Careful inspection and gentle removal of any scion roots is required when potting up. Graft site should be elevated above the soil level at this time, although temporary heaping up of soil over graft site during hardening period may be helpful.

GOOD LUCK! ■

Grafting Tapes

by Doug McKenzie

Basically, I use the same method on all plants that I graft. I tie the plants with a plastic tape. Many types are suitable and I have found it is largely a matter of which is found to be easiest and what one gets used to. There are many thin plastics around that are suitable and can be cut into thin strips. Unfortunately, some are electrostatic and are difficult to use because they are attracted to either your fingers or the plant that is being taped and they don't always go exactly where you want them to go. Some tapes I have used are:

STERICREPE — a self-adhesive bandage used for medical uses — sticks well to itself but is rather thick. It can be moulded around the graft.

THIN PLASTIC BAGS — such as those used in supermarkets — some of these are good and strong and very thin when stretched.

GLAD WRAP type plastics — very thin and suitable if the plant material being tied is very soft — the glad wrap breaks before too much pressure is applied to damage the soft stem tissue.

FLORIST'S TAPE — a waxy tape sold to wrap the stems of flowers. This can be stretched to be quite thin and cut into strips. Being waxy it seals well.

PLUMBER'S TEFLON TAPE — very thin but highly electrostatic and difficult to use.

PARAFILM — a waxy plastic film. It will stretch and adheres to itself well. Cut into thin strips before stretching. *Nescofilm* is similar.

When grafting, I always change the glass bottle or plastic covering at least once a day and for some difficult species twice a day, morning and night. I find that if I leave the glass over the plant, fungal problems easily develop in the stagnant humid air. I am also very careful with hygiene — all seedlings before grafting are treated with an anti-damping off systemic fungicide — I use PREVICUR but I am also experimenting with FONGARID (RIDOMIL) for some species. Glass jars are sterilised often. New pots and sterilised soil are used. I also use Benlate several times on the grafted seedlings while they are under humidity. As you may gather all these procedures (especially changing the plastic and glass coverings) are very time consuming but I have found they help eliminate fungal problems and my success rate is much better. ■

Exotic and Other Eucalypts Occurring Naturally Outside Australia

by Peter M. J. Fisher

There are seven hundred or so species of *Eucalyptus* but only a handful (13) occur naturally outside Australia. Most of these are shared with Cape York Peninsular or Northern Australia, frequenting similar habitats in southern Papua and Irian Jaya. Torres Strait is very shallow and has, with fluctuating sea levels, been replaced by a land bridge at various environmental epochs. The Malesian rain-forest which luxuriates on the east-west mountain range in PNG-Irian Jaya and in which Eucalypts do not occur, seems to have formed an uncrossable barrier. The truly exotic Eucalypts, *E. urophylla*, *E. deglupta* and *E. alba*, are therefore a remarkable oddity. *Eucalyptus* species that occur outside Australia, are:

Species	Extra-Australia Distribution	Distribution In Australia	Subgenus, Section (Pryor & Johnson, 1975)
<i>Eucalyptus</i> sp. nov.?	PNG, I ₃ (?)		<i>Corymbia</i> , <i>Rufaria</i>
<i>E. polycarpa</i>	PNG, I ₃ (?)	NWA, NT, Q, NSW	<i>Corymbia</i> , <i>Rufaria</i>
<i>E. sp. nov. aff. polycarpa</i>	PNG, I ₃ (?)	NQ	<i>Corymbia</i> , <i>Rufaria</i>
<i>E. papuana</i>	PNG, I ₃ (?)	NT, NQ	<i>Blakella</i>
<i>E. confertiflora</i>	PNG, I ₃ (?)	NWA, NT, NQ	<i>Blakella</i>
<i>E. urophylla</i>	I ₁		<i>Symphomyrtus</i> , <i>Transversaria</i>
<i>E. pellita</i>	PNG, I ₃	NQ	<i>Symphomyrtus</i> , <i>Transversaria</i>
<i>E. alba</i> var. <i>platyphylla</i>	PNG, I ₃ (?)	NQ	<i>Symphomyrtus</i> , <i>Exsertaria</i>
<i>E. alba</i>	I ₁	See Note A	<i>Symphomyrtus</i> , <i>Exsertaria</i>
<i>E. tereticornis</i>	PNG, I ₃ (?)	Q, NSW, V	<i>Symphomyrtus</i> , <i>Exsertaria</i>
<i>E. brassiana</i>	PNG, I ₃ (?)	NQ	<i>Symphomyrtus</i> , <i>Exsertaria</i>
<i>E. leptophleba</i>	PNG, I ₃ (?)	NW	<i>Symphomyrtus</i> , <i>Adnataria</i>
<i>E. deglupta</i>	PNG, I ₂ , P		<i>Symphomyrtus</i> , <i>Equatoria</i>

Distribution Codes: PNG — Papua New Guinea; I₁ — Indonesia (Lesser Sunda Is); I₂ — Indonesia (Sulawesi, Seran, Irian Jaya); I₃ — Indonesia (Irian Jaya); P — Philippines (Mindanao); NC — New Caledonia, and in Australia: NSW — New South Wales; V — Victoria; NWA — N. Western Australia; NT — Northern Territory; NQ — N. Queensland; Q — Queensland.

Compilation by: Peter Weston, National Herbarium of New South Wales.

Note A: There are populations that have been called *E. alba* in NWA, NT and NQ. These are not conspecific with *E. alba*.

This distribution is bounded in the north-west by Wallace's Line — a zoogeographical boundary running NNE between Bali and Lombok, Borneo and Sulawesi then turning east toward Mindanao. Wallace's Line, the line of contrast in flora/fauna diversity, separates the broad, stable continental area of Asia (Sundaland) from the linear unstable oceanic island-arc system, Powell *et al.* (1981) viz. the Seasonal Forests Belt running from the Lesser Sunda Islands, through Sulawesi to Mindanao, Whitmore (1982). Whereas many Asian groups penetrate across Wallace's Line, notably into PNG/Irian Jaya, few Australian/Papuan groups go the other way. The marked difference in the number of taxa either side of the line reflects these contrasting environments and marks the edge of the intermitantly exposed Sundaland continental plate¹ the south-east corner of which nearly collided with the Australasian continental plate comparatively recently in geological/biological time, some 15M years ago in the late Cenozoic.

¹ This may be an over-simplification. Recent work in plate tectonics has indicated that Borneo could be a fragment from some other plate, Weston (1986). This is a complex field of study marked by frequent revisions to our understanding.

Eucalyptus are a part of the sclerophyll flora which evolved from the Gondwanaland component over the long period of Australasia's remote isolation in the South Seas. Fossil records and other considerations indicate that the genus began to proliferate in the latter part of the tertiary period of the earth's development. Current scientific understanding is that in the late Cenozoic, the Australasian land mass was at its closest point of approach to the Malay archipelago and the relatively small sea distances would have permitted penetration by the Australian-Papuasian group (including some sclerophyll Myrtaceae) into the Seasonal Forests Belt and less successfully, into Sundaland.

The Exotics

(a) *Eucalyptus urophylla*

This species occurs on Timor and the other Lesser Sunda Islands such as Flores, Solor and Wetar. It has close affinities, both morphological and ecological, with *E. pellita* which occurs both on Cape York Peninsular and Papua-New Guinea/Irian Jaya. It is remarkable in that it colonises sites (on Timor) ranging from sea level to 2500 m.

Since *E. urophylla* and *E. pellita* must have had a common forerunner, *E. urophylla* would appear to have migrated (island-hopped) to Timor/Sunda Islands from Cape York. Pryor and Johnson (1981) have reported that a species reminiscent of *E. urophylla* was recorded in the drier parts of S.E. Irian Jaya in 1954 and *E. pellita* is now recorded for PNG.

As far as can be ascertained, *E. urophylla* has not, hitherto, been cultivated in Australia. It was introduced into Brazil in 1919 at the famous arboreteum created by Navarro de Andrade at Rio Claro in Sao Paulo, Pryor (1975). The author germinated seed of the species obtained from Flores Island in 1982 which has thrived in both pot and ground culture in Melbourne and Canberra. This is not surprising given its ability to colonise a wide spectrum of temperature regimes in Timor, coupled with the fact that a species closely related to *E. pellita* extends from S.E. Queensland to as far south as the Victorian border.

E. urophylla is an attractive specimen tree with bright green leaves and symmetrical branching reminiscent of Liquidambar. It deserves wider cultivation.

(b) *Eucalyptus deglupta* (Kamarare, PNG; Leda, Indonesia; Bagnas, Philipp.)

This species has a much wider (discontinuous) spread than *E. urophylla* occurring in Mindanao (Philippines), Sulawesi (Celebes), Seran (Ceram) and Irian Jaya in Indonesia, and parts of the mainland and New Britain in Papua New Guinea. Over this range it shows some interpopulation differences in morphological detail and growth responses. These differences are such that, within PNG, Blakely (1955) had identified the stunted, population occurring in the north east as a distinct species, *E. schlechteri* or New Guinea Gum, Yaueib (1983).

E. deglupta is an inhabitant of the lowest wet tropics where it is found on the perimeter of rainforests but it can occupy sites up to 1800 m. It is exceedingly fire sensitive having a bark only 3 mm thick and will die from the effects of small grass fires at its base when planted away from its natural habitat.

In some respects, *E. deglupta* is unlike any other eucalypt. Pryor and Johnson (op. cit.) have included it in the subgenus *Telocalyptus* which they assign to the *Symphyomyrtus* sub-alliance. Although it resembles the other three (Australian) species of the subgenus, (*E. brachyandra*, *E. ravertiana* and *E. howittiana*) in morphological characters, especially in florescence, flowers and fruits, *E. deglupta* differs considerably in appearance and ecology.

Blakely (op. cit.) had earlier associated *E. deglupta* with species now referred to the subgenus *Monocalyptus* but subsequent phytochemical analysis by Hills (1966) found that it did not contain the substance renantherin characteristic of the subgenus. As well, all other *Monocalyptus* species are absent from monsoonal regions. Because of its affinity in many characteristics, *E. deglupta* was transferred to *Symphyomyrtus* and to its own section, *Equatoria*. Recent findings by Pryor as communicated by Johnson (1986), suggest that *E. deglupta* can interbreed with other sub-genera in the *Symphyomyrtus* sub-alliance. A revision of Eucalypt classification may result in an upgrading of *E. deglupta* and the other three (Australian) species of *Telocalyptus*, to genus status.

E. deglupta is a truly tropical species which occurs in a pioneer phase leading by succession to a rainforest in wet tropical lowlands. The other exotic species and those species shared with Australia invariably occupy drier sites e.g. southern Papua-New Guinea and Irian Jaya.

The author has germinated the seed of the species from Mindanao in 1983 which has grown well in pot culture but is markedly checked by the cold of Melbourne winters at its early stages of growth. Mr Tony Bean (1986) is also growing the species at Nambour, Queensland, on a rather dry, winter-shaded hillside. These were severely cut back last year by frost but are now making steady progress, the tallest being 3 m high. The species was also grown for some years at the Royal Botanic Gardens, Sydney.

E. deglupta is invariably a stately tree in the wild with stands up to 70 m and 2 m girths — a tropical equivalent to the cool temperate Mountain Ash. Bark is decorticating with a highly attractive, multicoloured texture. New leaves on the Melbourne-cultivated saplings are very attractive being tinged red on the margins. The tree is one of the world's fastest growing and has been used as a major source of construction timber (e.g. poles and railway sleepers) in equatorial areas with rainfalls of 3000 mm or more.

Other eucalypts do not do so well in these latitudes unless they have the advantage of at least 600 m of altitude.

(c) *Eucalyptus alba* — (Tropical White Gum)

E. alba sensu lato occurs on Timor as well as Flores, Solor, Alor and Wetar of the Lesser Sunda Group of islands. *E. alba* is a complex possibly attributable to 4-5 species but if taken more broadly, then it could include Australian populations. Johnson (op. cit.) at present regards the latter as contributing several species of which the variant, *E. alba* var. *platyphylla*, of PNG and North Queensland, is but one. The variety *platyphylla* is in fact the species described by Blakely (op. cit.) as *E. platyphylla*. The populations in northern and north-west Australia called *E. alba* are not conspecific with *E. alba*.

E. alba is used as a forestry tree, the bark yielding 30% tannins. There is no record of its cultivation in Australia.

Reclassification: Redefining the Exotics?

Dr. L. A. S. Johnson and Mr. K. Hill of the National Herbarium of New South Wales, are currently revising the eucalypts. Some fairly radical changes could emerge from this re-examination of the various *Eucalypt* sub-alliances, described by Pryor and Johnson (1975) and similar treatment of Morley and Toelken (1983). In particular, the sub-genera of Pryor and Johnson will be upgraded to genera with substantial modification from Pryor and Johnson. The *Monocalyptus* sub-genus similarly upgraded would subsume the name *Eucalyptus* and be comprised of some 100 species. *Angophora* would retain its present separate genus status.

When this revision eventuates it will recognise the completely extra-Australian eucalypts as being in the genera *Symphomyrtus* and *Telocalyptus*, not in *Eucalyptus* at all. *Arillastrum* with one species, *Arillastrum gummiferum*, a tree with close *Eucalyptus* affinities recently discovered on New Caledonia, would constitute the remaining near-eucalypt exotic.

Arillastrum which is a member of a small alliance related to the *Eucalyptus* alliance and isolated for upwards of 60M years, has not developed the specialised, narrow lanceolate leaf characteristic of many *Eucalypts*.

There is a further tree in the *Leptospermoideae* with some eucalypt affinities namely *Eucalyptopsis papuana*, occurring in PNG. *Arillastrum gummiferum* together with *Eucalyptopsis papuana* and an Australian member of the *Eucalyptopsis* sub-alliance, *Allosyncarpia ternata* of Arnhem Land, are defined by a unique inflorescence and floral structure and a special hair-type.

However, there remains a great deal of field work to be done on tropical eucalypts/their generic successors, possibly leading to the description of further species.

Acknowledgement

The author is indebted to Dr. Peter Weston, Mr. Ken Hill and Dr. L. A. S. Johnson of the National Herbarium of New South Wales for their advice and review of the manuscript.

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Ornamental Eucalypts

The Project by W. H. Payne

Where are the northern Australians who love their *Eucalyptus*? We need your help. Previous issues of Australian Plants have awakened many people to the enormous potential of Australia's eucalyptus trees and encouraged them to join in a nationwide project to develop, by selection, dwarf forms with desirable horticultural characteristics. Suitable species from Tasmania, southern Australia and Western Australia have been shown in colour and these could become some of the most spectacular ornamental plants of the world.



Eucalyptus miniata

Photography by John Simmons

Pictured here is a small flowering tree of northern Queensland. It has good flower presentation, a pleasing canopy of leaves and a picturesque trunk.

All Australians — We Need Your Help

To develop hardy reliable plants we need to first select from the very best forms. Over the coming flowering season I hope you will all look around you and note any small growing flowering *Eucalyptus* trees. There are hundreds growing in gardens and parks throughout Australia. These are the survivors, trees that have grown when others have failed. They are not easy to grow and any that have prospered and formed a nice rounded canopy and flowered well, could well be the start of a whole new industry for Australia. Please advise the editor of your find and if possible, take a few photographs.

Western Australian people are especially urged to go out and seek, from their magnificent range of flora, those plants that are the very best say in stature and presentation of the leaf canopy, in flower size and colour and especially, those that are low growing.

Northern Australians! You have some magnificent flowering *Eucalyptus* species there including *Eucalyptus miniata* featured in colour on the previous page, *Eucalyptus ptychocarpa* a dwarf free-flowering tree, very widely grown in Queensland as an ornamental, *E. phoenicea* that extends right across the top to Darwin, *E. setosa*, usually white but with some excellent pink and red colour forms, *E. pachyphylla* that occurs, among other places, along the road side between Mt. Isa and the centre. In particular we need someone to find a good form of *E. pachyphylla*. Please get out this season and let us know about them. There must be someone up there who can loan us some good colour slides? or can have some taken.

And where do these species grow best? Who can advise of plants that flower well as far south as Brisbane and further into the cold? Queenslanders, please help us to promote your plants.

And the Project? Firstly, do not fool ourselves, the obstacles ahead are enormous. We will grow hundreds of trees and many will fail. The few survivors represent success. Initially, people engaged in the project are growing plants from seed as this was the only method of propagation generally available. To those pioneers already working on the project, good luck.

Modern propagation developments have evolved a mass production microculture system where plants are produced from fresh tissue. It is a very specialised technique requiring a lot of investment in plant and skilled labour. We have engaged four laboratories to produce plants for us. The first generation will not be available until 1989 and these will be distributed at \$1.00 for each tubed plant.

To produce this first generation of plants we need your help, as above, to find the very best forms with which to start. Australians, it is up to you. Go out and find them.

Eucalyptus rhodantha is a magnificent dwarf *Eucalyptus* with large red flower heads. We propose to feature this in an issue shortly. Will readers who have had any experience in cultivation of this species, or have good colour slides, please contact the Editor. Where are the best forms. In a letter from a competent observer, one of his comments was "The best example of *E. rhodantha* that I have seen was two years ago in a public lawn at either Ballarat or Bendigo. The tree was obviously well pruned and disease free". Readers in Ballarat and Bendigo please look around and observe. We must find this tree. It is exactly what we are looking for, a well presented mature tree, disease free. Where is it?

Eucalyptus dwyeri, a little known tree of NSW. Who knows where some small formed specimens are growing?

Trivia seems to be "in" at present and, as one who is always prepared to jump onto any bandwagon, here goes . . . "In whose honour was the genus *Darwinia* named?" All those who answered "Charles Darwin" go to the back of the class . . . the real answer later; but now, down to business!

Last time we looked at some eastern *Darwinia* for gardens. A few western ones are also adaptable.

Darwinia citriodora is probably the best known of all *Darwinia*. It is a beautiful foliage plant which may reach 1.5 metres high and wide. It usually remains dense to ground level and is a very under-rated garden plant. Flowers are terminal and surrounded by leafy bracts from which the orange/red styles protrude . . . not spectacular but who cares?

Darwinia oldfieldii is a small shrub usually less than 1 metre high with vivid clusters of red flowers held terminally on the ends of branches. This species appears to be reasonably hardy in a well drained sunny position. In my experience it doesn't seem to flower as well east of the Divide as it does to the west.

The really spectacular western *Darwinias* are the famed "Mountain Bells", including *Darwinia meeboldii*, *D. leiostyla* (colour plate on page 140), *D. macrostegia* and *D. hypericifolia*. These never fail to attract attention when they make an appearance at wildflower exhibitions but, regrettably, they can't be regarded as reliable on their own roots east of the Dividing Range (again, they do well on the other side of the range in suitable soils). At first sight the "Mountain Bells" appear nothing like their eastern cousins. But, if you pull off the colourful petal-like bracts you will find a cluster of small flowers inside very similar to the eastern species.

Some success has been achieved in growing these "Bells" in containers but you really need an open mix. Something like 40 to 50% peatmoss and the rest even-graded 5 mm gravel (no fines!) would be a good starting point. But to really grow the "Mountain Bells" successfully in the east you need to consider grafting.

Doug McKenzie, from Victoria, has reported the successful grafting of some 11 different *Darwinia* species. My own efforts are pitifully insignificant in comparison but, for the record, I have successfully used *D. citriodora* as a rootstock for *D. meeboldii* and *D. fascicularis* as stock for *D. hypericifolia*. In both cases grafts were done at the cutting stage (see page 119 for details). The "cutting graft" was then placed into a propagating frame and treated like any normal cutting. The normal "top-wedge" graft was used.

Finally, a word about *Homoranthus*. Unlike the closely related *Darwinia*, these do not occur in Western Australia. Most are confined to NSW and Queensland. My favourite *Homoranthus* (in fact one of my favourite plants) goes under the unfortunate name of *H. darwinioides*. If ever a plant cried out for a decent common name, this is it! Basically, the name means "a *Darwinia*-like *Homoranthus*" . . . which doesn't really help much seeing that all *Homoranthus* are "*Darwinia*-like". There's also *Darwinia homoranthoides* but that's another plant and another story. Anyway, *H. darwinioides* is a beautiful little shrub with very aromatic foliage and small, fringed bell-flowers which open white and age to red, particularly in cold climates. The effect is quite outstanding. The plant reaches about 1 to 1½ metres in height. See the photograph on the next page.

Oh! And the answer to the trivia quiz . . . "Dr Erasmus Darwin, Charles' grandfather. Now, if someone could just tell me what *Homoranthus* means. ■



Homoranthus darwinioides

Photography by Brian Walters

The Darwinia Book — This is available from the author, Trevor Blake, 22 Vista Avenue, East Ringwood, Victoria 3135 for \$7.00 including postage. A beautiful little book that describes and illustrates all the species of *Darwinia* and *Homoranthus* with beautiful clear sketches and many colour plates. Entitled "A Guide to *Darwinia* and *Homoranthus*", this 88 page (21 x 14 cm) book is excellent value. Let us support Trevor and his work by purchasing a copy.



Pultenaea procumbens

Photography by Colin Woolcock

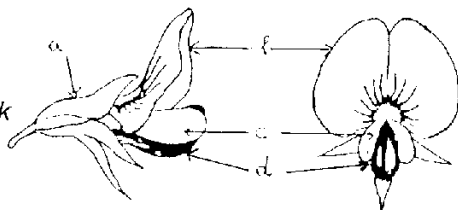
The yellow pea-flowered plants that abound in our bushland make ideal plants for the garden, none better than the above, mainly a prostrate plant. It is widely used in rockeries and as a ground cover. They are so easily grown from seed. Collect some of a yellow pea-flowered plant growing in the scrub next November/December and propagate your own plants as described in previous issues of Australian Plants.

Bush Peas

The Genus *Pultenaea* —

Part 6 by C. E. & D. T. Woolcock

a — the calyx cupping the flower
b — large petal — the standard
c — two petals — the winging keel
d — two petals — non-shielded keel



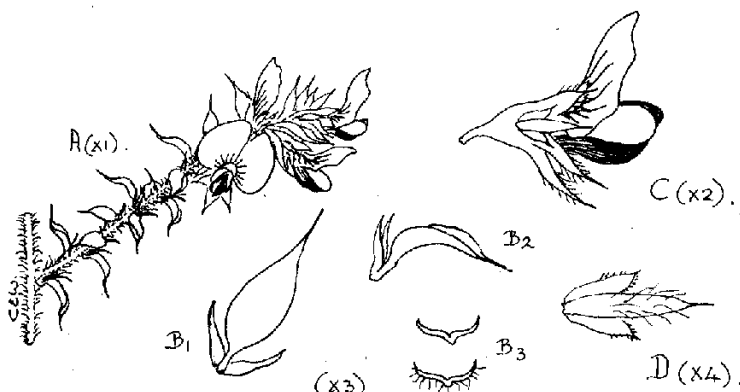
The showy yellow and orange bush peas are ideal for garden culture. There are so many of them. This series of well illustrated articles will enable you to identify them. To be a *Pultenaea* they need to have flowers as above. In this group the leaves are alternate along the stem and are lanceolate (broad about $\frac{1}{3}$ along then tapering to a point as in the head of a lance or spear as shown in the sketches). The leaves are mainly incurved as shown in the sketches and are a wonderful guide to identification by the beginner.

We start the descriptions with *Pultenaea procumbens* which is shown in the colour plate on page 129.

Pultenaea procumbens A. Cunn.

Heathy Bush-pea

Habit	Dense low shrub to 0.5 m high, sometimes procumbent. Branchlets pubescent. (A).
Leaves	Lanceolate, usually about 8 mm long (range 7-12 mm), recurved at apex, concave, with pungent point. Young leaves hairy, older leaves glabrous. (B, B ₂ , B ₃). Prominent stipules 2-5 mm long.
Flowers	Axillary, shortly pedicellate, somewhat crowded towards ends of branchlets. Calyx glabrous or loosely villous, particularly on margins of lobes; calyx lobes with pungent apices, lower lobes longer than tube. (C).
Bracteoles	Trilobed — central lobe green and pungent, often loosely villous; lateral lobes brown, stipulate, ciliolate, attached towards centre of calyx tube. (D).
Flowering	Mid to late Spring — October/November.
Distribution	Vic., A.C.T., NSW — woodlands and dry sclerophyll forest of tablelands and western slopes.



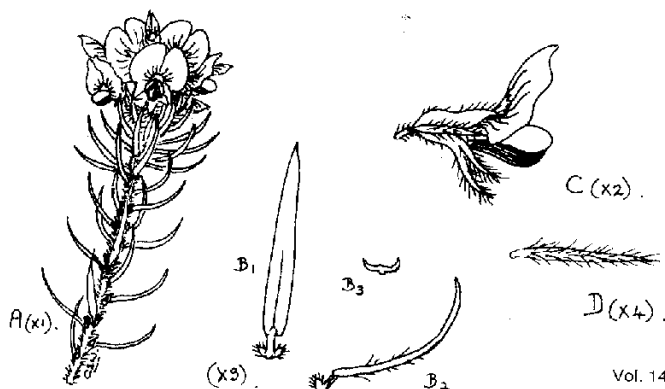
Editor's Note: These plants are easily grown from seed. Place the seed in a cup and pour on boiling water. After leaving to soak for a week the seed will swell. Plant in a pot of sand and pot when the seedling has four leaves. One problem is getting the seed. Look for it in late November and December — send me some samples. — Editor.

Pultenaea costata* Williamson*Ribbed Bush-pea**

- Habit** Erect shrub often above 1 m high; stems pubescent. (A).
Leaves Lanceolate, glabrous, concave with recurved pungent point, usually about 10 mm long (7-15 mm long); 3 or 5 prominent veins on undersurface. Stipules prominent, 4-6 mm long. (B_1, B_2, B_3).
Flowers Sessile in dense terminal heads. Calyx villous on lobes which are subulate. Keel red. (C). Colour photograph on page 133.
Bracteoles Ovate-acuminate, ciliate on margins and longer than the calyx tube; attached at calyx base. (D).
Flowering September-October.
Distribution Endemic in Grampians, Vic. — particularly the northern and central areas.

***Pultenaea incurvata* A. Cunn.****Incurved Bush-pea**

- Habit** Small straggling shrub, often less than 30 cm high. Stems with spreading hairs. (A). Colour photograph on page 133.
Leaves Lanceolate, incurved towards stem and with incurved margins, 5-10 mm long, apex acute. Young leaves with long hairs, old leaves glabrescent. (B_1, B_2, B_3). Stipules minute, light green, hairy.
Flowers In dense terminal heads, on short pedicels c. 1 mm long. Calyx pubescent, becoming glabrescent towards base of tube; lower lobes acuminate, longer than the tube. Floral bracts linear to ovate, pubescent. (C).
Bracteoles Linear pubescent, longer than the tube and fixed to the pedicel below the base of the calyx-tube. (D).
Flowering September-October.
Distribution NSW — Central Tablelands in swamps and wetlands.

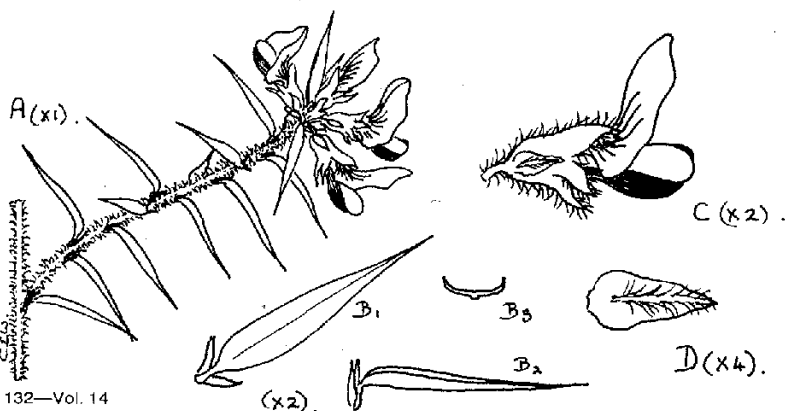


Pultenaea involucreta* Benth.*Mt. Lofty Bush-pea**

- Habit** Low spreading procumbent shrub, villous branches. (A).
Leaves Lanceolate, rigid, crowded, concave, pungent; glabrous above, villous on undersurface, with distinct midrib on both surfaces, 8-14 mm long. Petiole c. 2 mm long; stipules 2-3 mm long. ($B_1 B_2$).
Flowers Sessile, solitary at ends of short branchlets surrounded by terminal leaves, then by several small brown bracts. Calyx almost completely enclosed by bracteoles, glabrous except for marginal cilia at tips of calyx lobes. Keel red. (C).
Bracteoles Large, brown, ciliate, concealing all but the tips of the calyx lobes. (D).
Flowering October-December.
Distribution S. Aust. — Mt. Lofty Range.

***Pultenaea juniperina* Labill.****Prickly Bush-pea**

- Habit** Erect but spreading shrub, 2-2.5 m high, markedly pungent, branchlets lightly pubescent. (A). See colour photograph on page 137.
Leaves Lanceolate, rigid, spreading, incurved, 10-20 mm long, pungent, glabrous, with short erect petioles appressed to stem. Stipules 2-3 mm long. ($B_1 B_2 B_3$).
Flowers On short pedicels in axillary or terminal clusters. Calyx hairy with shortly pointed lobes. (C). Floral bracts trifid.
Bracteoles Lanceolate, no longer than calyx tube, with pubescent midrib and ciliate margins. (D).
Flowering October-December.
Distribution Vic., A.C.T., NSW — mainly in hilly forest conditions.





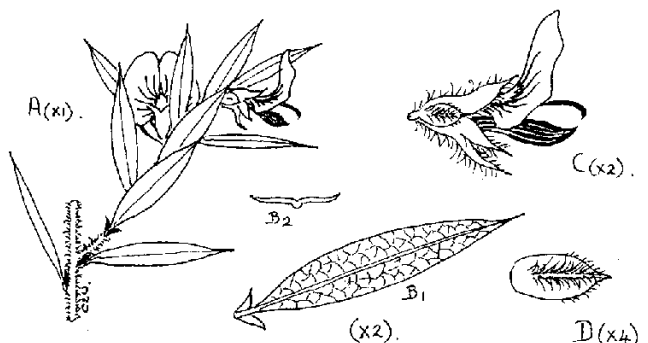
Pultenaea costata △

▽ *Pultenaea incurvata*



***Pultenaea reticulata* (Sm.) Benth.**

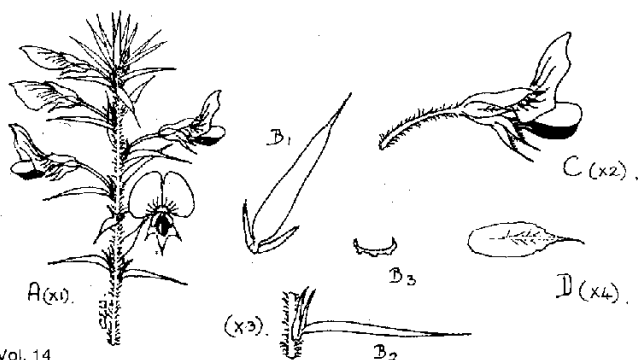
- Habit** Erect shrub to 1 m or more high. Branchlets shortly pubescent. (A).
Leaves Lanceolate, flat or slightly incurved, mainly glabrous, 10-25 mm long $\times$ 3-5 mm wide, with reticulate vening and pungent mucro; midrib prominent on undersurface. Petioles and stipules small, c. 1 mm long. (B, B₁).
Flowers Large, mainly solitary and axillary near end of branchlets, sometimes terminal, sessile. Calyx tube and lobes villous, lobes longer than tube, acuminate and mucronate tips. Keel dark red, as long as or longer than wings. (C).
Bracteoles Brown, ovate, hairy midrib, attached at base of tube and about as long as the tube. (D).
Flowering Spring—August/October.
Distribution WA—widespread and common in coastal and near coastal areas of the S.W. corner.



***Pultenaea rigida* R. Br.**

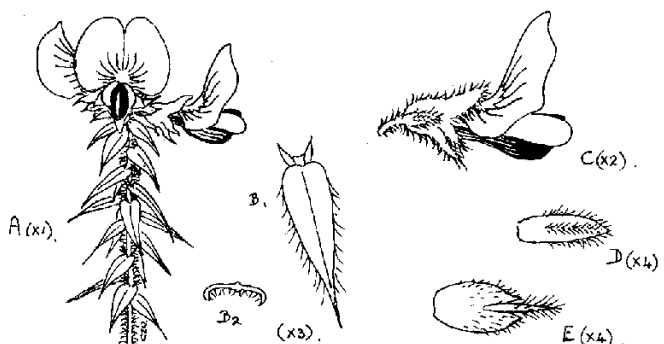
Island Bush-pea

- Habit** Rigid shrub to about 1 m high, pubescent branches. (A).
Leaves Lanceolate, incurved, rigid, glabrous, spreading, pungent, sessile, 6-10 mm long with conspicuous stipules, c. 3 mm long. (B, B₁, B₂).
Flowers Solitary, axillary with pubescent peduncles of 5-6 mm. Calyx mainly glabrous, except for a few hairs on the margins of the subulate, pungent lobes. Keel red. (C).
Bracteoles Lanceolate, glabrous except for some hairs on midrib, about as long as calyx tube and attached at its base. (D).
Flowering September-November.
Distribution S. Aust. (Kangaroo Island, Yorke and Eyre Peninsulas).



***Pultenaea skinneri* F. Muell.**

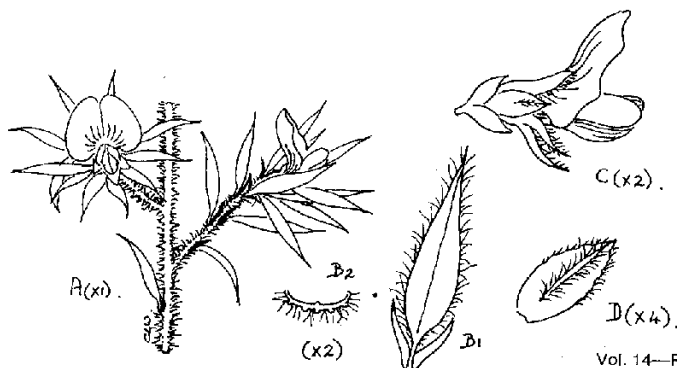
- Habit** Small, upright hairy shrub to 70 cm high. (A).
Leaves Lanceolate-cordate, reflexed, crowded, alternate, c. 8 mm long $\times$ 3 mm wide, mucronate, glabrous above with prominent central vein, hairy beneath and with recurved margins. Short petiole hidden by the reflexed leaf, giving it the appearance of being sessile (B, B₂). Stipules c. 3 mm long.
Flowers Large, showy, in loose few-flowered terminal heads, on short pedicels. Floral bracts trifid with long central lobe, hairy, viscid, not completely covering the calyx (E) which also has prominent brown hairs on both tube and lobes. Keel dark red and slightly shorter than the wings. (C).
Bracteoles Linear-lanceolate, shorter than the tube, hairy, attached at base of tube. (D).
Flowering September–October.
Distribution WA—South-West (Bunbury–Busselton area).



***Pultenaea villifera* Sieber ex DC**

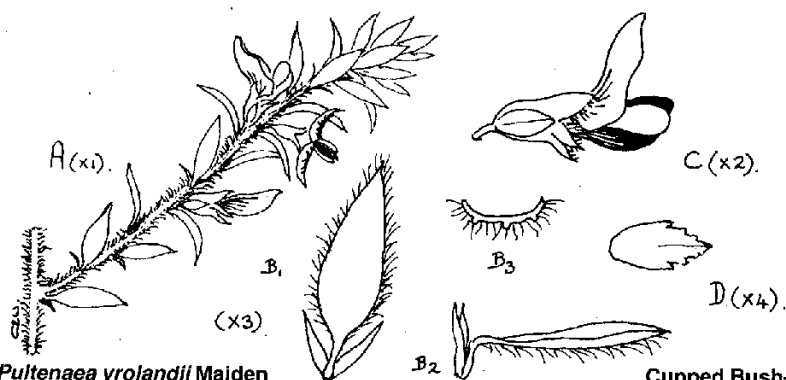
Yellow Bush-pea

- Habit** Erect shrub 1–2 m high, with villous branches. (A).
Leaves Lanceolate, incurved with pungent point, 10–20 mm long, villous on under-surface and usually 3–5 veins. Petioles c. 2 mm long; prominent brown stipules 4–6 mm long. (B, B₂).
Flowers Sessile in upper axils or on short branchlets, wholly yellow. Calyx lobes acuminate and ciliate, the tube mainly glabrous and partly enclosed by bracts. (C).
Bracteoles Lanceolate with pubescent midrib and ciliate on margins, slightly longer than tube, inserted at base of calyx. (D).
Flowering Spring—September/November.
Distribution NSW—Lower Blue Mountains and Central to Southern coast e.g. Cape Jervis. S. Aust. (var. *glabrescens*, with broader leaves almost glabrous and more pungent)—Kangaroo Island.



Pultenaea trinervis* J. M. Black*Three-nerved Bush-pea**

- Habit** Low diffuse procumbent shrub — similar to *P. involucrata*, branches hairy.
(A). Colour photograph on page 137.
- Leaves** Ovate-lanceolate, 8-12 mm long, glabrous above, villous below, with three nerves on under surface, which gives species its name; pungent pointed but not pungent mucro. Petiole c. 2 mm long, stipules c. 3 mm long. ($B_1 B_2 B_3$).
- Flowers** Axillary on branchlets with short pedicels, c. 1 mm long. Calyx glabrous except for short cilia on calyx lobes, which are shorter than tube. No floral bracts as in *P. involucrata*. Keel yellow or red. (C).
- Bracteoles** Brown ovate-oblong, glabrous, about as long as calyx tube, inserted at base of calyx. (D).
- Flowering** October-December.
- Distribution** S. Aust. — Mt Lofty Range, Pt Lincoln area.

***Pultenaea vrolandii* Maiden****Cupped Bush-pea**

- Habit** Erect shrub to 2 m high — stems pubescent (A).
- Leaves** Ovate/lanceolate, incurved, acute but without mucro, recurved tip, undersurface hairy, usually 4-8 mm long. Stipules 1-2 mm long. ($B_1 B_2 B_3$).
- Flowers** Terminal clusters on hairy pedicels 3-5 mm long. Ovate, reddish brown viscid bracts, almost enclosing calyx. Calyx glabrous or sparsely hairy, lobes acute, the lower shorter than the tube. (C).
- Bracteoles** Large, orbicular, viscid, brown, glabrous, attached at base of calyx. (D).
- Flowering** October-November.
- Distribution** Southern Tablelands of NSW and granite hills of N.E. Vic. ■





Pultenaea trinervis △

▽ *Pultenaea juniperina*



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