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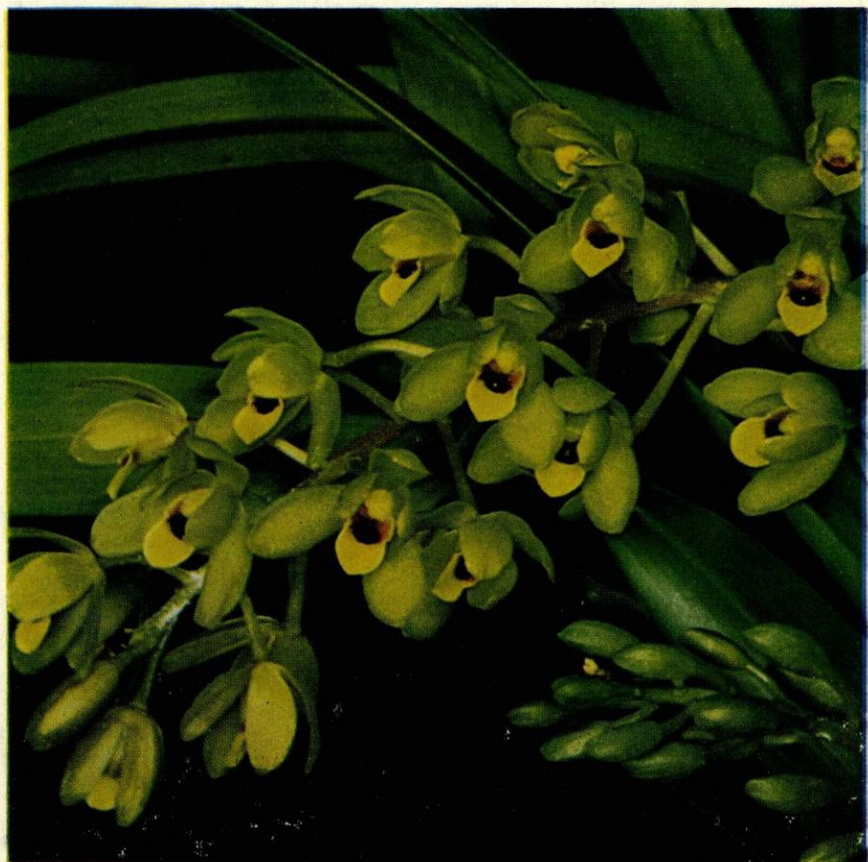
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Photography by R. F. Leaney.

CYMBIDIUM SUAVE

GROW AUSTRALIAN WILDFLOWERS
STURT'S DESERT ROSES FOR THE GARDEN
WILDFLOWERS THAT PREY ON INSECTS

CONTENTS OF THIS ISSUE

This is not an orchid publication. The last issue featured *Corybas* prominently and this issue our native *Cymbidiums*. We are concerned with the preservation and cultivation of all Australian wildflowers of which orchids are an important segment with a very wide following. Every issue presents a genus of our orchids, the terrestrial and epiphytes being in alternate issues.

CYMBIDIUM IN AUSTRALIA, by A. W. Dockrill—page 293.

NATIVE CYMBIDIUMS, by L. P. Butt—page 296.

CYMBIDIUM ORCHIDS, by R. F. Leaney, page 291.

Our principle effort goes to the presentation of simple articles that will assist the home gardeners in the cultivation of wildflowers in their gardens and these are listed below under "Growing Wildflowers" for easy reference.

The major article in the issue is "Desert Roses" and it would have warranted a cover colour plate if a suitable colour slide could have been obtained. Articles in this issue may be indexed in order of interest of the non-orchid grower as:—

DESERT ROSES, "The Wild Cottons of Australia" by P. A. Fryxell—page 301—A further article in our series of articles on *Malvaceae* or *Hibiscus* like plants. All species are fully described with notes on their cultivation.

AUSTRALIAN CARNIVOROUS PLANTS, by Rica Erickson—page 319—This well known author describes the families of wildflowers that prey on insects and explains the wonders of nature that enables a stationary plant to capture mobile creatures.

BYBLIS, "The Rainbow Plant"—page 321—A beautiful small plant.

THE NATIVE LAUREL, *Anopterus glandulosus* by A. M. Gray—page 324 and *Anopterus macleayanus* by H. C. Hayes, page 325.

SMOKE BUSHES—page 304—Unusual landscaping plants.

RUPICOLA, by Betsy R. Jackes—page 322—Part 3 in our series of articles on the *Epacridaceae*.

WILD BIRDS IN THE WILDFLOWER GARDEN—page 307—The third article in this series giving details of how to feed the beautiful wild birds.

GREVILLEA—"Their Use as Street Tree" by G. M. Hewitt—page 309.

LANDSCAPING WITH NATIVES—page 304.

GROWING WILDFLOWERS

The emphasis in this issue is the cultivation of wildflowers in areas of clay and heavy soils. Home gardeners in these areas do not know how lucky they are.

GROWING WILDFLOWERS by C. Jaede—page 297—This presents one solution to heavy clay areas, the building up of gardens. The method described here will be of particular interest to all home gardeners keen to grow the least hardy, or more demanding plants such as *Boronia*.

WILDFLOWERS IN CLAY, by N. Lothian, Director, Botanic Gardens, Adelaide, S.A.—page 298—Plants that have been grown in clay soils are listed.

CARDENING ON CLAY, by F. Haworth—page 299—To take full advantage of heavy soils it is essential that the gardener understand his problem. To all gardeners this first article in the series on soils is recommended.

NATIVES FROM THE SEASIDE OF W.A., by Prof. J. D. Sauer—page 335—Part 3 of the series recommending wildflowers for seaside planting.

PRUNING, page 305—An essential activity for the care of wildflowers in the garden.

PHOSPHORUS NUTRITION OF HEATH PLANTS, by Dr. R. L. Specht—page 323—Results of research of value to the home gardener.

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AUSTRALIAN PLANTS—Volume 2 Price \$6.00 each plus 20c postage.

Volume 2 comprises issues 13-20. Bound in the same volume is the publication *Descriptive Catalogue of West Australian Plants*, see below, giving this volume its exceptional value.

These volumes are beautifully presented in gold lettered, hard covers and include *The Language of Botany*.

DESCRIPTIVE CATALOGUE OF WEST AUSTRALIAN PLANTS . Price \$1.20 plus 16c post & pack

This book lists all the wildflowers indigenous to Western Australia, giving for each species, kind of plant, general size, flower colour, flowering months, localities of occurrence and type of soil and/or vegetative type. Illustrated with many full colour photographs and supplemented by articles such as "Planning, Making and Growing A Native Garden", "Notes on Growing W.A. Plants", "Recommended Subjects for the Beginner", "Propagation", etc., it is fantastic value.

CYMBIDIUM ORCHIDS

R. F. Leaney, F.R.H.S., describes species found in N.S.W.

Cymbidiums, large plants epiphyte or semi-epiphytic, found generally on trees in decayed sections, occur in Africa, Asia, the Malayan regions down to and including Australia. There are about forty species, but only three have been officially recorded in N.S.W. Listed in the order of their prevalence are *Cymbidium suave*, *C. canaliculatum*, *C. madidum*. It will be noted that the *Cymbidium* formally called *C. iridifolium* and before that called *C. albucæfflorum* must now be called *C. madidum* due to a certain amount of tidying up in the naming procedures.

Cymbidium suave is the N.S.W. *Cymbidium* most frequently seen. It grows in a number of our native trees, generally high-up in breaks and faults and the roots have been observed down in the decomposed heartwood more than 30 feet from the plant. It is a grass-like almost bulb-less *Cymbidium* which grows and flowers from the apex continuously and I have seen these pseudobulbs more than 3 feet long which must have been over 25 years old. Bush-fires burn them off periodically but out they come again with new young growths showing apparently, little damage.

C. suave, which means sweet, apparently has the ability to send rhizomes considerable distances down the inside of rotting trees for they will frequently pop out eight and ten feet away and certainly quite often, shorter distances. Careful observation splitting the trunk, will often show other plants above, but generally below the main plant to be connected. *C. suave* must have been quite common around Sydney at one stage, as I know of at least two large plants that have survived within a few yards of a public thoroughfare within ten miles of the G.P.O., Sydney.

C. suave is quite easy to cultivate specially if it is given good drainage and potted in the red clay-like substance in which it is generally found growing, which, with a bit of scouting around can be obtained from the centres of old stumps or rotten logs.

Flowers of *C. suave* are many on a stem, very fragrant, closely packed, usually a shade of light green, but can be quite golden-green at times with a red blotch.

Cymbidium canaliculatum—Until recently I always believed this plant to be a tableland and inland species of northern N.S.W., but understand on a very good authority, that plants have been found recently in coastal areas with high rainfall. Personally I have not been able to grow this plant well. However putting it in the full sun where it received practically no rain, ten or twelve inches in the year at the most and with very good drainage, gave best results. Water seems fatal to its cultivation.

I have added further notes on this species on the rear cover.

Cymbidium madidum. A very large epiphyte of the rain-forest areas, not common and I have not seen it growing except in the presence of staghorns and elkhorns. It forms tremendous masses and I know where there is one on a tree thirty feet up, the tree only about ten inches in diameter and the plant as big as a large motor car. It must weigh more than the tree



Photography by R. F. Leaney.

CYMBIDIUM CANALICULATUM

and some day expect the tree to give a bit of a shake and the weight of the plant will bring it sliding down the trunk to ground level.

C. madidum makes large bulbs up to ten inches long and three inches in diameter a big massive grower with long pendulous sprays of flowers and slightly pendulous long strap-like leaves. Flowers fairly well spaced on sprays up to and over four feet long, very heavy textured flowers, mostly a green-brown shade.

C. madidum can be easily cultivated and grows and flowers well with me in the bush-house. It is potted in tan-bark, leaf-mould and as much of the material from rotten stumps as I am able to lay hands on, with very good drainage. I find it much the best idea to suspend the pots so that the long pendulous racemes can come out over the edge of the pots and this they do with excellent effect.

CYMBIDIUM Sw. IN AUSTRALIA

by A. W. DOCKRILL

The Australian species of *Cymbidium* grow on trees, with, for the most part, their roots deeply embedded in the decaying hollows of branches or trunks, their stems closely appressed to each other and forming up to quite large masses at the entrance to these hollows. Stems rather short and pseudobulbous or rather thin and woody and continuing to grow for a number of years. Leaves rather long and slender, linear, channelled above to varying degrees but never plicate, thin, or occasionally somewhat thick, in texture. Inflorescences from near the base of the pseudobulb or near the lower leaves, racemose, when long enough, pendulous or at least downcurved. Flowers from one or a few to quite numerous and from moderate to rather large in size, few of the exotic species are fragrant but all of the Australian species are strongly and pleasantly so.

Three species occur in Australia, all widespread and extremely variable, particularly in regard to colour of flowers, and a number of separate species, varieties etc. have been erroneously named, mostly on the basis of colour of flowers, which is insufficient grounds for species or variety separation.

KEY TO THE AUSTRALIAN SPECIES OF CYMBIDIUM

- stems thick and pseudobulbous
 - leaves thick, rigid and deeply channelled; disc of the labellum with 2 parallel keels *canaliculatum* 1.
 - leaves thin, not rigid nor deeply channelled; disc of the labellum with 1 broad, somewhat indistinct yet viscid keel *madidum* 2.
- stems thin and not pseudobulbous
 - leaves thin, slender and not rigid; disc of the labellum without distinct keels but somewhat thickened, not viscid *suave* 3.

R. F. Leaney has described the occurrence of forms of these species in N.S.W. They must be more vigorous growers in the south or Mr. Leaney has been over enthusiastic with his dimensions. My observations on *Cymbidium* species in Tropical Queensland follow before each species is described botanically.

1. *C. canaliculatum* R.Br. has an extensive range in "open" forests throughout the inland areas, those of the coastal plain receiving about 45 or less inches of rain annually. It may be seen growing in hollows in branches or trunks of trees from a few to about 100 feet above ground level and usually grows in moderate to light shade, rarely completely exposed. It is not readily cultivated, on the coast at least, plants will sometimes appear to flourish for a few years but almost without exception will die within the following few years.

2. *C. madidum* Lindl. is found throughout the higher rainfall areas of the eastern tropics at altitudes from sea level to about 4,000 feet and from a few inches to over 100 feet above ground level. It may be seen growing in hollows of branches or trunks of trees, in masses of roots and debris of epiphytic ferns etc. or even occasionally with its roots embedded only in the bark of its host. It seems to prefer rain forests but is not infrequently seen in "open" forest and many grow in positions enjoying from dense shade to fully exposed. It is relatively easy to grow in the usual conditions given to other members of the genus, preferably if given plenty of air and light.

3. *C. suave* R.Br. has a much similar range to that of the latter species but is not nearly so common. It also may be seen growing at altitudes from almost sea level to about 4,000 feet, and from a few feet to about 100 feet from ground level, mostly in "open" forest but occasionally in rain forest. The author has seen it growing only in hollows in branches and trunks of trees. It is a very difficult species to cultivate and plants, almost without exception, will survive for a few years at most.

1. *Cymbidium canaliculatum* R.Br.

Prodr. 331 (1810); Lindl., Gen. et. Spec. Orch. 161 (1840) & Bot. Mag. t 5851 (1870); Benth., Flor. Austr. 6:302 (1873); Reichb. f., Beitr. 45 (1877); FitzG. ined. 80; F. M. Bail., Qld. Flor. 5:1547 (1902); Rupp, Proc. Linn. Soc. N.S.W. 59:95-100 (1934) & Orch. N.S.W. 127 (1943); Aust. Orch. Rev. 1, pt. 3:11 (1936) & 4:83 (1939) & 6:43 (1941); Menninger, Am. Orch. Soc. Bull. 30, no. 11:855-76 (Nov. 1961).

Cymbidium hillii F. Muell. in Regel's Gartenf. 138 (1879) & Fragm. 11:88 (1881); F. M. Bail., Qld. Flor. 5:1547 (1902); Rupp, Proc. Linn. Soc. N.S.W. 72:299 (1937).

Cymbidium sparkesii Rendl., Journ. Bot. 36:221 (1898) et ibid 39:197 (1900).

Cymbidium canaliculatum R.Br. var. *sparkesii* (Rendl.) F. M. Bail., Comp. Cat. Qld. Plts. 845 (1909); Rupp, Proc. Linn. Soc. N.S.W. 59:95-100 (1934).

Cymbidium canaliculatum R.Br. var. *canaliculatum* former *inconstans* Rupp, l.c.

Cymbidium canaliculatum R.Br. var. *canaliculatum* former *aureolum* Rupp, l.c.

Cymbidium canaliculatum R.Br. var. *marginatum* Rupp, former *fuscum* Rupp, l.c.

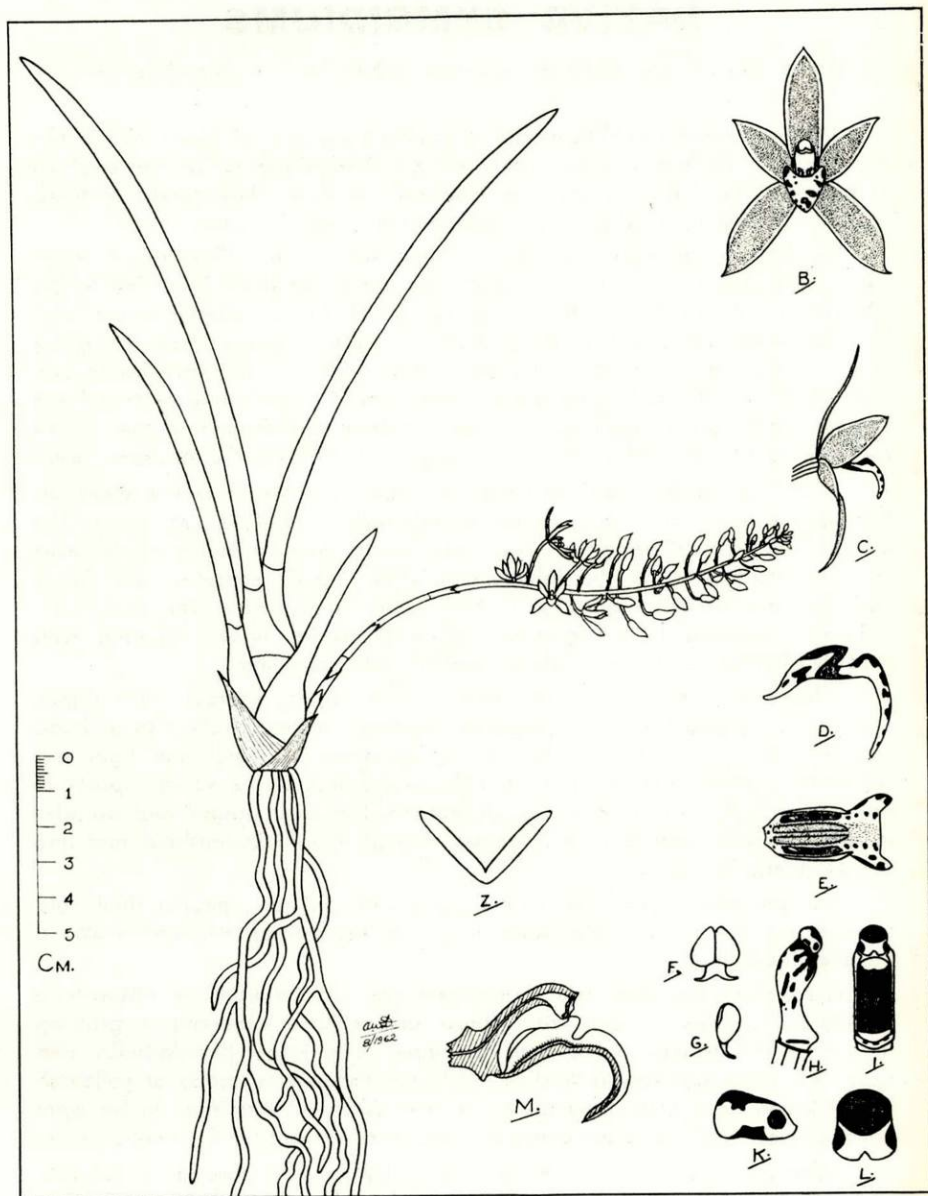
Cymbidium canaliculatum R.Br. var. *marginatum* Rupp former *purpurascens* Rupp, l.c.

Cymbidium canaliculatum R.Br. var. *barrettii* W. H. Nich., Aust. Orch. Rev. 7:40 (1942).

Stems pseudobulbous, 3-12 x 1.5-4.0 cms., usually grey-green and having a few large bracts arising from the base. Leaves 2-6, usually with 2-3 large ones near the apex and the remainder decreasing in size towards the base, the larger ones 10-50 x 1.5-4.0 cm., thick, rigid, deeply channelled above, acute, usually dull grey-green. Racemes 1-2 to a stem so that they may be numerous on a large plant, 15-40 cm. long, erect to pendulous, containing from about 12 to numerous flowers. Flowers usually widely spreading, 25-50 mm. diam., green, brown, purple, dull red or a combination of some or all of these, they may be totally green, green on the outside, not green at all and often the segments have green margins only when the remainder of the segments may be a uniform colour, mottled or spotted; the labellum however, is usually white with red or purple markings. Sepals subsimilar 12-25 x 5-10 mm., oblong, slightly ovate or slightly obovate, acute. Petals $\pm$ similar to the sepals but a few mm. shorter and slightly narrower than them. Labellum usually about the same length as the petals, distinctly trilobate; lateral lobes 1.0-2.5 x 4-10 mm., $\pm$ crescentic, the free apical portion usually $\pm$ deltoid; mid-lobe usually decurved, 6-15 x 5-10 mm., ovate to triangular, upper surface usually concave and papillose or hairy, particularly towards its base; disc with 2 distinct parallel keels which extend to, but not on to, the mid lobe and are from slightly pubescent to fringed. Column usually about half the length of the flattened out labellum, rather stout, slightly incurved, mottled, including the anther; lateral wings confined to the apical half, very short, crescentic; foot vestigial. Anther about the same length as breadth but only about half as deep as broad, $\pm$ emarginate in front.

Flowering Period: 9-11.

Distribution: From about the Hunter River, N.S.W., northward to the apex of Cape York Peninsula and westward to Western Australia. It is rarely found near the coast and is typically an orchid of the dry interior, shunning moist coastal or highland areas

**CYMBIDIUM CANALICULATUM R.Br.**

- A. Portion of plant . . . to scale $\times \frac{1}{2}$.
 B. Flower from the front . . . to scale $\times 2$.
 C. Flower from the side . . . to scale $\times 2$.
 D. Labellum from the side . . . to scale $\times 4$.
 E. Labellum from above . . . to scale $\times 4$.
 F. Pollinarium from the front . . . to scale $\times 10$.
 G. Pollinarium from the side . . . to scale $\times 10$.
 H. Column from the side . . . to scale $\times 4$.
 I. Column from the front . . . to scale $\times 4$.
 K. Anther from the side . . . to scale $\times 10$.
 L. Anther from above . . . to scale $\times 10$.
 M. Median longitudinal section of column and labellum . . . to scale $\times 4$.
 Z. Cross-section of leaf . . . to scale $\times 2$.

NATIVE CYMBIDIUMS

Some observations and notes on their culture by L. P. Butt, Brisbane

The indigenous cymbidiums are a fascinating group of plants distributed through part of N.S.W. and nearly all of Queensland to as far west as as perhaps Chinchilla and into the Northern Territory. They consist of three species, *Cymbidium madidum*, *C. canaliculatum* and *C. suave*.

Cymbidium canaliculatum is by far the most variable. The Rev. H. M. R. Rupp listed six, the varieties *inconstans* and *aureolum* (both listed by A. W. Dockrill in his article in this issue as forms of *C. canaliculatum* var. *canaliculatum*) the varieties *marginatum* and *purpurascens* (both listed by A. W. Dockrill as forms of the variety *marginatum*) and the varieties *fascum* (not listed) and *C. canaliculatum* var. *sparkesii*. Of these I have found the variety *canaliculatum*, both forms *inconstans* and *aureolum* and the variety *sparkesii* to be very adaptable to growing conditions in the Brisbane area.

In the areas between Fernvale, S.E. Qld. to Moore in the Blackbutt Ranges, the form has small rounded pseudo-bulbs and short stiff leaves. The blooms are yellowish green in sepals and petals, heavily blotched with liver coloured markings and the labellum is white, lightly speckled red. Some variants have greenish margins on both sepals and petals. The form from Chinchilla growing in my garden, yellowish brown, heavily spotted with reddish blotches, also has a white labellum with speckling.

I have seen several variant colours of the variety *sparkesii* with sepals and petals ranging from dark magenta, bordered white to yellow to a shade so near to black that only the turning of bloom to catch the light will reveal the reddish cast. The pseudo-bulbs and leaves of the variety *sparkesii*, are similar in texture to other *canaliculatum*s, but much larger and broader in size. *Sparkesii* ranges from Mareeba through North Queensland and into the Northern Territory.

My specimens respond well to a mixture of tan bark, peanut shells, old manure and the red crumbly mould from old tree stumps. Pit sand is also a beneficial addition.

Cymbidium madidum (syn. *iridifolium* syn. *albuciflorum*) is widespread throughout pockets of Qld. rain forest and I have observed it growing thickly in the Buderim area with *C. suave*. The large pseudo-bulbs and long soft leaves are very distinctive, while the drooping racemes of yellowish brown blooms are quite long lasting. I have found *C. madidum* to be quite hardy in most mediums, particularly so in the mixture used for *C. canaliculatum*.

Cymbidium suave in my experience is by far the hardest to cultivate and only specimens with ample root growth will grow with any certainty. Damage to root growth will invariably result in the death of the plant. This species has long narrow stems (not pseudo-bulbs) and narrow dark green grass-like leaves. Depending on where found, the flower colour is very variant. Ranging from gold sepals, through the shades of brownish green to clear apple green, the latter shade being typical of the S.E. Queensland variety especially around the Lamington Plateau area. The labellum of my plant is dark plum red in the throat with a yellowish tip. Dainty flower and delicate colouring makes this orchid well worth the effort to grow.

GROWING WILDFLOWERS

by C. JAEDE

I live in Strathfield, eight miles west of Sydney. Originally, fifty or so years ago, it was grazing land for a dairy—perhaps a foot of heavy loam overlaying clay underneath which is shale; the grazing cattle removed the coarse grass and the weather gradually removed the loam. When built upon and the owners commenced to develop gardens and lawns, soil was brought in. These were the local conditions when I moved into the area and when the acute infection of growing Australian plants attacked me.

In my residence at the rear of the house is a tennis court; at the bottom of this, the southern end (and the land slopes south), two terraces had been made in which loam had been placed. Some of this I replaced with bush sand laboriously brought in sacks from various places.

My early attempts with plants of *Boronia*, Christmas Bells, *Grevillea* and many others were not successful. The only plants which survived were *Grevilleas*, *Prostantheras*, a *Rulingea* and a lone *Hakea*. But the infection was severe. The native plants I preferred to grow were *Boronias* and *Eriostemons*. What to do?

Once I visited Bill Cane's place at Maffra and a few times Boddy's at Geelong. In both places great success had been achieved by building up beds from the ground surface, surrounding the beds with sand stone (or similar) slabs. In consequence of this I widened the bottom terrace, removed all the loam and at the bottom of the trench placed stones, etc., for drainage and then filled the trench with natural bush sand, complete with sticks and stones; to this I added some peat moss and then taking the Boddy's advice covered the lot with $\frac{1}{4}$ " to $\frac{1}{2}$ " blue metal.

Subsequently at the side of the tennis court I had built three beds, and filled them with the same material.

Now what was the result of all this and what lessons did I learn?

Firstly, the second bed at the bottom of the tennis court (which was partly shaded by *Grevilleas* in the top bed) and a bed at the side of the court, were made and planted some eighteen months before the two other beds at the side of the court. Certain plants thrived to wit—*Melaleucas*, *Leptospermums*, a *Correa*, and an *Eriostemon myoporoides*, but many other plants just died. I did notice, however, that when I replanted, those plants which were shaded by taller plants did not give up the ghost; in particular native roses (*Boronia serrulata*) which previously when planted out in the open, very promptly died, really grew; secondly, I discovered that old plants taken from tins, whether planted in the open or in the shade, tended to depart from this world whilst small recently rooted cuttings fared much better.

These observations, namely, shade and support for most shrubby natives, and the planting preferably of young plants, I subsequently put into practice in two new beds eighteen months later.

Shade and support were supplied with small branches of local scrub; these, when most of their leaves were dropped, were replaced by fresh pieces. Incidentally, the fallen leaves provided a type of compost.

The result? The plants lost can be counted on my fingers; young cuttings have really thrived. This latter result tends to confirm my theory that most natives first send down a tap root probably to reach a moist level and later develop surface roots whose main purpose is to collect nourishment; old plants in tins develop a curled tap root consequent upon which it does not grow downwards.

I also noticed that *Leschenaultias* planted near the sandstone slabs on the southern aspect really grew; previously most of them planted elsewhere did not respond.

To recapitulate, using shade, supports from small branches of shrubs and bush sand covered with fine metal, I am growing successfully in a clay loam area, *Boronias*, *Eriostemons*, *Leschenaultias*, *Baeckneas*, *Epacris*, *Actinodium*, and several other species.

WILDFLOWERS IN CLAY

NATIVE PLANTS WHICH CAN BE GROWN SUCCESSFULLY ON HEAVY OR CLAY SOILS—PART 1

by N. Lothian, Director, Botanic Gardens, Adelaide, S.A.

Within South Australia, limestone in some form is one of the features which controls the cultivation of many of our Australian plants. However, drainage is frequently satisfactory on limestone marl but it is the alkalinity of the soil rather than its degree of density (or lack of texture) which reduces the varieties which can be cultivated successfully.

In various parts of South Australia, and particularly in the under 20 inch rainfall areas, heavy soils (either alkaline or sub acid) found in these regions cause the severest test for the successful cultivation of our native plants. In addition to their density they usually crack badly on drying out, causing destruction of many fine young rootlets.

In the under 12 inch rainfall regions, dense soils such as those associated with gibber plains occur. Soils of this type powder under very dry conditions and often "blow," but once they are wet they become waterlogged and as they dry out are liable to cake. Watering these soils is difficult and must be done carefully.

Where these soils are on undulating or sloping ground the drainage is much easier. Plant roots occupy the sub-surface layers of the soil and their penetration of the soil is made easier if its surface is continually and heavily mulched. Further, if the soils are kept moist the deliberate introduction of earth worms after mulching has been applied for a year or so, may assist in ameliorating the soil density.

For the last decade or so trials have been carried out at Leigh Creek Coalfields (approximately 360 miles north of Adelaide) in an area which (prior to the establishment of the town), somewhat resembled a gibber plain. The soil is dense, cakes badly when wet and is very difficult to cultivate except when commencing to dry out. If actively cultivated at this stage by digging, the result is large lumps which must then be broken down, but the soil particles will coalesce if too much water is given.

To establish the young plants, creek gravel is added merely for better working of the soil, ensuring that it does not pack down into almost "cement hard" soil when it is replaced around and over the roots of the seedlings.

The following is a list of species which have been grown successfully at Leigh Creek under these soil conditions but most received some artificial watering because many of them came from regions of higher rainfall. Most of course will grow very well on lighter soils. Surface mulching either of creek gravel or sawdust, plus a coating of creek gravel to prevent it from blowing away, is standard practice.

- Acacia brachybotrya*—Grey Mulga.
Acacia cambagei—Gidgee.
Acacia cyanophylla—Orange Wattle.
Acacia kempeana—Witchety Bush.
Acacia ligulata—Small Coomba.
Acacia notabilis—Flinders Wattle.
Acacia oswaldii—Miljee.
Acacia pendula—Weeping Myall.
Acacia salicina—Pt. Broughton Wattle.
Acacia soudani—Western Myall.
Acacia stenophylla—River Coomba.
Acacia victoriae—Bramble Wattle.
Alyogyne hakeifolia—Red Throat Hibiscus.
Bauhinia carroni—Queensland Bean.
Cassia artemisioides
Cassia nemophila
Casuarina lepidophloia (crinata)
Casuarina glauca—Swamp Oak.
Eremophila alternifolia—Emu Bush.
Eremophila bignonioides—Emu Bush.
Eucalyptus torquata—Coolgardie or Coral receiving more than 20" rainfall).
Ficus macrophylla—Moreton Bay Fig.
Ficus rubiginosa—Rusty Leaf Fig.
Geijera parviflora—Wilga.
Gossypium sturtianum—Sturt Desert Rose.
Grevillea pterosperma—Desert Grevillea.
Hakea leucopetra—Needle Hakea.
Hakea suaveolens—Sweet Hakea.
Eremophila duttoni—Emu Bush.
Eremophila glabra—Emu Bush.
Eremophila longifolia—Native Flame Tree
Eremophila maculata—Native Fuchsia.
Eucalyptus astrinens—Brown Mallet.
Eucalyptus cneorifolia—Kangaroo Is. Peppermint.
Eucalyptus campaspe—Silver-topped Gimlet.
Eucalyptus erythrocorys—Illyriae.
Eucalyptus flocktoniae—Merrit.
Eucalyptus gardneri—Blue Mallet.
Eucalyptus gillii—Curly Mallee.
Eucalyptus grossa—Phillips River Gum.
Eucalyptus lansdowneana—Crimson Mallee.
Eucalyptus nutans—Nodding Gum.
Eucalyptus preissiana—Bell Mallee.
Eucalyptus pyramidalis—Ooldea Mallee.
Eucalyptus steedmanii—Steedman's Gum.
Eucalyptus stricklandii—Strickland's Gum.
Eucalyptus stoatei—Stoat or Pear Gum.
 Gum (must not be over-watered in regions
Hibiscus huegelii—Native Hibiscus.
Melaleuca decussata—Coarse-leaf Honey Myrtle.
Melaleuca lanceolata—Moonah.
Melaleuca wilsonii—Wilson's Honey Myrtle.
Myoporum platycarpum—Sugar Wood.
Pittosporum phylliraeoides—Native Apricot.
Westringia fruticosa (rosmariniformis)

Editor's Note: This is the first of a series of articles entitled "Cultivation of Natives on Heavy Soils," and is meant to introduce the home gardener to a few basic facts concerning the soil itself. It is my opinion that people with heavy soils are fortunate and with the correct treatment the range of wildflowers that they can grow is unlimited. I have reports from every State, from competent authorities such as the Department of Agriculture in each State, the C.S.I.R.O., etc., and these will appear in succeeding issues. Examining these reports reveals that no specific aspect or problem is peculiar to any one State so that the advice contained in this article applies to home gardeners in all States.

GARDENING ON CLAY

by F. Haworth, Ph.D., Dip. Ag. Sci. (Cantab).

This article is based on the article "Growing On Clay" in the Journal of the Royal Horticultural Society and is reprinted with permission of the Secretary. Mr. Haworth was formerly at the National Vegetable Research Station, Wellesbourne, Warwick, England. He is at present setting up a Research Organisation under a United Nations Development Programme at the Institute of Agricultural Research, Addis Ababa, Ethiopia.

The title of this lecture is rather broad and as a chemist I intend to confine my remarks to the problem of how the inherent properties of clay soils can be used to best advantage in the cultivation of such soils, and how the inherent properties can be modified by the use of materials such as lime and manure.

Mineral soils usually consist of mixtures of particles of different sizes, along with a small but often important proportion of organic matter. To help to classify soils, the proportions of the soil particles in a number of arbitrary size grades are measured to give what is known as the mechanical composition of the soil. The size grades used and the mechanical composition of certain soils are shown in Table 1.

Clay soils are usually defined as containing more than 50 per cent of clay-size particles but this is an arbitrary division and should be considered as such. In most mineral soils the clay fraction is of great importance; it often determines the nature and properties of a soil and the behaviour of that

soil under cultivation. Even in a sandy loam, the mechanical composition of which is given in the table, the small amount of clay is very important and has a larger effect on the properties of the soil than its amount might indicate. The reasons for this large effect are to be found in the chemical and physical properties of the clay particles, which are quite different from those of the other mineral parts (fractions) of the soil. Although it is convenient to consider chemical and physical properties separately, it should be remembered that the various factors interact, each influencing the others to some extent.

MECHANICAL COMPOSITION OF TYPICAL SOILS—

Size Grades	Diameter of particles in millimetres	Per cent of mineral matter		
		Sandy	Loam	Clay
Coarse Sand	0.2 - 2.0	50		5
Fine Sand	0.02 - 0.2	25		20
Silt	0.002-0.02	13		15
Clay	below 0.002	12		60

THE PHYSICAL AND CHEMICAL PROPERTIES OF THE CLAY PARTICLES—

The clay particles in a soil are derived from various potassium aluminium silicates by various physical and chemical processes; they are reactive chemically and are in process of active weathering although the rate of weathering may be slow.

In contrast, the silt, fine sand, and coarse sand fractions are generally made up of materials that have resisted weathering and are chemically much less active than the clay minerals.

Moreover, when a solid particle reacts with a surrounding solution, the rate of reaction depends on the surface area of the particle and this varies as the square of the radius of the particle. Thus the activity⁹ for a given weight of clay particles would be between 10,000 and 1,000,000 times that of the coarse sand particles even if the clay and sand particles were of the same chemical composition.

Perhaps the most important chemical property of the clay particles is that of BASE-EXCHANGE. A clay particle may be considered as having a layer of electrically charged particles or ions on its surface. There are mainly hydrogen, sodium, potassium, calcium, magnesium and ammonium ions and these elements are important in the nutrition of plants. When the surface is covered with water some of these ions are released and an equilibrium becomes established. If these ions are removed from the solution by plant roots or by leaching, the equilibrium can be restored by the movement of more ions from the surface of the clay particle. Conversely, if nutrient cations are added to soil in the form of fertilisers, these can be stored on the clay particles to be released later when the soil solution becomes depleted.

The relatively high Base-Exchange Capacity of clay soils has another important consequence. To change the pH of a soil in the acid direction implies removal of calcium ions and their replacement by hydrogen ions, the reverse process being necessary to render the soil more alkaline. To achieve a given change in pH the amount of ions to be exchanged increases with increasing Base-Exchange Capacity of the soil. Thus more lime is needed to counteract acidity in a clay soil than to remedy the same degree of acidity in a sandy soil.

DESERT ROSES

THE WILD COTTONS OF AUSTRALIA by Paul A. Fryxell

The genus *Gossypium* L. is noteworthy for its several species that produce the cottons of world commerce. Cotton agriculture and the spinning and weaving industries that are based upon it have had a profound influence on the course of human history and have, indeed, changed its direction markedly at certain times. The origins of these cultivated plants are to a large extent lost in the mists of antiquity, but intensive study by many scientists has



Colour Photography by W. H. Payne

STURT'S DESERT ROSE

Gossypium sturtianum var. *sturtianum*. The floral emblem of the Northern Territory. The flower colour is a deeper mauve than shown above. I find these plants are very easily cultivated in my garden, the essential requirement being a hot position with full sun. Watering or absence of watering does not seem to worry them. They must be very heavily pruned after flowering. Note the bud in the lower right corner. Editor.

enabled us to infer much about them. Less well-known, perhaps, are the wild relatives of these cultigens, the 25 or 30 species of *Gossypium* that occur as perennial shrubs in the desert areas of Mexico, Africa and Australia. The least well-known of these are doubtless the plants that are native to Australia.

1. Research Geneticist, Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture, in co-operation with Soil & Crop Sciences Department, Texas A. & M. University, College Station, Texas.

A recent study (Austral. Journ. Bot. 71-102, 1965) has shed some light on these Australian plants and on their distributions. Certain of them appear to have promise as ornamental shrubs. All have great scientific interest for the information they can give us on the evolutionary history of the cottons. Still, four of the nine Australian species are not yet available in culture for study and evaluation. Perhaps this discussion will stimulate interest in the collection of these plants.

Gossypium typically has showy malvaceous flowers that last but one or two days. The corollas of most of the Australian species are mauve with a dark spot in the centre. This colour is not found in the genus outside of Australia. Each flower is subtended by an involucre or epicalyx that is uniformly composed of 3 floral bracts, a feature that most clearly sets off *Gossypium* from its nearest Australian relatives, including *Thespesia* Sol. ex Corr., *Hibiscus* L., and *Alyogyne* Alef., all of which have involucres of more than three bracts.

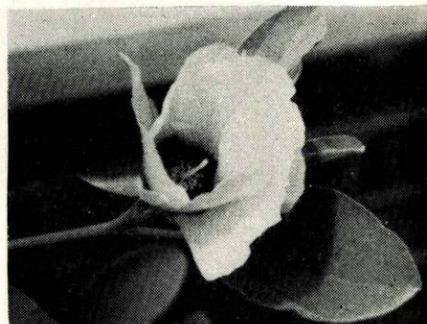
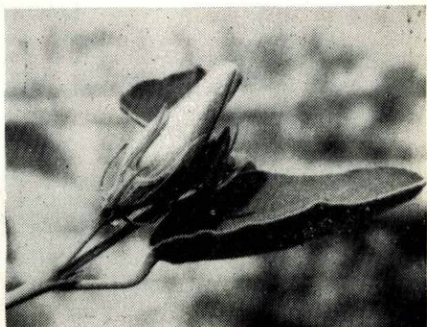
Another characteristic feature of *Gossypium* (which it shares with *Thespesia*) is the presence of small, dark glands in most parts of the plant. These are obscured in some cases (e.g., *G. australe*) by overlying hairiness but can readily be demonstrated by careful observation. They are quite prominent in certain other cases (e.g., *G. sturtianum*) but are lacking entirely in *Alyogyne* and *Hibiscus*. These glands have received considerable study in recent years in the cultivated cottons, because the substance gossypol is one of the various pigments found in these glands. Gossypol, an undesirable constituent of the edible oil extracted from cotton seed, is toxic to non-ruminant animals when the protein-rich seed meal obtained from the oil mills is used as livestock feed. Considerable recent effort by cotton geneticists and plant breeders has resulted in experimental strains of cotton lacking these glands and having a corresponding low level of gossypol in the seeds.

The stigma of *Gossypium* is clavate, as it is in *Alyogyne* and *Thespesia*. In *Hibiscus*, on the other hand, the style is typically divided, and the style branches are divaricate. The five stigmatic lobes of *Hibiscus* are capitate and distinct.

The leaves of *Gossypium* typically have one or more nectaries on the under-surface of the leaf, on the midrib and principal veins. Similar structures (three in number) are found at the base of the involucre of each flower. They may be small and obscure or quite prominent, depending on the species, but the Australian species (as far as living plants have been available for observation) are nearly unique in *Gossypium* in having these nectaries coloured bright red.

The seeds of cotton, of course, are of especial interest, because the cotton lint of commerce is made up of hairs that are epidermal outgrowths of the seed-coat. Most of the native Australian cottons have seed hairs, but none produces fibre that would qualify as cotton lint in commercial terms.

In addition to the native Australian species of *Gossypium* that will be described in succeeding paragraphs, a sizeable cotton crop is grown in various parts of Australia. This crop has developed significantly in recent years. In addition to present cultivated fields, remnants of earlier cultivations are still to be found in the form of isolated plants that have persisted in marginal situations or under a gardener's encouragement. Of note also are the little-known cottons that are found along the river banks in parts of



The author has also experienced what is known as "cleistogamy" in both *G. australe* and *G. bickii*. That is buds developed but then set fruit without the appearance of normal flowers. These inconspicuous self-fertilising flowers that had not developed a coloured corolla are known as cleistogamous flowers. On the plant photographed above the first true (chasmogamous) flower was produced only after some twenty fruits had set from cleistogamous flowers. Later flowering is of both types. Fully developed flowers tend to develop at the first node of a fruiting branch with cleistogamous flowers developing at subsequent nodes.

The fruits developing from the two types of flowers of *G. australe* can be distinguished by the size of the calyx. The calyx lobes of the cleistogamic fruit exceed the bracteoles by only 2-3 mm. as shown in top left of the figure above. The cleistogamic flowers are at various stages of development with "cap" persisting, $\times 1\frac{1}{2}$. The photograph top right is of a chasmogamic flower bud. Lower photographs are of the same flower, a few hours later, $\times \frac{3}{4}$.

These notes and photographs are reproduced from "Cleistogamy in the Malvaceae" by P. A. Fryxell in "Madrono," Vol. 17, No. 3, July, 1963.

Arnhemland, apparently established as a part of the natural vegetation. These are plants representative of the cultivated species, *G. hirsutum* L. (which derives ultimately from Middle America), but how or when or by what agency these plants arrived in northern Australia is not yet clear. They bear handsome white cotton.

The distinctive mauve flower colour of the Australian cottons has already been mentioned. The same colour is found in *Alyogyne* and in some species of *Hibiscus*. Indeed, Dr. J. S. Beard in a recent issue of this journal has noted the "curious preponderance" of mauve in general reference to the entire flora of north-western Australia. (I might add parenthetically that I have noted a similar occurrence of dark purple and red flowers in *Gossypium*, *Cienfuegosia* Cav., and *Senra* Cav. in Aden, Somalia, and adjacent areas, colours that are unusual for these plants elsewhere. Perhaps it too, pertains generally to the flora of that arid region). It seems to me that such a phenomenon (the association of a geographic region with a particular

SMOKE BUSHES

Those who have seen a number of mature bushes in full flower will readily agree that they are well named. In many species of *Conospermum*, their typically grey flowers, often woolly in appearance, are carried up above the foliage and give the illusion of a cloud of smoke lingering over the bush. What a fine contrast in colour these plants would give in the garden.

Blocks donated by Mr. W. B. Thomson, being a record of his trip to Western Australia.



Calytrix brevifolia, *Conospermum stoechedis*

The smoke bush in the rear provides contrast to the exquisite pink starlike flowers of the *Calytrix*. When growing smoke bushes in the garden prune severely as mentioned on the opposite page.



Conospermum crassinervium

Conospermum crassinervium would be a prize garden subject as it has very few leaves and the grey plumes of the flowerhead (above) are carried proudly by tall slender stems.

Editor's Note: Will readers please report on their experiences in growing and propagating "smoke bushes."

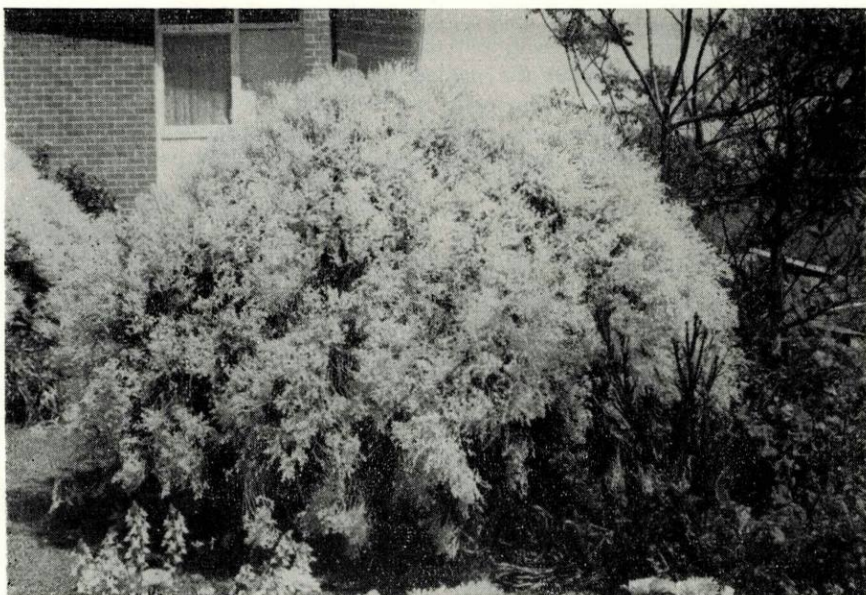
LANDSCAPING WITH NATIVES

With careful layout and selection and grouping of plants even the most ordinary garden can become a beautiful and relaxing setting for living. Hundreds of wildflowers have been described that are suitable for every situation but thought must be given to those plants that, because of some special feature such as their form or colour of foliage, will find ready application for landscaping. We have introduced the "smoke bushes" above. It is possible to get many native plants with a contrasting (with other shrubs) colour of foliage. Let us list all with a silvery or silvery grey appearance. Will readers please advise the editor of plants that they know, have a silvery or silvery grey appearance and their experiences if any, on methods of cultivation.

PRUNING

King's Park Newsletter No. 3

Most native garden subjects are shrubs of one sort and another and most of them stand, and benefit from, pruning. They are typically inhabitants of sandplains where they are devastated by fire from time to time, the shrub being either killed or killed back. If fire does not occur for a number of years the plants become overgrown and "leggy" and lose vigour, and this will also happen in gardens. It is a matter of common observation in the wild that the finest flower displays occur in the years following a burn and the gardener can judiciously keep his plants regenerated by pruning annually or every 2-3 years. It may be advisable to begin this process in the nursery by pinching out the leader of seedlings to promote branching from the base and growing a good bushy habit. Later on cutting back will promote vigorous new growth and lead to the maximum of flowering, even, it is suspected, prolonging the life of the plant.



CONOSPERMUM TRIPLINERVIUM

Smokebushes in this garden have been base-pruned annually after flowering for the past 5 years. The one in the foreground is 4'6" high by 5' spread. Grown and photographed by Mr. John Feeney, 115 Chrysostom Street, Trigg, W.A. The land is rather poor sandy soil on a limestone ridge, 400 yards from the Indian Ocean.

As a general principle, pruning (of matured bushes) should be carried out immediately after flowering. At this stage the plant tends normally to produce a new flush of shoot growth. Pruning should be followed by a good watering. Cut-back plants that are allowed to dry out may often die. Do not prune while plants are dormant, this may also cause losses. Sickly plants can rarely be restored to health and vigour by pruning. It is often resorted to in

these cases as a last desperate measure, but of course does not remove or correct the cause of the sickness.

Pruning of native plants can be undertaken with several different objects in view:—

Pruning for the promotion of flowering is only really successful with those species which flower on young wood. All those with terminal flowers and inflorescences fall into this category, and as pruning causes the production not only of vigorous young shoots but of a greater number of young shoots each capable of bearing flowers, the floriferous potential is enhanced. On the other hand, in the case of species flowering on old wood pruning will remove the portions which would bear flowers next season, and much reduce the floriferous potential of the plant for a certain period. Our native plants have not been catalogued as to flowering habit and there is an important field here for systematic observations to be recorded.

Pruning for shaping is a necessity if the plants show a tendency to grow up too spindly, a common fault of plants raised in pots, or otherwise of a bad form. Pruning of this kind should begin in the nursery with nipping out of the growing point to induce branching. It may be carried on later in the garden also by pinching out tops during the growing season. Early promotion by this means of the mallee habit may be desirable in certain species of eucalypts. *E. erythrocorys*, for example, will normally adopt the habit of a small spindly tree that sometimes becomes straggly and bent over, and is much improved in appearance if grown as a many-stemmed mallee.

Pruning for rejuvenation may be a necessity with many of those species which are sandplain shrubs. It is their nature to grow vigorously for a certain period but later to slow down and become somewhat stagnant. They may at this stage become straggly and of unattractive appearance. Cutting back at the right time will usually restore them to their early vigour, although not all species will stand cutting back to really old wood. Here again we need observations recorded.

In the King's Park Botanic Garden, both pruning and summer watering are now established practice and are both considered equally essential.

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GLENELG NURSERY

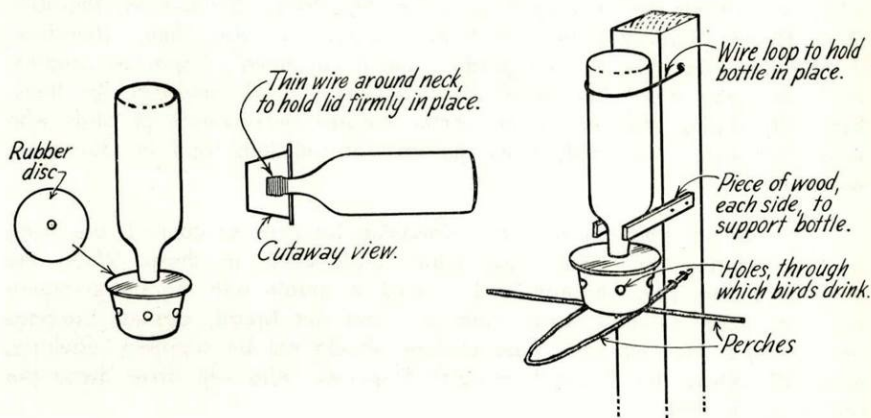
33 DRAYTON ROAD, TOOWOOMBA, Q.

BIRDS AND A NATIVE GARDEN

Further Notes by Mrs. A. J. Salter, Black Rock, Victoria—Pest Control Series, 3

Following the publication of the first article in the December, 1965 issue of *Australian Plants*, many enquiries have been received concerning the actual method of attracting native birds by providing suitable food.

The birds most easily attracted are the members of the Honeyeater family. To commence, it is best to accustom the birds to receiving food by putting up some small open containers, holding nectar, in the trees or shrubs which they may frequent. A small cup, or a 4 ounce Marmite glass (nothing narrow or deep, or a bird may drown), can be wired to a fork, and the birds should find this within a few days. The disadvantages of this method are that the rain will get in and spoil the food; the sparrows will learn to drink it and will drive away the native birds; bees, flies, and moths will flock to it; and the small container will be emptied very quickly.



At this stage, the permanent method should be introduced. Equipment needed is quite simple and inexpensive—an empty bottle, a small plastic pot with lock-on lid (6d. at chain stores), some wire, a piece of inner tube, a post about 6 ft. high.

Firstly cut a round of inner tube the size of the pot lid, with a very small hole in the centre to fit tightly over the bottle neck. This prevents the rain from getting in the pot. Cut a hole in the centre of the pot lid (heated tools will cut plastic without cracking it) to fit as closely as possible to the bottle neck, and going about $1\frac{1}{2}$ inches up it. In order to hold the lid firmly in place, I wind thin wire tightly around neck beneath it. To test where level of nectar will come, fill bottle with water, screw on pot, upend, and mark positions for holes (4 or 5 are enough) about $\frac{1}{4}$ inch above liquid level. Cut $\frac{1}{4}$ inch holes with a heated drill, and smooth the edges. (Should you be troubled by bees coming to the nectar, $\frac{1}{8}$ inch holes will exclude them, and the birds will still manage to drink, although those with shorter tongues may have some difficulty). The holes must be $\frac{1}{4}$ inch above nectar-level, as this will vary from time to time depending on atmospheric pressure and heat.

A post from which to suspend the bottle is necessary. I use old trunks of *Leptospermum laevigatum* (Coastal Tea-tree) which are tough, and give a pleasantly rustic effect. The stand should be placed close by a tree or shrub, for protection from predators, firmly embedded, and the bottle should be at least 4 feet high. If possible, place it where it may be seen from the house, and much pleasure will be gained from observing the activities of the birds.

The mixture I use depends on the price of honey, but generally I make a syrup from 1 lb. raw sugar (brown crystals), 1 lb. honey and enough water to make 1 quart of mixture, stirred over a low heat until dissolved (never boil). This syrup will keep for weeks. To feed the birds, mix approximately 1 part syrup with 2 parts water, making a well-flavoured, nourishing liquid; this will keep for only one day before turning sour. (If honey can be obtained very cheaply, then all honey and no sugar may be used).

At the beginning, when open containers were used, I found that many other native birds like to sample the nectar (Blue Wren, Scrub-wren, Thornbill, Grey Thrush, Silvereye), but the bottle method excluded them. Therefore, if these birds do come to your garden, and if you have no sparrow problem as I had, you might like to try leaving out a small container for them. Especially during the winter, the nectar ensures the survival of birds who would otherwise die simply from the lack of sufficient food in the severe weather.

In addition, small plastic pots containing fat (raw or cooked) are hung in trees, during the winter, and many birds come to these. When the weather is very bad, natural food is hard to obtain and the birds require more in order to keep warm, and so I put out bread, apples, bananas and oranges. However, this type of food should not be supplied regularly, as it will attract the harmful introduced species, who will drive away the useful native birds.

This year there has been a form of ant "plague" in this district; gardens are infested with ants of all sizes and types, and some damage to plants has been incurred. I have kept the worst (the Bull-ants) under control by flooding with the hose the extensive "galleries"; I am told that sheep-dip is the most safe and effective killer. Ants, of course, are of use in cleaning up debris and in turning over the soil, and should not be persecuted unless they are doing actual damage. Unfortunately, many of the local people have had recourse to the recognised modern ant-killer, Dieldrin—one of the most persistent and deadly of the modern pesticides. When the flying ants have swarmed, the birds have feasted on them. As a result, the native birds in my garden are now dying in great numbers from Dieldrin poisoning—by helping us to control an insect plague, they have met their doom. Birds dying of Dieldrin are a distressing sight—they suffer severely for several days, blundering half-blind around the garden, suffering convulsions and paralysis, and crying pitifully. Nothing can save them. I would beg of you all, never to use any of these deadly pesticides, whose present, and long-term effect must be disastrous and incalculable. The native birds attracted to your garden will be pleased to keep the insects under control.

GREVILLEA AS STREET TREES

by Dr. G. H. Hewitt, Bellingen, N.S.W.

Grevillea as street trees? Many more species have excellent prospects as street trees, than have been widely used so far. Experiences at Bellingen on the north coast of N.S.W. are worthy of record.

GREVILLEA HILLIANA

Grevillea hilliana grows naturally from the Clarence River northward, but is more common in Queensland scrub where it grows to 90 feet. In cultivation it is much more modest in height. The leaves are a glossy dark green above with the undersides a silky white. Usually lobed when young they become entire with age, about 5-6" long. Flowers are white in terminal racemes to 4" long and are honey scented. Fruits are small woody capsules splitting open on one side and contain two seeds.

The tree has a pleasing conical shape, flowers profusely each year and has much to commend it as a street tree.



Grevillea hilliana



Grevillea pinnatifida

GREVILLEA PINNATIFIDA

This tree comes from north Queensland. It is susceptible to frost damage at 26°F, but has recovered well and appears a quicker grower than *G. hilliana*. The leaves are large, 12" long, deeply lobed, dark green above with a beautiful golden silky reverse. Flowers are white in terminal racemes, about 7-8" long, and borne profusely. The fruit is a small wooden capsule, two seeded, splitting along one side.

The tree has a nice conical shape and is well furnished with branches.

Editor's Note: There was a very complete coverage on *Grevillea robusta*, "The Silky Oak" as a street tree in our No. 21 issue. Our next issue will feature *Grevillea* again for garden planting. Will readers please advise of their experiences and recommendations of *Grevilleas* that are low growing or prostrate.

The extended flowering season for *Grevillea* is about to commence. Will readers from all parts of Australia please send flowering specimens to Mrs. B. Malone, 18 Hurdis Ave., French's Forest, N.S.W. Please help us to record the 250 species for future issues of the journal.

GARDENING ON CLAY—continued from page 300

Clay soils, therefore, have considerable reserves of nutrients, including trace elements, in the clay minerals; they hold added fertiliser nutrients (except nitrate) against leaching by rain and they resist rapid changes in pH value. Hence, they may be regarded as potentially highly productive soils.

The small, colloidal clay particles have the property of absorbing water which is then held loosely around and within the particles. This moisture can be lost by drying but not all of it is available to plant roots. The absorption of water by the clay particles is accompanied by *swelling* of the clay and conversely drying is accompanied by *shrinkage* of the clay. Most clay soils in Australia, show appreciable swelling and shrinkage properties.

When clay particles are shaken in water their behaviour depends on the proportions of the various absorbed cations. If the predominant cation is calcium, as in near-neutral, neutral and alkaline soils, the clay will not disperse easily and will readily settle after shaking. In more acid soils where some of the calcium is replaced by hydrogen and potassium ions, the particles will disperse more easily and settle less readily. In very acid conditions, however, where the predominant cation is hydrogen, dispersion will be difficult. If for any reason, for example, inundation with sea water, the clay particles become saturated with sodium ions, they will disperse readily and the soil will become very sticky and difficult to cultivate.

When two glass plates are pressed together with a thin film of water between them, a considerable force is needed to separate them. Clay particles behave in much the same way and the very thin films of water between them cause the particles to stick together and to resist separation. This adhesion of the particles is responsible for the intractable nature of clay soils when they are wet.

WHAT SOIL CONDITIONS ARE NEEDED FOR PLANT GROWTH?

The chemical and physical properties of the clay particles already described, determine to a large extent the appropriate management practices on clay soils, but, before considering how the inherent properties of the clay particles can be used to the advantage of the cultivator, it is necessary to consider what soil conditions are needed to ensure good growth of plants.

Plant roots occupy the spaces or pores between the soil particles and obtain their nutrients and water from the solution in these pores. The roots of most plants also need a supply of oxygen if they are to grow normally and are to maintain their rigidity and ability to penetrate into the soil; oxygen is also required by the soil micro-organisms. This oxygen travels rapidly through those pores which are not filled with water but only very slowly through the water-filled pores. Thus the pore space within the soil is of considerable importance to the well-being of the plants. The size and shape of the soil pores is determined by the size and shape of the soil particles themselves and, although the clay particles have been considered so far as independent units, they are usually grouped together with the other soil fractions and the organic colloids into aggregates, and the size and distribution of these aggregates is of as much importance as the distribution of particles within the aggregates.

The small pores within the aggregates can be considered to contain water, while the larger pores contain air. Some of the water in the small pores can move out into the larger pores to replenish that taken up by plant roots which develop mainly in the larger pores; these large pores are easily drained and as a consequence are usually well aerated. Thus the distribution of pore sizes determines the amount of water held in available form in different soil types and it is well known that clay soils hold considerable quantities of available water.

Until recently it was not possible to arrive at any precise conclusion as to the best aggregate sizes to be aimed at in any given soil, but the work of my colleague Dr. D. J. Greenwood has gone some way towards defining what sort of soil physical conditions are necessary for root growth and for the activities of the beneficial soil micro-organisms. It would seem that for clay soils of reasonable organic matter content, the cultivator should aim at producing an aggregate size of about 0.3 to 0.4 inch diameter in the top soil, although it would be unwise to generalise from his, as yet, incomplete results. Further, adequate under-drainage conditions are of importance as they allow the larger inter-aggregate pores in this cultivated layer to drain freely after rain. Few clay soils are free draining under natural conditions and some form of artificial drainage system is usually necessary if the soils are to be brought into a highly productive state. The details of the drainage system most appropriate in any given situation will depend on local factors such as slope, rainfall and nature of the subsoil. The importance of adequate drainage cannot be over-emphasised because unless surplus water can be removed, the large soil pores cannot hold the oxygen needed for the functioning of plant roots and soil micro-organisms.

USE OF SOIL PROPERTIES TO ASSIST IN TILTH PRODUCTION—

The swelling and shrinkage of clays can be used to break down dense lumps or clods of clay. When a block of wet clay is dried, shrinkage takes place and cracks appear throughout the block. When the block is rewetted, especially if the rate of wetting is rapid, the block breaks down along these cracks and smaller clods are produced.

A similar effect is produced when a block of wet clay is frozen and subsequently thawed. Since water expands on freezing, considerable pressures are set up within the block when the water freezes and these pressures result in the formation of ice in layers between structural units in the soil; the ice is not uniformly distributed within the block. On thawing, the water drains out from the cracks which have been produced and the net effect is that the block is broken down into smaller pieces.

These two processes are the main ways and perhaps the only practicable ways of producing a good tilth on a clay soil.

The tilth so produced is usually not broken down by moderate rates of rainfall, but the tilth can easily be destroyed by tramping or by working the soil when it is wet. Since it is almost impossible to repair such damage without a further cycle of drying and wetting, or freezing and thawing, it is imperative that once a tilth has been produced great care be taken not to destroy it by impatience to get on to the land.

For vegetable culture there is much to recommend a system of permanent paths and beds, the beds being worked from paths after the annual autumn digging.

The shrinkage and deep cracking of clay soils during periods of severe drought is often regarded with anxiety because of the damage that must be done to the root systems of perennial plants. However, this damage is probably more than offset by the improvement in underdrainage which such intense drying conditions can produce.

ROLE OF LIME AND BULKY ORGANIC MANURES—

Quite apart from the calcium associated with the clay particles, some soils, notably the Lias and Gault clays, contain free calcium carbonate in appreciable amounts. These clays, when well cultivated, produce soils of very good tilth and structure and the aggregates are very stable to rain. The behaviour under cultivation of many other noncalcareous clay soils can be improved by heavy applications of lime but such action may not be desirable, since by increasing the pH of the soil the range of plants that can be grown is altered. Additions of gypsum have proved useful on some soils, and this material does not affect the soil pH to any marked extent.

Heavy applications of bulky organic materials such as farmyard manure (FYM) or compost, particularly if such materials are fibrous rather than well rotted, will often improve the workability of clay soils. Certain precautions are needed, however, in the method of application and the kinds of soils to which such manures are applied.

There is evidence from agricultural crops that when FYM is ploughed in and forms a layer at the bottom of the furrow, anaerobic conditions (lack of oxygen) can exist in this layer and that such conditions can be harmful to plant growth. To avoid such a possibility in the garden it would seem prudent to mix the organic matter into the soil rather than to place it in a layer at the bottom of a trench or planting hole.

Care is also needed in the use of bulky organic manures on calcareous clay soils if crops which are sensitive to iron and manganese deficiencies are to be grown. Since calcareous clay soils can be maintained in good physical condition without the addition of bulky organic manures, the use of such materials is best avoided particularly where sensitive crops, such as soft fruits, are grown.

On non-calcareous soils the problem of iron and manganese deficiencies does not usually arise and on such soils, bulky organic materials can be applied freely with considerable benefit to the workability of the soil.

SYNTHETIC SOIL CONDITIONERS—

Since the introduction of synthetic soil conditioners about ten years ago, many experiments have been done to assess their value on clay soils. So far no synthetic material has emerged which has long-term effects on clay soils and is economically worthwhile in normal horticultural practice, but in the garden where economic considerations are of less importance some of the available materials have proved useful.

USE OF FERTILISERS—

Most clay soils have considerable reserves of the main nutrient cations particularly of potassium, so that it is seldom necessary to add extra quantities in the form of fertilisers except under conditions of intensive cropping which are rare on clay soils.

In very acid or alkaline clay soils phosphate may become fixed firmly and its availability can be seriously reduced, and for this reason placement

of granules of phosphatic fertilisers in a band below or to the side of the plants is often more effective than a broadcast application; under moderately acid and near neutral conditions, however, availability is increased and normal broadcast applications are satisfactory. In general, organic matter applications reduce fixation of phosphate and hence increase its availability.

Nitrogen may be applied in the organic form or as ammonium or nitrate ions. Clay particles which have a large proportion of ammonium in their absorbed cations tend to disperse easily and this could lead to a loss of stability in the surface layers of the soil if heavy dressings of sulphate of ammonia were used. In practice, however, serious trouble seldom arises, but it would be a wise precaution to use either ammonium or potassium nitrates instead of sulphate of ammonia on soils of doubtful structural stability. Sodium nitrate is not recommended for clay soils since its use can lead to loss of stability of the soil aggregates and to increased stickiness of the soil.

Clay soils have a bad reputation but they are potentially rich and, if handled with care and patience, they can be highly productive and rewarding.

DESERT ROSES—continued from page 303

flower colour, which cuts across botanical groups) must have a basis. It appears reasonable to suggest that its basis lies in the behavioural patterns and sensory capabilities of the pollinators native to the region, presumably insects. Perhaps field observations and experimental studies of the pollinators will shed more light on the question.

DESCRIPTION OF SPECIES

Since the nomenclature has been dealt with in detail in the study referred to earlier, it will not be repeated here. Only the more commonly encountered synonyms will be included in the following descriptions. However, a few general remarks are in order. These plants have been assigned to various genera in addition to *Gossypium*, most commonly to *Cienfuegosia* Cav. (= *Fugosia* Juss.) and *Notoxylinon* Lewt. *Cienfuegosia* is a genus of perennial herbs and subshrubs that occurs in Africa, South America, and the Caribbean, reaching the very southern fringes of North America. It does not occur in Australia. *Fugosia* is simply an illegitimate synonym for *Cienfuegosia*. *Notoxylinon* was established as a separate genus to include most of these Australian cottons. Recent studies have shown, however, that there is no basis for generic distinction and that *Notoxylinon* must be submerged in *Gossypium*.

None of the species has a generally accepted vernacular name, except *Gossypium sturtianum*, Sturt's Desert Rose. The name "Desert Rose" has been applied to *G. australe*. The species may be distinguished by the following key:

- A. Plants glaucous with raised black tubercles on stems and petioles; foliage odoriferous when crushed.
- B. Leaves moderately divided to entire; foliar nectaries small, near base of leaf
- C. Leaves entire; foliar nectary single, reddish; floral bracts ovate to cuneiform, acuminate, entire to slightly laciniate *G. sturtianum*
- CC. Leaves entire to moderately 3-parted, lobes rounded, obtuse; foliar nectaries 1-3, colourless; floral bracts cordate, acute, entire to dentate *G. sturtianum* var. *nandewarensis*
- BB. Leaves deeply 3-5 parted, lobes acuminate; foliar nectaries 3-5, prominent, near middle of leaf lobes *G. robinsonii*
- AA. Plants more or less pubescent (at least on young foliage), without raised tubercles; foliage odourless

- D. Pedicel less than 2 cm; plants finely pubescent to coarsely hairy; calyx lobes acuminate
- E. Capsules pubescent, apparently glandfree; seeds covered with straight, bristly hairs; foliar nectaries large, elongate *G. australe*
- EE. Capsule glabrous, nigro-punctate; seeds not bristly-haired; foliar nectaries inconspicuous
- F. Seed hairs tightly appressed to seed; plant coarsely tomentose; calyx prominently nigro-punctate; flowers mauve *G. bickii*
- FF. Seeds glabrous; plant finely and densely puberulent; calyx (and foliage) seemingly gland-free; flowers white *G. pulchellum*
- DD. Peduncle more than 2 cm., axillary, articulate; plant finely pubescent to nearly glabrous; calyx lobes linear, large, foliaceous
- G. Leaves thick, broad, markedly cordate, nearly glabrous, long-petioled; plant decumbent *G. populifolium*
- GG. Leaves ovate to lanceolate, short-petioled
- H. Leaves elliptic to lanceolate, penninerved, glabrous (except when young); peduncle articulated near centre; calyx lobes glabrous, obscurely veined *G. cunninghamii*
- HH. Leaves ovate, palmately 5-nerved, puberulent; peduncle articulated near base; calyx lobes puberulent, ribbed *G. costulatum*

1. *Gossypium sturtianum* J. H. Willis var. *sturtianum* "Sturt's Desert Rose"

(Synonyms: *G. sturtii*; *Cienfuegosia gossypoides*).

A densely-foliaged, glaucous shrub that flowers abundantly through much of the year. Stems green, covered with prominent, raised black tubercles. Leaves odouriferous when crushed, orbicular to ovate, often apiculate, more or less adaxially rolled, entire. Foliar nectary single, basal, 1-2 mm. long, reddish. Floral bracts ovate to triangular, entire or rarely lacinate, acuminate. Calyx subtruncate to shallowly toothed. Corolla mauve with dark spot in centre. Capsules glabrous, nigro-punctate, 4-5 valved. Seeds 3-4 mm.; seed hairs appressed, whitish to greenish.

Sturt's Desert Rose, a relatively well-known plant, has been designated the floral emblem for the Northern Territory. It has found its way into gardens and deservedly so, for it makes a fine specimen shrub. Its growth habit is relatively compact, though it will achieve a height of 5 or 6 feet in a few years. Its flowering is not strictly seasonal, but tends to reach a peak in late winter, when it is covered with attractive mauve flowers. If it sets a heavy crop of fruits, it will often cease flowering until the fruits have matured.

It is a desert plant and can tolerate drought. However, it responds well to an adequate water supply. Like all *Gossypia*, it thrives on full sun and high temperatures. Even slight shading will inhibit flowering. Of all the *Gossypia* it is the most cold tolerant and will remain evergreen if not subjected to severe frosts.

Sturt's Desert Rose is rather widely distributed in the interior of Australia. It occurs in the southern part of the Northern Territory, in the north-eastern parts of South Australia, and through much of the western parts of Queensland and New South Wales.

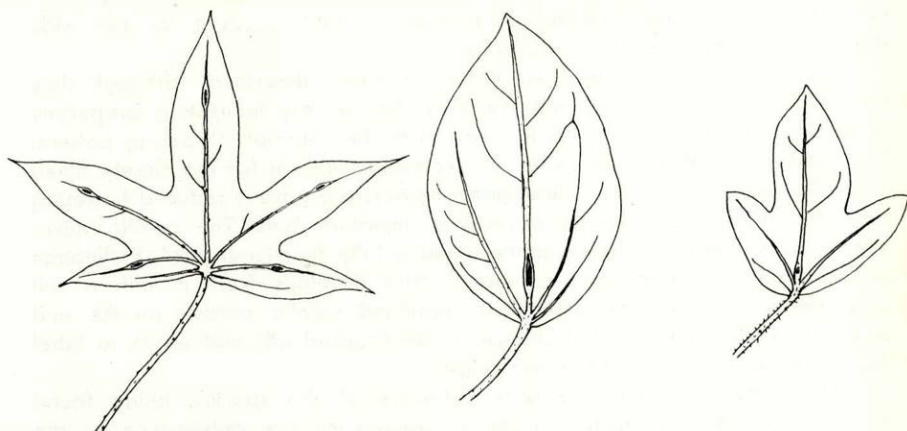
1a. *Gossypium sturtianum* var. *nandewarense* (Der.) Fryx.

This plant is similar to the preceding, but differs in the much more open growth habit of the shrub and the lighter green foliage. It has lobed leaves and differs in other technical details, as follows.

Leaves flat, entire to moderately lobed, with distinctive "ears" at the base; lobes obtuse. Foliar nectaries 1-3, colourless (or sometimes pinkish in cool weather). Floral bracts broadly cordate, entire to 3-5 dentate, acute. Calyx with five distinctive reddish spots on margin, alternate with acute lobes. Corolla pale mauve with dark spot in centre. Flowers larger than in the preceding variety. Seed hairs brownish.

Var. *nandewarense* probably has less value as an ornamental shrub than Sturt's Desert Rose, because of its more open growth habit and the tendency of the branches to break off at the base in the wind. Its flowers are larger but considerably less abundant. However, it may have value as a breeding stock, as will be discussed in a later paragraph on hybrids.

The plant derives its name from the Nandewar Range near Narrabri in north-eastern New South Wales, where it was discovered by Dr. N. F. Derera

Leaves of *G. robinsonii**G. australe**G. bickii*

just a few years ago. It is also known from another limited area in the vicinity of the Expedition Range in eastern Queensland.

2. *Gossypium robinsonii* F. Muell.

Stems glaucous, covered with prominent, raised black tubercles. Leaves deeply 3-5 lobed; lobes acuminate, entire. Foliar nectaries 3-5, prominent, red, located near the middle of the leaf blade. Floral bracts narrowly triangular to ovate, entire. Calyx teeth acuminate. Corolla mauve with a dark spot in centre. Capsules glabrous, nigro-punctate, 4-5 valved. Seeds 4-6 mm; seed hairs whitish.

G. robinsonii can only be grown in frost-free areas, as it is quite sensitive to cold. The seasonal pattern of flowering that is found in this species is apparently under photoperiodic control, the flowers appearing during the short days of winter.

Plants of this species appear to have been grown to a limited extent as ornamental shrubs, largely for their showy flowers. However, they do not seem to be as well adapted to the purpose as *G. sturtianum* because the flowers are less abundant and the habit of growth less disciplined. It is also unsuitable for areas where frost occurs, except in protected localities.

G. robinsonii occurs in dry river beds and similar localities in the west-central part of Western Australia, from the Fortescue River to the Gascoyne River.

3. *Gossypium australe* F. Muell.

(Synonym: *Notoxylinon australe*)

A low-growing, puberulent shrub. The black glands characteristic of *Gossypium* occur in this plant, but they are very obscure and are usually concealed by the tomentum, so that they are evident only on the calyx, where they are often sparse.

Leaves ovate, entire or rarely slightly lobed. Foliar nectary conspicuous, up to 10 mm. long, basal, red. Floral bracts filiform. Calyx ribbed and somewhat constricted near base, nigro-punctate except at the base. Corolla mauve with a dark spot in centre. Flowering more or less throughout the year. Capsules puberulent, 3-5 valved. Seeds 3-4 mm., bristly-haired; hairs tan, 5-7 mm.

Several peculiarities characterise *G. australe*. The foliar nectaries are quite distinctive. Their notable size and elongated form together with their bright red colouring makes them look like lilliputian saber slashes. The seed hairs are unique in *Gossypium* in standing straight out from the seed in all directions. Such an arrangement may be an adaption for wind dispersal of the seeds, since it enables each seed to be blown over the ground like a

miniature tumbleweed. The adaption may, in fact, account for the wide distribution of this species in Australia.

The flowers are mauve like those previously described, although they tend to be smaller. *G. australe*, however, has a very interesting propensity to produce cleistogamic flowers in addition to the "normal" flowering pattern. This capacity is unknown elsewhere in *Gossypium* except for the closely allied Australian species, *G. bickii*. Cleistogamic flowers are greatly reduced flowering structures that never expand beyond a miniature bud. The corolla never opens, but within it are a few anthers and a fully functional pistil. Pollination occurs within the bud, and a normal fruit develops from it with a full complement of seed. The miniature, unopened corolla persists on the end of the maturing fruit, unless it chances to be knocked off, and serves to label these fruits as to their cleistogamic origin.

The pubescent fruits are also distinctive of this species, being found in only one other (African) species of *Gossypium*. The pubescence on the capsule, incidentally, conceals the presence of black glands, which can be demonstrated readily, however, by examining the thin, inner wall of the mature capsule.

The attractive flowers of *G. australe* suggest its possible use as an ornamental, but it would seem to have more value as a perennial herb than as a specimen shrub because of its small size and low vigour. It is sensitive to frost but will grow back from the roots even after a hard freeze.

G. australe is widely distributed, occurring from near the eastern coast of central Queensland across most of the Northern Territory, along the southern edge of the Kimberleys, and along the coast of Western Australia as far as Carnarvon.

4. *Gossypium bickii* Prokh.

(Synonym: *Notoxylinon pedatum*)

This species bears a strong superficial resemblance to *G. australe* but can readily be distinguished from it in a number of particulars. It, too, is a low-growing shrub but is more coarsely hairy, and the black glands are fairly prominent in the foliage.

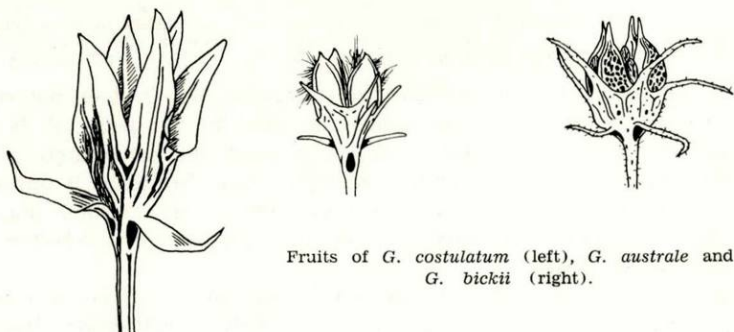
Leaves ovate, entire to 3-5 lobed, reticulate-veined. Foliar nectary very small (less than 1mm.), red. Floral bracts filiform, pubescent. Calyx broadly campanulate (not constricted at the base), prominently nigro-punctate throughout. Flowers and flowering habits similar to *G. australe*. Capsules glabrous, 3-5 valved, prominently nigro-punctate. Seeds 2-4 mm.; seed hairs appressed, brownish.

As already noted, *G. bickii* has the propensity to produce cleistogamic flowers in the same way as *G. australe*. Just what environmental factors influence the nature of the flowers produced in these two species is not certain. It appears that young plants just coming into flowering or plants in unfavourable circumstances tend to produce cleistogamic flowers, while plants that are more mature and vigorous will produce the "normal" (or chasmogamous) flowers.

G. bickii is a more vigorous plant and flowers more profusely than does *G. australe*. On this account it is probably more deserving of a place in the garden. Its natural distribution is much more restricted, however, since it is found only in the central and southern part of the Northern Territory and extending a short way across the border into Queensland.

5. *Gossypium pulchellum* (C. A. Gardn.) Fryx.

A densely puberulent, upright shrub. The density of the puberulence is so great in this species (although the puberulence is extremely fine) that



Fruits of *G. costulatum* (left), *G. australe* and *G. bickii* (right).

the black glands are completely concealed, except on the glabrous capsules.

Leaves elliptic to ovate, entire, acuminate. Foliar nectary small (1-2 mm). Floral bracts subulate. Calyx broadly campanulate; lobes acuminate, 1-nerved. Corolla white with a dark centre. Capsule glabrous, 3-valved, nigro-punctate. Seeds large (7 mm.), glabrous.

G. pulchellum is known only from the single collection made by Gardner in 1921 at Van Sittart Bay, W.A. Further collections are greatly to be desired. The name given it (and Gardner's description) indicate that it is a plant of beauty and one possibly worthy of cultivation as an ornamental. Its white flowers mark it as different from those that have been described previously, as do the glabrous seeds. Little more can be said about this species until further material is available for study.

6. *Gossypium populifolium* (Benth.) F. Muell.

(Synonym: *Notoxylon populifolium*)

Perhaps this species should not be called a shrub, because its stems are slender and prostrate. Foliage glabrate.

Leaves thick, profoundly cordate, entire, acuminate, long-petioled. Foliar nectary inconspicuous. Floral bracts subulate, reflexed. Calyx deeply lobed, nigro-punctate; lobes exceeding bracts. Corolla mauve with dark spot in centre. Flowers and fruits borne singly on long (3-7 cm.), axillary peduncles. Capsule glabrous, 3-valved, nigro-punctate.

G. populifolium occurs along the northern coast of Western Australia and on nearby islands from Montague Sound to King Sound, and probably inland to a greater or lesser extent. Being a prostrate plant, it is quite different from the upright shrubs that are typical of *Gossypium*. Living plants have never been available in cultivation, so it is difficult to predict its horticultural prospects. It has, however, the showy flowers typical of *Gossypium* and these are borne on long peduncles.

7. *Gossypium cunninghamii* Tod.

(synonym: *Notoxylon punctatum*)

An upright, glabrate shrub.

Leaves lanceolate, penninerved, and short-petioled. Foliar nectary inconspicuous. Floral bracts subulate. Calyx deeply lobed, and obscurely veined; lobes large and foliaceous. The corolla colour is unknown, but the flowers are large and showy. Flowers and fruits borne singly on long (3-5 cm.), axillary peduncles. Capsule glabrous, 3-valved, nigro-punctate.

G. cunninghamii is known only from a very few herbarium specimens, all collected before the turn of the century. It appears to be a very handsome shrub with attractive foliage and large flowers. Its "rediscovery" is greatly to be desired, but it apparently occurs only in a limited area in the Coburg Peninsula and on adjacent islands in northernmost Australia.

8. *Gossypium costulatum* Tod.

(Synonym: *Notoxylon latifolium*)

A finely-tomentose, more or less prostrate plant. Its leaves are broadly ovate and entire with moderately short petioles.

The foliary nectary is small. The floral bracts are subulate and sometimes reflexed. The calyx is similar in size and form to that of *G. cunninghamii* but differs in being puberulent and prominently ribbed. Corolla white with dark spot in centre. Flowers and fruits borne on long (4-7 cm.), axillary peduncles. Capsules glabrous, 3-valved, nigro-punctate. Seeds glabrous.

G. costulatum, too, is unknown in cultivation, but it does not appear to be as rare as the preceding species, so that the prospects of its being collected are probably greater. It occurs in much the same area as does *G. populifolium*, in northern Western Australia. Like the latter, it apparently has a prostrate habit of growth (although this is not certain) and long peduncles. Its flowers are white, similar to those of *G. pulchellum*, and apparently quite showy.

As has been indicated in the preceding descriptions, only about half of the Australian wild cottons are available for study in cultivation. The study of the available species has included, among other things, the study of hybrids among them. Certain of these are of some general interest and will be described briefly.

I might first note parenthetically that these plants, along with wild and cultivated sorts of cotton from all parts of the world, are maintained in a tropical garden in Iguala, southern Mexico, by the U.S. Department of Agriculture in co-operation with the National Cotton Council of America and the Mexican Government.

HYBRIDS

G. sturtianum and its var. *nandewarense* are quite similar in general appearance and apparently are closely related. As might be expected, they are easily hybridised. My experience in growing the hybrid suggests that it is a more favourable horticultural subject than either parent. The hybrid has the compact growth and dense foliage of the *sturtianum* parent and the delicate pale-mauve flower-colour of the *nandewarense* parent. In addition it flowers more profusely than either and the individual flowers are distinctly larger than either.

The hybrid is quite fertile and sets an abundant crop of seed. It is quite possible that in the progeny grown from such a hybrid, plant breeders might select some highly desirable horticultural types.

Another hybrid worthy of mention is that between *G. sturtianum* and *G. robinsonii*. It is a little more difficult to achieve, but makes a very handsome shrub. It is rather large and vigorous, and during its winter-spring flowering season is literally covered with large, delicate, mauve-pink blooms. The two species concerned here are distantly enough related that the hybrid between them has only partial fertility. Seed set is quite limited (although there will be one or a few seeds in most capsules), so that flowering continues freely. Plants raised from seeds of this hybrid will generally be "unthrifty" and not worth the effort.

Finally, if I may inject an international note into this discussion, the hybrid between *G. sturtianum* and the American cultigen *G. barbadense* has some interesting features. The latter species is the one that includes the varieties famous for their extra-long fibres. It is a tetraploid having twice as many chromosomes as *G. sturtianum*. Hence, the hybrid between them is a triploid; triploids are always quite sterile and produce no fruits. The flowers are large and showy. The striking fact is that in a cross between a mauve-flowered species and a yellow-flowered species, the flowers of the hybrid are red.

AUSTRALIAN CARNIVOROUS PLANTS

by RICA ERICKSON

Carnivorous plants are to be found in all continents and are not uncommon in Australia. It is thought that their unusual appetite for living creatures arises from a need to supplement certain deficiencies in the soil. The carnivorous habit is shared by plants in widely separated families. The Australian genera are *Cephalotus*, *Nepenthes*, *Byblis*, *Drosera*, *Aldrovanda*, *Utricularia* and *Polypompholyx*.

Darwin's classic work on carnivorous plants has been rivalled in modern times by the studies of F. E. Lloyd. Much research is still being conducted into the secrets of their digestive processes as well as into their structure and the many different ways in which their traps function. In each of the plants the leaves are the traps. Some snare their victims in passive traps, others are slowly active in their efforts, but some have evolved a swift positive action to secure their prey.

Examples of a "pitfall" type of passive trap are to be seen in two pitcherplants from very dissimilar families. The Western Australian Pitcherplant *Cephalotus follicularis* is confined to the extreme southwest of Australia. Excellent notes and illustrations on this plant have been published in this journal (Sept. 1961) so that little need be said here concerning it. The Tropical Pitcherplant *Nepenthes mirabilis* occurs only in the extreme northeast of the continent, at Cape York Peninsula. It grows also in Southern Asia and the East Indies. The Australian plant named *N. kennedyi* by von Mueller, and the ten additional forms named by F. M. Bailey are now considered to be growth variations of the common and very variable species *N. mirabilis*. The pitchers of both these plants resemble small jugs with lids, and hold a quantity of liquid. The rims of the jugs are ribbed with teeth which point down into the receptacle. Insects and other small creatures are attracted to this opening and crawl along the ribs down into the pit. The teeth prevent their exit and on venturing further they find themselves on a slippery zone which precipitates them into the fluid. Both these plants have been kept in cultivation at suitable temperatures in hot houses. *N. mirabilis* is an under-shrub or climbing jungle plant. The leaves may be up to a foot long on long stalks. The midrib is produced into a tendril or a pitcher. The flowers are small and green in terminal racemes or panicles, having stamens and pistils in separate flowers on different plants. The sepal-like segments of both kinds of flowers are usually 4 in number. The filaments of the stamens of the male flower are united in a central column and the anthers form a head. The stigma of the female flower is sessile and lobed.

PITCHER PLANT

Will all those who have had experience in growing the "pitcher plant" please advise the editor as it will be featured in our next issue.

A passive trap of the flypaper type is used by *Byblis* as described on page 321.

Sundews or *Drosera* employ "flypaper" traps of the active type. This family of plants is world wide in distribution but is most represented in Australia with about 55 species, most of them in south-western Australia. The leaves of these plants are covered on the upper surface with long sticky-tipped hairs or tentacles. These are sensitive and when a tentacle catches an insect it will bend over to begin enfolding it. In the meantime an impulse is

conveyed to its neighbouring tentacles causing them also to bend over to complete the capture. The digestion and absorption of the prey are also the function of these sticky tips. Sundews are easily recognised merely from these sensitive hairs. The plants range from tiny rosetted forms to tall climbers up to 6 feet tall and are among the most beautiful and delicate of our wildflowers. Most of the larger species grow from tubers which go very deep into the soil and are very tender rooted. They can be transplanted only with the most extreme care. However the small rosetted species so common in Western Australia are adventitious, the plant appearing to die every summer, yet after the first rains new roots and leaves shoot from the heart of the old. These roots go surprisingly deep for such small plants but if lifted early with a deep cut of soil they can be successfully transplanted. Seed of Sundews can be germinated fairly readily but the collection often needs to be made while the calyx is still green.

There are 7 tropical Sundews in Australia. Of the 50 or so remaining species only 9 appear in Eastern Australia and 2 of these occur also in Western Australia.

Sundews can be grouped according to their habit of growth as in the following table and it is interesting to note that at least one eastern species appears in each group except the third, while W.A. is not represented in the fifth. The tropical species are not included in these groups.

a. "Pygmy Sundews," miniature plants with rather dense rosettes of very small leaves with long slender stalks, roots fibrous (17 sp., three of them eastern).

b. "Rosetted Sundews," bulbous-rooted plants, with flat rosettes of leaves the leaf stalks of which can scarcely be distinguished from the blades. (8 sp., three of them eastern).

c. "Fan-leaved Sundews," usually erect plants with fan-shaped leaves scattered along the stem and clasping it (3 sp., all western).

d. "Rainbow Sundews," erect or climbing plants with cupped leaves on very slender stalks, often in groups of three (18 sp., three eastern).

e. "Narrow-leaved Sundews," plants with erect long, narrow leaves. (2 sp., both eastern).

The Waterwheel Plant *Aldrovanda vesiculosa* which is to be found floating in still lagoons and waterways of the tropics and subtropics resembles a small immersed bottlebrush. It is widely distributed in ditches and swamps of the Old World and is the only species of the genus. It is in the same family as the Sundews. The leaves are active "spring traps", being sensitive and very swift to respond. The leaves are on comparatively long, winged stalks set in whorls of 8 along the upright floating stem. Each leaf blade has sensitive hairs near the mid vein and when touched can shut very swiftly with a jerk, catching the water beetle or other such creature that is luckless enough to brush against them. The mechanism is too elaborate to be detailed here.

A more complicated trap has been evolved by the Bladderworts *Utricularia* and *Polypompholyx*. These plants grow by the side of receding swamps or in still waters. Sometimes known as "Fairy Aprons," they are usually smallish plants, some being minute, with flowers of the "Snapdragon" type and having prominent nectaries. The traps are bladders less than the size of a grain of wheat. Although seeming to be part of a root

THE RAINBOW PLANT — *Byblis gigantea*

Block donated by Mr. W. B. Thomson, being a record of his trip to W.A.



A field of rainbow plants near Mogumber, W.A.

A "flypaper" type of passive trap is used by the *Byblis*. There are only 2 species in this genus both confined to Australia. Commonly known as the Rainbow Plant, *B. gigantea*, a rather stout plant, is found in regions near Perth in Western Australia. Notes on this plant have been published in this journal (Dec. 1961). The second species, *B. liniflora*, is a much smaller, slender plant with long thread-like leaves. It is found in Northern Australia and by waterholes far inland. The leaves and stems of both plants are covered with sticky-tipped hairs which catch the prey. Sessile sticky glands aid in the digestion and absorption of the insect. The sticky-tipped hairs are not sensitive and are therefore defined as passive. This is one point of difference between *Byblis* and *Drosera*, which are often confused. The flowers of both are 5-petalled, but a difference in the structure of the ovary (2-celled in *Byblis*) and the form of the pistil and stamens set them apart.

CARNIVOROUS PLANTS

The above article may encourage readers to grow these fascinating plants. Write to the leader, Mr. M. C. Russell, 41 Lusk Drive, Vermont, Victoria. He particularly wants to hear from country residents of West Australia who, if they do not want to go to the special trouble of cultivation, will assist him in his research on this project. Special knowledge or experience is not necessary.

RUPICOLA Maiden et Betche

THE PLANT FAMILY EPACRIDACEAE—Part 3 by Betsy R. Jackes

This small genus from New South Wales, consists of two species both relatively rare. The generic name derived from *rupes-is*—a cliff, and *cola*—an inhabitant, indicates the preferred habitat of both species. Procumbent or erect shrubs with shortly petiolate leaves, the white flowers are solitary in the leaf axils. The corolla-tube is short with widely spreading, lanceolate to ovate-lanceolate lobes, which are 2-3 times the length of the tube.

Numerous seeds occur within each locule of the capsule.

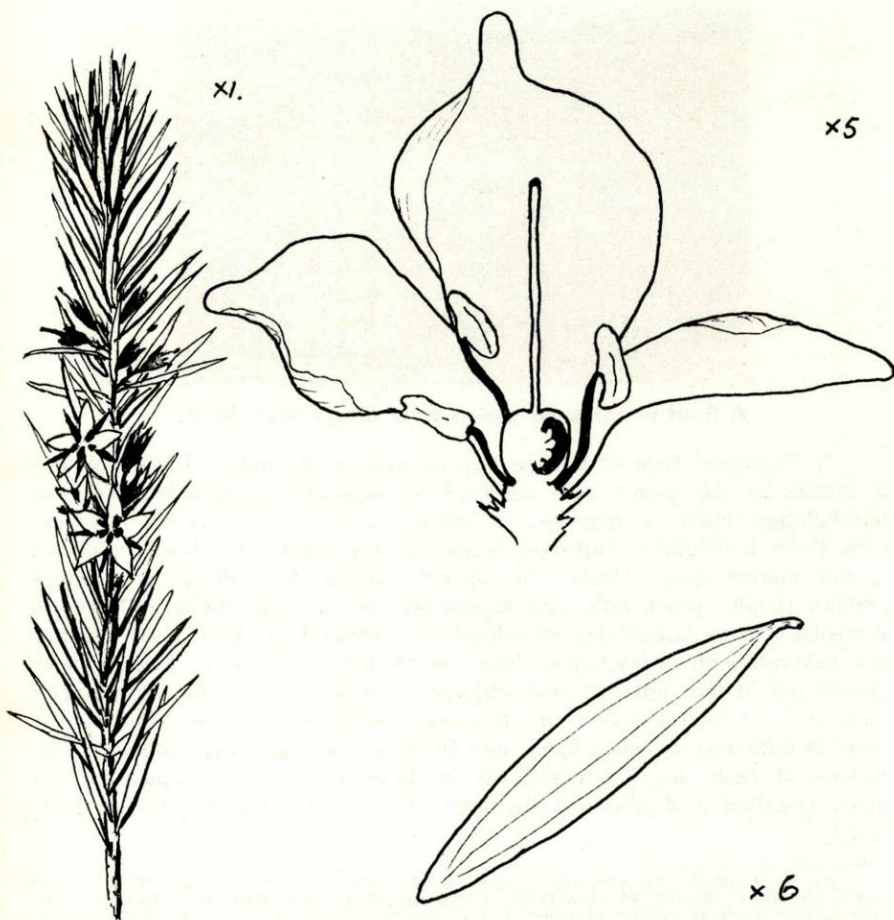
KEY TO SPECIES

Leaves glabrous, corolla usually greater than 7 mm. long, with anthers enclosed

R. sprengelioides

Leaves pubescent, corolla usually less than 5 mm. long, with anthers exserted

R. gnidioides



Rupicola sprengelioides flower spray, half a flower and the under surface of a leaf.

NOTES ON THE SPECIES

1. *Rupicola sprengelioides* Maiden et Betcher

An erect shrub frequently about 1.5 m. high, found either on sandstone cliffs or nearby, particularly around Cox's River and the Burrigorang Valley, as well as several other localities within the Blue Mountains area.

The crowded leaves are linear-lanceolate, 1-3 cm. long.

2. *Rupicola gnidioides* Summerhayes

A dwarf shrub to 25 cm. which may be either procumbent or somewhat ascending, with lanceolate leaves 5-8 cm. long. This plant is easily distinguished from the preceding species by the leaves which are pubescent on both sides, and the smaller flowers. The external surface of the bracts and sepals is pubescent as is the ovary and the internal surface of the corolla.

This species is found growing on sandstone cliffs south-west of Nowra, New South Wales.

PHOSPHORUS NUTRITION OF HEATH PLANTS

From a talk by Dr. R. L. Specht, Botany Department, University of Melbourne

These studies on the nutrition of heath plants are the results of fifteen years research, firstly in the Botany Department, University of Adelaide, more recently in the Botany Department, University of Melbourne. The story here presented is by no means completely proven but will serve to illustrate the complexity of the problem.

Heath vegetation, largely treeless vegetation dominated by low, hard-leaved, perennial shrubs of such genera as *Banksia*, *Hakea*, *Epacris*, *Leptospermum*, *Casuarina*, *Xanthorrhoea*, low *Acacia*, etc., may be found in the high rainfall areas of southern and eastern coastal Australia. The vegetation is always found on soils very low in plant nutrients, in particular the nutrients phosphorus and nitrogen. In fact, these soils are probably the most infertile soils in the whole continent. Nevertheless, the vegetation has been shown to produce $\frac{1}{2}$ - $\frac{3}{4}$ ton dry weight of tops per acre every year. In contrast, agricultural pastures and crops grown without fertiliser on the same soil will hardly equal their seed weight in the first year and rarely persist into the second year.

The first most striking characteristic of the vegetation is the concentration of roots in the surface foot of the soil. This extensive surface root layer is supplemented by deep tap roots penetrating deeply into the soil.

Deep roots enable the plants to explore a great volume of soil for stored water and, at the same time, bring a small amount of nutrient from the impoverished sub-soil to supplement the concentration of nutrients in the surface layers of soil.

The surface root layer is by far the most important. Firstly, it can make use of all heavy rain-showers; secondly, it is a favourable situation to trap any plant nutrients which are released from decaying leaf litter. This is especially so when the roots form a dense mat immediately under the litter.

Litter-decomposing microbes in southern Australia are most active during spring and it is then that elements such as phosphorus are released and, we

NATIVE LAURELS

ANOPTERUS GLANDULOSUS — ESCALLONIACEAE

Part 3 of a series on Tasmanian Wildflowers by A. M. Gray

Anopterus glandulosus, known commonly as "Native or Mountain Laurel" occurs in most rainforests over the whole of Tasmania. Although never very abundant, it is, nevertheless, one of the more prominent understory shrubs of the rainforests. It grows to a height of approximately 10'-15' and is rather an untidy looking shrub with long branches spreading in all directions; the leaves mainly being clustered at the ends of the branches. However the large, glossy, deep-green leaves are most attractive, some almost 9" long and 2" wide, the older leaves at the base of the cluster occasionally turn



ANOPTERUS GLANDULOSUS LABILL x ½

This attractive but straggling plant is found in most Tasmanian rainforests. It has very large, glossy leaves and flowers which resemble those of *Eucryphia lucida*—described in last issue. However, it differs from *Eucryphia* by having the flowers borne in large terminal racemes whereas in *Eucryphia* they are borne singly. *Anopterus* has 5-6 petals, two large carpels and as many stamens as petals. *Eucryphia* has only 4 petals, 4-5 small, inconspicuous carpels and very numerous stamens in whorls.

bright red or yellow prior to dropping off. The flowers are born in showy racemes at the ends of the branches; the racemes are about 6" long and support numerous delicate white or pink flowers each one approximately $\frac{3}{4}$ " in diameter and very closely resembling the flowers of the true laurels.

Anopterus grows usually in close association with *Telopea truncata* (Tas. Waratah), *Richea pandanifolia* and *R. dracophylla* (giant heaths or grass trees), *Phyllacladus aspleniifolius* (celery topped pine) and *Atherosperma moschata* (southern Sassafras), all requiring a high rainfall and rich forest humus.

Anopterus glandulosus Labill.—Native Laurel. A tall straggling shrub or small tree, usually 6'-12' high but occasionally 20' high. Leaves mostly clustered at the ends of the branches, evergreen, spreading—elliptical lanceolate to oblanceolate, base narrowed to a short petiole. Apex acute, 2"-9" long, 1"-2" wide, thick, leathery very glossy. Margin with widely spaced teeth having glandular tips. Flowers on slender racemes, terminal; pedicels often recurved usually $\frac{1}{2}$ "- $\frac{3}{4}$ " in diameter, receptacle inferior. Sepals 5-6 spreading. Petals 5-6 shortly joined at the base, lobes spreading. Stamens shorter than the petals, opposite the sepals. Carpels two, joined, ovary superior, conical tapering to a short style, stigma bifid, the base of the ovary continuous with the receptacle. Fruit capsular, opening by two valves—seeds winged.

Tas. Endemic frequent in wet sclerophyll forests and rain forests, from sea level in the S. & W. to 3,000'. Flowering—Spring and summer.

PROPAGATION

Although not considered as a tidy garden plant, it can however with care and patience be made to grow into a compact, attractive specimen, rewarding the grower with a fine display of beautiful flowers each summer and a constantly noticeable plant with regard to its large glossy leaves. Cuttings are quite successful but require a good deal of care during the early stages. Seed germinates quite readily if sown during the late summer in a mixture of one part well rotted forest humus and one part coarse sand. Watering and adequate drainage are essential, watering especially so during the warmer months. Damping-off is not a problem as long as drainage is adequate and cool air is able to circulate around the seedlings. These should be pricked out singly into small pots or tubes as soon as they are about 1" high. After growing on in this manner and they reach between 3"-6" high, they may be planted into a permanent position in the garden.

CULTIVATION

The position they require is one free from the hot afternoon sun or hot winds, preferably in the shade of a larger tree. The soil should be well drained but kept constantly damp all through the year. To keep the plant from spreading and becoming straggly it is necessary to prune, usually every second year and just following flowering.

Anopterus will tolerate light and not too frequent applications of "Aquasol" or a little sulphate of ammonia but no lime! Kept in trim and given attention it makes a rewarding shrub for the cooler positions in any garden.

ANOPTERUS MACLEAYANUS

by H. C. Hayes, Coff's Harbour, N.S.W.

An attractive tree with large fleshy toothed leaves and racemes of white flowers. Sometimes called "Tasmanian Laurel" in Queensland, this shrub or small tree occasionally reaches a height of 40 ft. and a stem diameter of 9 ins. Trunk usually straight, round when young, but may become a little irregular after branching.

Bark smooth, except for very numerous small lenticels on older trees, dark brown in colour.

Leaves up to 15 ins. or over in length, bunched towards the ends of the branches, glabrous or hairy. Branchlets downy. Petioles from indistinct to $\frac{1}{2}$ in. long.

Flowers white, in terminal racemes. Individual flowers $\frac{1}{2}$ to over 1 in. diameter, somewhat bell-shaped.

Fruit—a dry, hard pointed capsule, brown in colour, opening from the apex into two valves which usually curve backwards after opening an inch or a little over in length.

Habitat—Rain forests of various types and extending from the coast to the tablelands.

Distribution—from Hastings River to MacPherson Range.

Wood—Pinkish, soft, brittle and perishable.

THE FAMILY ESCALLONIACEAE

The genera now regarded as forming the family *Escalloniaceae* were previously included in the large unwieldy family *Saxifragaceae*. However they form a natural group and are regarded as a separate family by modern workers. There are more than 250 species with a strong development in the Australian-Malayan and Andean South American regions. Eight genera (and 22 species) are represented in Australia—*Tetracarpaea* (1), *Anopterus* (2), *Cuttsia* (1), *Abrophyllum* (2), *Quintinia* (4), *Polyosma* (7), *Argrophyllum* (3) and *Corokia* (2-incl. *Colmeirea*), while two others occur in New Zealand (*Ixerba* and *Carpodetus*) and a third in New Caledonia (*Dedea*).

Editor's Note: Mr. Gray will deal with the genus *Tetracarpaea* in our next issue. Who can comment on their cultivation? I need comments on species of other genera in the family as listed above. Who will help me?

PHOSPHOROUS NUTRITIONS OF HEATH PLANTS—continued from page 323.

believe, immediately trapped by the roots and stored as a complex polyphosphate molecule. There seems to be a special enzyme system in all the heath species that have been investigated enabling these special chemical compounds to be produced.

For this very crucial "trapping-device" to operate, little growth of the plants should occur and this appears to be the case for most of the heath species.

Growth in most species usually only starts in late spring and continues through summer as long as there is an adequate reserve of soil water. During this time the polyphosphates are probably broken down to simple phosphate which can be moved around the plant to the growing shoots and roots. Here they are incorporated into phosphorus compounds vital for the growth of the plant.

As summer progresses stored soil water is often greatly reduced and leaf-fall of older leaves then occurs. Before the leaves fall much of the phosphorus is moved from the leaves to younger leaf and stem tissues. Only a very small amount of phosphorus thus falls to the ground with leaf-litter to go through a cycle again as soon as the litter decomposes.

Author's Note: To avoid confusion, the term "heath vegetation" as used by ecologists in Australia applies to the low hard-leaved vegetation containing such common plants as *Ranksia*, *Hakea*, *Xanthorrhoea*, *Leptospermum*, *Casuarina*, etc. Members of the family *Epacridaceae* may or may not be present.

Editor's Note: This article is presented in association with our series on *Epacridaceae* as many people have difficulty in maintaining vigorous growth. However careful consideration should be given to this cycle of self fertilizing with many of our natives, particularly the heath flora and the sand plains flora of Western Australia.

BANKSIA

A major work is in preparation on all species of *Banksia*. Will any person with comments on the naming, classification, cultivation, etc. of any species please contact the editor immediately.

PHOTOGRAPHERS

To enable us to produce a worthy book on *Banksia*, good colour slides are essential. Please send every slide on *Banksia* to the editor for inspection. Slides are also needed on all species of NATIVE ORCHIDS FROM NORTHERN AUSTRALIA. If you know of any photographer who may have colour slides of natives, please advise the editor.

AUSTRALIAN CARNIVOROUS PLANTS—continued from page 320.

system they are actually modified leaves. They work like self-setting box traps. Water in the bladder can be expelled through the cells of the walls, thus creating a pressure from the outside. The door hangs like a curtain with the lower edge delicately wedged on the threshold. It is equipped with a protruding knob or a hair. When this is touched the balance of the door is upset and it instantly is opened inwards by the water pressure which rushes the victim into the bladder. Mosquito larvae etc. are the usual prey but some larger plants are known to catch small tadpoles by the head. The catch is slowly digested and the bladder expels the water to wait tensed for the next meal. Only the minuteness of the trap prevents it from being the most horrifying and spectacular plant in creation.

Bladderworts have a world wide distribution. There are about 40 in Australia, more than half of them in the tropical regions. The genus *Utricularia* is distinguished by the 2 calyx lobes; the genus *Polypompholyx* (consisting of only 2 species) is to be recognised by the 4 calyx lobes. These very interesting plants are most difficult to study. They are variable in habit and the identification of species is not easy, partly because the original descriptions are often inadequate and partly because the TYPE material may lack the most important part of the plant, namely the bladders. In the past collectors have often taken only the flowering scape, which comes away freely, leaving the bladders in the mud. The bladders are now essential for identification of many species.

Much painstaking work has been done on bladderworts by Mr. Peter Taylor of Kew Gardens, and only the Australian species remain to complete his world survey of the family. He needs collections of all Australian bladderworts. Many plants of the one species can be packed into a vaseline jar in a preservative fluid of about 70% methylated spirits and 30% water. Sealed securely and packed well they should be sent with notes concerning dates and localities. To obtain the whole plant it is necessary to dig out a small sod and wash the mud away from the roots (so-called). Here is an opportunity for us to assist in important research.

Address—Mr. Peter Taylor, Kew Gardens, Richmond, Surrey, England.

CYMBIDIUM IN AUSTRALIA—continued from page 294.

2. *Cymbidium madidum* Lindl.

Bot. Reg. Misc. 9 (1840); A. D. Hawkes, Aust., Orch. Rev. 26, no. 3:135 (Sept. 1961); Menninger, Orch. Soc. Bull. (America) 30, no. 11: 855-76 (Nov. 1961).

Cymbidium iridifolium A. Cunn. in Lindl. Bot. Reg. Misc. 34 (1839); Rupp, Proc. Linn. Soc. N.S.W. 62:299 (1937) & Orch. N.S.W. 128 (1943)—not of Roxburgh 1814 (*Oberonia iridifolia* (Roxb.) Lindl.).

Cymbidium albuciflorum F. Muell., Fragm. 1:188 (1859); Benth., Flor. Austr. 6:333 (1873); FitzG. ined. 79; F. M. Bail., Qld. Flor. 5:1547 (1902); Macpherson & Rupp, Nth. Qld. Nat. 3, no. 31: 7 & 26 (April 1935) (Cross pollination).

Cymbidium leai Rendle, Journ. Bot. 36: 221 (1898).

Cymbidium queenianum Klinge, Acta Horti. Petropolitani 17, 1:137 (1899).

A species of 2 varieties:—

(a) *Cymbidium madidum* Lindl. var. *madidum*

Stems pseudobulbous, 6-25 x 2-6 cm., bright to golden green. Leaves 20-90 x 2-4 cm., rather thin, not rigid, much decurved when long, not deeply channelled, shining green. Racemes pendulous when long, 20-60 cm. long, containing from 12-70 flowers which are usually not as closely packed as those of the other two Australian species. Flowers about 2-3 cm. diam., usually not very widely spreading as the petals are directed forwards, segments thick in texture, pale to dark brownish, brownish on the outside and olive-green inside or entirely olive-green or golden-green. Sepals $\pm$ similar, 9-15 x 4-7 mm., narrow-obovate slightly concave. Petals porrect, slightly smaller than the sepals, $\pm$ obliquely obovate. Labellum 9-15 x 4-6 mm., distinctly trilobate; lateral lobes 1-2 x 5-8 mm., crescentic, green, the free anterior portion $\pm$ triangular; mid-lobe about 4-5 x 4-5 mm., yellow, sub-obovate, very obtuse, lateral margins slightly decurved, the apical tip often decurved to give the lobe an emarginate appearance; disc with a single very low broad keel which is, $\pm$ linear, acute but contracted about the middle, glandular, glistening and slightly viscid, there is a dark brown or black transverse patch of colour between the lateral lobes and the mid-lobe, usually on the outside as well as on the inside, but not on the keel but the keel is often outlined in a similar colour and the colour may extend on to the keel near its base. Column 8-10 mm. long, slightly decurved about the middle, slightly dilated towards the apex. Stigma small, depressed scutiform. Anther broader than high but about as deep as high.

Flowering Period: 8-10 in the tropics but later in more southern localities.

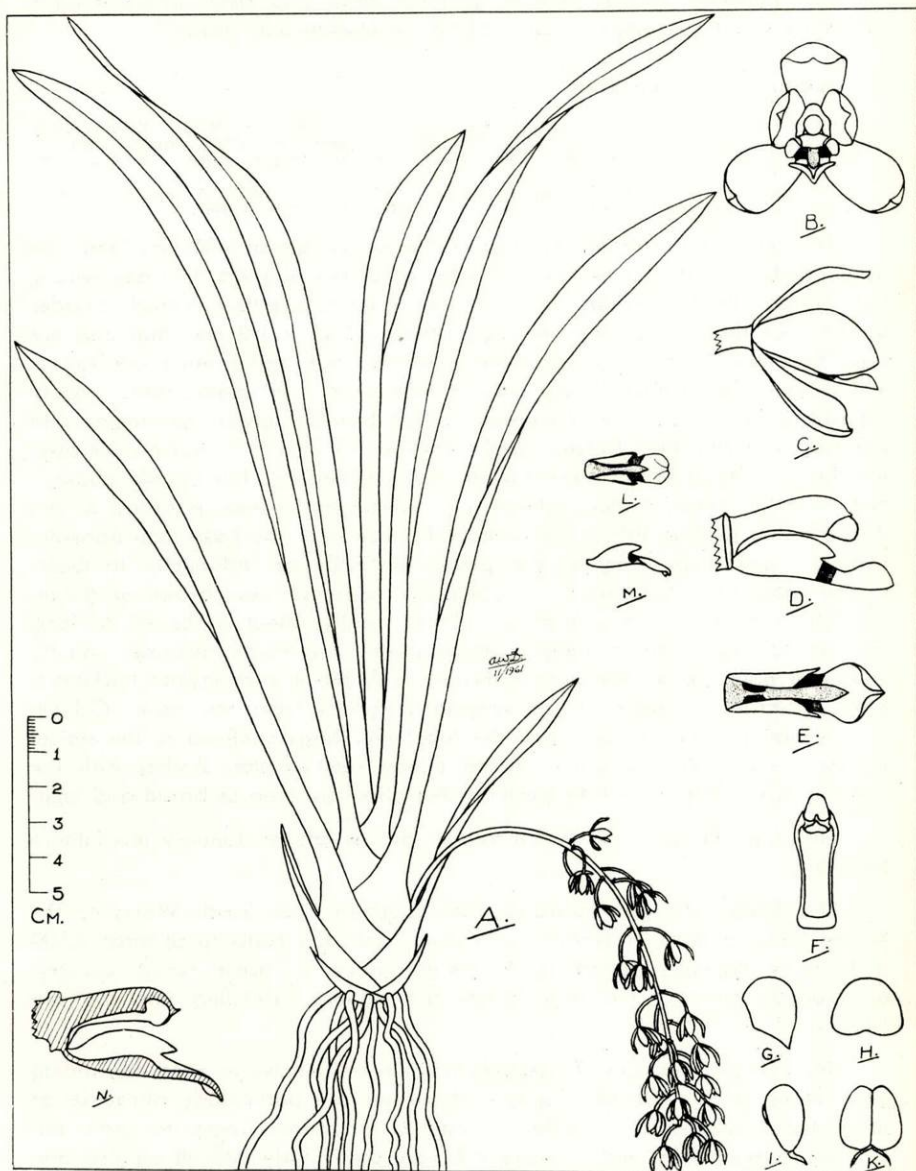
Distribution: Eastern Australia from about the Clarence River, New South Wales to the tip of Cape York Peninsula and from sea level to about 4,000 feet. It is found in moist open forests bordering rain forests and within rain forests.

(b) *Cymbidium madidum* Lindl. var. *leroyi* (St. Cloud) Menninger, Orch. Soc. Bull. (America) 30, pt. 11:865-76 (Nov. 1961).

Cymbidium leroyi St. Cloud, Nth. Qld. Nat. 24, no. 112:3 (Sept. 1955).

Plant indistinguishable from that of var. *madidum*, but the lateral margins of the mid-lobe of the labellum are recurved and almost meeting towards the apex of the lobe to give it and almost cymbiform appearance.

Flowering Period: 11-12.



CYMBIDIUM MADIDUM Lindl. var. LEROYI (St. Cloud) Menninger

- A. Portion of plant . . . to scale $\times \frac{1}{2}$.
 B. Flower from the front . . . to scale $\times 3$.
 C. Flower from the side . . . to scale $\times 3$.
 D. Column and labellum from the side . . . to scale $\times 4$.
 E. Labellum from above . . . to scale $\times 4$.
 F. Column from the front . . . to scale $\times 2$.
 G. Anther from the side . . . to scale $\times 10$.
 H. Anther from above . . . to scale $\times 10$.
 I. Pollinarium from the side . . . to scale $\times 15$.
 K. Pollinarium from the front . . . to scale $\times 15$.
 L. Labellum of var. *madidum*, from above . . . to scale $\times 2$.
 M. "L" from the side . . . to scale $\times 2$.
 N. Longitudinal section of column and labellum of var. *madidum* . . . to scale $\times 4$.

Distribution: South-east Cape York Peninsula; apparently confined to the lowlands between the Barron River and the Bloomfield River, where it often grows as a typical epiphyte on paperbark (*Melaleuca*) trees.

3. *Cymbidium suave* R.Br.

Prodr. 331 (1810); Lindl., Gen. et Spec. Orch. 164 (1840); F. Muell., Fragm. 1:187 (1859); Benth., Flor. Austr. 6:303 (1873); Reichb. f., Beitr. 46 (1877); FitzG., ined 17; F. M. Bail., Qld. Flor. 5:1548 (1902); Rupp, Proc. Linn. Soc. N.S.W. 62:301 (1937) & Orch. N.S.W. 128 (1943).

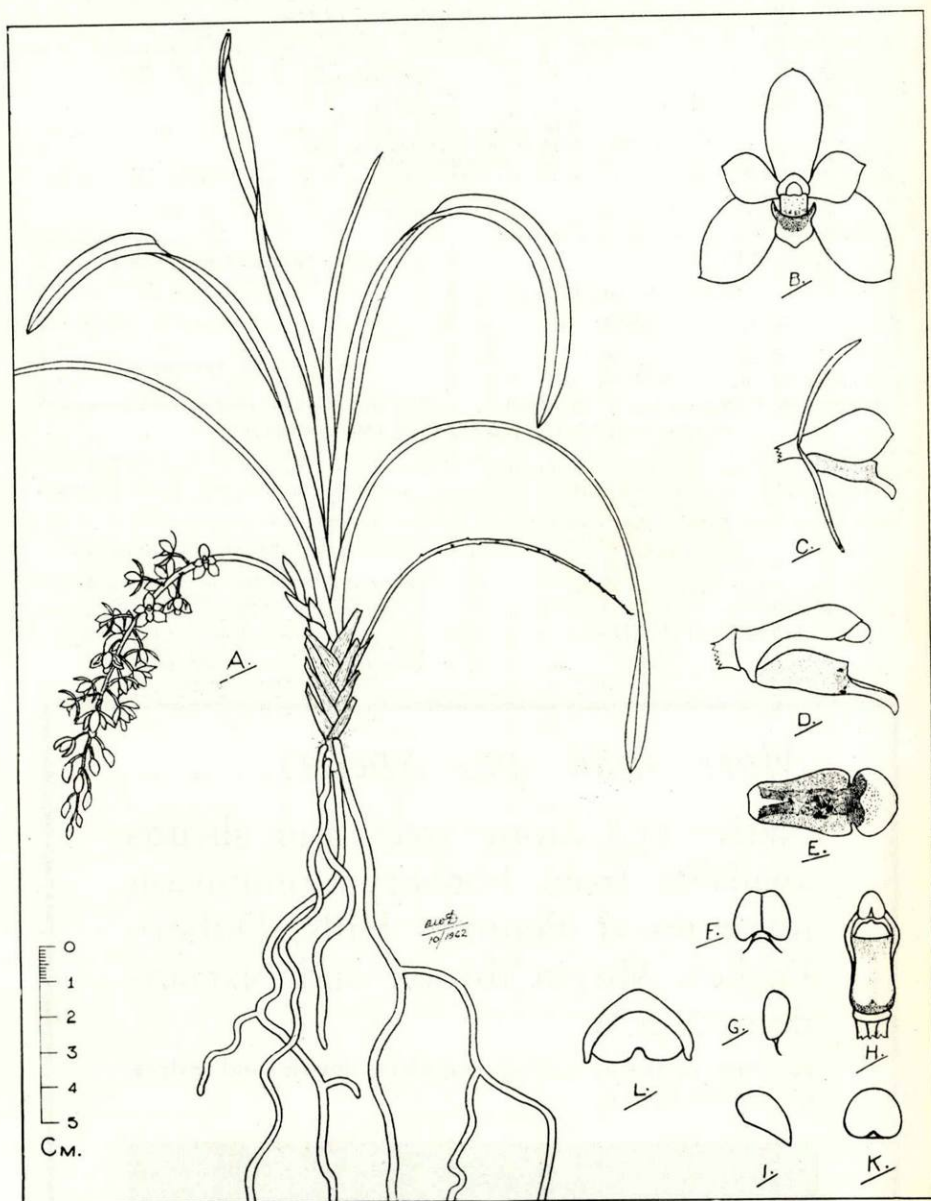
Cymbidium gomphocarpum FitzG., Journ. Bot. 21:203 (1883) & an unpublished plate in the Nat. Hero. of N.S.W.; Rupp, Aust. Orch. Rev. 4:66 (1939).

The smallest Australian member of the genus. Stems 5-35 cm. long, not pseudobulbous and continuing to grow for a number of years, thin and woody but covered with the scarious remains of leaf bases to give them a much broader appearance than is actually the case. Leaves 15-45 x 1-2 cm., thin and not rigid. Racemes 10-25 cm. long containing from a few to rather numerous flowers which are usually rather closely packed. Flowers 2-3 cm. diam., rather widely spreading, light green, golden green or dull brownish-green, sometimes with indistinct red blotches. Dorsal sepal 10-15 x 5-7 mm., $\pm$ narrow-obovate, mucronate. Lateral sepals much similar to the dorsal one but usually about 1 mm. broader. Petals usually several mm. shorter but almost as broad as the dorsal sepal, usually oblong for a short distance near the base then obovate. Labellum almost as long as the petals, distinctly or indistinctly trilobate; lateral lobes short but broad, $\pm$ obliquely crescentic, pale brown or green; mid-lobe variable, in most northern plants usually about as broad as long and broad ovate, but in many southern plants it is much narrower, usually yellow or pale green; disc without distinct keels but it is somewhat thickened, dark red-brown entirely or for varying distances from the base. Column usually about 2 mm. shorter than the labellum; wings confined to the apical portion, very short, crescentic. Stigma almost semi-circular. Anther with the anterior much deeper than the posterior but about as deep as broad and long.

Flowering Period: 8-10 in the tropics, but as late as January in southern latitudes.

Distribution: Eastern Australia from Southern New South Wales to the Annan River at least of North Queensland, from the coast to at least 3,500 feet. It is typically found in hardwood trees in open forest country, occasionally entering the rain forests but seldom extending into the dry interior.

The culture of species of *Cymbidium* is too well-known to need elucidating here. None of the Australian species, however, are particularly attractive as horticultural subjects. *C. madidum* Lindl. is moderately easy to grow but *C. canaliculatum* R.Br. and *C. suave* R.Br. are particularly difficult subjects and far less than 1% of the plants collected survive longer than 2-3 years.

**CYMBIDIUM SUAVE R.Br.**

- A. Portion of plant . . . to half scale shown.
 B. Flower from the front . . . to scale x 3.
 C. Flower from the side . . . to scale x 3.
 D. Column and labellum from the side . . . to scale x 5.
 E. Labellum from above . . . to scale x 5.
 F. Pollinarium from the front . . . to scale x 10.
 G. Pollinarium from the side . . . to scale x 10.
 H. Column from the front . . . to scale x 5.
 I. Anther from the side . . . to scale x 10.
 J. Anther from above . . . to scale x 10.
 K. Top of column, anther removed, from above . . . to scale x 10.

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NATIVES FROM THE SEASIDE OF W.A.

PART 4 IN OUR SERIES ON "PLANTS FOR THE SEASIDE"

by Professor J. D. Sauer, University of Wisconsin, U.S.A. Prepared from notes made on a recent Scientific Survey of coastal plants in an area of W.A.

INTRODUCTION

Tropical coast around Port Hedland (these species should perhaps be presented separately because they might be ill-adapted to the temperate regions):

Ground Cover: *Canavalia maritima* and *Ipomoea pes-caprae*, both with showy violet flowers on trailing vines that produce healthy, luxuriant foliage in extreme proximity to the sea.

Herbs and Sub-Shrubs: *Gomphrena canascens* and *G. leptoclada*, low bushy herbs with bright rose-coloured heads, large and small, respectively, on open dunes, zone II. *Crotalaria cunninghamii*, tall and rangy, with the curious greenish "bird-flower," zone II.

Shrub: *Acacia translucens*, with small, hard leaves and many pretty yellow heads, zone I.

Small Tree: *Ficus platypoda*, densely crowned, rough-barked.

TEMPERATE COAST:

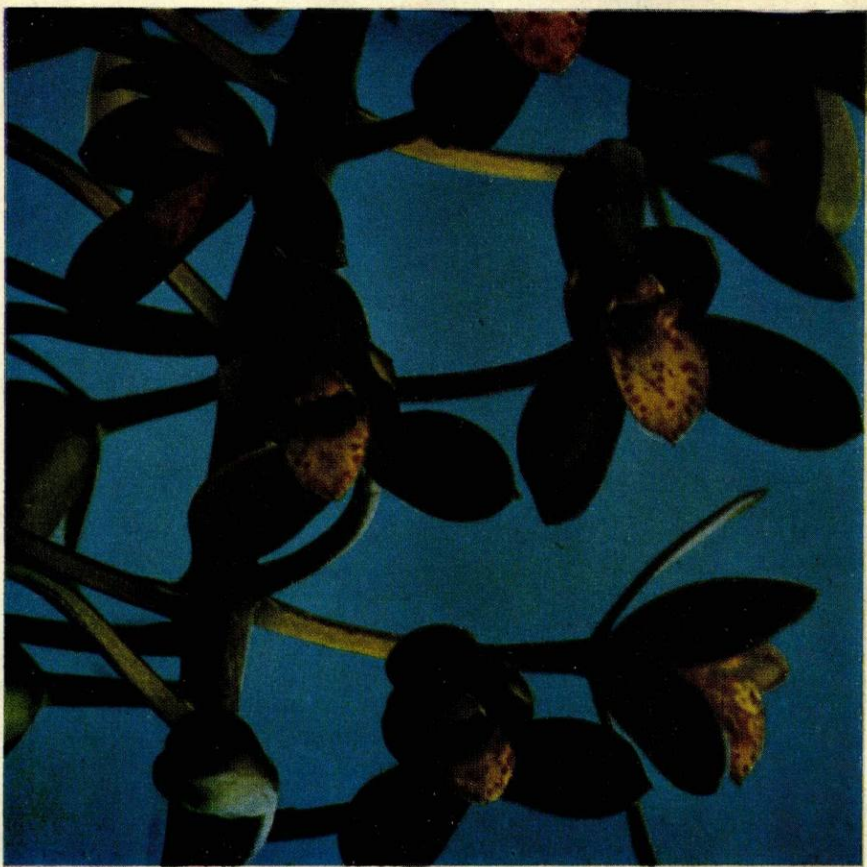
Ground Cover: *Carpobrotus aequilaterale*, of course, zone I. *Portulaca conspicua*, plants themselves nothing much but intense yellow flowers on exposed bare rock, zone I. *Hardenbergia comptoniana* is a vine for Zone II.

Herbs and Sub-Shrubs: *Angianthus cunninghamii* and *Calocephalus brownii*, both with striking whitish leaves and glowing yellow heads, zone I. *Rhagodia baccata* does well in zone I and individuals with sprays of purplish fruit are handsome, but there is much variation and the species is sometimes quite unattractive. *Dampiera incana*, foliage and flowers both pretty, zone II.

Shrubs: *Adenanthos sericea*, in both foliage and flowers among the loveliest of all coastal plants, zone I. *Beaufortia sparsa*, spectacular red inflorescences, zone II. *Pimelea ferruginea*, big colourful inflorescences, and *P. clavata*, small white heads and willow-like leaves, both *Pimeleas* in zone II. *Capparis spinosa*, tough little shrubs with curious flowers on limestone, zones I and II. *Atriplex isatidea*, more of a curiosity than a beauty, coarse plant with striking silvery colour on all parts—leaf, stem, and inflorescence—zone I. *Templetonia retusa* is the most colourful of the temperate coastal shrubs with its large red pea flowers and is rivalled only by *Melaleuca huegelii* when in flower.

There is a good selection of other shrubs that are not especially notable for flowers but give handsome, dense hedge-like growth in zone I: the broad and hard-leaves *Myoporum insulare* and the two *Scaevolas*, *S. crassifolia* a ± prostrate shrub tolerant of some salt spray and *S. nitida*, a taller plant for further back in the sheltered zones; and a nice group of heath-like species: *Andersonia sprengelioides*, *Alyxia buxifolia*, the fragrant *Westringia dampieri*, two *Melaleucas*, *M. huegelii* and *M. microphylla*, and of course, *Olearia axillaris*.

Small Trees: *Acacia cuneata* (often only a shrub on limestone), zone I, and *Acacia cyclopis* and *A. rostellifera*, handsome foliage with bronze flowers and finally, the graceful *Agonis flexuosa*.

CYMBIDIUM CANALICULATUM

Colour Photography by P. Featherstone.

THE "BLACK ORCHID"

C. canaliculatum is highly perfumed, it has a strong semi pendulous spike with many flowers, the colour variable from pale milk-chocolate and yellow, to dark chocolate and cream. Note that in some of the far northern Queensland forms the variety *sparkesii*, the dark plum-coloured flowers, almost black, give rise to the local name or misname of the "Black Orchid." The perfume of *C. canaliculatum* is strongly vanilla and when grown well is a very hardy and lovely plant.

C. canaliculatum has as the name implies, very canal-shaped leaves which catch every drop of rain or dew and conducts same straight down into the base of the bulbs where the root area is. They grow in the full sun in large old dead giants of trees that look as if they have been dead for 50 years at least. I have seen some very large handsome plants in the Boggabilla area but do not make the mistake of trying to get them out of the trees, you will smash them to pieces and destroy much more than you will get.

These plants are protected by law. An interesting side-light is thrown on *C. canaliculatum* by the fact that many tribes of aborigines knew that by pounding up the bulbs and drinking the liquid produced they could cure dysentery and I understand the plant or the medicine from it, was called "humpy-dumpy."