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Colour photography by Frank Hurley

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WARATAHS AND HOW TO GROW THEM
GREVILLEAS—The Spider Flowers—For the Garden

CONTENTS OF THIS BOOK

This is the first issue in Volume No. 4 of this periodical. Volume No. 4 will be a complete book in itself and although readers are advised to procure the previous volumes if available, they are not essential for the full appreciation of this book. The Australian flora is so large and diverse that the full coverage would be a never ending story. For the benefit of readers who have just found this publication we attempt to make each volume as complete a guide as would be necessary for the lay home gardener to immediately take up the cultivation of wildflowers.

CONTENTS OF THIS ISSUE

The principal theme of this issue is the large plant family *Proteaceae* with particular reference to *Telopea* the "Waratah", and *Grevillea*. Although many plants are mentioned and described in each issue, it being necessary to mention botanical names and semi-technical botanical classification schemes, we are essentially interested in the cultivation of wild flowers for the home gardener.

GROWING WILDFLOWERS

WARATAH—"Growing Waratahs" by F. H. Stone—page 3.

"Propagation of Waratah"—page 24.

"Propagation from Seed" by L. K. Bates—page 15.

GREVILLEA—There are a number of articles each describing different species that the competent writers recommend. The growing conditions for Waratah are also ideal for *Grevillea*.

"Small *Grevillea*" by P. Stanley—page 6—*G. capitellata*, *G. fasciculata*, *G. brownii*.

"Propagation of *Grevillea*"—page 14. The methods for Waratah also apply.

"Propagation from Seed" by L. K. Bates—page 15.

"*Grevillea* Gems From W.A." by F. Lullfitz & E. Wittwer—page 7.

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"*Grevillea wilsonii*" by A. L. Hargrave—page 13.

"*Grevillea aspera*" by P. Stanley—page 38.

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"*Grevillea* From the Far North" by K. Bates—page 14.

"*Grevillea* in South Australia" by Ron Hill—page 14.

"Nutrition of *Grevillea robusta*" by C. W. E. Moore—page 39.

BANKSIA & DRYANDRA—Cultivate as you would Waratah—page 37.

HIBISCUS LIKE FLOWERS—The previous four issues have each carried an article on a genus of plants that have hibiscus like flowers belonging to the family *Malvaceae*.

"Alyogyne—The Genus" by Paul A. Fryxell—page 16.

"More Hibiscus—*Malvaceae* Shrubs for South Australian Gardens" by R. L. Hill—page 19.

"*Thespesia populnea*"—page 20.

PLANTS FOR WET SITUATIONS—The two previous issues have been devoted to the cultivation of wildflowers in heavy soil and clay gardens. Continuing this series:

"Water Absorbing Plants"—page 25.

"Clay Soils in Gardens—Tasmania" by T. D. Raphael—page 26.

EUCALYPTUS—THE AUSTRALIAN "GUM" TREES. Although mention has been made of the Eucalypts in past issues, particularly the "Red Flowering Gum" in our No. 14 issue, and some of the mallees, it is intended to commence a new series of articles on these important trees.

"Eucalypts For Wet Situations"—page 25.

"*Eucalyptus forrestiana*"—page 48.

ORCHIDS—Each issue features some native orchids. The usual coverage is not provided this issue as the articles arrived to the editor too late and I am having great difficulty in obtaining good colour slides.

"Terrestrial Orchids—Some N.S.W. Orchids of the Swamps" by K. Holmes—page 27.

ROSACEAE—THE FAMILY by A. M. Gray—page 29.

"The Genus *Geum* In Australia"—page 29.

"The Genus *Acaena* In Australia"—page 30.

"The Genus *Rubus* In Australia"—page 30.

Potentilla anserina—page 31.

STYLOBASIUM—The Genus—page 33.

WILDFLOWERS OF TASMANIA—The article on "The Family Rosaceae" is actually the sixth in a series of articles on the wildflowers of our island State.

ALPINE FLORA AND GARDENING—The article "The Family Rosaceae" mentions a number of plants suitable for "Alpine Gardening."

ACACIAS—THE WATTLE TREES—Continuing a series.

"Small Acacias" by F. J. Rogers—page 32.

INSECTIVOROUS PLANTS—Unique plants that prey on insects.

"The West Australian Pitcher Plant" by F. Lullfitz—page 34. Cultivation—page 37.

"The Pitcher Plant as an Insect Trap" by Prof. B. J. Grieve—page 28.

"The Rainbow Plant—*Byblis gigantea*"—page 37.

NATIVE CLIMBERS—*Marianthus erubescens*—page 37.

FLANNEL FLOWERS—Pictured on the cover. Easily grown perennials that will romp in your garden. Obtain fresh seed, scatter in your garden, then burn some dead leaves over the seed. Water well the next day. For more complete coverage where these plants are featured see No. 22 issue.

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AUSTRALIAN PLANTS . . .

Volume No. 1, issues 1-12 has now sold out but except for issues 2 & 12 the remaining 10 issues are available at 40 cents each + 5c postage or \$4.00 + 20c postage for the Vol. 1 set. Supplies of Volume No. 2 (issues 13-20) at \$6.00 + 20c postage are still available, many of the issues being no longer available singly. Volume No. 3 (issues 21-28) will be available by March, 1967 fully bound at \$6.00 + 20c postage.

GROWING WARATAHS

by Frank H. Stone, Waratah Park, Bilpin, N.S.W.

Propagation from seed or cuttings now presents no real problems, however the subject of cultivation of our most prized and so far most difficult native plant to tame, to the big majority of gardeners still presents a challenge fraught with so much frustration that many have given up hope of ever producing a worthwhile specimen in their gardens.

At various times during the last eight years of close study of these plants both in their natural and cultivated state, I have felt that I may have "stumbled" on the secret but now at last I feel that recent observations coupled with previous experience may provide the answer.

First let us deal with the bush plants. There is no doubt whatever that a bush fire is the only complete answer to rejuvenation. It will be found that Waratahs usually grow in association with Leguminosae. The scraggy looking Waratah with many weak canes bearing an occasional flower or two, small and on very short stalks, is struggling. Its falling leaves have built around its base a small pyramid of leaves and leaf mould. This cool fertile area is eagerly sought by the roots of its widely foraging neighbours and the mass of fibrous roots at its base are almost certainly of foreign origin.

Fertilizer (blood and bone, foul manure, etc.) is eagerly snapped up by its competitors and is of little benefit to the bush waratah.

Now comes the fire:—

Most if not all of its surface feeding, foraging neighbours are burnt and die whilst the Waratah is, underground, very much alive and from its ligno tuber it soon sends up strong healthy canes. The plant now free of competition, makes good use of the supply of nitrogen, left by its "pea" family neighbours as well no doubt as the potash from the fire. Two springs later, i.e., say eighteen to twenty months, we find at least three or four large flowers on strong erect canes four or five feet high. Whether we prune them or not, the size and number of flowers decrease progressively as does the vigour of the plant in relation to the recovery and regrowth of the bush in its immediate vicinity. In five or six years our Waratah is back again to its scraggy struggling existence in fierce competition and occasionally only after a good season, producing a good cane or two.

During the sustained drought such as in 1965/6, the plant will, unless in a favoured position, die right back and all seems lost until good soaking rain produces fresh growth from the ligno tuber, "BUT" not the vigorous canes one expects after fire. Why? Because its competitors have weathered the drought and are again as voracious as ever. The conclusions to be drawn from this appear to be:—

1. That waratahs need a root run free from competition.
2. Nitrogen and probably potash.
3. A very friable top soil (most top soils tend to compact after a few years and a good fire undoubtedly loosens this up).
4. A constant supply of moisture in the sub-soil.

GROW WARATAH FROM SEED

Mr. Stone continues his article on page 21. Waratah belongs to the great plant family *Proteaceae* which also includes *Banksia*, *Dryandra* (see page 37), *Isopogon* and the principal subject of this issue *Grevillea*. The methods of cultivation are similar although most *Grevillea* are easier to grow. A method of propagation of *Proteaceae* including Waratah is given on page 15 and also page 24. Waratah are particularly easy to germinate from seed.

Grevillea aspera



Grevillea capitellata



Grevillea brownii

Grevillea fasciculata

Photography of *G. brownii* by J. Joshua, the other three by Clive Kane.

GREVILLEA

Easily grown plants with Spider-like Flowerheads

Articles by competent horticulturalists on the many Grevilleas that are prostrate or of only small stature and are especially recommended for rock gardens or as ground cover commence over the page.



Blocks by courtesy of Faterson Brokensha Pty. Ltd., Perth.

W.A. SPIDER NET BUSH (*Grevillea thelemanniana*)

FOUR SMALL GREVILLEAS RECOMMENDED FOR ROCKERIES

(For fuller descriptions see "SMALL GREVILLEAS" on page 6).

- Grevillea aspera*, it seems to me, should be known as the "Flinder's Range Grevillea." The inflorescence is fairly compact, about an inch to an inch and a half long. As well as being terminal it proceeds from each leaf axil, as is well shown in the picture.
- Grevillea capitellata*, anyone familiar with this species will recognise it immediately. Again, the rather compact inflorescence is typical, attached by a long peduncle (you have to look very closely to follow this brown-green attachment). This attachment is not terminal but arising from a leaf axil.
- Grevillea fasciculata*, this is probably a very good form which George Althofer released. It is quite prostrate. It is very hardy, flowers for a long period, appearing like a mass of glowing embers on the ground.
- Grevillea brownii*, this little plant will thrive if left alone, and one that is completely neglected has flourished, while others that have had "attention" have passed on. The vivid yellow colour of the style is not very evident in this print. The sparkling colour of this species is its chief glory.

SMALL GREVILLEAS

by Patrick Stanley, Canisius College, Pymble, N.S.W.

The objective is to describe more fully the species shown on the colour plate on page 4. The first species, *Grevillea aspera* is such a gem that I have devoted a whole article to it on page 38.

SOME GREVILLEAS SUITABLE FOR ROCK GARDENS

Grevillea capitellata—At the present time this specific name covers quite a few Grevilleas, and when the species is revised it is probable that these will be elevated to specific rank. A characteristic of the group is the "ball-like" arrangement of the flowers, on a rather long peduncle. Some forms are found south of Sydney, around National Park, while others are across the Hawkesbury River, in the Calga, Mangrove Mountain region. The lower growing forms make suitable rockery plants; the one illustrated being useful in this respect. The Mangrove Mountain form is perhaps the best of these, while one from near the Holdsworthy Military Camp, with grey-green linear leaves and pink flowers, should be an asset in the rock garden.

The two other Grevilleas are from Western Australia. In the recent publication of the Society for Growing Australian Plant's *West Australian Plants* we find *Grevillea fasciculata* described as a shrub, 3 to 6 feet, with red flowers. This description will surprise those in the east who are familiar with the procumbent form, which is such a gem of a rockery plant. The same may apply to *G. thelemanniana*; the form most frequently met with in Eastern States is a mat forming plant. A recent visitor to these parts, Mr. George Lullfitz, from Perth, assures us that we have yet to see the best forms. In spite of this we advise anyone looking for a Grevillea to use in a rockery, to lay hold of this procumbent form of *G. fasciculata*, with flowers the colour of glowing embers and an abundance of them in late autumn.

G. brownii is described in the above publication, as a slender shrub, 3 feet, with red flowers. Like *G. fasciculata* it comes from the Stirling district, south of Perth. We hear from authorities in the west that this species is also quite variable. This of course is no prerogative of the west, for unless a species is extremely rare, variation is sure to occur. *G. brownii* is however, a small plant, with small flowers, borne over a long period. What is lacking in the size of the flowers is made up for in the vivid colouring.

G. brownii should be an accommodating plant in a rock garden, as its leaves are quite small, and it could be used where a little height is called for. Low growing forms of *G. alpina* and the prostrate form of *G. lavandulacea* should not be overlooked in rockeries, while Edwin Ashby's form of *G. ericifolia* should be close to top priority.

These are but a few of the Grevilleas suitable for the small rock garden. Perhaps someone in the west may like to add to this list, because as George Lullfitz says, "We have a lot of good ones in the west that you don't see over here" (in the Eastern States).

Rather than leave this invitation "up in the air," I directed it to Mr. Fred Lullfitz, one of the most experienced men in the field of West Australian wildflowers. His response to this plea was immediate, and I thank him for his courtesy, and the valuable information imparted. Mr. Lullfitz writes: "I have consulted Ernie Wittwer about Grevilleas for rockeries, and I will write what he has given me."

NOTE: Mr. Wittwer is a very experienced nurseryman, and his contribution in the publication already referred to—"West Australian Plants" (page 120), is worth careful attention. Hence the following notes are of great value, being, as they are, the result of observations by a specialist nurseryman, and the man in the field.

Grevillea Gems from W.A.

Some notes on the prostrate or dwarf Grevillea from West Australia that would be ideal for use in small or rock gardens, by F. Lullfitz and E. Wittwer.

G. thelemanniana. Mat forming plant, or bushy (3 to 4 feet), the species is very variable, colour pinkish to scarlet, leaves green or greyish. Best form for rockeries is the prostrate growing plant (preferably grown from cuttings), which will cover approximately one square yard in the third year. This species has also proved itself in window boxes and large ornamental pots. About 19 months ago we planted in a 3 foot diameter concrete pot, a cutting out of a 5 inch pot. The plant is now travelling over the edges and has been flowering for 2 to 3 months (May) and will keep on till late spring. The pot stands on the east side of the potting shed and gets full morning sun, and in summer up till about 2 p.m. See colour plate page 5.

G. tridentifera var. biternata (*G. biternata*). The form growing at King's Park comes from near Ajana, is prostrate, grows easily from cuttings and quickly. In Perth's sandy soil it is rather shy in flowering, but in gravelly soil (laterite) it may be more floriferous. The foliage is fresh green and the plant is decorative even without flowers.

NOTE: In the eastern states this Grevillea from W.A. is known under a variety of names—*G. tridentifera*, *G. triternata* and *G. biternata*. The latter name is the best known and the correct name according to C. A. Gardner. So highly is it esteemed that a Government Department in N.S.W. has just taken delivery of 2000 plants. In the Victorian Mallee in spring 1965 I saw a plant, not quite 2 years old, with a diameter of 22 feet. (P.S.)

G. fasciculata. Very variable, 3 to 4 feet, its red flowers appear nearly the whole year. Dwarf forms again, to be propagated for rockeries.

G. quercifolia. A prostrate Grevillea from the Darling Ranges and Jarrah forest, and therefore likes some shade. The flowers are pink-purple.

G. pilulifera. A dwarf bushy shrub, 1 to 2 feet high, flowers woolly-white, the style yellow to orange.

G. saccata. "Pouched Grevillea." Compact shrub to 12 inches, flowers red, a very good rockery plant.

G. thyrsoides. This plant is outstanding for rackery work. It develops into a mound, fairly dense, to 18 inches high and up to 3 feet or more in diameter. The flower spikes are borne in ray formation, up to 24 inches away from the plant on bare stalks. The flowers are in panicles up to 4 inches long, and are a delightful pink, slightly hairy, and having a very long flowering period.

G. bipinnatifida. "Grape Grevillea." Very good, hugs the ground, 24 inches high to 3 feet across, free flowering with dull red flowers. Some forms have green foliage, while others, in the hills, have glaucous leaves.

G. synapheae. A shrub about 18 inches high and 3 feet in diameter. Masses of cream flower heads in spring, with very attractive "synaphea" leaves.

G. prostrata. Completely prostrate, cream flowers.

G. nana. Prostrate, with red flowers.

G. eryngioides. Suckers freely, large attractive novel leaves, with erect flower stalks, greenish-black flowers.

G. obtusifolia. A variable plant, flowers white to red, prostrate and hugging the ground, or erect to 10 feet. Foliage is a most attractive shining green, with entire, "unoffensive" leaves.

Of the species described on page 10, the following are especially recommended—*G. braunii* (outstanding low forms with usually red flowers), *G. asparagoides*, *G. nudiflora* and *G. rudis*.

GREVILLEAS

by Mr. Ivo C. Hammet

If Acacias and Eucalypts be excepted, Grevilleas are probably the most widely known and widely grown of Australian native plants, and this popularity it well deserved. Most of them grow easily, are simple to propagate, have showy flowers which are very attractive to honeyeating birds, and are very tractable—that is, they can be grown as hedges, (*G. juniperina*, *G. rosmarinifolia*), or espalier fashion (*G. juniperina*, *G. stenomera*).

As befits true members of the plant family Proteaceae, they differ very much in appearance and habit. They may be large trees—*G. robusta*, *G. striata*, semi-climbers—*G. stenomera*, and the climbing Mallee form of *G. ilicifolia*—or lovely creepers—*G. repens*, *G. laurifolia*, *G. fascicularis*. Some have tiny flowers—*G. australis*, *G. parviflora*, large flowers—*G. asparagoides*, *G. tripartita*, or even large terminal flower spikes—*G. excelsior*, *G. eriostachys*, *G. leucopteris*. The leaves may be large almost palmate—*G. barklyana*, very divided—*G. bipinnatifida*, *G. robusta*, soft as in *G. lanigera*, hard and prickly—*G. huegelli*. The varying colours almost defy description—dark red, almost black—*G. wilsoni*, grey—*G. buxifolia*, orange—*G. alpina*, green—*G. alpina*, white—*G. leucopteris*.



Block donated by N. B. Thomson.

"The Plume Grevillea"—*Grevillea leucopteris* Meissn.

Plants with brilliant flowers need not rely on perfume to attract pollinating agents, and so Grevilleas mostly are not perfumed, except perhaps those pollinated by flies or night flying moths. The scent of *G. leucopteris* on a warm night is something to be remembered. The No. 21 issue has a special section on "Scented Grevillea."

Space is not available to list all those Grevilleas which are desirable, but I might mention the few which I have found hard to grow. *G. eryngioides*, *G. synapheae*, *G. repens*, *G. juncifolia*, *G. leucopteris*, *G. pterosperma*. If I were starting afresh to grow Grevilleas I would choose the following:—*G. juniperina*, *G. lavandulaceae*, *G. tripartita*, *G. fascicularis*, *G. asparagoides*, *G. petrophiloides*.

I have grown over 100 different species of *Grevillea* over many years and to me the outstanding attribute is their tractability. By this I mean their response to disciplinary measure, chiefly pruning. Many plants resent pruning but I have no experience of any *Grevillea* that dislikes it.

THE PLUME GREVILLEAS

by R. D. Royce

Grevillea leucoptervis and *G. annulifera* are the only species of their section (*Cycladenia*) which bear panicles of flowers on long leafless branches. The flowers are similar in the two species, but the fruit and leaves are different. *G. leucoptervis* has pinnatisect leaves with long, erect, relatively soft segments, while *G. annulifera* has pinnatisect leaves with short, divaricate pungent segments. The fruit of *G. leucoptervis* is elliptical, compressed, and dehiscent, the seeds having an annular membranous wing. In *G. annulifera*, the fruit is globular, 2 cm. in diameter, breaking irregularly to shed 2 large hemispherical wingless seeds.



Block donated by N. B. Thomson.

Grevillea annulifera F. Muell.

It may be objected that in a wild flower garden, the presence of a plant whose appearance has been altered by pruning or other artificial means is an anomaly but this is not necessarily so. The long term result should be a plant whose situation and appearance is quite natural.

For example, *Grevillea thelemanniana* in its natural state will often be found scrambling over rocks or logs like a miniature cascade. I planted a species on a bank but because of the environment, light, shade and air, it persisted in growing upwards. However by anchoring its main branch to the ground with a heavy stone, it was induced to grow out and over the edge of the bank where now it hangs down quite naturally for about 5 feet. The top of the plant now spreads out flat without the necessity for further artificial restraint.

The same thing has occurred with *Grevillea repens* (Mt. Cole, Victoria type) and to a closer degree with the Kingslake type form.

The growth of *Grevillea rosmarinifolia* or *G. juniperina* as a hedge, a small tree, ground cover, or as an espalier specimen provides further examples of the versatility of the genus. *Grevillea juniperina* may be grown horizontally in sinuous fashion so that the branch will grow alternately up and down like the back of the conventional sea serpent.

It is well to remember that, whilst Grevilleas do not resent pruning, the most effective results are achieved by nipping the growing tips at the right place and time, a rule applicable to most native plants.

LOW GROWING GREVILLEA

Some Species from W.A. by Ken Newbey

There are a number of the smaller *Grevillea* species from the South-west area of W.A. which would be well suited for use in smaller gardens and rockeries. They have a good range of foliage, flowers, flowering periods and soil requirements, so that a selection of these species, blended in with species of other genera could produce a striking effect.

When selecting species it must be remembered that some of the species listed are low growing only under exposed conditions and will become tall when sheltered. Other medium growing *Grevillea* species may become low growing if subjected to exposed conditions.

Most of the species listed grow within the Ongerup area but some come from the Northern Wheatbelt. The descriptions of *G. asparagoides*, *G. rudis*, *G. thyrsoides* and *G. yorkkrakensis* are taken from limited observations only and should be treated as such.

Where the style of the flower is described as being long or short; this refers to the length of the style protruding from the perianth tube as compared with the length of the perianth tube.

Grevillea acerosa

A fairly well shaped shrub to 2 ft. in height and up to 3 ft. across found growing on sand, loam and granitic soil in 14" to 20" rainfall. Leaves are light green, almost terete, ending in a fine drawn out point, finely grooved, slightly under 1/16" in diameter, varying in length from 1/2" to 1" on short branchlets. Flowers are small, grey, 1/4" long forming small, loose axillary clusters almost along the entire length of the branches. Flowers from August to October.

An unusual and outstanding plant in flower for either exposed or sheltered situations. Will stand a certain amount of poor drainage.

Grevillea apiculoba

Found growing as a slightly open, divaricate and rigid branched shrub to 3 ft. in height and 4 ft. across on sands, loams and gravel clays in 14" to 16" rainfall. Leaves are dark green, terete, rigid, pungent, slightly under 1/16" diameter, varying in length from 1" to 2", usually divided into 3's, sometimes simple and plentiful on the newer growth. Flowers are grey, with long black styles, narrow, about 5/8" long forming "toothbrushes" up to 3" in length. Flowers throughout the year but is at its best in the spring.

An outstanding plant both in flower and foliage for either exposed or sheltered, well drained situations. Under poor drainage conditions it may reach the height of 7 ft.

Grevillea asparagoides

Found growing as a dense, rigid and much branched, fairly well shaped shrub to 4 ft. on gravel loam in 14" rainfall. Leaves are dark green, fairly rigid, pungent, narrow, under 1/16" wide, divided into 3 spreading segments which may be again divided. Overall, the leaves vary from 1" to 1 1/4" in length and from 3/4" to 1" in width. Flowers are red, have long styles, over 1" long forming terminal, pendant loose racemes up to 2 1/2" long and plentiful. Flowers August-September.

An outstanding species in flower with attractive foliage for well drained and exposed positions.

Grevillea brownii

A somewhat open, upright, few stemmed shrub to 2 ft. found growing on sand, loam or gravel in 20" to 30" rainfall. Leaves are dark green, soft,

usually ovate, sometimes linear, sessile, varying in length from $\frac{1}{4}$ " to $\frac{3}{4}$ " and plentiful on short branchlets. Flowers are red, with short styles, $\frac{1}{2}$ " long, axillary and plentiful. Flowers July-September.

An outstanding plant in both flower and foliage for either exposed or sheltered, well drained situations. Has a denser and lower spreading habit under exposed situations. See colour plate on page 4.

Grevillea concinna

The BUSHY FORM. Always found on granitic soils in 14" - 16" rainfall as a low, leafy, well shaped shrub to 3 ft. in height and 4 ft. across. Young plants are usually prostrate. Leaves are flexible, dark green, narrow, about $\frac{1}{8}$ " wide, from $\frac{5}{8}$ " to 2" in length, upright on short branchlets. Flowers are brownish red, with long red styles, about 1" long, forming numerous terminal 1" to 1½" "toothbrushes". Flowers on and off throughout the year but is at its best in the spring.

This is one of the outstanding small W.A. *Grevillea* species for well drained and exposed situations.

Grevillea disjuncta

Found growing on loams and gravel in 15" rainfall as an open, spreading, rigid branched shrub to 18" in height and 2' 6" across. Leaves are light grey green, soft, more or less terete, finely grooved, $\frac{1}{32}$ " in diameter, from $\frac{1}{4}$ " to $\frac{3}{4}$ " in length and often close together on the newer wood. Flowers are reddish brown, with long styles, about $\frac{5}{8}$ " long, axillary, solitary and fairly plentiful. Flowers from July till September.

An interesting average species both in flower and foliage for fairly well drained exposed or sheltered situations.

Grevillea fasciculata

Varies in habit from a simple, single stemmed, few branched upright plant to 2 ft. to a low, open, dome shaped plant to 15" in height and 3 ft. across, and usually found on sands or loams in 16" rainfall. Leaves are green, soft, narrow, about $\frac{1}{8}$ " wide and from $\frac{1}{2}$ " to 1½" in length. Flowers are reddish, with short yellow styles, broad, slightly under $\frac{1}{2}$ " in length, in axillary, and terminal clusters of about 8 and borne in profusion. Flowers from July till September.

This species has a somewhat variable habit ranging from a low, fairly dense shrub in exposed situations to an upright one in sheltered positions. Very good in flower with average foliage and it will stand some poor drainage. See colour plate on page 4.

Grevillea haphantha

A dense, low spreading or dome shaped shrub with many divaricate, rigid branches, found on sand and coarse sandy loam in 14" - 17" rainfall. Leaves are dull green, soft, narrow, $\frac{1}{8}$ " wide, varying from $\frac{3}{4}$ " to 1½" in length and more or less upright. Flowers are brownish red, with long styles, about $\frac{3}{4}$ " long, axillary in 1's or 2's and plentiful. Flowers from June till September.

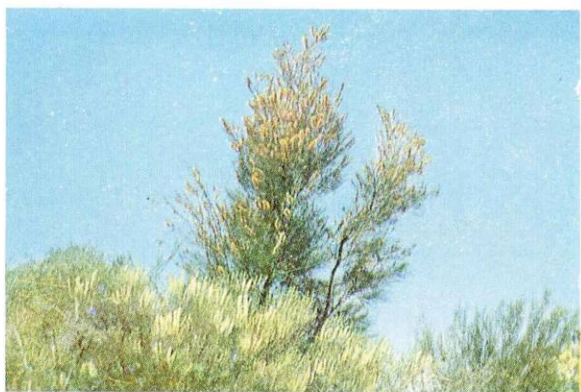
A very good ground cover plant for exposed or sheltered positions, average in flower and will stand some poor drainage.

Grevillea huegelii

Usually found on clays or heavier loams in 15" rainfall where it forms an untidy shrub up to 18" in height and 4 ft. across. Leaves are dull dark green, rigid, pungent, pinnate, up to 1½" long and 2" wide. Leaf segments are narrow, $\frac{1}{8}$ " wide, varying from $\frac{1}{2}$ " to 1" in length and

Flame Cone Grevillea

There are three *Grevillea* species with heads of flowers thrust out from the bush like flaming yellow cones. These are distinct from the "Plume Grevillea" on page 9 where a number of flower heads are grouped on the one long stalk. These are *G. eriostachya* (a colour plate of these large flower heads is on the front cover of the No. 21 issue), *G. excelsior* (shown below, the famous "Flame Grevillea") and *G. pteridifolia*. The first two species are almost identical but have not been grown very successfully yet. The editor suspects that if they were grown as recommended for Waratah in this issue, the result in the garden would be spectacular. *G. eriostachya* is small being a shrub only 3-4 feet high and is native to Central Australia as well as W.A.



Block donated by N. B. Thomson.

The Pine Grevillea, *Grevillea excelsior* and *Grevillea biformis*

Grevillea excelsior is mentioned above. *Grevillea biformis* is a shrub 3-10 ft. with bright yellow flowers. Various species of *Grevillea* have flowers ranging from white to red but who will advise of any other species with a bright yellow flower as shown on *G. biformis* above?

Grevillea pteridifolia offers the most promise for gardeners who want a more hardy plant of this type. It is a tree of tropical Australia (see page 14). It is drought hardy, tolerant of wet feet and high humidity and fairly frost hardy. A small compact form reported by D. N. Gordon in our No. 21 issue, with beautiful foliage and almost year-round flowering should be very widely grown.

RED POKER FLOWERED GREVILLEA

The red flower heads (shown in a colour plate in our No. 21 issue that does not do real justice to this fascinating plant) are in the form of a poker up to 10 inches in length and are carried on long stalks 6-8 feet above the small grey green fairly sparse bush, in these species. *Grevillea petrophiloides* is widely known. The only other *Grevillea* with a flower of this type is *G. rogersoniana*, a recent discovery. The latter differs in having flat, lobed leaves and much larger more verrucose fruit.

Cultivation is again as recommended for Waratah in the coastal areas. Further reports are required but very healthy plants are reported from hot inland areas.

GREVILLEA WILSONII

by A. L. Hargrave

One of the finest of our Grevilleas. It has proved difficult to grow for some. It likes open country. My own plant faces the west and the plant at Maranoa Gardens also faces the west and both are beautiful and very healthy plants. I have found that it likes a good well composted soil, a good top mulch such as wood chips and plenty of water in summer months.

I have not been successful with seed germination but find that vegetative propagation, i.e. by cuttings, is rewarding. As this species has a slight tendency to sucker I have also propagated from root cuttings.

From F. Lullfitz—Known in W.A. as "Native Fuchsia", this is an outstanding floral specimen with bright red flowers. It suckers freely, growing in laterite in forest country of the Darling Ranges.



Block donated by N. B. Thomson.

Grevillea wilsonii

This is not a good slide of the magnificent plant but it does show one of the outstanding features of this plant in the W.A. bush. The bright red flowers seem to blaze colour and stand out from a distance. It is the most sought after species by all Grevillea enthusiasts.

My Favourite Grevillea

by M. Ritson, Grindon, Boyupbrook, W.A.

GREVILLEA FLEXUOSA—

This prostrate Grevillea grows among the ironstone outcrops, is summer flowering but rather inconspicuous. When brought into the garden with summer watering it thrives and is one of my most attractive plants. In early summer it is a mass of pale pink flowers born on long heads that stand out conspicuously from the foliage, but for the rest of the season, it bears them more sparsely. However it is well worth a place in the garden for its foliage alone, soft green feathers to me, but what I believe you call very deeply divided leaves. This Grevillea is by far the most useful ground cover plant in my garden. It was named for me by Mr. C. A. Gardner.

GREVILLEAS FROM THE FAR NORTH

by L. K. Bates, Mareeba, Qld.

The following species grow naturally in a relatively hot monsoonal region, i.e. plants can stand dry out and also severe wet.

Grevillea pteridifolia. Tree of open habit, attractive when young, but becomes "gangly" with age. Often flowers more than once per year carrying over 200 orange flowers for at least 6 weeks. Transplants at any height. Germinations in neutral soil; fast growth; 15-30 ft.

Grevillea parallela. One of our best. Normally columnar, deep green foliage carrying masses of creamy white blooms at tree top during July and August, 15-20 ft. Germinates readily from seed.

Grevillea mimosoides. A 10 ft. tree with cork bark, of a somewhat straggly, Banksia-like habit. Blooms in November—light yellow multiple spikes are attractive, bring myriads of honey-seeking insects, and thus many native birds. Relatively low germination rate.

Grevillea dryandrii. The choicest of small plants, growing only 9 inches in height with a two foot spread. It is found in dry, stony, poor country. Foliage is most attractive, while large flowers (multiple spikes) of cream and pink adorn the plant for a long period. Seed germination less than 50%.

GREVILLEA IN SOUTH AUSTRALIA

by Ron Hill, Botanic Gardens, Adelaide

The only two prostrate *Grevillea* not described by other authors here, that I could recommend are.

Grevillea laurifolia. This is a native of N.S.W. I have seen it growing in the Blue Mountains where it makes a rather sparse tangled mat of deep green leaves, the leaves being 2"-3" long and 1"-2" broad. The deep red flowers are quite conspicuous during spring. In Adelaide there are several plants doing very well and I think the species is the best for a flat ground cover.

Grevillea ilicifolia* var. *lobata. Comes from the mallee areas of Vic. and S. Aust. and is usually completely prostrate in its best form. Long branches hug the ground with deep-cut holly-like leaves arranged along them. The flowers are red or greenish and are produced on terminal branchlets flat on the ground.

PROPAGATION OF GREVILLEA

The methods recommended for Waratah are suitable for most species. However, some seed appears reluctant to germinate and rot easily if kept too wet. Previous issues describe some special methods, one of these being the very careful peeling off of the covering of the seed which seems to inhibit germination.

Propagation by cuttings has been widely successful, an excellent method being as follows:

A 50-50 mix of coarse sand and peat moss is wetted and the excess moisture is squeezed out. The mixture is put into a clean pot, the cutting set in it and the pot is then placed in a plastic bag. This is tied at the top and suspended in a light place, but out of direct sunlight. Watering is not necessary for about three weeks.

PROPAGATION FROM SEED

For the Beginner, by a Beginner . . . L. K. Bates of Mareeba, North Qld.

The lower Atherton Tableland has a relatively hot climate with heavy monsoonal rain for nearly four months and drought conditions for seven months, when drying out is a great problem. The following cultivation methods have been successful in this climate, and may possibly be modified for other climates.

I have concentrated on growing the Honey Flora type of shrub and trees belonging to the Families *Myrtaceae* and *Proteaceae*.

GERMINATION—

(a) *Myrtaceae* Family (Tiny seeds of *Callistemon*, *Melaleuca*, some *Eucalypts*, etc.). These are germinated by bottom watering. Take a 2 lb. fruit tin, punch large holes in the bottom, and put it inside another tin larger in diameter but not in height. For soil I mix gravel and a good acid soil in the proportion 4:1. The gravel prevents soil from becoming too wet and the mixture is good to grow plants to 3 or 4 inches, when I plant straight into garden. Sprinkle a pinch of seed on top of soil, pat down with finger, keep moist with an inch or two of water in outer tin, and seeds germinate here in about a week. Tins should be protected from rain initially, but when plants are $\frac{1}{2}$ " high, they may be watered in the usual manner. Key points are constant moisture without drowning, no disturbance of seeds, and heat (no problem here—I germinate throughout the year, actually bringing tins inside during hottest summer months).

(b) *Proteaceae* Family (Large seeds of *Grevillea*, *Hakea*, *Banksia*, etc.). Again I use an acid soil, pH 5.9 (I cannot germinate in neutral soil). It is the worst soil I can find fertility-wise, a sand with a small clay content and no organic matter at all. Because it is so poor it appears to be virtually sterile, an important feature when planting seeds which may take months to germinate. I place soil in wooden packing cases (no old tins please—seeds do not like rust), plant seeds on top of soil, firm onto soil, cover with gravel, and water in the conventional manner. Germination times for me range from 9 days (*Hakea*), through 13 days (*Banksia*), to 6 months. Seeds and plants do best on any raised slab of concrete, where the extra heat is of great assistance.

Normally I prick seedlings out immediately they germinate. They go into bottomless tins containing the 4:1 mix, sitting on scraps of fibro-cement sheeting (simply split down the side for planting out); the bottomless tin also drains well, a good point here where tins need $\frac{1}{4}$ " water per day to stay moist in summer.

These methods have been successful for 92 species from all parts of Australia. Complete failures have been few.

PLANTING OUT—

This is done from 2 ins. up (or when roots reach bottom in open tins). Ground is kept continually moist as plants must be acclimatised to wet conditions ready for monsoon rains.

Editor's Note: It is particularly pleasing to have at last made contact with a wildflower grower from the north of Australia. A study of the above article will reveal that the propagation methods given are similar to those mentioned previously and successfully used in areas all over Australia. Other methods are given on page 24. Most of our natives are so readily grown from seed. Why not try some?

ALYOGYNE

The genus *Alyogyne* by Paul A. Fryxell, Research Geneticist, Crops Research Division, Dept of Agriculture, in co-operation with Texas A. & M. University, College Stn., Texas, U.S.A.

Part 2 in a series of articles on plants in the family *Malvaceae*—*Hibiscus*-like flowers.

This wholly Australian genus includes two or more shrubby species with showy flowers and distinct horticultural possibilities. The genus was originally proposed by Alefeld in 1863 to accommodate certain plants that had earlier been placed in *Hibiscus*. When Lewton revised the genus in 1915 he considered there to be four species, but Hutchinson in 1947 reduced this number to two: *A. cuneiformis* (DC.) Lewt. and *A. hakeaefolia* (Giord.) Alef.



Photography by F. W. Humphreys.

ALYOGYNE HAKEAEFOLIA (Giord.) Alef.

A beautiful shrub for the garden. The flower in the centre has the more usual colour, the others being more pink than normal. The anthers also are more of a rusty orange colour than the plate suggests. The flowers of this shrub bear a superficial resemblance to those of Sturt's Desert Rose (*Gossypium sturtianum* featured in colour in our No. 26 issue with full details of its cultivation) in form and colour, but can readily be distinguished by the 5 long, acuminate calyx lobes and the inconspicuous scales that are the floral bracts at the base of the calyx. The fruits are small and remain enclosed within the calyx lobes; one immature fruit may be seen at the bottom of the picture. The leaves are quite distinctive, being made up simply of very narrow linear segments.

He considered Lewton's other two species as synonyms of *A. hakeaefolia*, a view that is doubtless correct.

More recently Bates (1965) has suggested that two additional species of *Hibiscus* may be allied to *Alyogyne*: *H. huegelii* Endl. and *H. farragei* F.v.M. Bentham had made a similar suggestion in 1863, but the suggestion remains to be evaluated from more detailed studies.

Alyogyne has flowers that are large and showy and that bear a distinct resemblance to those of *Gossypium*. The resemblance is considered superficial, however, and *Alyogyne* must be considered more closely allied to *Hibiscus* than to *Gossypium*.

Alyogyne may be distinguished from *Hibiscus* by its characteristic six-toothed involucre, its semi-stipitate calyx, and its clavate style with decurrent stigmatic lobes. All of these traits are evident in the accompanying photographs. In addition, the embryo is quite small and much simpler than that typical of *Hibiscus* and is completely enclosed by a well-developed endosperm, a tissue that is much reduced in *Hibiscus*. These embryo and endosperm characters indicate *Alyogyne* to be more primitive than *Hibiscus*. More on this later.

The two species may be distinguished by the following key:

- A. Leaves simple, cuneate, spatulate, about 1 cm. broad; flowers white *A. cuneiformis*
- A.A. Leaves usually dissected; leaf segments narrowly linear to terete, 1-2 mm. broad, succulent; flowers mauve or sometimes yellow *A. hakeaefolia*

1. *Alyogyne cuneiformis* (DC.) Lewt.

A much-branched shrub with spatulate or obovate leaves; the leaves thick, glabrous, entire, acute to obtuse. Flowers barely exceeding leaves, occurring singly on axillary, jointed peduncles. The involucre is of about six subulate bractlets. The flower and fruit appears somewhat stipitate above the involucre; calyx deeply 5-lobed; calyx lobes acuminate 2-3 cm. long. Petals large, white with a dark-red spot at base. The anthers are of the same colour and are disposed in distinct whorls. Style clavate; stigmatic lobes decurrent. Fruits 5-celled capsules, 2½ cm. long, 1½ cm. wide. Seeds 2 mm., hairy.

Plants of this species were cultivated in England at Kew in the past century, but they have apparently never passed into cultivation otherwise. They occur principally along the coast and on islands in westernmost Australia from the Cape Peninsula south to about 28° latitude. The plants grown at Kew were derived from seeds collected at Dirk Hartog Island in Shark Bay.

The above description is of these island forms. There is indication that the plants found on the mainland differ somewhat and are, in fact, intermediate in certain respects between this species and the next. Some assiduous collecting and comparative cultivation will probably be needed to resolve the matter.

2. *Alyogyne hakeaefolia* (Giard.) Alef.

(Synonyms: *A. lilacina* (Lindl.) Lewt., *A. multifida* (Paxt.) Lewt.)

A much-branched shrub with filiform, divided leaves; the leaves most commonly tripartite but sometimes pinnately dissected or rarely unifoliate, glabrous; the leaf segments terete or grooved, 1-2 mm. broad, sometimes somewhat laminar. The floral structures are very similar to those of the preceding species except that the petals are generally mauve with a dark

spot at the base, and the filaments (with orange anthers) occur continuously along the androecium rather than in interrupted whorls. The fruits are similar to but smaller than those of the preceding species. The seeds of the two species are alike.

Alyogyne hakeaefolia occurs in South Australia in the Eyre Peninsula and in the southern part of West Australia, from Esperance and Kalgoorlie northwestward to Geraldton. It has been brought into cultivation as a specimen shrub and, being a desert plant, is well suited to dry locations. Its handsome flowers are both large and abundant, but its flowering period (in my experience) is restricted to a rather short period in late winter.

Variants have been found and perpetuated that have yellow flowers, thereby adding variety to the horticultural possibilities. A variant lacking the dark spot in the throat of the flower has apparently also been discovered.

One interesting feature of this species is that its juvenile leaves differ markedly from its "climax" leaves. The former are distinctly broader and more foliar than the latter, as the accompanying photographs show. Apparently, also, there is a considerable environmental influence on leaf development. This development plasticity presumably depends upon the amount of sunshine available to the plant. Lindley in 1837 found that plants from the Australian desert differed markedly from those raised (from the same seed lot) in a British garden. He said that the wild plant "is so little like the garden plant that, under other circumstances, I should have hesitated to consider them the same, for the leaves are filiform instead of being flat and broad . . ." These broader-leaved garden plants are, in fact, the basis of the name *Alyogyne lilacina* (Lindl.) Lewt.

It is not known to what extent such developmental plasticity in leaf growth may relate to the problem referred to earlier of the plants that appear to be intermediate in certain respects between the two species described here. It seems possible that this phenomenon may be involved. It might be a seasonal effect, or there may be a difference between the lush growth following a rainy spell and the sparser growth during the leaner times that follow. The question requires field study.

It was mentioned earlier that the embryo and endosperm characters indicate *Alyogyne* to be relatively more primitive than *Hibiscus*. It was also noted that Bates has suggested a possible alliance of *Alyogyne* with *H. farragei*. The latter species has a peculiarity of considerable botanical interest that seems previously to have been overlooked.

Hibiscus and its related genera, which collectively make up the tribe Hibisceae, are distinguished from the balance of the Malvaceae primarily because their fruits are capsular and dehisce loculicidally. The fruits of the balance of the Malvaceae dehisce schizocarpcusly. *Hibiscus farragei* is remarkable in that its fruits dehisce both laculicidally and schizocarpcusly. This characteristic appears to be transitional to the rest of the Malvaceae and thus primitive for *Hibiscus*. It is interesting that this species and the genus *Alyogyne*, to which its alliance has been suggested, each has primitive characteristics.

ALYOGYNE — A DESERT HIBISCUS ?

From R. D. Royce, Government Botanist, W.A.

While it is true that the plant does extend into dry areas and it is possible that these plants may be capable of cultivation in "dry locations", it is quite probable that the whole population may not. This species also occurs and is quite happy in a 30 inch rainfall belt.

MORE HIBISCUS

MALVACEOUS SHRUBS FOR SOUTHERN AUSTRALIAN GARDENS

by R. L. Hill, Botanic Gardens, Adelaide, S.A.

There are many interesting plants belonging to the "Mallow" family, some have been grown for some years as garden subjects whereas many are as yet to be tried.

The following species have proved successful under varying conditions in South Australia.

Lavatera plebeia "Australian Hollyhock"

This is a widespread plant in Australia and is found in all states, often along roadsides. Under favourable conditions this tall hollyhock-like plant makes a fine show indeed. Varying from 2 to 8 feet in height it grows like a garden hollyhock but with smaller flowers of white to deep pink and mauve. It is often seen in masses along watercourses after rain in dry country. It is usually grown from seed and can be grown as an annual or biennial plant.

Sida petrophila

A plant from the drier areas of South Australia and N.S.W. This should be ideal for inland gardens. It usually favours rocky soil where it grows into an attractive grey leaved shrub to about 3-4 feet high. During spring the one-inch yellow flowers are produced in abundance making a great show. Seed is probably the best method of propagation. This plant must have a well drained position to really succeed under garden conditions.

Hawittia trilocularis

This lovely shrub comes from Victoria and New South Wales usually inhabiting well drained but moist areas where it forms a large loose shrub up to 10 feet high. I have seen this shrub growing in a deep gorge at Mt. Arapiles in Victoria where its roots are always cool under rocks but the plants themselves withstand hot conditions during the summer months being exposed to the heat from surrounding rocks. The flowers are over an inch across, deep mauve pink like a small hibiscus and borne on long woolly stems. The leaves are 2-3 inches long and are also covered with bristly hairs. A lovely plant which should be tried more in our gardens.

Hibiscus sturtii

A small shrub from dry areas in S.A., Qld., and N.S.W. It is doubtful if this has been widely cultivated. It likes very dry conditions and bears rather large flowers of a deep mauve-pink amidst grey-green foliage. Often it forms a rather trailing shrub and because of this it should make a useful plant for rock garden work and well worthy of trials in dry areas.

Hibiscus farragei

A large leafy plant from the drier areas of most of Australia this is well worthy of garden culture. The large handsome grey-green leaves are up to 6" across and the comparatively small deep pink to mauve flowers are produced in clusters amongst the foliage. Another plant which must have well drained conditions to succeed and under these conditions it grows into a shrub up to 8-10 feet in height. Seed is the easiest method of propagation.

Hibiscus huegelii

This lovely plant is grown extensively in many Southern Australian gardens and well warrants a prominent place in any garden. It is a very variable plant but at best grows into a medium sized shrub up to 10 feet high

with deep grey-green leaves and large flowers about 4" across and of a deep mauve colour, there is also a pure white form which is very lovely and seedlings vary in colour from white to deep mauve. It can be grown from seed or cuttings.

The var. *leptochlamys* from Eyre Peninsula in S.A. and also from W.A., is a more compact grower with large flowers, a deep mauve-pink in colour and with a red blotch at the base of each petal, a lovely plant that deserves a place in our gardens.

Alyogyne hakeaefolia

This tall and upright shrub comes from S.A. and W.A. and is often seen in South Australian gardens. There are two forms most commonly seen one with pale mauve flowers and the other with creamy-yellow flowers. The foliage in both forms is similar, being long and narrowly divided into linear segments up to 3-5" long. The mauve flowered form usually opens only slightly when in full flower but the abundance of flowers compensates for this. The yellow form has wide open flowers but is somewhat more leafy in growth and is easily grown from cuttings. Both like well drained conditions.

Gossypium sturtianum "Sturt's Desert Rose"

This lovely dry area plant is the State Flower of the Northern Territory and is often grown in gardens in temperate Australia in well drained situations. At its best it forms a shrub to about 4 feet high with roundish leaves blue-green in colour and produces 3-4" wide flowers mauve to pink in colour with a deep maroon blotch at the base of each petal. Truly a lovely plant which is easily grown from seed. It is intolerant of wet conditions and is found growing naturally over a large area of temperate and dry Australia.

The following species are from the Eastern states but grow very well under conditions in Southern Australia.

Hibiscus splendens

A large leafy shrub from Queensland and N.S.W. with large grey green lobed leaves which is a rapid grower and is easily grown from seed which it sets in abundance. During early summer it covers itself with large 6" plate-like flowers of a beautiful pink colour with a dark centre. The flowers each last only a day but are produced in abundance over a long period.

Hibiscus heterophyllus "Batham Hibiscus"

This comes from Qld. and N.S.W. and makes a large woody shrub up to 12' high with large lobed leaves and produces large white and deep maroon flowers during summer. This grows very easily from seed and becomes almost deciduous during cold winter months in Adelaide.

HIBISCUS LIKE FLOWERS

To which family do they belong? The author of the article on *Gossypium* is of the opinion that that genus is the family *Malvaceae*. Other genera in this family, as listed by Burbidge ("Dictionary of Australian Plant Genera") will be reviewed in this journal, a genus at a time. I would like reports from readers of the following genera and especially colour slides—*Abutilon*, *Alyogyne*, *Brockmannia*, *Camptostemon* (each of the latter two have only one species in the genus and both hail from north and north west Australia. I particularly want reports and colour slides of these), *Hibiscus*, *Howittia*, *Lavatera*, *Malvastrum*, *Plagianthus*, *Sida* and *Urena*.

THESPEZIA POPULNEA

A further caption for the colour plate that appeared with the article on this "hibiscus" in our No. 27 issue.

Thespesia populnea (L.) Sol. ex Corr. The flowers of this small tree are yellow, as in the plate, when they first open, but as they wither and drop from the plant on the second day, they develop a pinkish coloration, eventually becoming brown. There are five maroon spots within at the base of the flower. The green fruits turn dark brown at maturity and do not dehisce, but remain unopened, hard, and semi-woody.

GROWING WARATAHS

(Continued from page 3)

OBSERVATIONS OF PLANTS IN CULTIVATION—

Anyone of us who has visited "Floralands" will know that for many years, Mr. and Mrs. Parry's Waratahs have been regularly cultivated, fertilized, watered and severely pruned back each year. They are growing in very loose, well drained sandy soil and we may as I did, assume that these old plants have been conditioned to this treatment in which the nature of the soil may have assisted. Against this I have also seen cultivated Waratahs ten to twelve feet high and as wide bearing without any organised pruning, one hundred to one hundred and fifty large flowers each year. These trees as one might call them, have not been artificially fertilised or watered and after forty years their ligno tuber, as big as a cow pumpkin, is partly above ground. They are growing amongst, but not closer than their perimeter, to azaleas and other exotics and have had the same cultivation.

I have carefully watched the progress of many Waratahs growing as specimens in lawns with a small area (18" to 24" diameter) of cultivation, some pruned occasionally, some never. Others in sheltered gardens with exotics regularly cultivated and occasionally watered, pruned and fed, others left alone, but the most amazing growth and one which confirms my theory is as follows:—

A plant about ten years old was struggling for a bare existence without flowering, almost smothered by a dense mass of honeysuckle. My friend noted that another plant nearby accidentally burnt off with the long grass that surrounded it was making strong fresh canes and decided to get rid of the honeysuckle. He did the job thoroughly, even digging right into the Waratah to remove all the honeysuckle roots and without doubt damaging the roots of this spindly sick looking plant. The canes were cut right to the ground and sealed with "Col Graft" to prevent bleeding. This plant without artificial water or fertilizer has since been cultivated to a depth of five or six inches very regularly and the soil has been kept to a fine tilth which despite the drought still retains some moisture.

After about 18 months it has developed four extraordinary canes, five to six feet tall, with not only large terminal buds but two or three smaller buds at the base of each of these. In every leaf axil is an embryo bud (twenty or thirty on each cane). The plant is literally jumping out of its skin. The soil is a deep medium loam, over shale, which would compact very quickly if not cultivated.

The other plants I have mentioned are growing in a variety of soils from deep rich friable black volcanic to light chocolate coloured slightly clayey shale soil.

CONDITIONS REQUIRED FOR BEST RESULTS—

I feel safe now in saying that waratahs require:—

1. Deep soil of any texture that can be kept friable with cultivation and provided there is good drainage.
2. Some shelter but not necessarily shade is desirable.
3. Regular cultivation to keep the top soil in fine tilth.
4. A free root run without competition.

To further illustrate the foregoing, there is a group of old waratahs in a little triangular park at Parramatta North, on Pennant Hills Road. These rangy unpruned old plants occupy a well drained, built up area and receive the same cultivation and watering as the other shrubs and annuals in this garden and never fail to put on a good show every spring.

Once they commence to flower, prune the first two or three years to establish a compact showy bush. Keep pruning hard if you want cut flowers, but a shapely bush with a dozen or so brilliant red flowers is something worth waiting for.

Cut off seed pods if they appear.

As to fertilizer, there is no doubt, that a good dressing of blood and bone in late winter or early spring will show results. I might mention that the white waratahs flowering each year are growing in a fowl run, which tells its own story.

This is an absorbing subject and the experience of other members to confirm or deny its authenticity, would be interesting. In short, we must find the right answer to cultivation so that every home garden can feature our *Telopea speciosissima* ("Seen from Afar").

LOW GROWING GREVILLEA FROM W.A.—continued from page 11

usually in 4 pairs with a terminal one. Flowers are reddish, with short styles, narrow, about 1" in length forming 1½" long, spreading terminal spikes. Flowers from August till October.

A good ground cover plant for heavier, well drained soils. Does well in either exposed or sheltered positions and has attractive and unusual flowers.

Grevillea muelleri

Grows as an open, upright spreading, simple rigid stemmed shrub to 2 ft. on sands or loams in 20" rainfall. Leaves are bright green, fairly rigid, narrow, about ⅛" wide, from ⅝" to 2½" in length, either simple or terminating in 3 small acute lobes and often borne sparingly. Flowers are bright yellow, with long styles, ¾" long, forming axillary or terminal dense clusters. Flowers from July till September.

An outstanding yellow flowered species for either exposed or sheltered, fairly well drained positions. Foliage average. Tends to have a low spreading habit when grown in exposed positions.

Grevillea nudiflora

An unusual species with the main section of the plant being dense, leafy, dome shaped and up to 2 ft. high and 5 ft. across. Usually found growing on sands, sandy loams or quartzite soil in 16" to 25" rainfall. Leaves are bright green, soft, narrow, under ⅛" in width, from ¾" to 2" in length and usually borne on short branchlets. Flowers are red, with long styles, about ¾" long, from 2 to 5 in open terminal clusters on ½" long branchlets borne sparingly on leafless branches up to 4 ft. long, which radiate from the main section of the plant. Flowers on and off throughout the year but is at its best in the spring.

This species has very attractive foliage with usually prostrate, leafless, flower bearing branches giving it a very unusual effect. Sometimes these leafless branches have a tendency to climb. Likes well drained, exposed or sheltered situations and it will stand salt spray.

Grevillea paniculata

COASTAL FORM. Grows as a low, dense, much rigid branched shrub to 2 ft. in height and up to 6 ft. across on rocky loam in 20" rainfall. Leaves are light green, rigid, pungent, narrow under ⅛" in width, usually divided into 3 spreading segments, varying in length from 1" to 4". Leaf segments are often unequal in length and may be again divided. Flowers are light cream, with short styles, narrow, under ¾" long, forming loose,

pendant, terminal spikes up to 1½" in length and borne sparingly. Flowers July-September.

A good ground cover plant for exposed and well drained positions. Below average in flower and will stand salt spray. This species usually grows as a fairly well shaped shrub to 5 ft.

Grevillea patentiloba

The habit of this species varies from an open, upright plant about 2 ft. in height to a dense, slightly untidy, dome shaped plant up to 4 ft. in height and 6 ft. across. Usually found on loam or sand in 14"-20" rainfall. Leaves are dull green, rigid, pungent, under ⅛" wide, usually divided into 3 segments, sometimes pinnate with a terminal segment and occasionally divided again. Overall length of the leaf is usually about 1". Flowers are reddish, with long styles, up to 1½" in length, usually in loose terminal clusters of about 3 on short branchlets. Flowers June-September.

A useful species for well drained exposed or sheltered situations. Habit depends on environment. Featured in colour in No. 21 issue.

Grevillea pilulifera* var. *uncinulata

Grows as an upright, open, simple rigid stemmed, little-branched plant to 2' 6" on gravel or loam in 15-20" rainfall. Leaves are light green, almost terete, 1/32" wide, about ¼" long, hooked and borne in bundles of about 6 on the stems and branches. Flowers are yellow, with long styles, narrow, hairy, under ½" in length, in loose clusters of up to 4 and borne in the axis of each bundle of leaves over almost the entire plant. Flowers June-September.

A good interesting and unusual species for fairly well drained, exposed or sheltered situations.

Grevillea pulchella

Found growing on sands and ironstone ridges, this species grows as an open, spreading, rigid, little-branched shrub to 15" in 20"-30" rainfall. Leaves are dark green, fairly rigid, pungent, variable, usually pinnate with a terminal segment which may be 3 prickly lobed. Overall length of the leaves is about 1¼" and ⅝" in width. Flowers are cream, with short styles, narrow, about ⅜" in length forming 1' long terminal spikes. Flowers off and on throughout the year.

An average species for well drained, sheltered or exposed positions.

Grevillea rudis

A low, rigid stemmed, dome shaped shrub to 9" in height and up to 3 ft. in diameter found growing on gravel in 25" rainfall. Leaves are light green, soft, slightly hairy, variable, basically wedge to fan shape with the leaf ends being divided into from 3 to 8 small lobes. Flowers are yellow, narrow with short styles, about ¼" long, forming 2½" long spikes borne on long branches which are usually prostrate and clear of the foliage. Flowers in September and January.

A good and unusual species for well drained and exposed positions.

Grevillea tenuiflora

This species is very similar to *G. pulchella* differing in the more leafy habit, leaves bipinnate and the flower spikes larger and denser. Flowers August-October.

A more desirable species than *G. pulchella* which grows under similar conditions. Will grow in clay.

PROPAGATION OF WARATAH

PROPAGATION BY SEED—

Waratahs are easily propagated as are most *Grevillea*. The principal objective is to keep the seed moist but not wet in a reasonably sterile medium where minute animals or bacteria in the soil cannot attack the seed. Various methods from previous issues are summarised by the editor.

Put 2-3 inches of sand in a seed box, scatter your seed on the surface and then lay an old damp towel on top. Keep the towel moist and after a couple of weeks, lift in and check the seed. Remove seed that has developed a root at least $\frac{1}{4}$ inch long and sow in a pot. It will need further cover or shade until the seed casing comes away and the seedling has four leaves, when it may gradually be hardened off. Variations of this method are mentioned in various past issues. One competent propagator covers the seed with damp paper instead of a towel. Other experienced propagators prefer to germinate all seed of this type in damp bags, ashes or in damp cotton wool.

Apart from the requirement that the medium on which the seed is set is "wog" free it does not appear critical. A coarse damp sand or the grey bush sand is often used. I prefer vermiculite, a sterile exploded mica, readily available in hardware stores, as I can be certain it is "wog" free and it holds moisture nicely.

It is important that immediately the seed begins to germinate, that it must not be covered by glass or confined in plastic. The free movement of air prevents fungal attack and damp off. The quicker the seedlings are potted out and placed in a position of full sun for all seasons, except the hottest summer months when some overhead protection is necessary to maintain moisture, the more robust will be the plants.

POTTING ON AND PLANTING OUT—

Even the rawest amateur, if the above advice is followed, can grow Waratah and most *Grevillea* from seed. Success in bringing these plants to strong vigour free flowering bushes has proved more elusive. The article "Growing Waratahs" should be carefully read. Much has been written following observations of a white fungus that lives with the roots of healthy waratah and considerable speculation has ensued as to its function. It has been shown that healthy Waratahs can grow without it. However the present learned opinion is that this fungus forms a mycorrhizal fungal association with the roots of the plant assisting it in the quest for nourishment for healthy growth. This friendly fungus is also associated with most *Proteaceae* and it is my practise to mix some old rotting leaves and debris collected from under some large old *Banksia* trees, into the mixture of good garden soil provided in containers when the seedlings are potted on.

Plants should be potted on to larger half gallon containers and be at least two years old before planting out.

CULTIVATION OF WARATAH IN HEAVY SOILS—

Past issues (Nos. 1, 20, 21) give interesting articles by competent growers on this subject. A report by H. Brackpool in our No. 21 issue has an important message:—

"Waratah will prosper in heavy soil that has reasonable drainage provided that the plants are first planted in small mounds of soil 12 inches in diameter and 5 inches high to ensure that the crowns, that develop between the stem and the roots, will never get waterlogged and rot. Once the plants are established they should not be watered except in a long very dry spell, mulching of the top of the ground and overhead shade in hot weather being sufficient."

WATER ABSORBING PLANTS

Many country towns in South Australia have a difficult ground water problem. When they were established there was no such thing as scientific soil study or town planning and the finding of water in shallow wells was an attraction to settle.

Nowadays, instead of being drawn off for use, water is added to shallow ground water tables. Most towns have a reticulated supply. Water is brought in pipes from a distance and because of this its use is much increased. With the introduction of modern amenities into houses, waste water and septic tank effluents have to be disposed of. This is usually done into the ground and the water added to the shallow table.

The result has been that water has risen in many places, almost, if not quite, to the surface, and drainage wells will not work, foundations suffer and trees are damaged.

In many overseas countries, Australian native plants are much valued. Not at least of their virtues to others is the power that many species of Eucalypts have to dry out swampy areas, and in doing so to provide shade, beauty and timber.

Here is a list of suitable trees—there are many others of course, both Australian and exotic.

EUCALYPTS FOR WET SITUATIONS

Coolabah (*Eucalyptus coolabah*)

Dense drooping ashy foliage, grey trunk, white branches (natural habitat, banks of billabongs). Moderately large tree.

Bimble Box (*Eucalyptus populifolia*)

Thick shining foliage, poplar-like. Moderately large tree.

Flooded Box (*Eucalyptus bicolor*)

Similar to last. Very ornamental. Easily killed by fire. Moderately large tree.

River Red Gum (*Eucalyptus camaldulensis*)

Common and well known. Fast growing. There are several varieties. A specially ornamental one is a weeping type. A fine specimen grows at Gumeracha, S.A. and should be propagated. A large tree, providing valuable timber.

Tasmanian Blue Gum (*Eucalyptus globulus*)

Reputed to be the fastest growing of all trees and highly suitable for taking up water. It is used widely in other countries for this purpose and will endure a wide range of climate. There is a dwarf variety which is very ornamental. A large tree, producing valuable timber.

None of the above are conspicuous flowering gum trees. The majority of the best known small flowering gums grown for ornament are dry country and desert forms, but the next two mentioned are suitable for taking up water, have pretty white flowers, and are valuable honey producers.

Grey Peppermint (*Eucalyptus radiata*)

Fine weeping habit, black trunk, white branches, pretty white flowers. Small to moderate size.

Cup Gum (*Eucalyptus cosmophylla*)

Small tree with white flowers, called on Kangaroo Island, the Bog Gum. Very ornamental.

OTHER NATIVES

Other than gum trees there are many trees and shrubs also suitable. Grey Bullock (*Casuarina glauca*), the blue oak and swamp sheoak.

Very hardy and very ornamental. See No. 23 issue for *Casuarina*.

The next trees are paperbark tea trees. See No. 2 issue for *Melaleuca*. Scented Paperbark (*Melaleuca squarrosa*)

Large shrub with yellow flowers.

Swamp Paperbark (*Melaleuca ericifolia*)

Large shrub, fast growing with yellow brush flowers. One of the plants which provides "brush" for feeding. Will take up salty water well.

Flax-leaf Paperbark (*Melaleuca linariifolia*)

This one flourishes specially near the coast.

Native Plants — Clay Soils in Gardens

Submitted by T. D. Raphael, Senior Horticulturist, Dept. of Agriculture, Tasmania

As building expansions and planned housing programmes are no respecter of soils, many hundreds of gardens are located on clay soils of varying degrees of "weight" and intractability. In areas of heavy rainfall these become very difficult, but where rainfall is average to light, clays, can usually be cultivated to very good effect. See No. 27 issue.

Methods employed to handle the heavier soils would closely follow those reviewed and discussed by Dr. Haworth—good drainage, correctly applied cultural operations, liming, green manuring, the application of farmyard manures, judicious use of inorganic fertilisers, and for the smaller garden the incorporation of sand and lighter soils, use of conditioners and raised beds.

Where vegetables and flowers (such as annuals) are sparingly grown or not grown at all, many shrubs and fruit trees such as plums, apricots and pears appear to succeed (if local climate is right) without much trouble, provided the drainage is good. Such conditions would also doubtless apply to the growing of many selected native trees and shrubs, such refinements as indicated above being introduced rather for smaller or more difficult native species.

No reference has been made to the creation of localised conditions for native plants which may perhaps prefer very moist to almost waterlogged soil, or certain pH levels in heavy soil types. However, there would be many instances where the success of a species under certain conditions was due rather to its adaptability (so less competition) rather than specific preference, and good growing conditions could be expected to suit most plants.

Editor's Note: Following receipt of Mr. Raphael's comments above the previous article on "Water Absorbing Plants" was obtained. Not only do these trees grow in wet or bog conditions but they have been used throughout the world to take up the water and transform a bog to a garden for moisture loving plants that cannot take water logged conditions.

STUDY SECTIONS

We intend now to carefully record all plants that flourish in clay. Will readers please report on their experiences to the leader of this study section, Mr. M. Landuogt, 399 Waverley Road, Mount Waverley, Victoria.

These groups comprise home gardeners from all parts of Australia who correspond with a leader with a view to exchanging experience and information and the conducting of simple practical experiments under direction. Each group studies a family or genus of plants with a view to developing good easily grown garden forms of wildflowers. The cost is limited to stamp addressed envelopes for a reply and the entrance qualification is an enthusiasm to help.

TERRESTRIAL ORCHIDS

SOME N.S.W. TERRESTRIAL ORCHIDS OF THE SWAMPS AND DAMP PLACES

by K. HOLMES, Kempsey, N.S.W.

Along the N.S.W. coastal strip are large areas of low lying land, often forming swamp and near swamp conditions. On the North Coast in years gone by, these swamp areas were the home of the Swamp Lily (*Phaius australis*) but due to the depredations of collectors and vandals it is now virtually extinct in its natural habitat. However, many cultivated plants are in existence and specimens are seen at Orchid Shows where it often wins the prize for "Best Native Orchid."

Plants of the "Purple Hood Orchid" (*Cryptostylis erecta*) grow in the swamps, sometimes being under water for months at a time, but they rarely flower under these conditions.

The swamps near Brunswick Heads on the far North Coast are the home of "Fordham's Helmet Orchid" (*Corybas fordhamii*). This quaint little orchid grows on the small mounds that rise just above water level.

Around the margins of the swamps are usually found thickets of broad and narrow-leaved Paperbarks (*Metaleuca* spp.) and Swamp Oaks (*Casuarina glauca*). During the wet autumn months these areas are inundated for quite long periods but by the springtime they dry out and many species of orchids may be found flowering there. In the densest shade I have found colonies, often mixed together, of "Nodding Greenhoods" (*Pterostylis nutans**), "Little Red-Riding Hoods" (*P. pedunculata**), the king of the Greenhoods (*P. baptistii*) and solitary plants of the "Blunt Greenhood" (*P. obtusa*) which are usually finished flowering, and the many flowered *Pterostylis longifolia**.

Where the ground is less shaded grow the "White Caladenias" (*C. albo**) and the large and beautiful bright pink Caladenia (*C. carnea* var. *gigantea*).

In the open areas, but where it is quite damp, one may find plants of *Thelymitra pouciflora* and *T. carnea*. These two species of "Sun Orchids" are self-pollinating so it is only on very rare occasions that the flowers open. The "Onion Orchids" (*Microtis porviflora** and *M. unifolia**) with their upright spikes of tiny green flowers are often overlooked, but two species which catch the eye are "Parson's Bands" (*Eriochilus cucullatus*) with their conspicuous pair of large white to pink lateral sepals, and "Ladies' Tresses" (*Spiranthes sinensis*). These both flower in the late summer and autumn. The "Ladies' Tresses" are perhaps my favourite of the terrestrial orchids. The tiny flowers are the brightest pink with a pure white labellum and they form a dense spiral up the bright green spike.

Other terrestrials which favour damp conditions, especially in deep gullies and on hillsides with a southerly aspect are the "Autumn Bird Orchid" (*Chiloglottis reflexa*), the Greenhood species (*P. nutans*, *P. hildae*, *P. longifolia* and *P. obtusa*) and "Pixie Cups" (*Acianthus fornicatus**)

Growing at the foot of the gullies, where the shade is very dense and the soil always moist, are the "Scrub Lilies" (*Calanthe veratifolia*) which produce their tall spikes of pure white flowers at Christmas, and the "Superb Greenhoods" (*Pterostylis grandiflora*). The flowers are striated with reddish-brown markings and the red petals are very broad making this a very attractive species.

Three N.S.W. terrestrial orchids appear to grow under specific conditions. The "Green Rock Orchid" (*Rimacola elliptica*) is confined to the Hawkesbury Sandstone area where it is found growing on heavily shaded cliff faces in the thin layers of grey shale between the sandstone. This shale is never dry.

On moist mossy rocks also in the Hawkesbury sandstone areas grows "Daintrey's Greenhood" (*Pterostylis daintreana*). Often found growing in association with it are "Parson's Bands" and the "Hairy Leek Orchid" (*Prasophyllum morrisii*).

The small, solitary white flowered terrestrial *Adenochilus nortonii* is only found growing at high altitudes (over 3,000 ft.) on the Blue Mountains and the Barrington Tops in wet crevices or in spagnum moss.

* These species are not confined to these situations but may be found growing over a wide range of conditions.

THE PITCHER PLANTS AS AN INSECT TRAP

Portion of the article by Prof. B. J. Grieve on this plant in our No. 8 issue.

See the article on page 34 and the colour plate on page 36.

The young pitchers are bright green in colour as shown on the colour plate on page 36 but as they grow older they tend, at least when exposed, to develop bright red and purple colours. Full grown specimens may be one inch diameter and up to one and a half inches deep.

Three strong ridges are visible on the outside and the central one can be seen to extend from the base of the pitcher almost up to the mouth of the trap. Long stiffish hairs develop on these ridges and particularly when young it appears to bristle with hairs. It is believed that these hairs assist the progress of crawling insects into the trap. Flying insects may also be attracted to the trap since the half open lid has whitish patches on it and on the pitcher itself purplish-red veins are present and could at a distance be mistaken for a flower.

Once the insects in the course of their search for nectar get upon the smooth slippery inner surface of the mouth of the pitcher, they easily fall into the interior cavity. This is generally part full of liquid so that the majority drown within a short time. Those that are active enough to struggle out of the liquid are then confronted by other barriers to escape. Ants, flies and beetles are the commonest insects trapped.

Research has so far not proved whether the insects are digested by a secretion from glands that do exist in the pitchers or whether bacteria assist in breaking down the insect protein to make these available to the plant.

NATIVE PLANTS

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THE FAMILY ROSACEAE

Sixth article in a series on "Wildflowers of Tasmania" by A. M. Gray although for completeness some mainland species are also mentioned here. Some plants mentioned are weeds and these are carefully defined. However others show promise as being very suitable for Rock Gardens and Alpine Gardens and this article also becomes part of a series on these two subjects.

The family Rosaceae consists of about 120 genera and more than 2,000 species) over 3,000 according to some authorities), widespread throughout the world. They occur in all forms—trees, shrubs, herbs and climbers, sometimes thorny.

A natural family, diverse but usually identified by the peri- or epigynous flowers with more or less numerous stamens. It is most closely related to Saxifragaceae. It is easily confused with Ranunculaceae, but apart from the perigynous flowers, the presence of stipules will separate any species likely to be taken as a member of the Ranunculaceae.

The family is of considerable importance in temperate regions for the cultivation of fruit and some ornamental specimens. Apples, pears, peaches, plums, raspberries, strawberries, etc., are widely cultivated for fruit; whilst the "Rose," cherry-laurel, hawthorn, japonica etc. are cultivated for their attractive flowers, foliage or berries.

The following species occur naturally in Australia—*Geum urbanum*, *G. renifolium*; *Acaena ovina*, *A. anserinifolia*, *A. montana*; *Stylobasium spathulatum*, *S. lineare*; *Parinari nonda*, *P. griffithianum*; *Pygeum glandulosum*; *Rubus gunnianus*, *R. rosifolius*, *R. parvifolius*, *R. hillii*, *R. moorei*; *Potentilla anserina* (two authors to my knowledge have classed *Potentilla anserina* as being native in Australia).

Flowers are regular and usually hermaphrodite though occasionally unisexual, the petals and stamens being either epigynous or perigynous. Petals and sepals 4-5, sometimes with an epicalyx outside the sepals, occasionally the petals may be absent. Stamens 2-3-4 times as many as the sepals, rarely 1 or 2. A nectar-secreting disk is often present at the base of the stamens and in perigynous flowers, forming a ring lining the receptacle. Carpels 1 to many, free or sometimes united to each other and to the receptacle, rarely united and free from the receptacle. Styles free, very rarely united. The fruits can occur as drupes, achenes, syncarps, follicles or pomes, rarely a capsule, usually 1 or more in number, the receptacle sometimes becoming fleshy and coloured. Leaves mostly alternate and stipulate, the stipules occasionally united to the petiole, they may be entire, serrate or compound.

THE GENUS GEUM IN AUSTRALIA

1. *Geum urbanum* L. var. *strictum* (Ait.) Hook. f.

This is an erect herbaceous plant with leaves which are variable in size and form, mostly compound, orbicular in shape, with 3 or 4 large leaflets intermixed with smaller ones, margins toothed, and large leafy stipules. The flowers form a loose panicle and are up to $\frac{3}{4}$ " wide, petals yellow and larger than the sepals. The flowers resemble those of the buttercup but are not shining and are borne in loose clusters. The fruit comprises a large globose head, consisting of hairy achenes with long awns hooked at the tips. It is found in damp, shady places in Tasmania and the highlands of Victoria and N.S.W. It occurs also in New Zealand and South America. Typical *Geum urbanum*, which is found in Europe and Western Asia, differs from the variety *strictum* chiefly in its smaller flowers and less robust habit.

2. *Geum renifolium*

A herbaceous perennial with large rootstock. The flowers are larger than in the former species, white in colour and occur singly. The radical leaves are large, have one terminal segment reniform and shallowly lobed. The upper surface is very wrinkled and hairy, the under-side showing prominent veins. The petiole occasionally has a number of small toothed

segments along its length. Flowering stems are up to 18" high, with a single terminal flower. This plant occurs only in Tasmania on mountains in the south and south-west. Its possibilities as a garden plant are being investigated.

THE GENUS *ACAENA* IN AUSTRALIA

Acaena ovina

A herb with a rosette of radical leaves, perennial rootstock and annual erect leafy stems about 12"-18" high. Leaves pinnate, usually with 6-8 pairs, ovate or orbicular in shape, divided into blunt lobes, the upper surface smooth, the lower surface finely hairy. The leaves resemble somewhat those of the Rowan tree, though smaller and slightly hairy on the underside. Flowers small, inconspicuous, green or mauve in colour, without petals, having purplish anthers; many are borne on a long spike. The receptacle surrounding the fruit is oval, hairy and with short prickles arranged irregularly. This plant occurs in Vic., N.S.W., S.A., Tas. and Qld. It occurs also in N.Z. and South America, is abundant in pastures and of little horticultural value.

Acaena anserinifolia

A common and well-known plant, almost a weed in many places. Commonly known as "biddy widdy" or "buzzy," the quadrangular achenes having 4 long barbed spines which catch very easily in clothing and are difficult to remove. Flowers and leaves are similar to those of *A. ovina*, the former being in spherical heads instead of in a spike. It is included here to make the reference complete; little horticultural value. A perennial with tough woody branches, creeping but with the flowering heads ascending, leafy. Leaves pinnate with 3-4 pairs and a single terminal one, upper leaflets largest $\frac{1}{4}$ "- $\frac{1}{2}$ " long, oblong-orbicular in shape, deeply serrated, upper surface smooth, lower surface finely pilose. Flowers minute, green or purplish in crowded globular heads. In the fruiting stage, the receptacle is about $\frac{1}{8}$ " long, and has four prominent ribs, with a spine diverging from the summit of each. The spine is about $\frac{1}{2}$ " long and barbed at the tip. It occurs in S.A., Vic., N.S.W., Tas. and N.Z., being regarded as a nuisance wherever its burrs become caught in clothing or sheep's wool.

Acaena montana

This dainty little plant resembles *A. anserinifolia* but is smaller in all parts and differs in the receptacle. Because of its rather compact, spreading habit of growth it has interesting possibilities as a rockery or alpine plant as it usually occurs between 3,500' and 4,500' on most Tasmanian mountains. Leaflets sometimes almost smooth or silky hairy, the margins and the midrib on the under surface densely so. Receptacle about $\frac{1}{12}$ " long, obovoid and with four slender spines about $\frac{1}{12}$ " long. This species is endemic in Tasmania.

THE GENUS *RUBUS* IN AUSTRALIA

Rubus gunnianus

A small perennial, usually growing in compact mounds, the stems slender and rather woody, creeping just beneath the surface of the soil and developing rosettes of leaves at the ends of the branches. The whole plant may cover an area 1'-3' in diameter. Leaves fairly small and shining, roughly resembling small blackberry leaves but with deeper serrations; petiolate, pinnately lobed or divided, occasionally trifoliate, ovate in shape, the

terminal one larger than the rest, $\frac{1}{2}$ – $\frac{3}{4}$ " long, serrated. Flowers occur singly on short peduncles, often unisexual and are quite large in proportion to the rest of the plant. They resemble small white Clematis flowers, except that the apparent petals in Clematis are really sepals and *Rubus gunnianus* has petals which are creamy-white, oblanceolate-blunt about $\frac{1}{2}$ " long. Fruit a collection of 4–5 drupelets each $\frac{1}{4}$ – $\frac{1}{2}$ " in diameter, edible and of excellent flavour. This species occurs only in Tasmania on mountains at altitudes from 3,000–5,000'. It is somewhat difficult to propagate and grow successfully. However, with encouragement, it makes a delightful rockery plant, worth growing even if only for the fruit.

Rubus parvifolius

A slender, prickly shrub with straggling branches, well furnished with hooked prickles. It resembles the cultivated raspberry both in flower and leaf. Leaves pinnate—3–5 leaflets—ovoid-rhomboid in shape, the terminal one 1–2" long, the lateral ones shorter, the upper surface green and wrinkled, the lower surface white-tomentose. The flowers occur singly or in panicles in the axils of the upper leaves. Petals pink, shorter than the reflexed sepals. Fruit a collection of red drupelets, edible and reputed to be of pleasant flavour. Widespread in Tas., S.A., Vic., N.S.W., Qld. and northward to China. Would possibly make a good garden specimen if kept well pruned.

Rubus rosifolius

Similar to *R. parvifolius* from which it differs in having the leaflets acuminate and green beneath, the larger petals ($\frac{1}{4}$ " wide) white, the ovoid fruit much larger ($\frac{1}{2}$ – $\frac{3}{4}$ " long) and drupelets very numerous—more than 100. It is a weakly erect shrub extending from jungles in eastern Vic. along the coasts of N.S.W. and Qld. to New Guinea, Indonesia, Japan, S. Asia, Madagascar and S. Africa.

Rubus hillii

A very variable tall scrambler of rain forests. Leaves all simple, ovate, cordate at base, shortly 3- or rarely 5-lobed, 2–4" long, very wrinkled, almost hairless above but felted on under-side, with a pale brownish wool. Flowers in congested terminal masses; calyx-lobes silky-villous, acuminate; petals mostly white, up to $\frac{1}{4}$ " wide. Fruit red, globular, about $\frac{1}{2}$ " wide, with many drupelets. Extending from eastern Vic. to N.S.W., Qld. and N. Aust.

Rubus moorei

A tall jungle climber covered with numerous reflexed prickles (hence the impolite name "Bush Lawyer"). Leaves with 5 digitate, sharp-pointed, almost glabrous, ovoid leaflets, each 3–5" long and bordered with spiny teeth. Flowers white, in loose axillary racemes or panicles. Fruit dark red. Restricted to N.S.W. and southern Qld.

Potentilla anserina

This plant is described by W. M. Curtis as "found in temperate regions throughout the world, it may be introduced but was recorded as a native by J. D. Hooker in his *Flora Tasmaniae* (1856). It is also recorded as native by Rev. W. W. Spicer in his *Handbook of Tasmanian Plants* (1878). Occurrences in Victoria and South Australia are few and far between, J. M. Black remarking of the latter State "perhaps introduced."

From G. Chippendale, Botanist, N.T.A., Alice Springs:

"*Parinari corymbosa* and *P. nonda* (The Nonda Tree), have been recorded near water courses in the top end of the Northern Territory. They are both tall trees to 50 ft. with grey tasselled bark, flowering in winter to spring."

Stylobasium is now regarded as being in the plant family *Stylobasiaceae*. See page 33.

SMALL ACACIAS

Some Notes by F. J. C. Rogers

In a friend's garden at Montrose, Victoria, many interesting species of acacias are growing. There is room for the usual species grown in Victoria—*Acacia baileyana*, *A. pycnantha*, *A. cultriformis*, *A. buxifolia* etc., but the more interesting ones are the smaller bushes and lesser known species from Western Australia.

For them to withstand the wet and cold of three parts of our year is quite a feat as many of these species are from the drier parts of Australia. Drainage and some raised beds have helped them; also the admixture of black soil and rotary hoeing in of decayed sawdust to the natural compact poor soil.

Under these conditions and provided there is never much water lodged around their roots, they may perhaps grow cleaner and better looking than in their natural home. There is no damage by wind blown sand and hot winds, leaf-eating pests are not prevalent either. However some fasciation is frequently seen, possibly from aphids or other sucking insects. *Acacia merrallii* is particularly subject to this defect. Fortunately the bush discards these thickened stalks—they die and new growth soon continues with its attractive appearance.

It is possible to grow many small acacias not only for the flowering at various times but for the diversity of foliage shapes and colours.

The winged-stem Acacias such as *A. alata*, *A. glaucoptera*, are very unusual. The filiformes, or threadlike leaf, or phyllode, are an immediate contrast with phyllodes in *Acacia longiphyllodea*, from Kalgoorlie, up to eighteen inches long. Here we note also *Acacia merinthophora* or *A. hynesiana* with an extraordinary thin stem, somewhat zig-zagging in new growth, and threadlike phyllodes of six inches or more. We come on types such as *Acacia extensa* and *A. trigonophylla* with its three narrow ribs on its stem giving a triangular appearance to the young growth. *Acacia complanata* is noted, a Queensland plant of about six feet, slender with a very flattened stem growth.

Finally, *Acacia denticulosa* is met and one wonders how such a thing originated as an Acacia. Large round to oval phyllodes are crinkly and rough—the edge and surface being covered with stalked vesicles—amazing under the glass. The young leaves and stems are crowded with this feature, which gives a brown colour until maturing when it is left on the stalk as a prickly growth.

The colour of Acacia foliage is always interesting. Species like *Acacia cultriformis* and *A. podalyriaefolia* contrast throughout the year with silvery white, *A. glaucoptera* with its pink tips, and the magnificent wattle, *A. penninervis*, Buchan form, with its blue foliage, a tree of say 20 feet and flowering in December.

Some wattles flower repeatedly, *Acacia retinodes* usually carries a flower head or two at most times. Others, if the season is beneficent, may be seen with young pods and a new crop of flowers—the second flowering.

One of the stringybark wattles in *Acacia fragilis* is a slender threadlike foliage Acacia with the rough thin brown bark hanging in shreds. A small rod flower is attractive and the new pods unusual in pigtail form, covered with golden hairs and appearing at first like a flower bud.

Acacia inophloia is a shrub of five feet, also with rod flowers, and most attractive. Its thread foliage is golden shaded, including the stem and the new growth is somewhat sticky. *Acacia lasiocalyx* is somewhat similar to *A. inophloia*. It has rod-flowers about one inch, and a narrow leaf. It is of upright growth, the young stems are golden and it too is worthy of cultivation.

Acacia bancrofti is also noted, a small tree with very large young leaves. Various species are met that have hooked phyllodes like thorns—such as *A. stenoptera* and *A. triptera*—the latter being handsome in flower and new growth.

You, too, can have joy from acacias just as I do when I visit my friend's garden at Montrose.



Photography by Ron Hill. Reproduced from "Growing Australian Plants" by courtesy of Rigby Ltd.

ACACIA ROTUNDIFOLIA Hook.

This species, which is a spreading shrub 2-5 ft. high, occurs in S.A., north-western and north-eastern Victoria as well as on the tablelands and western slopes of N.S.W. *Acacia rotundifolia* is characterised by obliquely obovate or orbicular, mucronate, 1-veined phyllodes about $\frac{1}{4}$ to $\frac{1}{2}$ " long. The globular flower-heads are borne on solitary or twin peduncles which are often longer than the phyllodes.

THE GENUS STYLOBASIUM

Closely related to the family Rosaceae these notes by Paul Wilson, W.A. will serve to complete the picture.

Stylobasium—Shrub or small trees. Calyx cupular with five broad lobes. No petals. Stamens ten, hypogynous with long slender filaments, anthers large, linear, exserted. Ovary subspherical, glabrous, style arising from one side of ovary at its base.

S. lineare Nees.—Erect shrub 3'-5' high with slender broom-like stems, glabrous. Leaves linear-cuneate 2-4 cm. long. Flowers reddish green; fruit spherical (drupe) ca. 5 mm. diameter. Distribution: Central and Northern Wheatbelt of Western Australia (Perth-Geraldton area).

S. spathulatum Desf.—Erect shrub or small tree 3'-10' (15') high. Leaves grey-green, cuneate-oblong or obovate, 2-4 cm. long, ca. 1 cm. wide. Flower buds dark purple; flowers greenish brown. Fruit (drupe) spherical, ca. 1 cm. diameter. Distribution: Central and North-western Australia.

From G. Chippendale: *Stylobasium spathulatum* grows to 6 feet in red sandy desert country, but also occurs on river frontages and calcareous soil. It has a greyish-green appearance, in significant small green flowers followed by small dark berries.

THE WEST AUSTRALIAN PITCHER PLANT (*Cephalotus follicularis*)

by F. Lullfitz

The "Pitcher Plant", *Cephalotus follicularis*, is an insectivorous plant, that is, in the wild it obtains its nutritional requirements by trapping and digesting insects which happen to stray into the "pitchers." It produces both true leaves and modified leaves which assume the typical "pitcher" shape, complete with a "lid." Once in the pitcher the insect is prevented from escaping by virtue of the smooth inner surface and also the ingenious downward-growing hairlike protuberances at the lip and lid of the pitcher.

In response to a heavy demand for seed of the Pitcher plant, attention has been paid to the plant over the past twelve months.

HABITAT—

It has been assumed that it only grows in bog. This is false, as it also was found growing on high ground in fine white sand. The range of the plant—a few miles east of Albany, westward to Augusta, with a small area near Busselton, rarely more than ten miles from the coast.

The soil seems to be entirely of granite origin, with a Ph of 4-5. Some good patches of the plant were in peaty bog along the upper perimeter of swamps, the water oozing from soakage. Other patches were in tight white sand where dampness indicated a soakage area, although no free water was found.

The area of its occurrence is where summer drizzle is not infrequent and heavy night dews are prevalent. This means that some overcast sky prevails in summer and coupled with the undergrowth would cut down the amount of sunlight considerably. In every case it was at its best when sheltered from the direct rays of the sun. This showed fine plants matted in with the roots of *Beaufortia sparsa*, *Leptospermum firmum*, and various Sedges. Where the plants grew in the open and were exposed to more sun they showed signs of damage and withering in the late summer.

THE PLANT—

In March and early April, a number of plants were investigated. In the bog areas where they grew almost totally in mossy fibrous material with free water, seedling plants were found. These still had the testa attached to the stem below the "pitcher" leaves. No Cotyledons were seen and the foliage was in the ratio of about 4 or 5 pitcher leaves to one normal leaf. These pitchers were from 1/8" long and larger.

The "pitcher" leaves are of course modified leaves and are not in any way related to flowers. There were signs that some earlier Pitcher leaves had decayed immediately above the testa. There was a root descending and in the smallest plants only about an inch long, in some cases with two or three short roots at the bottom. In larger plants the stem had increased in size and became tuberous, in adult plants 3/16" diameter and up to six inches long below surface. Particularly noticeable was the almost complete absence of roots. It would appear that as the plant develops the rhizome is drawn into the soil medium. Water intake would then be by absorption through the stem.

HOW DOES IT LIVE?

The fact that so many more Pitcher leaves than true leaves, are produced, would point to the plant receiving most of its nutrient from live organisms digested in the Pitchers.

A report was received of some plants which after transplant of two years in the garden had developed all true leaves and discontinued growing pitchers. Would this indicate that the plant was receiving its nutrients from the soil and thus not requiring food from Pitchers?

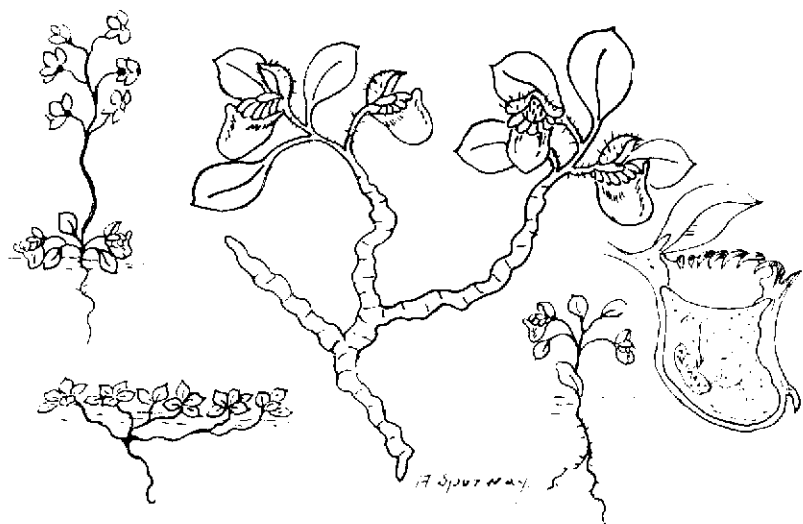
I assume that a soil medium predominantly carbonaceous—peat moss and say clear sand or vermiculite in a damp condition—Ph 4-5 and using rain water would free the plant to depend on organic feeding and develop pitchers. These then would of necessity have to be fed with insects or other small organisms.

Some larger pitchers when cut open showed a small excess of watery material with partly decomposed insects and in one a grub $\frac{1}{2}$ " long.

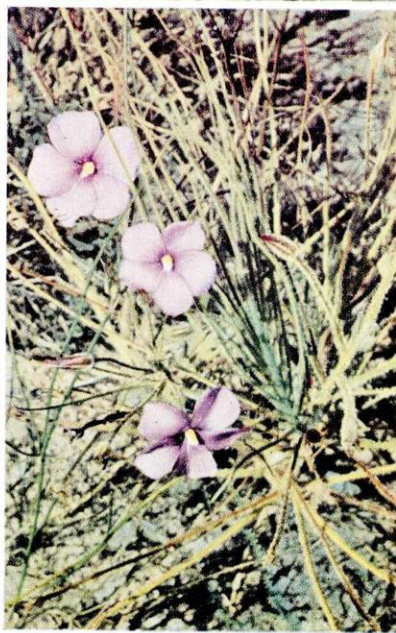
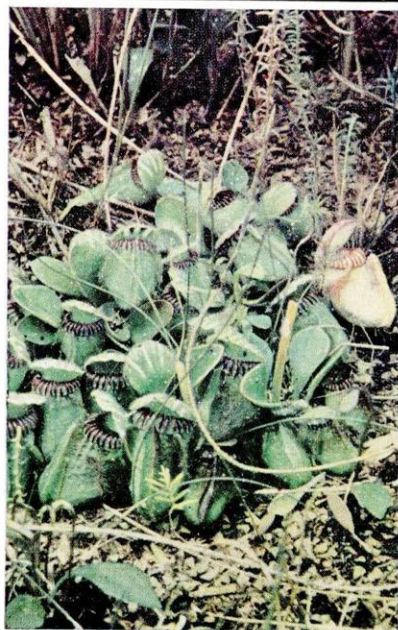
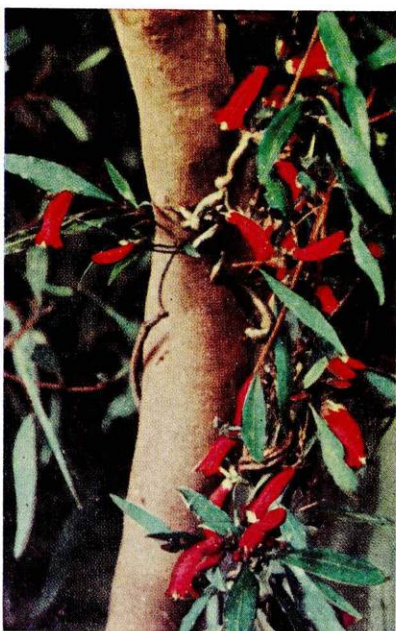
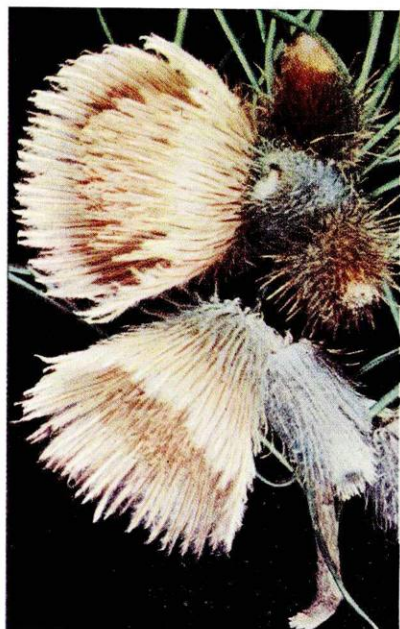
The clumps of Pitchers so often seen and admired are generally one plant, the original stem being branched below the ground and developing many rosettes of leaves at ground level.

FLOWERS—

However the Pitcher does produce flowers. In late spring a flower stalk develops which by Christmas is about 9" high with a bud bunch on top (about $\frac{3}{4}$ " in diameter). This emerges and produces a loose panicle of small white flowers with a stem up to 24" high. The inflorescence is a panicle and produces from 9-14 heads of flowers and bears a total of from 40-100 flowers. The flowers have six white petals.



Large numbers of spiders have been found inhabiting these inflorescences. Specimens were sent to the Museum for identification as it was thought they might have something to do with pollination. However, they were found to be a species of *Chiracanthium* (a poisonous type) and *Diaea* (flower spiders). These prey on insects which visit the flowers. Hence their effect on pollination may be negative—destroying pollinating insects.



Colour plates reprinted from "How to Know Western Australian Wildflowers" by W. E. Blackall and B. J. Grieve, by courtesy of the University of Western Australia Press.

Dryandra speciosa Meissn.

Marianthus erubescens

Cephalotus follicularis

Byblis gigantea Lindl.

"Albany or Western Australian Pitcher Plant"

"Rainbow Plant"

BANKSIA & DRYANDRA

Two other famous genera of plants in the family *Proteaceae* are *Banksia* and the lesser known but very similar *Dryandra*. These have been described in previous issues but most of the comments on propagation and cultivation of Waratah also applies to these plants.

***Dryandra speciosa*.** The colour plate opposite, of this species shows the typical flower structure of the group. Some species have bright yellow, orange or red flowers their charm being in their scraggy, primitive usually large flower heads and the vast variety in foliage form. The foliage is keenly sought after by dried flower arrangement enthusiasts. *Dryandra speciosa* grows to 3-4 feet in height and like other *Dryandra* is winter to spring flowering.

NATIVE CLIMBERS

Reports by readers on attractive native climbers are sought, the following species being an example of a desirable form.

***Marianthus erubescens*.** The red bell-like flowers of this plant are up to 1 inch long and quite bright and attractive on the plant. It is not a vigorous grower.

INSECTIVOROUS PLANTS

Our No. 27 issue describes many unique native plants that prey on insects. We have a special study section (correspondence is used to exchange notes, plants, etc.) for those interested in these fascinating plants. Two such plants are:—

***Cephalotus follicularis*.** "The Pitcher Plant." This plant is fully described on page 34 of this issue. Its method of trapping insects is described on page 28. The following is the experience of a grower in Melbourne.

***Byblis gigantea*.** "Rainbow Plant." This plant is fully described in our No. 27 issue.

MY PITCHER PLANT

by A. L. Hargrave

My pitcher plant has been grown continuously for about three years in the glasshouse and in that period has about trebled its size. The pitchers are not as big as those growing in their native habitat. One of our members tested the soil it grows in W.A. and found it contained a fair amount of salt. I have been able to obtain some peat from a farm on the South Australian Coast which by test from the Victorian Agricultural Dept. was found to have 10 times more salt content than most plants require. The plant has been in this mixture most of the time I have been growing it and there are about 40 pitchers from the tiny size to the largest. The plant has been kept continuously wet.

FLOWERS AND SEED OF THE PITCHER PLANT—continued from page 35.

The flowers, by late March, produce six seeds each. The seeds are quite tiny and are enclosed in the base of a papery envelope. When ripe the seeds protrude in a brush formation. Unfortunately the flowers continue to mature over quite a long time and there are ripe seeds and all stages down to unopened buds on the same stalk.

It would probably be possible to divide the clumps and grow plants by vegetative reproduction.

GREVILLEA ASPERA

A SOUTH AUSTRALIAN CONTRIBUTION TO THE FLORA

by PATRICK STANLEY, *Canisius College, Pymble, N.S.W.*

South Australia's most extensive mountain system is the Flinder's Range. It extends from the vicinity of Port Pirie, a centre of industrial activity, northwards for about 270 miles, to within 20 miles of Lake Callabonna, whose mud has preserved the bones of giant marsupials of past ages. For the most part, and especially towards the north, it is very sparsely inhabited.

Towards the centre of this Range is the remarkable Wilpena Pound, an elevated basin, 12 miles long and 5 miles wide, resembling the crater of an extinct volcano, with a surround of rugged hills. St. Mary's Peak, a mountain bordering part of the Pound is 3,900 feet above sea level. As the crow flies Wilpena Pound is approximately 260 miles from Adelaide.

While the crows however are busy commuting on this direct flight, some adventurous spirits set out from Newcastle, N.S.W., through "Burke and Wills" country to Wilpena Pound. Those who followed a subsequent lecture by Mr. Don McNair would remember the red sandy track, flanked at times by golden Cassios, and brilliant red and purple "hop bushes" (*Dodonaea*). A picture comes to mind of a drift of beautiful "mint bushes" (*Prostanthera striatiflora*) growing in desiccated country; while patches of Sturt's desert pea (*Clianthus formosus*) lured them from the ill-defined track to a point of danger. Salt bushes "lamb's tails" (*Ptilotus*) and acacias could be added, but it is mainly a story of sand, sand, and more sand, until one approaches the Flinder's Range itself. Now the picture changes to green, with pools in creek beds, and one recalls a beautiful *Eremophila*—*E. reedingii*, and finally, high up among the rocks a *Grevillea*, with drooping panicles of red and lemon-green flowers—*Grevillea aspera*.

As a result of this expedition, and through the intercession of Mr. McNair, I obtained seed of this *Grevillea*, which is now growing in Sydney in a 4 gallon drum, and flowering profusely in July, although only a foot high.

In order then to get some authoritative information on this little known *Grevillea*, I wrote to Mr. Ron Hill of the staff of the Botanic Garden, Adelaide. Mr. Hill is well-known to readers of this journal for his articles on *Eremophilas* and other inland flora. Mr. Hill writes . . .

"I have seen *Grevillea aspera* growing naturally at Wilpena Pound and at Mount Searle, Arcoona Bluff, and Gammon Range, which all form part of the rugged northern Flinders. It is also recorded from Gawler Range, in South Australia and the southern part of Eyre Peninsula, but I have not seen it here. I think it is more common in the Flinder's Range than elsewhere. It is endemic to South Australia.

"I have not seen it more than about 3 feet high, and it seems to favour rocky situations. We have several plants doing well in the Botanic Garden, and they are rarely without a few flowers. At the moment—July—they are flowering very well. For garden purposes I think this *Grevillea* would be very useful in larger rockeries; or for normal gardens I would suggest it be planted in groups of several plants together, for best effect. It certainly appears very hardy, and should be grown much more than it is."

In a later note from Mr. Hill, dated September 14th, he writes: "I have just returned from the Northern Flinders . . . whilst there we climbed to the

top of Mt. Searle, approximately 3,000 feet above sea level, and *Grevillea aspera* was there in profusion and full of flower, bushes were about 3 feet high and wide and very compact, truly a beauty!"

My thanks then to Mr. Hill for this detailed information, and commendation of *Grevillea aspera*; which should be enough to convince any wavering *Grevillea* fancier of the value of this plant.

On one of the plants that I have growing in a container there is a profusion of blossom unusual even among *Grevilleas*. It has trusses of flowers hanging like bunches of grapes from each leaf axil, and terminally as well. Perhaps you may like to grow this *Grevillea* as a link between those of the East and the West. The difficulty then would be, not so much in growing it, as in obtaining a plant. This has been said before. Nurserymen can only afford to stock those plants for which there is a demand. They will however if a firm order is placed.

In conclusion may I thank Mr. Don McNair for introducing this inland *Grevillea*, a member of a very ancient family, which happily remains with us; while the *Diprodoton*, possibly a *Grevillea* fancier too, but less adaptable to changed conditions, settles deeper into Lake Callabonna.

NUTRITION OF GREVILLEA ROBUSTA

by C. W. E. Moore

It has frequently been noted that native plant communities in Australia show a distinct preference for a particular soil type, and thus many species are restricted naturally to certain soils. Under artificial conditions, of course, the range of soils on which a species may be successfully grown can be greatly extended. The wide range in fertility between soils derived from different parent materials suggests that available soil nutrients may be an important factor in the delimitation of the various communities, but at the same time it must be stressed that this is only one of many factors in a complex environment, and many others interact to provide a suitable habitat for any species or community.

Grevillea robusta (commonly known as silky oak) occurs as scattered individuals in the rain forests of Queensland, and does not form pure stands. Attempts to grow silky oak in plantations have been commercially unsuccessful, and it has been noted both in natural occurrences and in plantations that seedlings do not establish in the neighbourhood of mature trees. Following seed-fall there is usually abundant germination, but the seedlings subsequently die, and usually none is left alive within the root zone of parent trees after a period of six months.

Symptoms prior to death include severe chlorosis and the development of typical black lesions on the leaves. The affected leaves die, and the blackening extends into the stem, subsequently resulting in death of the plant. A study of the effects of nutrient deficiencies on seedling growth of *Grevillea robusta* was made to assess the possible role of nutritional factors in relation to the ecological behaviour of the species, and to record the symptoms of deficiency of the various nutrient elements.

Seedlings were grown in Perlite in a glasshouse in which the day/night temperature regime was controlled to approximately 25/20°C. The effects of absence of individual elements, and interactions between nitrogen and potassium were studied in a series of three experiments.

NUTRITION OF GREVILLEA ROBUSTA

PLATE 1

Fig. 1.—Leaf of plant with complete nutrients. The symptoms are the same as those produced when boron is omitted from the nutrient solution. Note that the older leaves are normal and that symptoms become progressively more evident towards the growing point. The youngest leaves show typical broad lamina on either side of the midrib, with small pinnae, but no pinna segments.

Fig. 2.—Wilting of young leaf of plant grown without calcium in the nutrient solution.

Fig. 3



Fig. 2

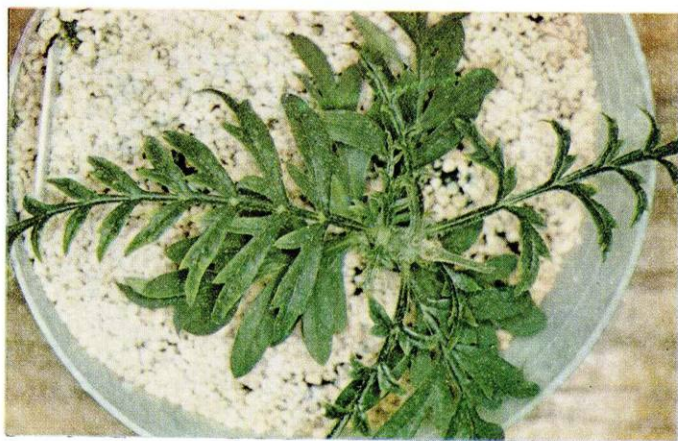


Fig. 1



NUTRITION OF GREVILLEA ROBUSTA



Fig. 1

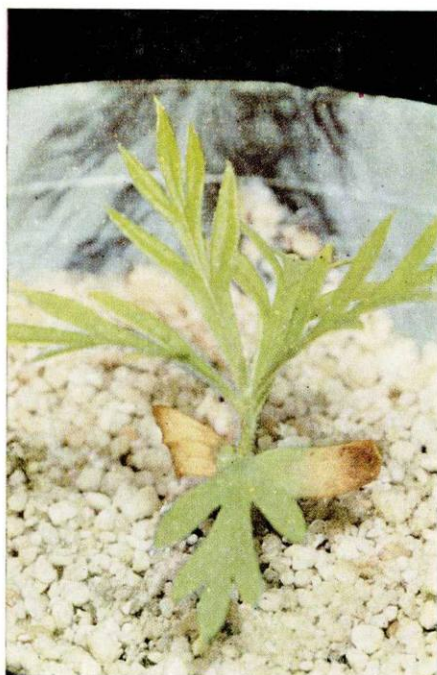


Fig. 2

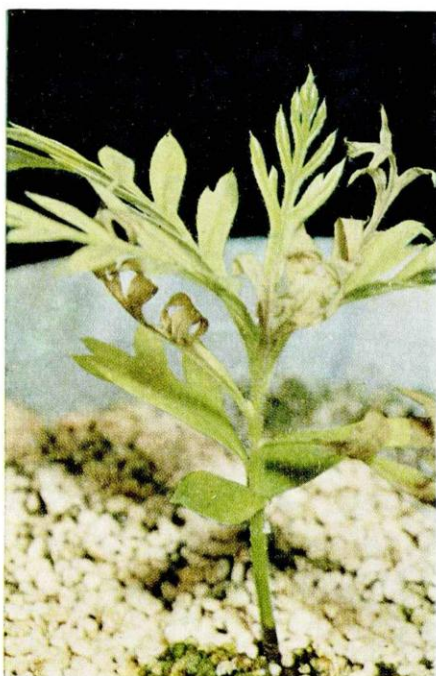


Fig. 3

PLATE 2

Fig. 1.—Leaf of plant grown without potassium. Note that blackening commences just below the tips of the pinna segments, and spreads in both directions. The tips of the pinna segments turn inwards.

Fig. 2.—Plant grown without nitrogen. Note stunting and general chlorosis, but the chlorosis is most severe in the older parts of the plant (cotyledons and older leaves).

Fig. 3.—Plant grown without iron. Note stunting and severe chlorosis in younger parts of the plant. The cotyledons and first leaves remain green. The development of pale brown areas on the leaves is also characteristic of iron deficiency.

In the first experiment there were nine treatments, viz. complete nutrients, complete minus each major element (calcium, nitrogen, phosphorus, potassium, sulphur, magnesium and iron), and complete minus trace elements (copper, manganese, zinc, boron and molybdenum). In this experiment no attempt was made to determine the effects of individual trace elements produced recognisable symptoms, and had a marked effect on growth.

TABLE 1

Seedlings were transplanted to the pots on May 15, 1962

Date	Symptoms
June 15:	Plants fed with complete nutrients minus nitrogen. Plants had three true leaves; leaves small; leaves and cotyledons chlorotic; plants stunted. Plants remained chlorotic and stunted until harvest (Plate 2, Fig. 2).
June 15:	Plants fed with complete nutrients minus iron. Plants had three to four true leaves; cotyledons and oldest leaves normal green, younger leaves severely chlorotic (pale yellow to almost white).
June 28:	Small pale brown necrotic areas at tips of pinna segments. Little or no subsequent extension of these necrotic areas. Plants showed little further growth (Plate 2, Fig. 3).
June 21:	Plants fed with complete nutrients minus magnesium. About five true leaves developed; growth approximately the same as for control plants; brown flecking on the two lowest leaves. Later the majority of leaves became affected, and the flecking more obvious.
July 23:	Plants fed with complete nutrients minus trace elements. Plants stunted; youngest leaves had broad lamina along the midrib, very short pinnae, and no development of pinna segments; pale yellowish green on margins, dark bluish green along midrib.
Aug. 9:	Internodes very short, and branches developing.
Aug. 29:	Purplish brown necrotic areas at tips of oldest leaves (Plate 1, Fig. 2).
July 23:	Plants fed with complete nutrients minus sulphur. Slight chlorosis of the younger leaves, commencing at margins and spreading to centre of pinna segments.
July 23:	Plants fed with complete nutrients minus phosphorus. Plants stunted; youngest leaves purplish, small, and the pinnae and pinna segments much narrower than in control plants.
July 23:	Plants fed with complete nutrients minus potassium. Plants stunted, but at this stage deficiency symptoms not clearly visible. On one plant dark brown necrotic areas had developed at the tips of the pinna segments of the older leaves.
July 27:	Two plants had black necrotic areas at tips of the pinna segments of the upper fully developed leaves, and all leaves were severely spotted. Necrosis often developed slightly below the tip, later spreading in both directions along the pinna segment. There was a very sharp boundary between the necrotic and living areas. As the necrosis developed, the tips of the pinna segments turned inwards.
Aug. 8:	Necrosis of leaves had developed on all four plants; internodes short; branches developing in axils of unaffected (i.e. oldest) leaves. Up to two-thirds of area of affected leaves was necrotic (Plate 2, Fig. 1).
Aug. 14:	Plants fed with complete nutrients minus calcium. Injury of the younger fully developed leaves similar to wilting or frost injury appeared on one plant, though there had been no water stress and the plants had not been subjected to low temperature.
Aug. 19:	Wilting of the younger fully developed leaves occurred on a second plant. All plants had by now developed small reddish brown necrotic areas on the older leaves, chiefly near the tips and along the main veins of the pinna segments (Plate 1, Fig. 3).

A second experiment was therefore designed to determine the effects of individual trace elements. Nutrient solutions containing all major elements but lacking one of the trace elements were used.

TABLE 2

Seedlings were transplanted to pots on October 10, 1962

Date (1963)	Symptoms
Jan. 15:	Plants fed with complete nutrients minus boron. Youngest leaves affected; development of broad lamina on each side of midrib; pinnae very small, pinna segments did not develop.
Feb. 28:	Lateral branches developed. First leaves on the branches normal, subsequent leaves as above (Plate 1, Fig. 2).
Jan. 1:	Plants fed with complete nutrients minus manganese. Plants smaller than controls, paler in colour, but not chlorotic.
Feb. 28:	Brown necrotic areas at tips of pinna segments of some leaves. Groups of plants fed with complete nutrients minus zinc, plants with copper and plants without molybdenum. No visible symptoms of deficiency.

The third experiment was designed to study the effects of all combinations of five levels of nitrogen and five levels of potassium. The first experiment had shown that absence of nitrogen resulted in severe chlorosis (as would be expected), and that absence of potassium produced blackening of the leaves closely resembling the condition noted in the field. Since these were

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GREVILLE PINASTER

A small shrub, grey green foliage with masses of bright red flowers.

LOW GROWING GREVILLEA FROM W.A.—continued from page 23

Grevillea thyrsoides

A low, dense, spreading, dome shaped shrub to 15" in height and 3 ft. across found growing on quartzite soil in 18" rainfall. Leaves are green, flexible, narrow, 1/16" wide, pinnate, roughly from 6 to 12 pairs with a 1/2" terminal segment. Overall length of the leaves is from 1" to 2 1/2" and from 1" to 2" in width. Flowers are reddish pink, with long styles, 1 1/4" in length forming loose 2" "toothbrushes" up to 10" away from the plant on mostly prostrate and leafless branches. Flowers September.

A good foliage plant with very attractive flowers for well drained and exposed positions.

Grevillea trifida

Usually found growing as an upright, open, rigid and little-branched shrub to 3 ft. on sand, gravel and ironstone in 20"-35" rainfall. Leaves are green, fairly rigid, slightly pungent, about 1/8" wide, variable, divided into 3's at about 2/3rds of the leaf's length and sometimes divided again. Overall length of the leaves is about 1" and the width from 1/2" to 3/4". Flowers are yellow, with short styles, very narrow, about 3/8" long, forming loose axillary clusters or larger, dense terminal clusters or spikes. Flowers May-September.

An excellent species in flower for well drained, sheltered or exposed positions.

THE AUSTRALIAN FLOWER ARRANGEMENT CALENDAR DIARY

Available from newsagents and booksellers at \$1.75.

The idea of producing this diary was conceived by Mrs. R. C. Normand and Mrs. G. M. Wilson in 1964 with the aim of showing Australian Floral Art and Australian Native flowers to advantage. Typical of the full colour plates used, the colour plate on our rear cover of *Eucalyptus forrestiana* shows what can be achieved in floral arrangements using Australian natives. In the 1967 edition of the diary there are 12 colour plates although unfortunately not all natives. Both western and "Ikebana" styles are depicted.

This diary would make an excellent Christmas gift. I have pleasure in recommending such an excellently produced diary, the proceeds of which will be used to produce a diary of ever-increasing standard.

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EXPERIMENTS IN NUTRITION OF GREVILLEA—continued from page 42

the two major symptoms noted as finally resulting in the death of seedlings in the field, it was desirable to determine the effects of various combinations of these two elements on growth and on the development of symptoms.

The effects of the various treatments on measurable growth characteristics (leaf number, leaf weight, stem height, stem diameter, stem weight, root weight, total top weight, and total plant weight) were determined at the time of harvest. Visual symptoms of deficiencies were observed at different growth stages, and where possible photographed.

Descriptions of deficiency symptoms are shown in Tables 1 and 2, while Table 3 shows the occurrence of symptoms of deficiency of nitrogen and potassium with different combinations of these two elements. Plates 1 and 2 illustrate the symptoms produced by deficiency of some of the nutrients.

The first experiment indicates that absence of calcium in the nutrient solution had no effect on any of the growth characters measured; sulphur and trace element deficiencies resulted in a decrease in all characters except stem diameter; while deficiencies of all other nutrients affected all characters measured.

The second experiment showed clearly the effects of boron and manganese on growth and the development of deficiency symptoms. Absence of copper, zinc or molybdenum had no effect on growth, and produced no visible symptoms. Boron deficiency caused a marked reduction in height and leaf weight, while manganese deficiency reduced height, stem diameter, stem weight, leaf weight and root weight.

TABLE 3—EFFECT OF TREATMENT ON DEVELOPMENT OF SYMPTOMS OF DEFICIENCY OF NITROGEN AND POTASSIUM

n, nitrogen deficiency; k, potassium deficiency

Potassium Supplied (m-equiv./pot.)	Nitrogen Supplied (m-equiv./pot.)				
	N ₀	N _{0.5}	N _{1.5}	N _{4.5}	N _{13.5}
K ₀	n	n	n (slight)	k	k
K _{0.15}	n	n	n (slight)	k (slight)	k
K _{0.3}	n	n	n (very slight)	k (very slight)	k (severe)
K _{0.6}	n	n	n (slight)	—	k (slight)
K _{1.2}	n	n	n (very slight)	—	k

K—potassium; N—nitrogen. The figures will have significance for the laymen only as an indication of the relative quantity of the elements nitrogen and potassium that are available to the plants under test.

The results of the third experiment were of interest in indicating the necessity for achieving a correct combination of potassium and nitrogen levels for maximum growth and for preventing the development of deficiency symptoms. Note, for example, that at high nitrogen levels symptoms of potassium deficiency occurred at all levels of potassium, indicating that the higher the nitrogen content of the medium the greater the potassium content must be to avoid potassium deficiency. Conversely, where nitrogen is inadequate plant growth is reduced so that even at low potassium levels there is apparently sufficient potassium in the relatively large seed to prevent the development of typical deficiency symptoms in 5-month-old seedlings.

Chemical analyses of plant parts indicated that symptoms of potassium deficiency generally developed when the potassium content of the leaves fell below 0.50% and that symptoms of nitrogen deficiency were evident when the nitrogen content of the leaves was less than 1.00%.

Note that the data obtained in these experiments applied to young seedlings. It is emphasised that adequate field evidence has not yet been obtained, and that other possible causes of failure must be investigated before role of nutrient deficiencies can be determined.



Plate No. 31 from *The Australian Flower Arrangement Calendar Diary* reproduced by permission of the publishers. See book review on page 44.

EUCALYPTUS FORRESTIANA

The rich colour and form of *Eucalyptus forrestiana* inspired the arranger to select this rare piece of pottery as a container. The use of Australian wildflowers for artistic flower arrangements is becoming very popular due to their unique colour, form and texture.

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