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BOSSIAEA

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GARDENING WITH WILDFLOWERS—THE ANSWER TO HOT DRY CONDITIONS—LITTLE WATER?

The recent drought in southern Australia has awakened many gardeners to the problems that they must face in future as water for gardening is regulated. Is it necessary to grow exotics of other lands that demand considerable attention and regular watering? Of course it is, but . . . there are many Australian wildflowers that are just as spectacular and suitable for an exotic garden, which over the ages have become adapted to our natural climatic conditions. With the same garden sense that is given freely to exotics, our own natives are quite adaptable and in most cases easier to cultivate. Aspects to be considered are: 1. Selection of the right plants; 2. Preparation of the garden and 3. the care of the plants. Our No. 33 issue examined the problems to be considered in the preparation of the garden and in this issue aspects of ground cover and mulching continue this treatment (Garden Preparation, pp. 313; Mulching, pp. 314). It is proposed to devote an issue to the whole problem of creating a garden that will not only survive but thrive under the conditions experienced in the recent drought. In many parts of the country this problem is always with the farmer's wife who strives against odds to produce a flower garden.

Will readers please contribute any articles, notes or observations that will help me produce the issue?

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TINY PLANTS THAT PREY ON LIVING CREATURES

by Rica Erickson

These plants are fully described by the author in her book "Plants of Prey", see the book review on page no. 302. "Australian Carnivorous Plants" on page 319 of *Australian Plants* issue no. 27 introduces the subject and follows with descriptions of the "pitcher" type and the "passive fly-trap" type of insect traps. The following article describes the "active fly-paper" type traps represented by the "Sundew", *Drosera*. Plants using the suction type trap are described on page no. 282.

Drosera, meaning "dewy" is the botanical name of the "sundews". Small plants with shining five-petalled flowers but more widely known for their leaves. The upper surfaces of the leaves are covered with fine hairy tentacles tipped with sticky red glands. It is these tentacles, glistening in the sun that make one stop, look and wonder. "Sundews" are among the most beautiful and delicate of our wildflowers and will be of special interest to the gardener interested in miniature plants.

Trapped! An insect caught on one of the sticky tentacles causes the tentacle to bend and enfold it. In the meantime an impulse is conveyed to its neighbouring tentacles causing them to bend over to complete the capture. Over a period of days the soluble matter of the prey is reduced to a fluid and absorbed by the plant. It is thought that this diet only supplements the food the plant takes up from its roots.

The plants range from tiny rosetted forms to but none are large. However some are climbers to six feet. They are more easily identified by grouping in accordance with their habit of growth as follows:

- (a) "Pygmy Sundews", described below.
- (b) "Rosetted Sundews", larger bulbous-rooted plants, with flat rosettes of leaves, the leaf stalk of which can scarcely be distinguished from the blades—8 species, three occurring in the east, *D. whittakerii* with flowers larger than the leaves, *D. spathulata* and *D. lovellae*, the latter also being classified as a pygmy sundew.
- (c) "Fan-leaved Sundews", usually erect plants with fan-shaped leaves scattered along the stem and clasping it. All three species, *D. stolonifera*, *D. platypoda* and *D. ramellosa* are from W.A.
- (d) "Rainbow Sundews", erect or climbing plants with cupped leaves on very slender stalks, often in groups of three. Of the 18 species three occur in the east, *D. planchonii* (leaves rounded without pointed lobes) and *D. peltata* (greenish leaves) and *D. auriculata* (reddish leaves) with two long pointed lobes.
- (e) "Narrow-leaved Sundews", plants with erect, long narrow leaves. Both species are from eastern Australia, *D. arcturii* with simple, strap-like leaves and *D. binata* with forked very narrow long leaves.

PYGMY SUNDEWS

In the *Drosera* family there is a typically Australian group of miniature plants which I have designated as Pygmy Sundews, from their prototype *Drosera pygmaea*, the Eastern Australian species. Many of them are minute plants. All of them have very small leaves on slender stalks arranged in rather dense rosettes. Unlike other *Drosera* they are not bulbous but have fine fibrous roots.

Another characteristic is the tuft of shining transparent stipules at the heart of the tiny leaf rosette. A stipule occurs at the base of each leaf and is bristly, or scarcely divided, in varying degrees according to the species. In pressed material in herbaria the stipules are well preserved while often the minute and very delicate floral parts are spoilt or missing. Although minute, these stipules can be a dependable guide to the identity of many of the species, but in others the difficulty in describing the form of the stipule has led to confusion. It is for this reason that sketches of these parts of the plants are included along with their floral details.

The flowers of pygmy sundews are extremely beautiful but are rarely appreciated until seen under a good magnifying lens. They fade almost immediately when picked and the petals bruise almost beyond recall at the slightest touch. So if you would enjoy their frail beauty to the fullest you must preface kneel to to inspect them in their own environment.

Australian Sundews were much admired by the first settlers and many were soon collected for botanists overseas, but perhaps there was no one more appreciative of their beauty and interest than a certain dour-faced Scot, James Drummond, the first Government Botanist in the colony of Western Australia. In the old world *Drosera* are usually associated with bogs and it was assumed by the botanists there that Australian *Drosera* frequented the same habitat. In 1839 Dr. Lindley, an eminent English botanist published an account of the Swan River plants in which he remarked "If there were no other evidence of the springy nature of the soil at Swan River, the abundance of (*Drosera*) would attest it."

Drummond was quick to refute this, stating that "three-quarters of our species grow in the most arid spots of this arid country, (and) are found on the dry stony hills and the dry pasture land of the colony . . . The bulbous rooted species . . . appear above ground only from May to October when the ground is moist, but there are small fibrous rooted plants that grow in the most arid situations of our ironstone gravelly hills and with their curious glandular, apparently dew-covered leaves bid defiance to the sun in all his strength. I have often knelt down to admire the beautiful, scarlet, satiny-looking flowers of these plants when the soil in which they were growing was so hot that I could scarcely bear my hands upon it."

The pygmy sundews pictured in the accompanying illustration represent the red-flowered members of the group, and it will be seen that two of them have pink-flowering forms as well. A key to species is:

Calyces covered with long, red, woolly hairs.	
Leaves narrow elliptic, stigmas slender	<i>D. drummondii</i>
Leaves round, stigmas club-tipped	<i>D. sewelliae</i>
Calyces smooth or with short glandular hairs.	
Stigmas clubbed	<i>D. platystigma</i>
Stigmas slender, simple.	
Flowers rather conspicuous.	
Fringes of stipules all bristly and hairy	<i>D. leucablasta</i>
Fringes of stipules scarcely bristly	<i>D. miniata</i>
Flowers small, stipules scarcely bristly	<i>D. pulchella</i>
Stigmas forked, stipules inconspicuous or absent	<i>D. glanduligera</i>

There are approximately 17 specimens of Pygmy Sundews, fourteen of which are confined to south-western Australia. There are specimens assigned to *Drosera leucablasta* and *D. miniata* which present problems of identification and it is believed that several unnamed species are involved.

Growing Tuberous Sundews

by M. C. Russell

Australia is fortunate in having many interesting tuberous sundews (*Drosera* spp) which are not difficult to grow provided some care is devoted to maintaining a suitable water balance.

The sundews are carnivorous plants which, apart from their unusual and somewhat bizarre adaptation to an insect diet, are dainty and interesting as pot plants. Although some Australian species rarely flower and some others set very little seed when they do they are almost exclusively perennial and have adopted a variety of interesting means of perennating.

Those which undergo drought perennation by means of a true tuber which is reconstituted annually are almost restricted to Australia and New Zealand and are readily found in most States.

They may be lifted with native soil intact, taking care not to disturb the tuber which is attached to the base of the stem by a very fragile narrow process. If potted in their own soil in a cracked pot placed in a saucer or tray of water they will show a drying out of their glistening tentacles but otherwise flourish no matter at what stage of growth they have been transplanted. This drying of the tentacles (the shiny gland-tipped hairs on the leaves) appears to be due to shock which can be avoided by very careful handling.

When collecting from the bush do please collect sparingly and only where the plants are plentiful, and do repair the soil-damage which need be quite small if a narrow trowel is used for cutting around the plant and lifting cut. In the tuberous species root development is so meagre that one need have no fears of cutting roots but the tuber, located directly at the base of the stem, must not be damaged. Usually the tuber lies only an inch or two below the surface except in deep sand.

At all cost avoid drying out by daily adding a little water to the bottom tray or saucer until the plant begins to wilt naturally, as it will eventually. The pot should then be slowly dried out over several weeks if this amount of care is possible and then left absolutely untouched until the next season's shoot begins to show above the soil. At this stage again place the pot in a saucer or tray and maintain the water supply throughout the life of the plant above the soil.

Obviously some care and attention is needed but the results can be quite gratifying and, to those with a botanical bent, there is the added interest provided by the special adaptation to leaf feeding which can be observed by placing the pot on a window sill where a few midges will usually be caught in the tentacles and slowly consumed. Part of the charm of these plants is in the glistening appearance of the sticky glands but this may change to a mess of dead flies if you give in to the temptation to feed the leaves by hand. Carnivory is a secondary method of nutrition which does not supplant those normal to plants and is probably never essential to any species of carnivorous plant.

With some luck seed may fall into the pot when it will often germinate in the same season. The seedlings cannot be pricked out. They soon form minute tubers which are proof against dessication so eventually when all the seedlings and the parent plant have died back the pot can be

allowed once more to dry out and stored in a corner of the garden during the resting season.

As shoots arise each year then ultimately die back to the tuber a pipe of old dead stem material will form above the tuber. This provides an easy path for the next season's shoot to reach the surface and should on no account be broken by any attempt at cultivation. If this should be broken accidentally, the dry soil must be broken, the tuber located, and it should be replaced in the same soil just below the surface with bud uppermost. After several years the tuber, which is replaced annually, will find its most satisfactory level naturally.

Natural seeding will often lead to an attractive clumping of plants in the pot but in some species this will be effected by development of new plants from underground fleshy stolons.

Suitable tuberaus species quite well adapted to this method of growing are listed below.

Eastern and Southern States: *Drosera auriculata*, *D. peltata*, *D. planchonii* (a tall species requiring a small stake), *D. whittakeri* (forms a flat rosette of leaves and requires a wide pot for clumping).

Western Australia: *D. neesii*, *D. menziesii*, *D. macrantha*, *D. pallida* (all needing a small stake), *D. stolonifera*, *D. erythrorhiza* (another flat rosetted species) and others so easily obtained in this State.

Editor's Note: M. C. Russell 41 Lusk Drive, Vermont, Vic. 3133, is the leader of our "Carnivorous Plants Study Group". Do not write to him unless you are really keen to grow and study these plants. We need good colour slides of species to illustrate the future articles.

DROSERA BURMANNII VAHL.

First of a series on Carnivorous Plants by G. Ashley and M. Russell

It is hoped to publish from time to time notes on plants studied by members of the Carnivorous Plants Study Group but these will not appear in any systematic order. *Drosera burmannii* has been selected for the following notes because it was readily available to one of us and, although common enough in Queensland, is not well known elsewhere.

The family Droseraceae contains only four genera, three of which are monotypic: *Aldrovanda vesiculosa* L. is an aquatic widespread from Europe to North Australia and extending also to Africa and Japan; *Drosophyllum lusitanicum* Link. has a habit reminiscent of the unrelated carnivorous plant *Byblis* (Grieve, 1961) but occurs only in parts of Spain, Portugal, Gibraltar and Morocco; *Dionaea muscipula* Ellis is the widely known Venus Flytrap native to North and South Carolina. The remaining genus, *Drosera* L., is so widespread as to be almost cosmopolitan and differs from its fellow genera in having about 90 recognised species.

Erickson (*Australian Plants* 27:319), has discussed the range of Australian *Drosera* and given a description of the feeding process. While the leaves vary greatly in shape throughout the genus the gland which surmounts each tentacle and which is the tiny laboratory responsible for most aspects of the process is remarkably uniform in basic structure suggesting a similar uniformity in the feeding process in the genus. It is unlikely, however, that any *Drosera* requires this form of nourishment as an essential. We mention this because the capture of insects by *D. burmannii* where it has been studied near Brisbane is not a marked phenomenon. Darwin (1875) drew attention

(Continued on page 331)

BLADDERWORTS — “FAIRY APRONS”

by Rica Erickson

Sundews and Bladderworts are very dissimilar in floral structure and are but distantly related but they share the distinction of being *carnivorous* plants, adapting their leaves to trap insects and other minute forms of life for their food.

The Bladderworts' have evolved diabolical suction traps which work unseen in mud and water. There is an extraordinary way of life for a plant, for they have eliminated root systems and have modified some of their leaves into special “feeding bladders”, such as those drawn on some of the plants in the illustration.

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

The Bladderworts depicted include several from Northern Australia, two of which do not qualify for the common name of “Fairy Aprons” bestowed on many of these plants. The extraordinary thread-like flowers of *Utricularia dunstanii* and *U. capilliflora* prompt many questions as to the purpose of such unflower-like parts.

The function of flowers is to produce seed. A modification in the floral parts is usually made to suit the form and needs of a pollinating agent. The purpose of the Fairy Apron is to provide advertisement and a landing platform for the insect that will pollinate the flower; but who can judge the function of the thread-like segments of *U. dunstanii* and *U. capilliflora*? Could their development have been enforced on them by their environment in dense growths of grass in the tropical north?

The search for bladderworts in Northern Australia can be long and unrewarding because of this preference by many of them for sheltered grassy places, but at least one of them, the blue Dragonfly Bladderwort, *Utricularia leptoplectra* (of a similar form to that of *U. biloba*) can be quite conspicuous. It favours the margins of lagoons among paperbarks. In the dry season the receding waters leave a mat of drying debris on the ground like a layer of tough blotting paper. Above this the flowers of the Dragonfly Bladderwort, on stems over a foot tall, hover like insects in the air.

The southern species of Bladderworts are often small but make a colourful show because of their preference for growing in dense colonies beside the drying margins of swamps or creek-beds, or in mossy cushions on racks, which makes them conspicuous.

South-western Australia is the richest in species but in Eastern Australia, *U. dichotoma* is so widespread that Fairy Aprons or Bladderworts may be said to be a common Australian wildflower.



Colour Plate reproduced from "Plants of Prey" by Rica Erickson with permission from the publishers, Lamb Patterson Pty. Ltd. See Book Review. "FAIRY APRONS", Flowers of Bladderworts. 1. *Utricularia daniellii*, 2. *U. capilliflora*, 3. *U. biloba*, 4. *U. kamienkii*, 5. *U. flava*, 6. *U. dichotoma*, 7. *U. simplex*, 8. *U. menziesii*, 9. *U. hookeri*, 10. *U. violacea*. 11. "PINK PETTICOATS", *Polypompholyx multifida*, 12. "PINK FANS", *P. tenella*—For a description, see page 324.

GROW FROM SEED

GERMINATION OF WOODY LEGUME SEEDS WITH IMPERMEABLE SEED COATS

by A. J. Fordham, Harvard, U.S.A.

Foremost in the chain of events that leads to seed germination is the imbibition of water. Many types of seeds will germinate as soon as they are provided with a favourable environment of moisture, air and warmth. Other sound seeds are prevented from doing so by various barriers such as the inability of water to penetrate seed coats, internal physiological conditions, or a combination of these factors. Germination of many seeds is retarded only by impermeable coats which hinder the admission of water. If these coats are not subjected to pretreatment, germination can be erratic and prolonged, sometimes extending over a period of many years.

When seeds with impermeable coats reach maturity, the seed coats, which will provide protection for the contents, start undergoing changes in structure. Seeds of *Albizia julibrissin rosea* were collected in autumn when the pods were turning from green to buff colour, indicating ripeness. At this stage the coats consisted of a thin, soft membrane. Fifty seeds weighing 5.12 grams were placed in dry storage, during which changes took place involving the seed coat structure and a reduction in weight and size. Within a week or two the seeds were much smaller, had stony-hard, water-impermeable coats and their weight had diminished to 1.75 grams.

Seeds which nature has furnished with these water-tight protective encasements have the ability to retain viability for remarkably long spans of time when conditions unfavourable to germination exist. When locked up in this manner respiration takes place at such a low rate that life can continue for extended periods. The term *macrobiotic* has been used to define seeds capable of remaining alive for fifteen years or more.

Albizia julibrissin furnishes a good example of a plant which produces macrobiotic seeds. Seeds of this species, collected in China in 1793, were stored in a box at the British Museum of Natural History in London. As a result of an air-raid in 1940, they were soaked by water during a fire and were reported to have germinated after 147 years of dry storage. How much longer these particular seeds might have sustained life will never be known.

Methods of Overcoming Seed Coat Dormancy

To obtain prompt germination of seeds characterised only by seed coat dormancy, a rapid means of effecting the entry of water is necessary. Several procedures will accomplish this.

Mechanical treatment

Large seeds, in small quantities, can be perforated with a knife, file or any tool that performs the job. Seeds large enough to hold between the fingers can be easily prepared for the entry of water by scraping them along the uppermost edge of a three-cornered file placed on a bench. Several brisk strokes are usually sufficient to cut through the seed coat if the file is sharp. Seeds too small to hold, or those handled in volume, can be treated with one of the methods next described or by mechanical scarification. Specially designed equipment is made for users who process large quantities, but individuals, or organisations such as the Arnold Arboretum, do not

normally handle seeds in sufficient amounts to warrant the employment of such aids.

Hot Water Treatment

Treatment with hot water involves placing the seeds in a container and pouring water heated to a temperature of about 190°-200° F. over them. The seeds are then left in the water overnight. In amount, the water should be at least five or six times the volume of the seeds, and this is important, as too small a quantity can cool before it has the desired effect. On being removed from the water, the seeds are sown at once, without being allowed to dry out. A second, but less effective method, is to sow the seeds and pour boiling water over the seed-pan or seed-flat.

In the case of the fifty seeds of *Albizia julibrissin rosea* described above, which were collected, weighed and kept in dry storage, the seeds were treated with hot water one afternoon and by the following morning had resumed their original size, weighed 5.42 grams, and were ready for germination.

Concentrated Sulphuric Acid Treatment

Some seeds with coats not responsive to hot water treatment can quickly be germinated after a more drastic measure—immersion in concentrated sulphuric acid, (H_2SO_4). This highly corrosive substance, when employed for this purpose, accomplishes in hours, or portions thereof, a process that could require months or years if the seed coats were not treated.

Sulphuric acid treatment, when dealing with small amounts of seeds, consists of placing the dry seeds in a glass container and carefully pouring acid over them until they are covered. Sulphuric acid is a viscous substance of high surface tension which acts superficially on seed coats without penetration. In fact when trials were carried out on an unfamiliar subject suspected of having an impermeable seed-coat, periods of acid treatment as long as one and one-half hours have been given seeds which later proved to be water permeable. Despite such mistreatment, however, the seeds were not destroyed but germinated when sown. The acid did not have the ability to penetrate the seed coat, although water did.

As acid treatment progresses gummy by-products of corrosion will fuse the seeds into a cohered mass which must be separated from time to time to insure that all seeds are acted upon uniformly. Cautious prodding and careful stirring with a glass rod will accomplish this. The length of treatment varies greatly, depending upon the subject, the objective being to corrode away sufficient seed coat to permit the entry of water without exposing the interior to destruction by the acid. Observations can be made during treatment by removing a few seeds, rinsing them and examining the seed coat to see how much of it has been eaten away. When treating large batches it is advisable to run a few trial lots to determine proper timing before processing the main bulk. An important point which must be considered when using sulphuric acid is the effect of temperature. Higher temperatures accelerate the rate of action while lower ones retard it. Acid treatments at the Arnold Arboretum are usually performed in the winter when room temperature is maintained at approximately 70° F.

On completion of the treatment, seeds are placed in a sieve and washed thoroughly in running water for several minutes to remove all the acid.

PEA FLOWERS — PHYLLOTA

VARIATION IN THE GENUS *PHYLLOTA* (DC.) BENTH.

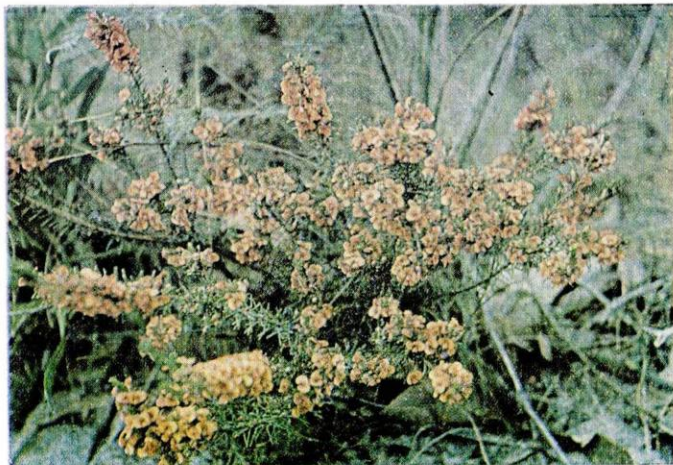
by R. C. JANCEY, University of Ontario, London, Canada

The genus *Phyllota*, which is endemic to Australia, belongs to the tribe Podalyrieae, which in turn is confined for the most part to Australia and South Africa. The distribution of the genus is limited both by soil composition and climate, being confined to temperate regions with a rainfall in excess of 20 inches per annum, also to fixed sand dunes or soils derived from sandstone.

The genus contains 10 species, all of which are shrubs with stems characteristically echinate from the decurrent leaf bases which persist after leaf abscission. The leaves are alternate, simple, entire and linear, with revolute leaf margins; stipules are minute or absent. The flowers are produced in the axils of ordinary foliage leaves, either solitary or crowded towards the ends of the branches. In some members of the genus, the production of a crowded spike is followed by the death of the distal axis, with the result that the inflorescence appears terminal.

SIMILAR GENERA

Phyllota is closely related to three other genera of the Podalyrieae, *Pultenaea*, *Dillwynia* and *Aotus*. The following characters may be used to distinguish these genera. Whereas the leaves of *Phyllota*, *Aotus* and some species of *Pultenaea* are similar, *Dillwynia* can readily be distinguished because, although its leaves are narrow linear, they are without exception, involute instead of revolute. The leaves of a few species which at first sight appear to be revolute, will be found on closer inspection to be spirally twisted. As previously stated, the flowers of *Phyllota* are subtended by



Blocks donated by N. B. Thomson

SHOWY PARROT PEA, *Dillwynia floribunda*

The pea flowered plants dominate the bush scene in many areas. They are so easy to propagate from seed and grow in the garden, it is strange, even unnatural that they do not "dominate" the wildflower garden. Rather than "dominate" shall we say, provide that background of colour that gives that measure of continuity to landscaping that is so often missed in gardens of wildflower cranks who grow only a few plants of such a wide range of species. We have an article on the species of *Pultenaea* in preparation so will readers please report on all the species of *Dillwynia* that they know—Editor.

unaltered foliage leaves, although two species show a tendency away from this condition, and will be considered again later. Bracts are generally small, brown, and scarious in *Pultenaea*, *Dillwynia* and *Aotus*. In the latter two genera they are also deciduous. Other characters which have been used to distinguish the genera are stipules, bracteoles, petals, stamens, style, and seeds. These characters are, however, rather less constant.

While no difficulty arises in distinguishing *Phyllota* from *Aotus* and *Dillwynia*, the distinction of *Phyllota* from *Pultenaea* is much less clear. In Eastern Australia, the two genera are quite distinct, *Pultenaea* having scarious bracteoles and stamens free from the petals, while *Phyllota* has



Photography by F. W. Humphreys

PHYLLOTA BARBATA

A plant from Western Australia previously classified as a *Pultenaea* shown at half full size. Flowers may be scattered along the branches as above or crowded into leafy spikes towards the ends of the branches as in the eastern species of *Phyllota*.

For a description of the West Australian species of *Phyllota*, see page no. 323.

herbaceous bracteoles which characteristically continue to grow after flowering (hence the generic name), and stamens clearly attached to the claws of the petals.

BOTANICAL CHARACTERISTICS

The pedicels of the flowers are short, 1.5 mm., and bear a pair of usually lanceolate bracteoles just under the calyx. The calyx has two broader upper lobes, which are also united higher up than in the case of the three lower lobes. The petals are all clawed, the standard being ovate to orbicular, and equal to or rather longer than the other petals. The stamens are adnate to the petals at the base, or almost free in some species. The ovary is sessile, pubescent to villous, and containing two ovules which are born on short funicles. The style is thickened at the base, incurved and subulate above, with a small terminal stigma. The legume is inflated at maturity, twice as long as the calyx, and contains 1-2 seeds. The seeds are reniform, and do not bear a strophiole.

KEY TO THE SPECIES OF *PHYLLOTA*

- A. Style bearded upwards on inner edge
 - B. Flower 12 mm. long, pedicel less than 1.5 mm. long *P. barbata*
 - B'. Flower 5 mm. long, pedicel 4 mm. long, exceeding the calyx *P. gracilis*
- A'. Style not bearded on inner edge
 - C. Bracteoles herbaceous, linear or lanceolate
 - D. Stem, bracteoles and calyx yellow tomentose, flowers in dense heads, keel purple, petals and stamens deciduous after flowering *P. luehmannii*
 - D'. Stem glabrous to pubescent, bracteoles and calyx glabrous to villous, if flowers in dense heads then keel not purple, petals and stamens persisting until maturity of legume
 - E. Flowers in lax spikes towards the ends of the branches, leaf tips acuminate and recurved, numerous root suckers formed *P. squarrosa*
 - E'. Flowers scattered, in lax spikes or dense terminal heads, leaf tips never acuminate and recurved, root suckers absent or few from a thickened root-stock
 - F. Procumbent shrub with purple-red corolla; flowers solitary or few together, bracteoles linear *P. humifusa*
 - F'. Erect shrub with flowers in dense spikes at or towards the ends of the branches
 - G. Leaves massive, 1.25-2.25 mm. broad, standard 10-15 mm. long, calyx densely villous *P. grandiflora*
 - G'. Leaves slender, 0.75-1.25 mm. broad, standard 5-11.5 mm. long, calyx glabrous or pubescent *P. phyllicoides*
 - C'. Bracteoles scarious or coriaceous, not green
 - H. Bracteoles oblong-ovate, as long as the calyx, keeled, mucronate *P. remota*
 - H'. Bracteoles ovate, less than 2 mm. long, not keeled
 - I. Flowers solitary or in pairs, in virgate clusters of leaves along the stem; leaves recurved and acuminate *P. pleurandroides*
 - I'. Flowers in spikes towards the ends of the branches; leaf tips not recurved, obtuse *P. diffusa*

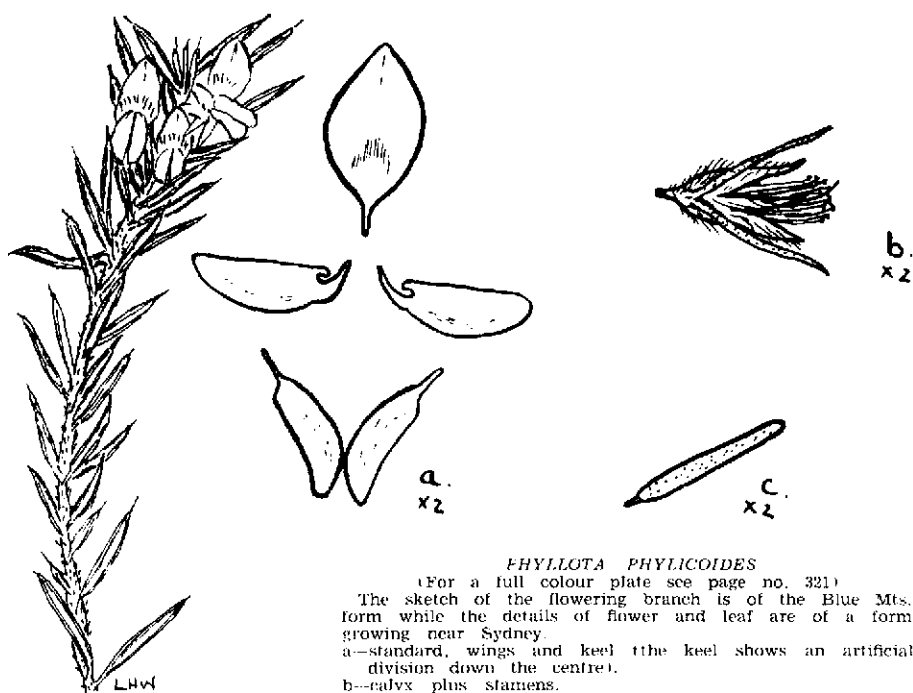
THE EAST AUSTRALIAN SPECIES

Phyllota diffusa (Hooker f.) F. Mueller from Tasmania, is similar for the most part to some forms occurring in N.S.W., but has its flowers in a rather less dense spike, and more significantly, has stamens which appear to be virtually free of the petals. It was, in fact, included in the genus *Pultenaea* by Curtis in the Students Flora of Tasmania.

Phyllota pleurandroides F. Mueller and *P. remota* J. H. Willis, occur in the sand plain country of South Western Victoria and South Eastern South Australia. The former species is one of the members of the genus in which the flowers are subtended by slightly modified foliage leaves. These leaves are slightly narrowed and villous towards the base, similar leaves being associated with them in virgate clusters. *P. remota* differs from the above in only occasionally forming virgate clusters of leaves, and also in growth habit. *P. pleurandroides* forms frequent root suckers, and occurs growing in deep sandy soil of sand ridges in the sand plain, whereas *P. remota* does not produce root suckers, and occurs in the shallow sandy soil between the sand ridges.

Phyllota phyllicoides (Sieber ex DC.) Benth. which has been considered for a long time as one species, extends down the east coast from Bundaberg

through N.S.W. to the Victoria border. Except for the Sydney region, the species is quite constant, having flowers in dense terminal spikes, for the most part becoming terminal by die-back of the axis. In the Sydney region however, a remarkable series of variants are found, showing various forms and degrees of isolation from each other. South of Botany Bay, in the Royal National Park is found a form similar to the one extending all along the coast, and from which it is largely isolated geographically. It differs in having very dense flower-heads, which are invariably followed by die back of the axis, as opposed to usually so in other forms. There occurs at Appin a very much larger-flowered *Phyllota*, the flowers being in lax, non-terminal spikes. This group is in geographic contact with the form occurring in the Royal National Park, but reproductively isolated by having a different flowering period (August-September in the Royal National Park, and January-



PHYLLOTA PHYLLOIDES

(For a full colour plate see page no. 321)

The sketch of the flowering branch is of the Blue Mts. form while the details of flower and leaf are of a form growing near Sydney.

a—standard, wings and keel (the keel shows an artificial division down the centre).

b—calyx plus stamens.

c leaf, no point as with Blue Mts. species.

February for the Appin plants). This large-flowered form has been joined with a very similar form which occurs on the north shore of Sydney Harbour to form the species *P. grandiflora* Benth. Two or three plants occur on the Hume Highway just south of Bargo and were indeed recorded from there by MacArthur. Herbarium specimens exist from the Como area, just south of Sydney, but do not appear to be growing there now. Apart from the large-flowered, lax inflorescences, the species is distinctive in having very much more massive leaves, giving every appearance of being a tetraploid version of *P. phylloides*. Investigation has shown however, that all forms of *Phyllota* found in N.S.W. have a chromosome number of 14.

(Continued on page 321)

EUCALYPTUS MACROCARPA IN CALIFORNIA

by Don Renfro, California, U.S.A.

An ornamental eucalypt that has not been properly introduced in California gardens is *E. macrocarpa*. It is difficult to understand why such an exotic and ornamental plant has escaped our "nursery trade" for so long. After several years of working with this plant, I have found it to be one of the most exotic and interesting of all the eucalypts.

ORNAMENTAL VALUE

Not many plants offer more ornamental value to the small garden than does *E. macrocarpa*. I feel that it rates with *E. caesia*, *E. tetraptera* and *E. grossa* in all around point-for-point ornamental value. For instance, *E. macrocarpa* is one of the few eucalypts that is ornamental from the time it is a tiny seedling in a pot. By the time it is transplanted to the garden, it has already taken on its characteristic glaucous foliage. For this reason, I treat it as a specimen and place it in the garden where all attention can be focused upon it.



Blocks donated by N. B. Thomson

In form, *E. macrocarpa* grows in one of two ways. It either grows straight up 8-15 feet, or it branches at the ground forming a dense growth of glaucous branches. I prefer the vertical growth, though it requires support, and select my seedlings on that basis. But either way, its form is entirely unique and contributes a great deal the year around.

E. macrocarpa generally flowers in the second or third years. Then it puts on a spectacular show of colour on a massive scale. There is nothing modest about the size of the flowers, which measure up to four inches across. Even the buds, which are metallic silver, are showy and redeeming in any garden situation.

Last, but not least, the foliage and stems rate *E. macrocarpa* a place where its heavy texture can fully be appreciated. Its large, leathery leaves are practically pure white they are so glaucous. Against a planting of dark foliage or a dark wooden structure, its colour creates a feeling of space and depth.

SOIL

I have found that *E. macrocarpa* does well in just about any type soil. It readily adapts to soils ranging from clay to sandy loams. It also accepts varying pH from slightly acid to slightly alkaline. I have even noted excellent examples of *E. macrocarpa* on granite and alluvial soils. So, it might be said that, under cultivated growing conditions, *E. macrocarpa* is not fussy about soil conditions.

CULTIVATION

E. macrocarpa prefers full sun. If this is not possible, filtered sunlight is good but deep shade should be avoided.

Naturally, frequent watering, under cultivated conditions, has an influence on the general character of the plant. It has a tendency to be more robust in habit and foliage size. It also has a more rapid rate of growth. On the other hand, if cultivated under field conditions, it is less vigorous in growth and size but it still remains a very beautiful plant.

PROPAGATION

As with most of the eucalypts, *E. macrocarpa* is not difficult to raise from seed. In fact, owing to the largeness of the seed, planting them is much easier. By planting only the seeds and not the chaff, there is less likelihood of damping off.

Seed can be planted in either flats, pots, or directly into the garden bed. Sand, soil, or a mix of sand and soil with peat humus can be used. The latter, however, is the best for flat and pot planting. Germination is usually quite high percentage-wise, and dicot leaves appear within 10 to 18 days, depending upon whether or not bottom heat was used. Bottom heat promotes rapid germination and growth.

Transplanting can be done as soon as the plants are large enough to "prick out". Usually this is when seedling leaves form but I have transplanted successfully in the dicot leaf stage. Vitamin B1 is a good root stimulant and I treat all seedlings to periodic irrigations of B1 in the early growth stages.

In hardiness, I have found *E. macrocarpa* to be reasonably hardy if given some protection in frost areas. It does not tolerate frost as does *E. niphophila*, *E. urnigera*, etc., but if grown in tubs in cold areas the tubs can be moved or covered quite readily. Tub planting, by the way, is a highly successful way to grow this plant.

EUCALYPTS — SOME EARLY USES

Contributed by A. Mitchell

***Eucalyptus woollsiana*, "The Grey Box."** This tree was used extensively by early settlers. Box bark was used for roofing houses, huts, dairies and sheds by the early settlers and miners. Sometimes even the walls were of Box bark.

It was attached to a frame of white Cypress Pine (*Callitris huegelii*, previously known as *Callitris glauca*).

The settlers would choose a big tree with good, straight bark. The operation had to be carried out when the sap was rising, after a good rain, for example, as the bark then peeled off well, in large sheets, varying from half to one inch in thickness.

To remove the bark, one scarf was cut low down on the tree, and another higher up, according to the length of sheet required. Cuts were made lengthwise up the tree.

A curved stick, with a wedge shaped point was used to pry the bark off the tree. The sheets were curved, of course, and had to be flattened. This was usually done by placing weights on the bark but sometimes a small fire was lit underneath, to straighten it out.

The bark sheets were placed on the framework in the same way as galvanised iron is today, and were then kept in place by timber being laid across them and secured.

These roofs shed the rain and were comparatively cool in summer. They lasted many years.

The grey box was sometimes used as fencing posts, and the timber was also used to some extent in brick kilns and bakers' ovens, but cypress pine was preferred.

Box was the chief timber used for firing the boilers in the mines.

Eucalyptus sideroxylon, "Ironbark". This tree was used for making charcoal, which was used for forge work by blacksmiths and farmers.

A pile of wood, arranged in layers, was covered with soil, with vents left at both ends. A fire was lit at one end, and the draught carried it through to the other vent.

When properly alight, and the logs reduced to charcoal, it was thoroughly sealed off, and left for several days to cool down. The procedure prevented the coals turning to ash.

Ironbark fencing posts lasted a long time. They were fairly resistant to white ants, and very resistant to fire.

The bark from the ironbark was used extensively for heating steel tyres prior to fitting them on to waggon and sulky wheels.

Once the tyres were in place on the wheels, cold water was applied to make the metal shrink and fit tightly.

BOOK REVIEW

Books not available from the Editor but through your bookseller.

"The Beauty of Australia's Wildflowers" by Norman Sparnon Price \$7.95

This is a book showing 75 flower arrangements using Australian wildflowers in full colour. This 130 page large book is superbly produced, the colour plates being twice the size of the illustrations in this journal. A study soon reveals that the arrangements are the work of an artist, the author. Norman Sparnon is a Director of the Sogetsu School of Japanese flower arrangement and a Professor of Ikenobo and has used the presentation known as Ikebana. It would be an injustice to attempt to describe this in a few lines although the author has given a clear, simple description in the introductory section of the book. Essentially it appears to be a modern form of flower arrangement based on the artist's impression of how best to display the subject and an idea. Because of the unique character of many of Australia's wildflowers, the arrangements are unique, arresting and appealing. Each of the 75 arrangements is completely different and each is analysed by a simple diagram for a reader to follow, understand and reapply. For those with the time, concentration and desire to learn modern flower arrangement this book is ideal.

"Plants of Prey" by Rica Erickson Price \$4.50

As author of the books "Orchids of the West" and "Trigger Plants", Rica Erickson is well known. This 94 page book with many detailed sketches and full colour illustrations, is of the same high standard. The plants described are indeed fascinating. The author has described in this issue of "Australian Plants", some of the plants, those illustrated on two colour plates reproduced from the many in the book. This will illustrate that not only is the text readily understood but together with the additional more detailed descriptions in the book, there would be no difficulty in identifying a plant found on trip in the wild.

What fascinating miniature garden plants these would make. A book of value and interest to all and at an amazingly low price for such a well produced book.

TREE PRUNING

PRUNING AND TREE MANAGEMENT WITH PARTICULAR REFERENCE TO EUCALYPTS
Part V of a series on "Some Garden Eucalypts" by Richard C. Barnard. Reprinted from Vol. XCI, Part 6 issue of the "Journal of the Royal Horticultural Society, England" with permission. Readers are reminded that the seasons quoted are for the Northern Hemisphere and England in particular.

POOR GROWTH?

Physiological reasons are responsible in cases where frost-resistant eucalypts fail to thrive or die. The supply of nutrients and water to the leaves is inadequate, i.e. the balance between roots and leaves has been lost, and the cause may have originated recently or at some time in the past. The commonest symptoms other than wilting due to drought are summer die-back of the leading shoot, loss of leaf colour, leaves turning red or yellow, dropping of many green leaves and stunted growth. The die-back of the leading shoot usually appears to occur in over-rich soil resulting in a long soft shoot growing like a coach whip and a new leader will develop the following year. The other symptoms indicate that the plant has received a severe check from which it is unlikely to recover unless an attempt is made to restore the root/shoot balance. The "cure" which has proved effective in several cases is to cut the plant right back to ground level in mid-March. One miserable 2-year-old *E. gunnii* which I cut off with a mattock and mowed over regularly for much of the summer produced new shoots so persistently that I eventually took pity on it and let it grow to form a nice multi-stemmed bush before winter. It is still quite a good coppiced plant though less vigorous than average. One outstanding characteristic of the eucalypts is that, once established, they will recover vigorously from the most devastating damage, for example after bush fires in Australia.

Eucalypts are very sensitive to "stimulants" and chemicals. Some garden sprays, wetting agents, glasshouse "smokes", herbicides and weedkillers have damaged foliage, young leaves or occasionally killed established plants. Young plants need to be protected from the attentions of dogs. Fertilizers should be applied in moderation to plants which are cut back annually and on infertile sites. Adequate nitrogen is needed for vigorous growth and sulphate of ammonia at the rate of a handful to 3 sq. yd. in early spring appears to keep my pruned plants growing in grass in full vigour.

PRUNING AND TREE MANAGEMENT

The pruning of trees and the management of eucalypts as shrubs needs description and some knowledge of the unusual growth characteristics is necessary to understand this. Many eucalypts exhibit a striking change in leaf shape, colour and arrangement on the stem as the tree grows, known as heterophylly. Five stages or types of leaf develop from germination to maturity, namely: cotyledons or seed leaves (one pair), seedling leaves (never more than a few pairs, opposite and usually sessile), juvenile leaves (a few pairs in some species to an indefinite number in others, usually opposite and sessile), intermediate leaves (covering the change from juvenile to adult leaf shape which may be completed in a few leaves as growth proceeds or over one to several years' growth, accompanied by the development of leaf stalks and from opposite to alternate arrangement on the stem) and adult leaves. The juvenile and adult leaf stages are of importance in the garden and one may keep some plants in the juvenile leaf stage if that type of foliage is desired. It is important to realize that none of the species which, as seedlings, develop only a few pairs of juvenile leaves

will develop more than one pair, or a few juvenile leaves, after pruning or cutting back before reverting to adult leaves, and that the term "juvenile" in this context bears no relation to the age of the leaf, i.e. the time that has elapsed since the leaf unfolded. Both juvenile and adult leaves are young and old.

The other important growth characteristic is the enormous shoot potential which all eucalypts possess. Shoots can develop in four ways (1) from the "naked buds" or growing points which have developed at the base of every leaf before it unfolds; (2) from accessory shoot-producing tissue lying at the base of the naked buds which remains dormant as long as growth is uninterrupted; (3) from strands of bud-producing tissue which develop from (2) with diameter growth and also remain dormant until upper shoots and leaves are destroyed; and (4) from lignotubers or basal swellings which contain reserves of food and bud-producing tissue which again remains dormant until the stem of the tree is destroyed or severely damaged. If a tree suffers no damage, growth is very rapid from the naked buds (1). If naked buds and young leaves are destroyed during the growing season (as happens frequently in Australia by defoliating insects) they are rapidly replaced by accessory shoots (2) and growth suffers only a minor setback. In this country winds and frosts may cause such damage but it is soon made good by new growth in the current growing season or the following spring. It is only following the loss of a considerable amount of foliage and growing points by pruning, wind-break or frost that the dormant bud strands (3) or the lignotubers (4) develop into shoots. These shoots will have the juvenile type of leaves for one, several or many pairs of leaves depending upon species.

Eucalypts have very strong "apical dominance", particularly when young, leading to a whip- or wand-like growth with short and few side shoots. In shade fewer side shoots are retained and develop less than in full light. In the hot, dry and sunny summer of 1964, shoots on pruned trees retained more side shoots with greater development than in the dull and wet summer of 1965. Light intensity, therefore, seems to have an effect but when extension growth slows down each autumn in shorter days and poor light conditions, side shoots at the end of the shoots are retained and develop vigorously in the following spring until the apex of the leading shoot starts producing sufficient hormone to inhibit side-shoot development. Successive "clusters" of side shoots with a length of stem or branch with few or no side shoots are often clear indication of seasonal growth. If a well-branched tree is desired, instead of a straight pole, the apical shoot must be removed and, subsequently, no shoot allowed to become dominant otherwise the growth of all other shoots will become inhibited.

No account of the pruning of eucalypts for garden purposes has been traced. Pruning is, therefore, still at the experimental stage and the following summarizes what I have learned to date and I am still learning.

All the species I have grown as pruned or coppiced plants have thrived on it with the exception of *E. coccifera*, which died back from some cuts but its adult foliage is much more beautiful than its juvenile and severe pruning is undesirable. I have killed a number of plants, and expected to, by cutting back at the wrong time of year; which was the only way to learn what maltreatment they would or would not stand.

One thing which became quite clear in 1965 was that hard frost will kill back newly exposed wood. I had started cutting back my coppiced and

pollarded plants in January and a hard frost (minimum temperature 9°F.) occurred on March 2. Plants which had not yet been pruned suffered no damage but many already pruned were killed back several inches and a number of coppiced plants killed. For plants which are to have all the previous year's growth cut off, the best time is after any hard frost is likely (10" of frost had done no harm in previous years) but before spring growth starts. In southern England, mid-March would be the time. The removal of unwanted branches or the shortening of branches in a tree can be done earlier as the exposed wood will receive some shelter from the other branches.

The simplest method of managing eucalypts for foliage effects is to cut them right back to near ground level in mid-March following planting and cut off all the previous year's growth as near the base as possible at the same time each year—i.e. annual coppicing. Two or three times in summer any over-vigorous upright shoots should have their tips pinched or cut back to a pair of side shoots otherwise one or a few shoots will become dominant and 6 feet or more tall and other shoots from the base slow down and stop growing. This method is recommended for the hardest species with very glaucous juvenile foliage such as *E. gunnii* and *E. glaucescens*.

Another simple method is to shorten the stem to anywhere between 1 and 3 feet from the ground and prune off all side shoots flush with the stem in the March following planting. Shoots will appear all down the stem and should be rubbed off whilst small except those on the top 6 to 9 inches. As in coppiced plants, over-vigorous shoots growing upright should be pruned to remove apical dominance and enable side shoots to grow. Every March the annual growth is cut back as near to its base as possible, i.e. annual pollarding. The advantages of the "leg" are to make winter basal bark protection and staking and tying easy, and it is easy to prevent climbing weeds such as bindweed, getting up into the foliage. Pollarding is recommended for all species which are not fully frost-hardy so as to enable basal protection to be given for the first few winters. The "leg" for *E. gunnii*, *E. glaucescens* and *E. urnigera glauca* should not be more than 1 foot or the change to intermediate foliage will start before the end of the summer; *E. dalympheana* and *E. rubida* not more than 2 feet; *E. perriniana* 3 feet for the same reason; *E. pulverulenta* and *E. cordata* show little change in leaf shape and the *E. pauciflora* group do not have persistent juvenile foliage so can be pollarded at any convenient height.

A combination of these two methods is also good. The plant is cut down to ground level once and in the following March a few of the strongest shoots are cut back to the desired height of "leg" and all other shoots cut off to their base. The retained stems are treated the same as for annual pollarding and a greater mass of foliage developed, in the form of a multi-stemmed pollarded tree.

All the above three methods mean that the plant is bare for a month or two but the new shoots grow very rapidly and soon make a colourful display. If it is desired to keep plants at the juvenile leaf stage, cutting back annually seems to be essential except with *E. pulverulenta* and *E. cordata*. It is desirable with these two because last year's leaves have lost much of their glaucous bloom.

Textbooks on pruning usually give instructions for the formation of "a good framework of branches" for the development of a nicely shaped

bush-type of shrub or tree. This is exceedingly difficult with eucalypts on account of their very strong tendency to apical dominance and a low order of branching. With newly planted seedlings of *E. gunnii* I have tried snipping out the growing point as soon as large enough to cut without damaging the axillary shoots and repeating this as soon as the two latter were large enough, which means weekly attention or the axillary shoots are shed and the apical shoot "gets away". An easier way, and on present results more effective, is to do no pruning during the first growing season or until mid-June in the second summer by which time a considerable growth will have been made by the leading shoot. Cut this back as close as possible above the "cluster" of side shoots which develop at the end of each growing season. These side shoots will then grow vigorously (and shoots lower down the stem with moderate vigour) and one of them will very soon start out-growing the others. This shoot must be pruned back to a side shoot several times during the summer otherwise it will inhibit the growth of the other shoots. The following summer, the same pruning should be done cutting back the central leader of each of the vigorous upper shoots to the start of the year's growth (just above similar clusters of side shoots). Do no pruning to the lower shoots if foliage to the ground is wanted unless they become straggling in which case prune the straggling shoot to a side shoot. Once again summer pruning of any upper shoots showing dominance must be done. This type of pruning will maintain growth from naked growing points, no shoots from dormant bud strands will develop because plenty of foliage is retained and the bush will be clothed in leaves all the year. In subsequent years all that is likely to be required is the removal of any shoots which out-grow the outline of the bushy tree, always pruning to a side shoot. It is thought that mid-March and early July are the best times to do this.

A bush pruned in this manner becomes larger each year. The rate of increase can be reduced by pruning upper and the longer shoots biannually but it must be remembered that eucalypts are an outstanding example of the pruning prescription "the harder you prune, the stronger the regrowth". The aim should be to take off about one-quarter or one-third of the previous year's growth on upward growing shoots at the top of the branches (to encourage slow, more or less, pendulous growth on the side branches) in March and a similar amount in July off the current season's growth. If the bush or tree becomes too large, never hesitate to cut it right back in mid-March to a framework of branches with an outline the shape of an inverted pudding basin, or to a short stump, and a mass of shoots from the dormant bud strands and lignotuber will appear by the end of May and summer prune the more vigorous shoots before they become dominant.

If a tree with a long straight bole is desired, no pruning is necessary (other than the removal of one shoot if a double leader develops) unless height becomes seriously out of proportion to diameter, i.e. wand-like. When the tree has developed alternate branching, shorten the leading shoot by about one-third of the previous year's growth (in mid-March) to a sloping cut just above a side shoot forming an acute angle with the main stem. This shoot will soon straighten up to form a new leader and in a couple of years the bole will be as straight as in an unpruned tree. A leading shoot like a coach-whip for the first few years is quite common and it is remarkable how such shoots can straighten up before winter. Sometimes they do not and a new shoot will develop naturally just below the bend to form a new leader or it can be pruned off just above a leaf or leaf scar

in mid-March. If more than one shoot appears, one will soon become dominant and grow straight or all but one can be rubbed off when still young.

If a standard type of tree is wanted, cut out the leading shoot in June when the required height of stem has been passed and the side shoots below the cut will develop. One or more of these may need similar treatment the following year to encourage branch development. Side shoots starting at an acute angle with the main stem will soon be bent down by the weight of the leaves and the angle widen. However, if shoots remain more or less equally dominant, the angle will remain acute and, with rapid and equal diameter increase, the bole soon split. Branches forming acute forks should be avoided as far as possible by cutting one off before it is too large. Branches low down on the main stem will mostly die off naturally very soon, but may be pruned so that the bark may be in full view. In any young tree pruning of branches should not go higher than half the total height.

Eucalypts grown as standard or half-standard types of tree assume a delightful form. Branching is "thin" and I have not yet traced any branchlets above the fourth order of branching. The leaves form a thin canopy at the ends of the twigs as leaves seldom persist for more than 2 years. The shade cast is light and, in species with deciduous bark, the beautiful colouring of the bark on bole and branches is fully exposed to sight. An architect who called recently commented that a couple of pruned Snow Gum *E. niphophila*) had the same form as the "perfect tree" which all architects draw on building elevations and he had never seen a tree exactly like them before!

FROST HARDINESS

In our No. 26 issue it was announced that a study would be made on the frost hardness of natives grown in the garden, and a large number of hardy plants listed. Will readers in severe frost areas please record observations made on this aspect over the present winter and advise the editor. For those concerned with this problem and interested in Eucalypts, the series of articles on "Some Garden Eucalypts" on page 303 will be of value.

ROCK GARDENS

There are many natives very suitable in fact especially desirable for rock gardens large and small. For all year colour, I would prefer a rock garden of Australian natives to one of exotics. This subject was principally introduced in our Nos. 22 and 23 issues although most issues described desirable rock garden plants. Our studies in this aspect of gardening have reached such a stage now that it is desirable to collect the information, reports and observations of readers so that firm recommendations may be made. We hope to achieve the conditions whereby a gardener can plan and construct a rock garden to full instructions and plant it out in such a way that it will be the floral showpiece of his garden. Will readers please assist this project by sending reports on plants that they consider will be suitable rock garden subjects to the leader of this new Study Section, W. F. Tongue, University Farms, Private Bag, Camden, N.S.W. 2570. Please do not leave it to some one else. Send in a report even if it is on only one plant.

AUSTRALIAN NATIVE SUCCULENTS

There are many "succulents" among our wildflowers. These are described in our issue no. 23. One problem that faces us is to get plants as there is no doubt of their appeal and value to the garden once we produce the best forms. Fortunately they strike readily from pieces. Will those readers who know of any native succulents in their area please send them to the Succulent Study Section Leader, R. Thomas, 17 Frank Ave., Clayton, Vic. 3169. Those wishing to join the section and help in this enjoyable and easy task may also write to him. Now readers from all over Australia, please do not let me down and leave this small task to others. Please have a day out and collect some specimens and send them off say in a jam tin.

Native Orchids and Fertilization

by G. A. Patterson

The first essential is to give an epiphytic orchid suitable growing conditions. While some of our natives such as *Dendrobium gracilicaule* and *D. speciosum* are only semi-epiphytic and will grow well in loose, coarse compost even better than they do as epiphytes, there are many such as *Sarcophilus falcatus*, *Dendrobium teretifolium* and *Thrixspermum tridentatum* that will not tolerate any attempt to turn them into pot plants.

Provided the plants are given their correct culture and environment however, extensive experience has produced evidence in favour of regular fertilization. Most growers favour more dilution than the manufacturers of chemical products recommend. It is the old principle of little applied often and regularly. Fortnightly application appears adequate.

In experiments with another chemical product on staghorns, I killed the most heavily fed one, had amazing growth with one receiving less, and little result with one receiving a minute dose.

The most outstanding plant I have had was a *Dendrobium gracilicaule* which with regular chemical fertilizer, produced 36 pseudo bulbs, 83 racemes, with an average of 40 florets per raceme.

Most of my correspondents and the owner of the best collection of native orchids I have seen, use commercial liquid products. One grower has produced outstanding blooms on her epiphytes by tying them on limbs of red cedar (about the most lasting of the softwoods) and dipping them in liquid cow-manure so thick that some of the material sticks to the wood and the roots of the plants where it dries out. It then gives up some plant food with each watering.

Growing Terrestrial Orchids in Cymbidium Orchid Compost

by Marian Beek

Mr. R. C. Nash, our Terrestrial Orchid Study Group Leader, advised us to make up a suitable compost of sharp sand and sawdust, in which to grow our native orchids, but when I could not get any old sawdust, I decided to use a commercial Cymbidium Orchid Compost instead, with astonishing results. The *Pterostylis* in particular flourish in it; growing and multiplying well and forming big tubers. The *Corybas* and *Acianthus* species are happily sending out adventitious roots in it, and *Acianthus exsertus* grew very tall and robust. One spike was 9 inches tall and had 19 flowers. The last species which I tried to grow in this compost, is *Microtis atrata*. They have multiplied well and are now coming up in little clumps of two and three leaves.

All the *Pterostylis* species which multiply vegetatively, like *P. nana*, *P. nutans*, *P. baptistii*, *P. curta*, etc., also *P. longifolia*, *P. pusilla*, *P. mutica*, and *P. cynnocephala*, are planted in this compost only, but *Pterostylis vittata*, *P. woolsii*, *P. boormannii* and *P. squamata*, are planted in sharp sand, with only a mulch of about one inch of Cymbidium Orchid Compost.

All the *Corybas*, *Acianthus* and *Microtis* are planted in a mixture of 50% sharp sand and 50% Cymbidium Orchid compost. I agree that this wonderful Cymbidium Orchid Compost is more expensive than sawdust or leafmould, but don't our native orchids deserve only the best?

TERRESTRIAL ORCHIDS IN A LIMITED SPACE

by R. C. Nash

In this article I hope to give the person who may live in a flat, rooms or other confined living area and who would like to grow the native terrestrial orchids, confidence enough to do so.

During 1965 I obtained a position in Canberra and went to live in a room in a Hostel. After a short period I wondered if I could grow a few terrestrial orchids in this room. While moving around the Hostel I observed that many people living there had one, two or more pot plants growing in their rooms. Well, I thought, I could get one pot and try, if the management objected I would soon find out.

Now that the decision had been made, how would I go about growing these plants. I could go out into the countryside and collect my compost materials and soon get things going. Wait a while, what would a person living in a big city do? Where and what type of composting materials would this person be able to procure? Let me see. What have the shops to offer? First a container is required, terra-cotta pots are expensive, heavy and inclined to be a little unsightly in a room. Plastic pots are cheap, light and come in many attractive colours and styles. A four inch plastic pot was purchased with its small saucer.

What do I put in this pot? The prepared compost mixtures sold in the shops did not look very attractive. After some deliberation I choose one that appealed the most. Eventually this compost proved to be quite useless. It was far too alkaline and soon poisoned the few plants that a friend had kindly sent to me.

With this failure, what should I do? Why not attempt to make up one of my older compost mixtures. Where would I get the coarse sand required for this type of compost in a city? Looking around I found a storm water drain. Searching along this drain I found a sand bar and part of this bar consisted of nice coarse gritty sand. Before I used this sand it had to be washed to free it of foreign material. My old composting sand had pieces of mica in it. Should I put mica in these new composts? Where would I get mica? Vermiculite would do, so a bag of this material was purchased. What about the humus material? Here I am afraid I had a question I could not answer. Canberra is not like a typical big town or city, with sawmills, firewood suppliers' yards or similar industry to call upon. So I cheated. My sawdust was collected from around a tree stump in forest country along the highway near Batemans Bay. For drainage material I collected a few small stones while walking along the street.

More pots were purchased until my window sill was full of them. Still no objections from the management. Four compost types were tried with varying results.

Compost number one: A sandy base with the prepared compost on top. Quite hopeless as mentioned earlier.

Compost number two: All sand with a one inch layer of sawdust on top. This worked well during the first season, while I kept the pot on the inside of my window, but failed during the autumn of the following year when the pot was put outside of the window. The cause, the pot would dry out too quickly, causing the tubers to rot. During the first season I watered a little each day and had only *Pterostylis mutica* growing. During the second

year I tried to grow *P. mutica*, one plant only grew; *P. boormanii* and a few *Prasophyllums*, all rotted.

Compost number three: Vermiculite was placed in the lower half of the pot with sand on top of this. A sawdust topping of about one half of an inch was put on top of the sand. During the winter this compost stayed on the outside of my window and the plants appeared to grow well. On tipping this pot out, the results were as follows. The four *Thelymitras* had made nice new tubers, lower than the old ones, there was not much new root activity. Two plants flowered. *Chiloglottis reflexa* and *Lyperanthus suaveolens* had plenty of new root growth but no new tubers, the root tips had rotted. Both of the above species form their new tubers on the ends of these roots. The *Pterostylis* species tried had mixed results, some rotted out completely while others thrived. The damage caused by rotting in this compost could be put down to (a) very cold conditions, on many a morning the temperature dropped well below 32 deg. F., (b) badly regulated watering.

Compost number four: This proved to be very successful. Pure coarse sand and small stones were placed in the base of the pot, topped by the coarse sand which graded up to 50/50 mixture of sand and vermiculite. This mixture in turn graded up to 20% sand, 20% vermiculite and 60% sawdust at the top of the pot. This compost system kept a very even dampness and needed watering once or twice a week. Pots containing this mixture were placed both inside and outside of my bedroom window. The room was heated during winter by a hot-water type radiator placed below the window. Pots placed inside of the window were heated almost directly by this radiator.

The results of this last compost system were, all plants grew very well. *Pterostylis*, all species tried grew very vigorously with long roots and many new tubers. *Thelymitras* produced strong healthy new tubers and many plants flowered. *Diuris* species had strong growth and flowered well as did the few *Prasophyllums* I tried. Plants of *Acianthus* and *Corybas* that were placed in this compost without tubers continued to grow and produced new tubers at the ends of the adventitious roots.

Summing up the results of my experimenting, I would say that the fourth compost type is by far the most successful to try. Care must be always shown when watering and the plants should not be over or under watered.

ORCHID GROWERS—Editor apologises

As you are well aware alternative issues feature epiphytic orchids and terrestrial orchids. There has been delays in the epiphyte orchid articles but a very interesting series is being prepared for future issues with full colour plates.

Correction—As clearly stated in "Australian Plants" No. 4 issue *Dendrobium delicatum* n.m. *kestevenii* (Rupp) Leaney, is a natural hybrid between the N.S.W. *D. kingianum* and *D. speciosum*. *D. delicatum* F. M. Bail., is the same cross using a Qld. form and as F. M. Bailey gave it this name 65 years before Rupp, this name must apply to both plants. In some plants the difference between the forms is very pronounced so if orchid fanciers must continue to name Rupp's cross differently then it should be named *D. delicatum* n.m. *kestevenii*. Thank you to Norm Hellier for this correction to the incorrect use of the name *D. kestevenii* in our No. 33 issue.

Cymbidium canaliculatum. Which variety should be called the "black orchid". On the rear cover of our No. 27 issue is a colour plate of a very dark form with a caption "The Black Orchid." Len Butt, leader of our epiphytic orchid study section has pointed out that the species in the colour plate is not the variety known as *sparksii* and that this common name should be used for the dark forms of this variety. He says "the black is really a plum red shade and in some instances is so intense that it verges on the blackish maroon." He has submitted some excellent facts on the forms of this species and I have no doubt that he is correct. However the book "Australian Orchids" by Alick Dockrill, that we will publish early next year will clear up many doubtful aspects on the names of varieties so rather than add to the confusion, we shall wait until then. Meanwhile will readers advise the editor of what they know of the subject.

BUSHRANGER ORCHIDS IN TASMANIA OR "THE CALOCHILUS GANG"

by P. A. Palmer

It would be difficult to find a more ferocious-looking band of bushrangers than the *Calochilus* orchids. Five different species lurk in the Tasmanian bushland, ever-watchful, determined to avoid capture.

Master of disguise, the "Cally Gang" will often hide among species of *Thelymitra*, which they resemble. Both Spring-flowering, the dainty Sun Orchids usually open first, and while they are in bud the *Calochilus* pass undetected; however, when the *Thelymitra* are almost finished, and the collectors have wandered by, assuming only Sun Orchids to be present, our cheeky friends burst forth in bearded splendour, no longer needing to hide, and delighted with the success of their trick.

Of the five species of *Calochilus* in Tasmania, four have beards, but the fifth, "Beardless" (*C. imberbis*) lacks the colourful hairs upon its labellum—for this reason it looks remarkably like a Sun Orchid, even when the flowers are open. Possibly this is the reason *C. imberbis* is so rarely collected—its disguise is too good to be detected.

"Brown Beard", *C. robertsonii*, is a tall, handsome fellow, with colourful basal glands and long brown, red or purple hairs making up its beard. Two glittering eye-like glands, connected with a raised ridge, at the base of the column, and a large hooked nose above them, form the face of this flower. Sometimes the beard of *C. robertsonii*, leader and wise man of the Gang, is a beautiful grey or pale mauve.

"Strap Beard", *C. paludosus*, is the "dandy" of the Gang, and is elegantly slender, with a colourful beard trained to an angular, strap-like tail; the long silky hairs are either red or yellow (these do not have glands on the hairs of the beard). This species lacks the glittering "eyes" or glands on the column which are present in other species, but has a prominent lobe in the centre of the column base.

"Peaked Beard", *C. campestris*, is most handsome; its beard is broad, almost triangular, and beautifully trimmed. The beady, eye-like glands on the column are not as slanted as those of *C. robertsonii*, and there is no connecting red ridge between them. The usually smooth (sometimes ridged) base of the labellum of this species is a coppery purple, developing into purple hairs, and ending in a short peak.

"Pale Beard", *C. saprophyticus*, can be most readily distinguished from its twin, *C. campestris*, by the absence of the long channelled leaf of the former, and by the yellow-green colouring of the plant. A lazy fellow, "Pale Beard" lives off the energy-giving foods produced by other plants. The base of the labellum is purple or dark blue, smooth, and often the hairs are short and bristly, forming a shorter beard than that of *C. campestris*. Glands at the base of the column are usually connected by a red streak. "Pale Beard" is the only species without a long channelled leaf, although it does have several bracts on the stem.

Both *C. campestris* and *C. saprophyticus* open very briefly (usually no more than 24-36 hours) and open fully only when the weather is very warm and humid. Within a few days they have finished flowering, and in the tradition of their friends, the Arabs, fold their tents and quietly steal away, determined not to reveal their hiding places.

CALLITRIS

THE CENTRAL AUSTRALIAN CALLITRIS by D. J. Nelson

The family *Coniferae* is not represented in Central Australia but the closely allied family *Cupressaceae* is represented by a single species, *Callitris columellaris* (formerly *C. huegelii*), known most commonly locally as "Native Pine", also as "White Cypress." This is usually a small tree of about 30 ft. in height, occasionally reaching 50 ft. It is confined mainly to the rocky ranges and is not found on the open country. One cattle station, "Pine Hill" to the north of Alice Springs is named after this tree. It is quite common in some areas in the local ranges but is very drought resistant as was proved in the recent devastating Central Australian drought. I have noticed two interesting facts about this tree. First it does not extend very far to the north of Alice Springs, its limit is probably inside 150 miles north and this corresponds roughly with the northern frost limit. Could it be that frost is a requirement for seed germination? The second peculiarity concerns this tree's preference of locale. I have noticed that it occurs most commonly on the southern slopes of the ranges ascending to the summits, but is markedly more rare on the northern slopes. In the centre the prevailing wind is from the south-east and yet this tree is most common on the sides of ranges exposed to this wind. The southern slopes are also the most shaded, consequently are cooler. Can this again be a tie up with temperature. These observations lead me to believe that *Callitris columellaris* may be left over from a cold period in the Centre's past, when it was probably more widespread. It is common in the Macdonnell ranges around Alice Springs and travelling north, it is not seen again until the next nearest range, the Hann Range, 60 miles away.

This tree is often nicely shaped, presenting the classical pine tree shape with a single straight trunk, dark greyish fissured bark and dense needle-like foliage. The woody fruit is rather small, about 1" long and the seeds are winged. The timber is light in weight, whitish in colour, has the typical pleasant pine odour, is reputedly resistant to termite attack and when dry, as firewood it burns hotly with a bright yellow flame but explodes and spits coals. It is not used for timber these days but trees near town are lopped for branches used as Christmas trees. It is not palatable to stock although the Phosphorus content of the leaves is higher than other trees of the Centre. Its relative inaccessibility renders it safe from extinction. As far as I know very little, if any, attempt has been made to cultivate this tree in the Centre but it would be an interesting subject for this purpose.

A NORTH QUEENSLAND CALLITRIS by L. K. BATES, Mareeba

In some of the dry areas adjacent to Mareeba, *Callitris columellaris* is outstanding because of its striking green foliage. It grows up to 30 ft., with sparse foliage, and, while conical in shape, is somewhat spreading. It is sometimes found in slightly wetter areas, but in the dry parts may be seen along storm water gullies or in poor soil depressions (with such trees as *Melaleuca minutifolia*, *M. viridiflora*, and *Casuarina luehmannii*), where I suspect underground moisture is retained for a longer period than is usual here. It is hard to believe this to be the same tree as the magnificent, dense, tall tree which Queensland's Moreton Bay area supports.

GARDEN PREPARATION

Concluding an article by W. M. Martin in our No. 33 issue entitled "The Root and the Soil" followed by a section entitled "Garden Preparation for Summer". The advice given on soil preparation and watering must be supplemented by a suitable surface mulching treatment.

SURFACE TREATMENT IN A WILDFLOWER GARDEN

There are various materials used for the purpose these days—some of them because they are readily available, or for various ideas of aesthetic appeal. Each have their advantages and disadvantages.

Slopes can only be effectively dealt with by rock wall or rock garden construction. A second choice would be effective use of ground covers such as *Viola hederacea*, *Cotula filifolia*, *Myoporum parvifolia* etc., which will prevent scouring by heavy rain, and hold some water to the soil.

Pebbles are often used, both with and without an underlay of black polythene. They are usually attractive if not overdone. They must be at least 3" depth and above ¾" size to be an effective insulator. They are partially effective in preventing run-off on slopes and will keep their position. Pebbles are commonly used with polythene underlay which is an extremely effective weed inhibitor until build-up of humus and weed seed in crevices will negate its use. The polythene is also ideal for preventing evaporation; but just as effective at preventing entry of water. The usual method of slitting about plants is not very suitable as plant roots extend beyond the foliage.

If the pebbles are used without Polythene, annual weeds can be effectively dealt with by the chlorophyll weed-killers; but perennial weeds such as Couch, *Paspalum distichum* or the Bent grasses require regular treatment.

Gravel has about the same value as pebbles; but is cheaper to purchase and may or may not be so attractive according to colour used. If weed can be tolerated, gravel is a good environment for self-sowing and germination of many native plants.

Seaweed—There are many types available if you live close to the coast and estuaries. They are all good for insulation and water holding properties. Some types are very light and are easily piled into drifts by the wind so may represent more work in the garden. They will eventually rot down to good humus for the soil. There is no need to wash seaweed to remove salt. Incidentally, the gravel and pebble mulches, prevent any effective addition to the soil of natural food material, and must eventually cause some plants to deteriorate.

Grass clippings can be effectively used as an insulating mulch. There are two ways of using it. Firstly by spreading thinly direct from mower onto garden beds, so that it dries quickly without compacting into an impervious layer, and can then gradually be increased in depth week by week. Secondly, by leaving in heap for week covered by plastic sheeting, when it will then be physically similar to fresh cow manure. It is then spread out to dry into dabs, which are later spread onto the beds. This is as effective as old cow manure, without the serious introduction of weeds.

Horse manure, if available, is a very good mulch. It is better than cow manure, as not so many weeds are introduced. Sheep manure is efficient as mulch, but is worst of all for weed introduction.

Tan Bark is probably the best of all as an insulator and water holding material. It is also ideal for native garden because of its "natural" look, and its eventual addition to soil as humus. However, because of its almost

unavailability, I think the most practical material is Wood Shavings or Buzzer Chips of hardwood, which are generally available free from any timber supplier. A proportion of softwood shavings are tolerable; but they are slower to settle down and look more unattractive longer. Generally, after about 9 months, hardwood shavings begin to "naturalise" into the garden scene. They should be spread to a depth of 3" or more, and should not have a high proportion of sawdust. They are an excellent suppressor of weeds, and will make easy the elimination of couch and sorrel etc. Weeds will germinate on the surface after a few months; but are easily removed by hand or sprayed. The shavings will absorb water well, and will hold it in the surface layer of the soil for months. Before laying the shavings, go over the ground with a dutch hoe or similar, to remove top growth of weeds which can be left on the surface. Spread blood and bone over the ground to provide nitrogen for the bacteria, which will use it in attacking the lower surface of the shavings; otherwise some plants may suffer a nitrogen deficiency. More nitrogen fertilisers may be added over shavings later if required.

MULCHING

by W. M. Bristow, Sherwood, Queensland

Weeds are the gardeners' curse. Weeds were what prompted this idea into being. The weeds on the spare ground at the bottom of my slope had beaten me. When a forty-foot high willow was blown down in a storm, two large *Acacia oligocarpa* had to be removed because of danger from borer infestation, and a flowering peach and a *Grevillea banksii* died. The weeds took over and the task ahead of me appeared hopeless.

When one-woman power viewed catsclaw, potato vine, pest passion, lantana, stinking roger, scotch thistle, eight foot high Johnson grass, wild oats, *sideretusa* (2 species), cobblers' pegs and wild *ageratum* vying with one another for space, admitting defeat seemed the only solution.

I thought of mulch but the cost of covering 25 perches with 4" to 6" of mulch was too high.

My idea came while we were looking at a friend's garden where some opened out cartons were used to suppress weeds. I became an ardent collector of cardboard in any forms, newspaper, cement bags, old cloth, bags, fibre glass, leaves.

Beginning at the wide western end of the land, I began laying layer upon layer of these materials, first clipping off the weeds with hedge shears and placing them on top of the cardboard, etc. As the land had a considerable slope, it was necessary to place the layers so that rain running down one sheet ran underneath the next and so on to the bottom.

All pruning material from my top, old-established garden, no matter how woody, was taken down and put on top of the cardboard and paper. This prevented the wind blowing it away and also made it less unsightly. Leaves were the most valued cover of all because they have a charm of their own.

Plants that have prospered in this area are: *Acacia* 4, *Baeckea* 2, *Banksia* 2, *Brachychiton* 1, *Brassia*, *Buckinghamii* 1, *Eucalyptus* 3, *Graptophyllum* 1, *Grevillea* 4, *Hakea* 3, *Hibiscus* 2, *Hovea* 1, *Jacksonia* 1, *Jagera* 1, *Leptospermum* 2, *Melaleuca* 11, *Pandorea* 1, *Rulingia* 1, *Thryptomene* 1, *Vitex* 1, *Westringia* 1.

This project has been in operation for two years. Systematically I covered the ground surface from west to east and have now completed it once and done some areas twice. The second layer is not systematic. I cover where the need is. This is a long range plan needing patience, for weeds like catsclaw are very persistent, needing a great deal of starvation before they eventually die. So persistence and effort will be needed for years to come. Now, however, I can use the land and I have been planting numerous native trees and shrubs.

This piece of land was virgin soil and the great thrill is that here the native plants live, whereas in my top garden, cultivated for 36 years, they invariably died, although I have been making a few plantings ever since S.G.A.P. came into existence.

WILDFLOWERS AND BIRDS

Preface by the Editor: Previous issues have given details of how to attract the beautiful native birds to your garden. The articles have been presented in what, in my opinion, the order of importance. Firstly grow wildflowers to provide food and succour for the native birds. This in turn provides a natural protection against garden pests as the birds will repay you by devouring the pests. Details were then given for those who wish to supplement the natural diet provided by artificial feeding and reports were printed of readers who were overjoyed with the result. The danger to the bird life and possibly to the survival of life, by the use of chemical sprays was fully described. How important this message is. However those who agitate against the use of sprays but do nothing to provide natural food by growing suitable wildflowers are rather "hollow vessels".

Following is another aspect to this problem that has as yet not been mentioned. The first three paragraphs are from a letter from one of our readers and this is followed by a reply by Barbara Salter.

We have a small property of two acres bordering an orchard and grasslands. For many years I have only planted native trees and shrubs and now have a pleasing, relaxed, informal garden. The last fifteen months I have concentrated on Mrs. Satler's method of feeding with the brown sugar, honey and water for all the honeyeaters and nectar-eating birds. There was a large increase in the number of "Grey Wattle" birds with their bullying tactics and harsh call and these drank all the mixture I put out not allowing any other birds within reach of the many receptacles I had in the trees.

Now I have changed the feeding methods entirely. I am concentrating on the ground eating birds. I put out bread, bird seed or lumps of fat tied to branches and this is a great success. The raucous wattle birds have gone but there is a fantastic increase in the Grey Thrush, the lovely warbling Magpies (families of them), Mudlarks, Willy Wag Tails and many more varieties. The tiny honeyeaters are still in the garden but get all they want from the flowers on the native plants. There are even enormous black crows that visit us every day. The Minors and the Starlings and Sparrows all come in for their share. It is a joy to see all these birds in the garden now instead of only Wattle Birds and they certainly are very lovely to listen to.

I also have a shallow pond in a natural setting of Eucalypts, Banksias, Melaleucas and small ground cover plants where the birds love splashing around and cooling off on a hot day.

From Barbara Salter:

My object in feeding the native birds, and in encouraging other people to do so, is to help them to survive during the colder months when food is scarce; and to survive at this time when their natural bush is being destroyed, and they would become extinct in many areas if we did not give them some assistance.

It appears that you do not like the "grey wattlebirds", which I assume are the Red Wattlebirds; certainly, these are raucous birds (but this is hardly their fault), and they are aggressive. However, nobody else has the trouble with them that you describe, and many hundreds of people are now feeding the native birds. I have simply put out a number of feeders in my garden, and the Reds are allowed to feed undisturbed at certain ones, whilst at others I chase the Reds away and the remaining species of honeyeater are able to obtain all the food they want; the Reds soon learn that I will not disturb them at "their" feeders, and they behave themselves quite well, and no bird goes hungry. A friend has had success with a cage which he made of wire netting, the holes being sufficiently large to permit the entry of all the smaller birds, whilst denying entry to the big Reds. I might point out that the Reds, although they may annoy you, are good and useful native birds, helping to keep the insect pests in check.

The provision of extra food during the winter months does definitely save the lives of birds, who would die from cold and insufficient food even though healthy; before I put out food, my native garden (planted for the birds) always had casualties in winter.

Native birds are ALL good and useful, and being our own Australian birds we should do all that we can to protect and preserve them. Every Indian Mynah, Sparrow and Starling which you feed and thereby help to keep alive, means that one or more native birds will not be able to survive; the introduced birds are strong and aggressive, and always occupy a habitat and refuse to tolerate the native species, thus the native birds are deprived of food and living space, and having nowhere else to go, they simply die out. In addition, the introduced birds are predatory cannibals—particularly the Mynah and Sparrow—and they eat the eggs and young of the native birds, and destroy their nests. Therefore, in supplying food to these predatory pests, you are actively helping to destroy our native birds, who are not able to withstand the aggressive behaviour of the introduced species.

I know that you mean well, and that you have some feeling for the birds, but it is necessary to draw the line between native and introduced species, otherwise the day will come when our country is populated with vast numbers of destructive foreign birds, and our own native species will have disappeared from many areas.

QUEENSLAND WILDFLOWERS

There must be someone with knowledge of the lesser known wildflowers of Qld. Reports and colour slides should be forwarded to the editor, of the following plants:

The Plant Family *Bignoniaceae*—*Tecomanthe hillei*, *Neospicacea jucunda*, *Dolichandrone filiformis* and *D. heterophylla*, *Deplanchea tetraphylla* and *D. hirsuta*. The Plant Family *Melastomaceae*—*Medinilla bailey-headleyi*, *Melastoma polyanthum* and *M. malabathricum*, *Mimocylon umbellatum*, *Osbeckia chinensis* (also another three species not native to Qld. including *O. australiana* of W.A.) and *Otanthura bracteata*. The Plant Family *Proteaceae* Such choice plants usually trees such as *Austromuellera*, *Curdueella*, *Carnarvonia*, *Darlingia*, *Gervina*, *Hicksbeachia*, *Hollandaea*, *Musgravea*, *Opisthiolepis* and *Placospermum*.

Small Acacias

by F. C. RODGERS

Acacia diptera is a small shrub with winged stems. It seems to prefer a shady spot in a well drained situation where it may reach about four feet.

Acacia glaucoptera also has winged stems and branchlets on a round compact bush, which may grow about six feet, but is usually less. The foliage grey green—its hardiness both inland and along the coast and the large golden flowers in late spring are worth mentioning.

Acacia triptera is a queer shrub and not very like the usual wattles. The leafy phyllodes are stiff, stout and pointed, and fused to the branches for some distance along the base of each leaf. The shrub is at least eight feet tall, quite dense, and in the late spring and early summer it bursts forth into gold with small, loosely arranged spikelets of flowers.



Blocks donated by N. B. Thomson

COMMON MYRTLE WATTLE—*Acacia myrtifolia*

Acacia myrtifolia is common throughout temperate Australia. In the Mount Lofty Ranges and the Grampians it is particularly prevalent bringing a wealth of colour to the bush in early spring. The flowers are usually pale yellow in colour but many forms are deep bright yellow and particularly fluffy. The bush is very neat and compact to a height of usually, three feet. It is particularly hardy and succeeds under a variety of soils provided they are not too alkaline or too dry. Better results are achieved in semi-shade although the plant will thrive in full sun.

Acacia stenoptera is a handsome species from Western Australia. It also has long hooked stiff spines for phyllodes. It makes a bushy shrub about four feet high and its large globular flower-heads are produced in spring.

Acacia restiacea is rather like *A. spinescens* in that the stem appears to be leafless. It looks very like a rush or grass bush growing about 3-4 feet tall. It is upright with flowers in small groups. It is certainly an unusual looking shrub.

Acacia enterocarpa (Jumping Jack). This plant is restricted to a small area in Victoria. The small bush may not attract particular attention. Its long slender phyllodes and ball flowers are very like several others, particularly *A. colletioides*, but when the pods have formed there is a remarkable change for they are crinkled and twisted just as a "jumping jack" fire-cracker.

Acacia diffusa is usually a low growing shrub but may at times reach to six feet or more under favourable conditions. It has rather widely spaced needle-like phyllodes. The flowering is usually 2 or 3 globular flowers on short stalks from each leaf axil. It is at home where conditions are dry in summer and it does not mind the soil wet in winter. It comes into flower in the late winter when its strong odour adds to the scent of the bush but is sometimes too strong for indoors.

Acacia rupicola is to some a little similar. This is called Rock Wattle and grows in profusion in dry stony soil around Mt. Arapiles, Vic., but it also extends into S.A. In the spring the bush is smothered with pale blossom which covers and yet leaves the bush transparent. The phyllodes are narrow, triangular and pungent.

Acacia ulicifolia (syn. *A. juniperina*). This acacia may sometimes be confused with *A. diffusa* and it is indeed very similar. However, flowering is usually earlier, even as early as autumn when its pale globular heads of flower mingle with the short prickly phyllodes. When in the spring the other wattles are in bloom it is often decked in small wavy flattened narrow pods. This is a hardy species naturally widespread.

Acacia gracilifolia is an attractive tall shrub with long slender phyllodes which are distinctively grooved. This is a rather rare acacia in its natural habitat, but it has proved hardy and attractive, particularly when not in flower, under all conditions that it will soon take a prominent place in gardens.

Acacia rigens makes a tall smooth bush up to about 8 ft. high with a similar spread. It has long narrow phyllodes about three inches long. These may be sticky. In late winter and in early spring the dense globular flowers makes this a rewarding plant for the shrubbery, particularly in the drier areas.

Acacia havilandi is very similar and equally attractive. It, too, is at home in the drier areas and Mallee country of Australia. The phyllodes are not as tough as *A. rigens* and they have a small kink in them.

Acacia calamifolia is a mallee wattle sometimes growing to fifteen feet or more where conditions are favourable. It has narrow foliage, sometimes so narrow that it appears to be cylindrical, but it is never quite this. This wattle has phyllodes 2 to 4 inches long, and each has a slender bent point. Its rich yellow stalked flower heads spring from the leaf base—one or several together. Later the narrow nearly straight wavy-edged pods develop up to six inches long.

WHAT ACACIA IS THAT?

Would readers please forward to me, any specimens of *Acacia* bearing flowers and in due course, mature seed bearing pods. It does not matter if these are bush or garden specimens but please state if native to the area. To prepare specimen, put them between two sheets of newspaper, place flat object on top to press and change paper daily until thoroughly dry. Place between two sheets of cardboard to post. These specimens are required for the purpose of correct identification and for the preparation of a check-list of all our *Acacia*, varieties, synonyms, distribution and other facts of interest. R. Coveny, 4 Churchill Crescent, Concord, N.S.W. 2137.

Acacia gunnii (syn. *A. vomeriformis*). This small shrub is widespread but not very common in Vic. It occurs in Tas., N.S.W. and S.A. as well. The phyllodes are variable in shape but usually are triangular with the upper side sharply angled. It does well in dry well drained soils and its ball flowers give a dainty appearance to the whole bush.

TWO SMALL ACACIAS

by Ross Doig, Turrumurra, N.S.W.

Acacia alata . . . your correspondent (F. C. Rogers, *Australian Plants*, June 1965) in an article on "Small Wattles for the Rockery" asked for comment on this species. I have grown this species for five years and have had the following results.

One specimen is in a rockery, five years old and only about three feet tall, at least it is at the moment, as it has at least one section of stem dying back at all times. This particular plant sends up new growth from near ground level at irregular intervals, flowers on this growth which then dies back. Leaves (or should I say stems rather than leaves) brown very readily as the plant is in full sun and little protection is afforded from winds in any direction. The soil is six inches of bush sand over ironstone riddled hardpan.

The second specimen is in a sheltered position and protected from winds, and partially from sun, by other shrubs up to ten feet in height. Its height, after two and a half years is approx. 10 feet, straight up with little spread. Staking has been necessary, but even with this support the shrub leans alarmingly when in full bloom and wetted by heavy rain.

There appears to be two colour forms of this species, for the first mentioned specimen is a pale cream (much like *A. juniperina* in colour) and the second a rich golden yellow (closer to *A. cyanophylla*), the latter being the taller of my two. The golden variety is true from seed as mine came from seed from Brother Stanley of Canisius College in Sydney. His shrub was in forest and at least eight feet high and the bloom golden. A final point of interest is that the paler of the two regenerates readily from self-sown seedlings.

Acacia decora . . . has not been so far mentioned by writers on small Acacias, and this is a pity as it is not only attractive in foliage and bloom but is also very adaptable. Its mature height is more often than not about five feet, it is upright and obconical in form, possesses glaucous foliage and the phyllodes, about an inch and half long are held at a jaunty angle from the stems. Its habitat is over a large area of inland N.S.W. but it is equally at home in gardens in semi-shaded conditions on the moist and humid N.S.W. coastline.

Flowers in spring for about three weeks, a rich gold and in abundance, but even when not in flower it is attractive and shapely. I have it growing in almost full shade in medium moist loam and in a raised island barely two feet in diameter in six inches of soil over rock. In both situations it has flourished. Being obconical in form it is possible to plant small shrubs underneath, or ground covering plants, a worthwhile thought for the small garden.

THE POISON PEA FLOWERS

Oxylobium and *Gastrolobium* belong to that tribe of the *Papilionaceae* (pea-shaped flowering plants) in which the ten stamens are all distinct and quite free from each other. The flowers are a clear yellow, or suffused with red, or in some species, red. The toxic species of both genera are precisely those which have terminal racemes of flowers (i.e. raceme in the case of the toxic species has the individual flowers stalked and arranged along a single unbranched elongated axis that commences at the end of the branches), or if the racemes are axillary (the flower stalk commencing at the junction of a leaf and the stem) they are elongated or a long spike of flowers. These racemes usually exceed the leaves in length, so that they protrude above the foliage. The notable exception is "Heart-leaved Poison", *G. bilobum* in which the raceme is contracted.



GASTROLOBIUM GRANDIFLORUM

Blocks made available by Western Australian Newspapers Ltd., from the book "The Toxic Plants of Western Australia" by C. A. Gardner and H. W. Bennetts from your bookseller.

The flowers of the racemes are almost invariably arranged like the leaves, opposite to each other or in threes or fours, and at the base of each individual flower-stalk (pedicel) there is a bract—a leaf-like organ which envelopes the young flowered-bud, but which falls as the flower buds mature.

(Continued on page 324)

PEA FLOWERS—PHYLLOTA—continued from page 299

P. grandiflora is certainly the most striking species of *Phyllota*, but is now confined to scattered patches in the areas where it occurs. Occurring much more widely in the area between Sydney Harbour and the Hawkesbury River is yet another form, which has, like the National Park form, been retained in the species *P. phyllicoides*. It has very long, dense spikes of flowers, through which the axis continues to grow with undiminished vigour, thus being in striking contrast to the National Park form. The flowers are no bigger, and although the leaves do tend to be bigger, they do not approach



Photography by Eric Gordon

PHYLLOTA PHYLLOIDES

the massive leaves found in *P. grandiflora*, which shares the same area of distribution. Apart from the difference in size of flower, these two forms occurring on the North Shore of Sydney Harbour differ in flowering period, the *P. phyllicoides* flowering during September and October, and the *P. grandiflora* in November and December (it will be noticed that *P. grandiflora* in this area flowers earlier than the Appin plants ascribed to the same species).

In contact with the western edge of these North Shore variants, extending northwards across the Hawkesbury River, also west to the foothills of the

Blue Mountains thence south is what might be called the basic form of *P. phyllicoides*. It is this form also which extends along the N.S.W. coast into Queensland, and south to the Victorian border. It is very similar in appearance to the form occurring in the Royal National Park.

Phyllota humifusa A. Cunn. ex Benth. occurs in a small area to the west of Mittagong known as Wombat Brush (sometimes mis-spelt Womhal) on the Bullio Road. It has long prostrate branches, from which arise erect shoots about four inches high. On these erect shoots are borne small flowers scattered in the axils of the foliage leaves. The flowering season extends from January until the onset of winter. At first four or five flowers are produced in a loose spike, successive bursts of flowering producing fewer and fewer flowers until only single flowers are produced. It is completely isolated geographically from other species of *Phyllota*, and also in flowering time from *P. phyllicoides*.

Phyllota squarrosa (Sieber ex DC.) Benth. extends over the Upper Blue Mountains, in the Katoomba, Bell, Mt. Victoria region, and south to Kanangra Tops. To a diminished extent it shares a number of characters with *P. humifusa*. The flowering season extends from January until winter, the number of flowers per inflorescence reducing to one or two. At the beginning of the flowering season however, the inflorescences will contain 10 to 20 flowers. The growth habit is low and spreading, about 12" in height and spreading not through decumbent stems, but through the frequent production of root suckers. Other distinguishing features are the recurved leaf tips with sharp, tapering yellow apices.

The root suckers are also found in other species of *Phyllota*. Their occurrence in *P. pleurandraoides* has already been mentioned. In N.S.W., they occur in *P. grandiflora*, though here they are much thicker, shorter, and occur less frequently. The same is true of the "basic" form of *P. phyllicoides*, though here they occur even less frequently, it being more usual to find a short horizontal root, which has failed to produce a sucker. Root suckers are quite absent in the forms of *P. phyllicoides* occurring in the Royal National Park and on the North Shore of Sydney Harbour, also of course in *P. humifusa*.

The N.S.W. plants are confined to sandstone soils, although to a wide range of types of sandstone. On numerous occasions, however, it has been found that *Phyllota* is not distributed evenly over sandstone bush but appears to be associated with some strata only. It is unlikely that this effect is due to other environmental factors such as shading, moisture exposure etc., because *Phyllota*, if it occurs at all in an area, may be found in shaded, relatively ill drained spots, or in dry cracks of exposed rocks with the minimum of soil. A slight negative correlation has been noticed between the presence of *Phyllota* and the presence of some species of *Pultenaea* normally found on sandstone, though this has not been investigated thoroughly. *Phyllota* has not been found on any of the sandstone headlands.

Growth of these plants away from their natural habitat presents a considerable challenge, certainly as far as the New South Wales species are concerned. The author has tried growing plants from seed and also transplanting adult plants, neither with any great success. If long term success were achieved, a great deal of information could be obtained concerning the variation in the New South Wales species. From the horticultural point of view, perhaps the most rewarding *Phyllotas* to grow would be the

Royal National Park form of *P. phyllicoides*, a compact shrub, which for a short time bears a mass of bright yellow flowers, also the North Shore form of the same species, though this latter might well need judicious pruning to form a bush of attractive shape. The same criticism might apply to *P. grandiflora*, since, like the previous example, it tends to produce a tall, relatively unbranched bush in its natural surroundings. A gardener might however feel some sense of triumph if he succeeded so well that he had to resort to pruning a cultivated specimen!

THE WEST AUSTRALIAN SPECIES

Phyllota barbata Benth. occurs in the coastal area of the south-west, the specific epithet being derived from the characteristic bearding of the distal half of the style, on the inner side of the curve. Both bracts and bracteoles are similar to the linear foliage leaves, the flowers tend to be scattered along the stem, or in lax, interrupted spikes. The keel is boat-shaped and longer than in other species of *Phyllota*. One form of *P. barbata* has a more compact, terminal spike. This was considered to be of specific rank in Blackall and Grieve 'How to Know West Australian Wildflowers', where it appears as *P. andrewsii*. The additional distinction of not having a bearded style was claimed for the latter species, but this does not appear to be the case.

Phyllota luehmannii F. Mueller, grows in the Victoria Desert region of Western Australia. Its most striking feature is a pale golden tomentum which extends over the upper branches, bracts, bracteoles and calyx. The bracts resemble foliage leaves, except that they are sometimes a little broader, and with less strongly revolute margins. The flowers are crowded into spikes at the ends of the branches, and appear terminal due to die back of the distal part of the axis. There seems no reason to distinguish from this species, *P. georgii* Hemsl. or *P. luehmannii* var. *georgii* Gardn. ex Blackall and Grieve.

Phyllota gracilis Turcz. occurs somewhere in Western Australia. It was collected by Drummond for Turczanimow in about 1845; and according to collection number probably was collected in some inland region, towards the Victoria Desert. The locality given by Drummond is Swan River, but this of course merely means the Swan River Colony, i.e. Western Australia. This plant has never been collected again and only three fragments with this collection number exist. Kew has a piece with a very few small buds, Kiev, where the Turczanimow herbarium is housed has a piece with some seed pods, and Melbourne has a fragment no larger, but bearing a very good flower. This species is quite distinctive, and well suited to its specific epithet. The specimen was probably no more than a foot high, although no one can be sure. It has minute leaves, 1-3 mm. long. The flower appears very like that of *P. barbata*, and has indeed, a bearded style. From the material at Kew and Kiev it appears that the flowers were distributed very much as in *P. barbata*, though more sparsely. The major differences from *P. barbata*, apart from the minute leaves however, are the long pedicel (4 mm.), which is particularly striking in view of much smaller size of flower (5 mm. as opposed to 12 mm. in *P. barbata*). In view of its similarities with *P. barbata*, a more likely locality would seem to be bordering on the range of that species. Certainly, after about 112 years it is high time that a fresh collection was made.

Footnote by Government Botanist of Western Australia—A number of botanists at considerable expense, have spent a long while trying to recollect over 100 of Drummond's species.

All the species described from Western Australia are placed in the genus *Pultenaea* by Blackall and Grieve, indeed, it is in the west that the two genera achieve their greatest similarity. It may well be that they are congeneric. This was certainly the view of de Candolle in 1825, when he made *Phyllota* a section of the genus *Pultenaea* in his *Prodromus*. However, more work is needed before the generic limits can be established with certainty.

REFERENCE

JANCEY, R. C., 1966—An investigation of the genus *Phyllota* (DC.) Benth. (Leguminosae). Proc. Linn. Soc. N.S.W. 90, 341-375.

THE POISON PEA FLOWERS—continued from page 320

The calyx is five-lobed or toothed, and usually the two upper lobes (those immediately behind the standard) are more or less united to form an upper lip, the three lower lobes being equal and usually smaller. Then ten stamens are all equal and entirely free from each other. The ovary (the immature pod at the time of flowering) is stalked and covered with fine silky hairs which may or may not be present on the mature pod.

In *Gastrolobium* the ovules are constantly two in number. In *Oxylobium* the number varies from 4 to more than 20, but in the toxic species it ranges from 4 to 8. The ovary and pod are not divided internally into two compartments—a characteristic peculiar to *Mirbelia*, some species of which have a very close superficial resemblance to the toxic species of *Gastrolobium*.

The leaves in the toxic species are entire i.e. not deeply lobed or consist of a number of leaflets, opposite each other along the stems or branches, or three or four (exceptionally five) arise from the same point or node. An exception is "Rock Poison" *G. callistachys* and "Narrow-leaved Poison" *G. stenophyllum*, where the leaves are never strictly opposite but in clusters at more or less regular intervals. At the base of each leaf are two small organs, the stipules, one on each side of the leaf base or stalk. They often fall before the leaf has reached maturity so will be more readily seen on young branches. Stipules with opposite leaves also occur in *Jacksonia*, *Brachysema*, a few species of *Mirbelia*, *Eutaxia* and *Bossiaea*.

For all plants of *Gastrolobium* or *Oxylobium* that meet the above description, the flowers and seed are highly poisonous. Seedlings and particularly suckers and usually young lush growth are also poisonous.

PINK FANS AND PETTICOATS

by Rica Erickson. See page 293 for full colour plates of these species

The colour plate on page 293 illustrates the two species of the genus *Polypompholyx* with the plants of *Utricularia* from which they may be distinguished by the four calyx lobes. Entrance to the bladders of *Polypompholyx* is by passing under the lateral wings into an ante-chamber guided by long hairs pointing towards the door. Combs or bristles on the stalk lead also to the entrance.

Pink Fans, *Polypompholyx tenella* has one to two small pink flowers on stalks to 2½ inches high and is found in water courses and wet flats near the coast of southern Australia from Victoria to W.A.

Pink Petticoats, *Polypompholyx multifida* has more flowers on a stalk to nine inches high, the leaves often disappearing before flowering. Found on the coastal plains of W.A.

AGONIS FLEXUOSA (Willow Myrtle)

A series on "Street Trees"—by H. Oakman

The West Australian Willow Myrtle has been widely used for coastal planting because of its capacity for rapid growth in sandy soils and its tolerance of salt-laden winds. Average height is from 20-30 feet. The stem is usually squat and is inclined to lean rather than develop vertically; it also has a tendency towards low-branching and therefore requires regular attention while young to ensure a clean stem. The crown is globular in outline; main branches are rather sparse with numerous smaller canes, generally slender and often drooping. The foliage is dense, evergreen; leaves are sessile, alternate, willow-like in appearance and exude a strong peppermint smell when crushed.



WILLOW MYRTLE,
Agonis flexuosa

Stocks donated by
N. B. Thomson

This tree is fast growing when in open soil but its behaviour is unpredictable in clays. As a rule it is not dependable in so far as uniformity of growth is concerned and cannot therefore be recommended for formal avenue planting. It will tolerate a good deal of pruning but seldom needs regular cutting; as a rule the only pruning needed is when trees tend to become straggly.

At flowering time the branchlets are covered with small white tea tree-like blooms. These are sessile and can be terminal or axillary. Although attractive when in bloom the tree is not spectacular. *Agonis flexuosa* was at one time listed as *Leptospermum flexuosum* and its common name was Peppermint Tree. It belongs to Myrtaceae.

As a street tree its success will depend very largely on soil and situation as it is not very adaptable. Reports from the various towns that responded to a survey of local Government bodies by this Society are contradictory. Some reports claimed that it is heat and wind tolerant while others claimed the reverse; similarly with soil; in some areas it did well in clay and in others the reverse was the case. Drought tolerance was noted in some cases and so was the opposite. My own experience is that it flourishes in sandy soils with a water table some 6 feet down; also that while the tree can stand up to prevailing winds it dislikes wind channels.

Under ideal conditions it is a handsome evergreen specimen tree but to obtain the uniformity necessary for street trees, a selection should be made from advanced stock in vigorous growth.

POLYTHENE BAGS AS CONTAINERS FOR NATIVE PLANTS

by R. W. Boden, Research Officer, Parks & Gardens Section,
Department of Interior, Canberra.

The polythene bag has become a part of every day life over the past ten years, being adopted for a wide variety of uses particularly in the fields of food, clothing, fertiliser and tool packaging.

For some years polythene bags have been used as plant containers in overseas countries where the more conventional pots and cans are not readily available. They have been used widely in the propagation of tea and rubber plants, but have perhaps found their greatest application in raising eucalypts and wattles for forestry plantings in India and Africa. More recently they have been adopted in New Guinea and Northern Territory nurseries and are likely to be widely used elsewhere in the future.

Advantages are light weight, cheap cost, and ease of storage and handling; however the major advantage where native plants are concerned is the ease with which they can be removed at planting time, thus reducing the risk of breaking the root ball. Most growers are all too familiar with the difficulty of extracting plants from rigid containers, and of the risk of cut hands where tins are used.

Polythene does not readily deteriorate in the soil and bags must be removed (however this is very easily done by simply slitting down the sides and folding the bag away from the root system. (Photograph).

Either clear or black polythene bags can be used. Algae tend to accumulate in clear bags and this may affect plant growth, on the other hand black bags tend to absorb more heat in summer. Trials are at present being carried out to compare plant growth in both clear and black polythene bags.

Drainage is achieved through holes punched in the bags—it is far more effective to punch a clean hole than to slit or tear the bag to provide drainage. The number of holes should be determined by the type of soil used and water requirements of the plant.

Bags can be used for all sizes of plants ranging from the equivalent of 3" pot up to 5 gallon containers. The former cost less than a cent the latter in 0.01 gauge polythene approximately 16 cents each. Small bags are flat as commonly used around the home, whereas the larger size bags are gusseted to provide a flat base when filled.

Filling bags is slower than filling rigid containers and whilst this may affect the nurseryman it should not worry the home grower who is generally not handling large numbers of plants at any one time.

One of the most interesting observations to date has been on the root systems of plants grown in large polythene bags. There is very little if any root curling which is so common in tapered and vertical rigid containers and retards root development in the soil after planting in field or garden.

The reasons for the marked difference in root systems between plants in tins and those in large bags are not known, and are the subject of current investigation.

One point of importance to observe when using bags is to fill them to within $\frac{1}{4}$ – $\frac{1}{2}$ " of the top—this avoids the top of the bag falling over around the plant during watering, thus preventing water reaching the plant.

For the home grower and nurseryman alike the ubiquitous polythene bag is a cheap, effective and very useful plant container.

GERMINATION OF LEGUME SEEDS—continued from page 295

Now they are ready for the next step, which involves either immediate sowing or cold stratification. We do not employ a neutraliser after the use of acid and have never noticed detrimental effects for not having done so.

A few years ago we conducted trials with seeds of *Albizia julibrissin rosea*. Concentrated sulphuric acid treatments were run at room temperature, for half an hour, one hour and two hours. Each test resulted in general germination after ten days, the longer treatments being neither beneficial nor detrimental. Immersion in hot water was also tried and this proved to be the simplest method of germinating *A. julibrissin rosea*. It too produced general germination in ten days with time saved, and the precautions involved, when working with acid, avoided. This test, however, shows that it is not necessary for timing to be exact when using acid on this particular subject. Although it is always wise to strive for precision, acid treatment has a degree of latitude that makes it a relatively easy tool to use.

Cold Stratification

Some seeds of woody legumes are in the category known as doubly dormant, or two year seeds, and require two stages of pretreatment before general germination takes place. After water has penetrated the seed coats, and broken the first dormancy, a period of cold is necessary to overcome physiological barriers within the seed that prevent germination. Stratification is the term commonly used to define treatment of seeds by combinations of time and temperature; in this case, cold stratification.

At the Arnold Arboretum, pretreatment of seeds requiring stratification is done by enclosing them in polyethylene bags. Polyethylene film has the property of being air permeable yet vapour proof; with the result that oxygen is available to the contents by diffusion, together with the moist environment which is essential for stratification to be effective. Stratifying media may consist either of sand or a combination of half sand and half peat moss. The medium to be used is dampened, and emphasis should be placed on the word dampened, for wet soggy material could exclude sufficient oxygen. In proportion the medium should not exceed two or three times the volume of seeds. This too is important, for at sowing time the entire content of the bag is sown and too large an amount would result in some seeds lying at unfavourable depths. The seeds are distributed throughout the medium and placed in the bag which is twisted at the mouth and made vapour tight with a rubber band.

Bags of seeds needing pretreatment by cold are placed, for the required time, in a refrigerator set at about 40 F., but any temperature at which a household refrigerator is normally set would be satisfactory. After the required period of stratification the contents of the bag are sown and rapid germination should follow.

One cannot generalise when considering seed dormancies; species differ even within the same genus. In *Cladrastis*, for example, we find that *C. lutea*, American Yellowwood, requires cold stratification after water has permeated the seed coat, while *C. platycarpa*, Japanese Yellowwood, produced a 98% germination in seven days when sown after its coat is modified with sulphuric acid. To find different behaviour among species of the same genus is not uncommon.

Editor's Note: Reprinted from the publication "Arnoldia" (Vol. 25, No. 1) of the Arnold Arboretum, Harvard University, U.S.A. Author Alfred J. Fordham.

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DROSERA BURMANII continued from page 291

to the extremely small amounts of some substances required to bring about the feeding response and it is likely that even minute pollen grains settling on the tentacles might prove of some benefit without being obvious to an observer.

D. burmanii Vahl. This is a member of the sub-genus *Drosera* to which belongs the type species, *D. rotundifolia* L., on which many of Darwin's classical experiments were conducted. The sub-genus is characterised by possession of fibrous roots, styles simple or with simple branching and, in most cases, a conspicuous stipule associated with each leaf.

D. burmannii itself may be further described as having all leaves broadly cuneate to obovate, arranged in a radicle rosette, the blade often distinctly cupped. Flowering scapes (1-3) arise laterally from beneath the rosette then ascend to a height of about 10 cm. bearing 3-10 flowers close to the top on short ascending pedicels; petals white to pink; styles 5, filiform, curving upwards and brushlike at the apex. The styles readily separate this from any other species in the Australian region.

Distribution: North Australia from the Kimberleys across to Queensland and down to the north coast of N.S.W. Near the N.S.W. border it reaches at least as far inland as Stanthorpe. Outside Australia, *D. burmannii* ranges through New Guinea and Indonesia as far as South China and Japan and across to Burma, India and Ceylon. Specht and Mountford (1958) mention West Africa in which case the total range almost equals that of the very widespread *D. indica*.

The only species of similar rosetted habit which could be confused because of overlap in range are *D. petiolaris* (with long dilated petioles bearing a distinctive woolly covering) and *D. spathulata* (with spatulate leaves and 3-4 styles not brushlike at the apex).

Possession of stipules in *Drosera* is usually associated with perennation in the form of resting buds (life form: hemicryptophyte) in which the stipules serve to protect the buds during periods of adverse conditions. However Arnhem Land specimens of *D. burmannii* are described in Specht and Mountford (l.c.) as therophyte (regenerating only from seed and taken in this case to mean "annual"). Plants observed near Brisbane do seem to disappear completely after seeding but 60 miles to the north and at Stanthorpe to the south, specimens were found to carry the remains of leaves from growth over several seasons indicating a perennial (hemicryptophyte) mode. These differences are probably functions of the climate and may even vary in a given locality according to the severity of the seasons. Adaptability of this kind and by way of a variety of vegetative structures is common in the genus and has probably contributed greatly to its almost world-wide distribution.

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