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Photography by M. Fagg

BULBOPHYLLUM WEINTHALII

The beautiful tiny *Bulbophyllum* orchid is shown to correct size on page 215.

NATIVE AUSTRALIAN ORCHIDS

Their cultivation and propagation

An Introduction to Orchids

by Brian Muffet, Canberra Botanic Gardens

Orchids are flowering plants. They are opposed to such plants as fungi, mosses and ferns which do not produce flowers.

The family of Orchids are collectively known as Orchidaceae.

It is a well developed family, though variable to the extreme. Orchids inhabit almost every climatic zone on Earth, from the slopes of Mount Everest to the edges, and even the centre in some cases, of the most arid lands. The orchid *Oncidium olivaceum* var. *nubigenum* lives and flowers in constant snow on a mountain in Columbia, South America.

Some grow as semi-aquatics and others, such as the Australian plants *Cryptanthemis slateri* and *Rhizanthella gardneri* are actually sub-terrestrial. They develop and mature their flowers below the surface of the soil, and are only found by accidental digging.

Orchids are perennial herbs with the only known exception to date being *Zeuxine strateumatica* which is an annual. Their habit is very variable. They can be found growing on trees and shrubs and are known as "Epiphytes" or aerial rooted plants, or on rocks when they are termed *lithophytes*. Those which grow in or on the soil are known as *terrestrials*, and certain of the terrestrials grow in association with decayed wood and are termed *saprophytes*.

Most temperate orchids are terrestrial in habit, while those from tropical areas are mostly *epiphytic* or *lithophytic*. There are exceptions of course, some can adapt their growth to be equally at home on trees, rocks, or in the soil, while orchids like the Australian genus *Galeola* are terrestrial vines which climb or clamber to heights of 13 metres or more.

As far as present knowledge goes, no orchid is truly parasitic, such as the *Mistletoes* (*Loranthaceae*) etc. To the lay person, the sight of orchids growing on trees, sometimes in extremely large clones, their roots travelling for many feet and indeed completely covering branches, would lead them to such a conclusion. The tree, though referred to as a "host" tree supplies the orchid with a place to spread its roots so that they can absorb moisture and mineral salts for their existence.

Vegetatively the family of orchids is divided into three main groups, Sympodial, monopodial and pseudomonopodial. In the sympodial tribes, genera such as *Eria*, *Bulbophyllum*, for example, the growth of the principal part of the plant or the axis, continues to grow annually, producing pseudobulbs joined by a short *rhizome*, each pseudobulb capable of forming adventitious roots. In the monopodial genera such as *Vanda* and *Sarcochilus*, the axis continues to grow annually from the same stem, producing new leaves at the apex, and new roots from the older part of the stem. The pseudomonopodial genera such as *Camarotis* are intermediate between the two, having stems that elongate annually and produce lateral shoots as well.

Terrestrial genera such as *Glossodia* and *Pterostylis* are characterized by their basal leaves and possession of an underground tuber. They are deciduous and produce new tubers annually. A single tuber may produce as many as 6 new tubers in a season. These are produced by a rhizome like appendage of the stem below ground level.

Other genera of terrestrials such as *Cryptostylis* arise from underground rhizomes.

(Continued on page 236)

GROWING BULBOPHYLLUM

by Brian Muffet, Canberra Botanic Gardens

The genus *Bulbophyllum* Thou. is the largest genus of the Orchidaceae. It contains approximately 2000 species and varieties. The distribution of this great number is vast occurring in most tropical, subtropical areas and some temperate zones and reaches its greatest concentration in New Guinea where some 600 species occur.

The Australian species are found from far North Queensland to South Eastern New South Wales. They are mainly confined to the coastal strip occurring from sea-level to altitudes of 3000' to 4000' and generally favour rain or cloud forest areas. The Australian species number 20 with one species *Bulbophyllum macphersonii* Rupp. having 2 varieties.

Some species are extremely floriferous though small flowered compared with other genera. They are easy to re-establishment though most species will lose some growth initially. Because of the natural range of altitude of some species it is helpful to know the origin of plants and grow those from higher altitudes in a cooler spot than those from tropical lowlands.

Due to the elongated rhizomes of most species of *Bulbophyllum*, few if any are adaptable to pot culture, preferring a slab or limb as a suitable host where they can grow undisturbed for a long period of time.

In Canberra all species are grown in glasshouses but in more temperate areas bush and shadehouses are ideal. Most species require more winter moisture than tropical *Dendrobiums*.

Bulbophyllum elisae F. Muell. occurs as either an epiphyte or occasionally a lithophyte. It is a temperate species and requires a cool spot 50% shade and moderate winter moisture. I have found that the plants occurring naturally as lithophytes are easier to re-establish.

Bulbophyllum weinthalii Rog. occurs as an epiphyte on *Araucaria cunninghamii* at altitudes of between 2500' and 3500'. This species appears to be one of the most difficult to re-establish. Its main requirement is the choice of a suitable host and branches of its natural host would seem best though not easily obtained. The shade requirement is probably best around 60% and the watering will depend upon the ability of the host to retain moisture. The cultural requirements of this species should be the subject of further study as it is one of the most attractive of the genus, being floriferous and relatively large flowered.

Bulbophyllum minutissimum F. Muell. is either epiphytic or lithophytic usually found at lower altitudes in fairly open country. Its usual hosts are species of *Ficus* and branches of the host are suitable in cultivation though the bark is not persistent enough to allow for undisturbed growth for any suitable great period of time. Pieces of *Quercus suber* the Cork Oak seem a suitable alternative host. Shade of 60% and constant moisture is necessary.

Bulbophyllum exiguum F. Muell. occurs in a wide range of habitats. It is a widespread and common species being found from South Eastern New South Wales northwards almost to the tropics. It is either epiphytic or lithophytic and can be found growing in dryer situations than most other species of the genus. Many varieties of host are suitable and a shade intensity of 40% to 60% is ideal.

Once established all *Bulbophyllum* spp. respond well to feeding both organic or inorganic fertilizers during the main period of growth. Light applications of organic foods such as 'Nitrosol' or Fish Emulsion may be given at any time of the year with good affect. Most species do not experience such clearly defined periods of growth and dormancy as evident in other genera, and should not be allowed to dry out at any time of the year.

Bulbophyllum globuliforme Nich. occurs in similar situations to *B. weinthalii* and the cultivation requirements are somewhat similar.



Photography by A. McWhirter

BULBOPHYLLUM BAILEYI

The cream flowers with irregular reddish purple spotting, comparatively large petals and small tongue-like lip, are a feature of this species. It is not the policy of this publication to magnify flowers in colour plates but perhaps we will be forgiven in the case of the tiny *Bulbophyllum*. These flowers are 2-3 cm. across as described on page 212.—Editor.

Bulbophyllum baileyi F. Muell. is also epiphytic or lithophytic. It ranges from sea-level to about 3000'. The origin of plants of this species seems most important when re-establishing. The plants from higher elevations being easier to start moving again. Host of either *Melaleuca* or tree fern seem best suited to this species because of their capacity to hold moisture. Shade of from 50% to 64% is ideal.

The remaining species *B. macphersonii* Rupp., *B. aurantiacum* F. Muell., *B. bowkettiae* F. M. Bail., *B. johnsonii* Hunt & Rupp., *B. lageniforme* F. M. Bail., *B. crassulifolium* (A. Cunn.) Rupp., *B. newportii* (F. M. Bail.) Rolfe, *B. bracteatum* F. M. Bail., *B. lilianae* Rendle, *B. evasum* Hunt & Rupp., *B. wadsworthii* Dockr., *B. gadgarrense* Rupp. though from different habitats along the east coast of Australia are all adaptable to very similar cultivation. Their requirements are herein treated together. A wide range of hosts are suitable though many growers seem to favour medium texture tree fern slabs. Shade of 56% to 72% is ideal with a good supply of water during the growing season.



Photography by J. Wrigley

BULBOPHYLLUM GADGARRENSE

Cirrhopetalum umbellatum see A.O.R. 1972 (the author citation of *C. umbellatum* is not stated) syn. *Bulbophyllum clavigerum* (FitzG.) F. Muell. This species has been removed from the genus *Bulbophyllum* and has become the only Australian representative in the allied genus *Cirrhopetalum*. The plant is similar in appearance to *B. baileyi* and can probably be cultivated in much the same manner though I have had no experience with this species.

AUSTRALIAN BULBOPHYLLUM

by A. W. Dockrill

The genus *Bulbophyllum* is the largest of all of the orchid genera, comprising about 2,000 species and varieties. Some species occur in almost all of the tropical, subtropical and temperate countries of the world, even in New Zealand. The greatest development occurs in New Guinea where there are about 600 species. Compared with New Guinea, Australia is poorly represented with only about 21 known species (and one, from near the tip of Cape York Peninsula, as yet unidentified).

In this genus, each spasm of growth (branch of the sympodium) consists of a length of prostrate or pendulous rhizome (from very short to rather long) terminated by a pseudobulb of one internode which, in turn, is terminated by a solitary non-sheathing leaf. New branches of the sympodium commence growth either from the base of the pseudobulb in front of the end of the previous branch and often in line with it so that the rhizome looks continuous, or from nodes of the rhizome. The pseudobulbs may be almost vestigial, minute, small or rather large, vary in shape and be from erect to prostrate and rhizome-embracing. Leaves vary from vestigial to very large and may be thin or thick and fleshy. The inflorescences arise from the base of the pseudobulbs or from nodes on the rhizomes and are from very short to long and from one flowered to many-flowered and when plural-flowered, the flowers may be scattered along a stalk, clustered at the tip of a stalk or be in a fan or circlet. The flowers vary from minute to quite large and assume a wide variety of shapes and colours. The top sepal may be from almost vestigial to quite large. The side sepals are joined at their bases to form a chin (mentum) which is often open in front but these sepals are also sometimes joined for varying distances either on the bottom or top margins and sometimes they are very much longer than any other segment of the flower. The petals are usually very much smaller than the side sepals but sometimes are almost the same size. The lip, in typical members of the genus, is usually small but may be moderate in size, is hinged (sometimes tremulously so) to the tip of the upturned column foot and is usually rather simple in structure (often thick and $\pm$ tongue-like) but may be thin or complex in structure; in some sections of the genus. However, the lip is rigidly attached to the base of the column and it is possible that at some future date someone will remove these from the genus *Bulbophyllum*. The column is short, usually has a $\pm$ well developed erect horn-like tooth on either side at the front of its top but sometimes these teeth (stelidia) are vestigial; the column foot is usually well developed and either curved or bent upward or forward but may sometimes, as referred to above, be vestigial.

The genus has been subdivided into at least 6 subgenera and numerous sections but these need not concern us here except to say that Australia has representatives in 12 sections (13 if we include the unidentified Cape York Peninsula species). Of the 22 Australian species of the genus, 16 are found in the eastern Tropics where 12 of them are endemic with 2 extending to N.E. New South Wales and probably 2 to New Guinea. The 6 non-tropical species occur in eastern New South Wales and south-eastern Queensland.

Cirrhopetalum is treated as a separate genus by some authors and as a section of *Bulbophyllum* by others. It falls within the description of the genus as given above so is herein included in *Bulbophyllum*.

CULTIVATION OF BULBOPHYLLUM

Most members of the genus respond to ordinary methods of cultivation for epiphytes and are usually rewarding subjects. Most species have short thin roots and are small plants and hence do not require great quantities of compost; if grown in pots, the pots should be at least $\frac{3}{4}$ full of crocks and the compost that is used for most epiphytes (every grower has his own

ideas on compost, varying from a highly porous but rich mixture to gravel with frequent applications of liquid fertilizer). They can also be tied to slabs of hardwood or even treefern root and also usually romp along if tied to a suitable live host tree. This latter varies considerably according to climate but citrus trees and frangipanni are usually suitable.

KEY TO THE AUSTRALIAN SPECIES OF BULBOPHYLLUM

- 1a plants large for the genus (as known in Australia) with well-developed pseudobulbs & leaves; the combined length of these being at least 10cm. unless the plant is growing under very adverse conditions—
 - 2a inflorescences plural-flowered—
 - 3a Flowers in a whorl; lateral sepals joined along their front margins; petals fringed *umbellatum* 1
 - 3b flowers not in a whorl but in a $\pm$ second raceme; lateral sepals free; petals not fringed *elisae* 2
 - 2b inflorescences not plural-flowered but 1-flowered—
 - 4a Flowers about 2 cm. or more in diam.—
 - 5a inflorescences short; flowers usually facing upward *baileyi* 3
 - 5b inflorescences tall (at least as tall as the leaves); flowers usually facing forward—unidentified Cape York Peninsula species.
 - 4b flowers not attaining 2 cm. diam. (usually under 1 cm. in the fresh state; flowers not widely opening) inflorescences moderately tall but not as tall as the leaves *nematopodium* 4
- 1b rather small to very small plants with the combined length of pseudobulb & leaf less than 10 cm. (seldom as long as 7 cm. & usually less)—
 - 6a side sepals joined for at least part of their length; plants with creeping or pendulous sympodia; pseudobulbs small; leaves thick & fleshy; segments of flowers of diverse form—
 - 7a sympodia normally not pendulous—
 - 8a flower stalk (peduncle) moderately long; flowers dark red or purple; lip with ciliate margins *macphersonii* 5
 - 8b peduncle very short; flowers with sepals which are not red or purple (but whitish with yellowish or orange tips); margins of lip not ciliate *crassulifolium* 6
 - 7b sympodia normally pendulous *aurantiacum* 7
 - 6b side sepals not joined to each other—
 - 9a plants with sympodia which are creeping, either short or long, rooting to the host tree or rock almost throughout their length & are not normally pendulous or stem-like—
 - 10a inflorescences 1-flowered—
 - 11a plants of moderate size with well-developed leaves—
 - 12a plants compact with rhizomes short & branching & the pseudobulbs closely appressed to each other; inflorescences very short with the peduncle too weak to support the weight of the comparatively large flower; side sepals almost as broad as long *weinthalii* 8
 - 12b rhizomes elongated with pseudobulbs spaced well apart; inflorescences rather tall or short but peduncle rigidly erect; side sepals at least twice as long as broad—
 - 13a side sepals almost evenly tapered from the base to a sharp point; lip grooved in the back 2/3rd *bowkettiae* 9
 - 13b side sepals not evenly tapered; lip grooved on top in the front 1/3rd only *johnsonii* 10
 - 11b plants diminutive with very small pseudobulbs & vestigial leaves—
 - 14a pseudobulbs flat; flowers red & on short peduncles *minutissimum* 11
 - 14b pseudobulbs not flat ($\pm$ egg-shaped); flowers not red & on long peduncles *globuliforme* 12
 - 10b inflorescences normally plural-flowered—
 - 15a pseudobulbs well-developed; leaves thin; flowers not densely crowded at the tip of the inflorescence—
 - 16a lip with 2 converging keels & 2 less prominent ones (flowers few; leaves rather long & very narrow) *lageniforme* 13
 - 16b lip without keels—
 - 17a lip with inconspicuous thread-like side lobes & a few short hairs on the margins & part of the disc shortly hairy or warty *newportii* 14
 - 17b lip without side lobes & neither hairy or warty anywhere—
 - 18a flowers in a dense raceme, heavily blotched with purple; lip very thick; pseudobulbs crowded together *bracteatum* 15
 - 18b flowers neither in a dense raceme nor heavily blotched with purple; pseudobulbs usually spaced well apart—
 - 19a nerves of the sepals & ovary dotted with warts; top sepal cap-like; lip not constricted at about the middle (& margins of the lip rolled) *lillianae* 16
 - 19b nerves of the sepals not dotted with warts; top sepal not cap-like; lip constricted at about its middle *exiguum* 17
 - 15b pseudobulbs very small; leaves very broad, rather thick & fleshy; flowers densely crowded into a head at the tip of the inflorescence *evasum* 18
 - 9b plants with sympodia which are stem-like, but may be branching, usually pendulous, rooting to the host or rock only near the base but other roots may be rhizome-embracing; inflorescences very short but may be in clusters—
 - 20a lip hairy on the under surface *radicans* 19
 - 20b lip not hairy on the under surface (& leaves very thick & fleshy & grooved)—
 - 21a leaves without petioles; sepals constricted near their tips & sharply pointed *wadsworthii* 20
 - 21b leaves with petioles; sepals not constricted & not sharply pointed *gadgarrense* 21

1. *Bulbophyllum umbellatum* (formerly known as *B. clavigerum*).

(Opinions are divided about the advisability of treating the sections to which this species belongs as a separate genus, if so, then this species would be *Cirrhopetalum umbellatum*).

Plant growing into compact clumps. Pseudobulbs about 1.5 x 1.25 cm., conical or egg-shaped. Leaves 4-15 x 2-3 cm., oblong. Inflorescences 10-20 cm. long, with 6-8 flowers in a horizontal semicircle. Flowers averaging about 4 cm. long, the sepals usually greenish cream, ageing to dull yellow, with purple dots and suffusions and the petals and lip purple. Top sepal about 8 x 5 mm., cap-like with a hair-like process at its tip. Side sepals 20-40 x 2-4 mm., joined together for about $\frac{3}{4}$ of their length. Petals 6-9 x about 2 mm., almost triangular with hairy margins. Lip 4.5 x about 2 mm., curved almost into a semicircle.

Apparently confined to the north-eastern half of Cape York Peninsula (but does not appear to be anywhere common) but with an extensive range overseas.

2. *Bulbophyllum elisae*

Plant usually seen as compact clumps on trees or occasionally rocks. Pseudobulbs 1.5-3 x 1.2 cm., $\pm$ egg-shaped, grooved and rather knobby. Leaves 3-11 x 0.8-1.4 cm., $\pm$ narrowly oblong. Inflorescences 8-25 cm. long, containing from a few to about 12 flowers which usually $\pm$ face the same direction. Flowers about 15-22 mm. long, usually a vivid green but occasionally pale with a pinkish tinge or rarely wholly reddish purple; lip dark red or purple; sepals directed $\pm$ forward. Top sepal 6-8 x about 3 mm., ovate. Side sepals 15-22 x 3-4 mm., tapered from the base to the tip. Petals about 3 x 2 mm. and having a blunt tip. Lip slightly longer but narrower than the petals and ovate or oblong when viewed from above.

This is typically a mountain species and its range extends from the Blue Mountains of central New South Wales to south-eastern Queensland.

3. *Bulbophyllum baileyi*

Plant sometimes growing into extensive masses, at other times into long strands on either trees or rocks. Pseudobulbs about 12-30 x 10-15 x 7-12 mm., $\pm$ flattened egg-shaped, $\pm$ prostrate and rhizome-embracing. Leaves $\pm$ erect, 5-20 x 2.5-5.5 cm., usually $\pm$ oblong, moderately thick, brittle. Inflorescences 4-10 cm. long, 1-flowered. Flowers strongly scented, usually facing upward, 2-3 cm. diam. (flattening to 3-4 cm.). The sepals and petals are $\pm$ equal in length, incurved, white or cream with irregular red or purple spots or blotches on both sides and the whole flower turns pink or pale purple after maturity. Lip 5-6 x 2.5-3.5 mm., $\pm$ tongue-shaped.

Occurs in a wide variety of situations throughout the eastern tropics.

4. *Bulbophyllum nematopodum*

Pseudobulbs densely massed together to obscure the rhizomes and usually covered with the hair-like remains of bracts, 12-20 x 5-9 mm., globular or egg-shaped with a long neck. Leaves 4-13 (of which the petiole is 1-3) x 1-2 cm., $\pm$ oblong, slightly fleshy. Inflorescences 3-7 cm. long, 1-flowered. Flower $\pm$ nodding, about 1 cm. long, not widely expanding, pale yellowish green or cream with some delicate red spotting on the inside and the lip red. Top sepal somewhat shorter than the side sepals. Petals minute. Lip about 2.5-3.0 x 2.0 x 1.5 mm., $\pm$ tongue-like.

Typically a mountain species, occurring above 660 m. in the southern half of the eastern tropics.

5. *Bulbophyllum macphersonii*

Grows on trees or occasionally rocks, forming densely matted smallish clumps. Pseudobulbs closely appressed to each other along the sympodia, 1.0-1.5 mm. long, from globular to egg-shaped. Leaves erect or decumbent, 10-25 x 2-4 mm., variable in shape and thickness but usually very thick and fleshy, grooved on the upper surface and rounded on the lower surface. Inflorescences 2-5 cm. long, 1-flowered. Flowers with the side sepals uppermost and joined together, 10-15 mm. diam. in var. *macphersonii*, 15-25 mm.

diam. in var. *spathulatum*, widely opening, deep red or purple. Sepals about equal in length. Petals almost the same length as the sepals, with a tail-like tip and fringed. Lip tremulous, as long as sepals, $\pm$ spoon-shaped, fringed.

Mainly occurring at altitudes above 470 m. in the southern half of the eastern tropics but its northern limit is not known for sure.



Photography by R. Deane

BULBOPHYLLUM MACPHERSONII—Three times natural size

6. *Bulbophyllum crassulifolium*

Plants growing on trees or rocks, forming extensive matted masses. Pseudobulbs 2-3 x 2-3 mm., depressed globular or egg-shaped. Leaves usually without a petiole, 15-40 x 4-8 mm., very variable in shape, usually $\pm$ elliptic, very thick and fleshy, grooved on the upper surface. Inflorescences 5-9 mm. long, 1-flowered. Flowers not widely opening, about 4-5 mm. long, whitish with the sepals yellowish- or orange-tipped and the lip reddish brown. Top sepal 4-5 x about 2 mm. Side sepals joined for almost half of their length, about the same length as the top sepal. Petals about 2 x 1.5 mm. Lip about 2 x 1 mm. when flattened but in the fresh state is curved downward or even rolled almost into a circle from about the middle.

A species with a distribution from south-eastern New South Wales through eastern Queensland practically to the Tropics. It grows under a variety of conditions from almost sea level to about 1000 m.

7. *Bulbophyllum aurantiacum*

Plants growing on trees as a bunch (usually few) of pendulous sympodia up to 40 cm long, which are rooted to the host from near the base only. Pseudobulbs erratically spaced, 3-8 x 2-4 mm, usually decumbent, cylindrical to globular but flattened on top and usually partly obscured by the remains of bracts. Leaves 1.5-10 x 0.8-2.5 cm., extremely variable in shape and thickness but thick to very thick and fleshy. Inflorescences solitary or in clusters of up to 10 in number, rarely more than 3 or 4 mm long, 1-flowered. Flowers 3-7 mm long, barely opening, usually cream or pale green near the base, the remainder red or orange but occasionally cream or pale green throughout. Sepals $\pm$ similar 3-7 x 1-2 mm, the side sepals joined together practically throughout their length. Petals 1-3 x 0.7-2 mm. Lip about 1.4-2.0 x 0.8-1.2 mm, curved gently throughout its length and the margins shortly fringed. Occurring from mangrove swamps to over 1200 m in closed forests from the Hunter River in central N.S.W. to about the middle of eastern Cape York Peninsula.

8. *Bulbophyllum weinthalii*

Plants growing into masses so densely packed that the pseudobulbs are often of very irregular shape. When mis-shapen, the pseudobulbs are 80-20 x 5-15 mm and $\pm$ egg-shaped and the younger ones are clothed in woolly bracts. Leaves 15-30 x 4-9 mm, usually $\pm$ oblong, not thick and fleshy. Inflorescences usually shorter than the pseudobulbs and too weak to support the solitary flower. Flowers 15-20 mm diameter, widely opening, white, cream or pale green either heavily and irregularly marked and suffused with red, reddish brown and reddish mauve or with rather numerous irregular small spots of the same colour; the lip is purple or mauve. The sepals are broad but the petals are narrower and shorter. The lip is about as long but twice as broad as the petals, $\pm$ oval but curved.

A temperate species, occurring from the Dorrigo Plateau of N.E. New South Wales to the ranges of the extreme south-east of Queensland. It seems to confine itself to hoop pine as a host at altitudes 650-1500 m.

9. *Bulbophyllum bowkettiae*

Plants growing with the pseudobulbs widely spaced along the rhizome. Pseudobulbs 7-11 x 3-5 mm, depressed egg-shaped, rhizome-embracing ($\pm$ prostrate). Leaves 7-25 x 4-12 mm, ovate, not thick and fleshy. Inflorescences 5-10 mm long, 1-flowered, the flower nodding. Flowers about 6-8 mm diameter appearing to be red but sometimes cream with pink stripes; the sepals are moderately broad; the petals are much smaller than the sepals, the lip is 2-2.5 x about 0.7 mm, $\pm$ tongue-like.

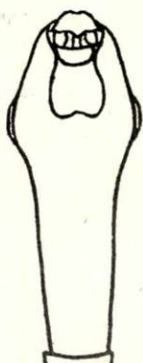
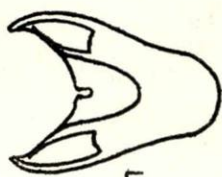
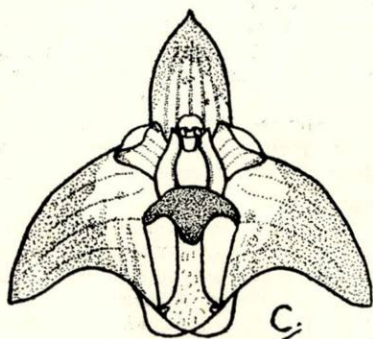
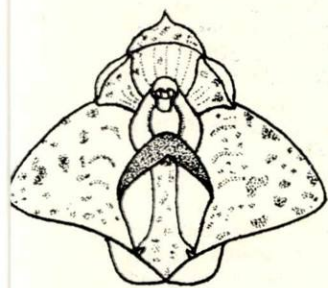
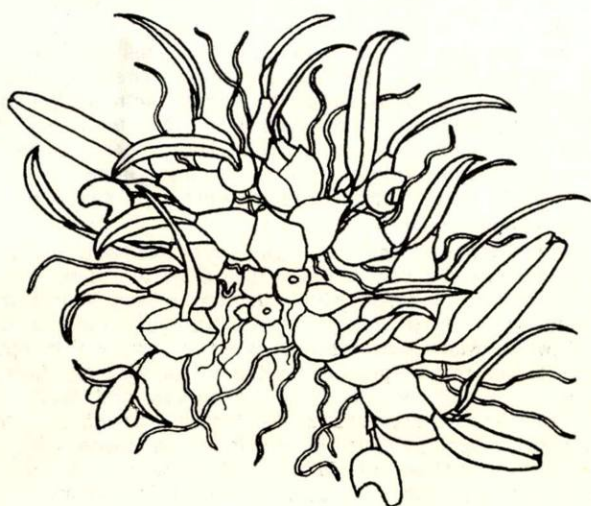
Occurring in the southern half of eastern Cape York Peninsula, this species is usually found above 600 m altitude but toward the southern limits of its range at least, it extends to the coastal lowlands.

10. *Bulbophyllum johnsonii*

An extremely variable species. Pseudobulbs spaced well apart on the rhizomes, and $\pm$ rhizome embracing, 7-18 x 7-15 mm, obliquely depressed conical to egg-shaped but the degree to which they are oblique and depressed varies considerably; their colour varies also from green to red. Leaves 1.5-7 x 1-2 cm, from almost narrowly oblong to almost circular but usually ovate, not thick and fleshy. Inflorescences 1-3 cm long, 1-flowered with the flower not nodding as much as in *B. bowkettiae*. Flowers 10 to almost

BULBOPHYLLUM WEINTHALII—In colour on front cover—Key to sketch opposite

- A. Plant shown full size.
- B. Flower of typical form from the front to scale x 3.
- C. Flower of "red" form from the front to scale x 3.
- D. Flower of typical form from the side to scale x 3.
- E. Longitudinal section of column and labelum to scale x 5.
- F. Labelum from above to scale x 5.
- G. Pollinia from the front to scale x 10.
- H. Pollinia from the side to scale x 10.
- I. Column from the front to scale x 5.
- J. Anther from above to scale x 10.
- K. Anther from the side to scale x 10.



20 mm wide, dominated by the widely expanded side sepals which are $\pm$ oblong, are typically a glossy yellow but may be greenish yellow, orange or red. The top sepal forms a hood over the column and lip, is shorter and narrower than the side sepals and tapered. The petals are much smaller than the sepals and are usually yellowish, but always seem to have a large red blotch near the tip. The lip is about the same length as the top sepal, is $\pm$ narrowly tongue-shaped, usually yellow in the front half and red at the back but sometimes there is no red. This species occurs in the southern half of the eastern tropics, mainly on the ranges at an altitude of 600-1200 m. but in some areas extends almost to sea level.

11. *Bulbophyllum minutissimum*

Plants growing, either on trees or rocks, into extensive masses which can be readily mistaken for a lichen. Pseudobulbs 2-3 mm diam., $\pm$ circular, flat, dark green and often suffused with red. Leaves less than 1 mm long, narrow, not persisting for long. Inflorescences averaging about 3 mm long. Ovaries hairy. Flowers with sepals 2-3 x about 2 mm, which open fairly well and have 3 broad red stripes giving the effect that the flower is all deep red. Petals about half the length of the sepals, and much narrower. Lip slightly shorter than the sepals and about 1 mm broad, $\pm$ tongue-like.

A species with a sporadic distribution from the Clyde River of S.E. New South Wales to south-eastern Queensland, occurring in the lowlands or low in the ranges, and does not seem to occur in rainforests.

12. *Bulbophyllum globuliforme*

Plants growing on trees (often the branches of hoop pine) either as long strands, or into closely packed masses. Pseudobulbs 1-2 mm diam., globular or egg-shaped, pale green. Leaves 1.0-1.5 mm long very narrow. Inflorescences 10-15 mm long, 1-flowered. Ovaries glandular but not hairy. Flowers with rather broad sepals, about 3 mm long, which open moderately well, white or cream, sometimes suffused with pale yellow or rarely crimson; lip pale yellow. Petals slightly shorter than the sepals but only about half their breadth. Lip 1.5-2.0 x about 1 mm, somewhat tongue-like.

Apparently confined to the ranges of N.E. of N.S.W. & S.E. Qld.

13. *Bulbophyllum lageniforme*

Plants growing into small clumps with the pseudobulbs close together. Pseudobulbs rhizome embracing but usually $\pm$ erect 5-10 x 5-10 mm, usually depressed ovoid or almost flat but sometimes $\pm$ conical, usually grooved. Leaves 4-10 x 0.4-0.8 cm, linear. Inflorescences 4-7 cm long, usually 2-flowered but varying from 1- to 4-flowered. Flowers $\pm$ bell-shaped, averaging about 8 mm long, usually pale green with brown veins but sometimes cream or rarely pale pink and the nerves of the sepals rough and warty. Top sepal 7.0-8.5 x 2.5-3.0 mm; side sepals slightly longer than the top sepal and about twice as broad at the base. Petals 5-6 x about 2 mm. Lip about 6 x 3.5 mm, somewhat tongue-like, curved through about 180°, having 2 keels which converge and 2 less prominent ones, one on either side of the first-mentioned pair.

This rather rare species is apparently confined to south-eastern Cape York Peninsula or extending a little south at altitudes above 770 m.

14. *Bulbophyllum newportii*

Plants growing on either trees or rocks, sometimes forming extensive masses. Pseudobulbs 7-15 x 6-12 mm, globular, egg-shaped or conical, shallowly grooved. Leaves 3-7 x 0.5-1.0 cm, $\pm$ linear. Inflorescences 4-9 cm long, containing 2-8 flowers. Flowers 4-6 mm diam., usually not very widely opening, white, sometimes ageing to pale pink or rarely pale pink or pale green when first opened. Top sepal 5-7 x 2.5-3.0 mm. Side sepals about the same length but a little broader. Petals about half as long and half as broad as the side sepals. Lip about 3 x 1.5 mm, tongue-like with thread-like side lobes, which vary in length.

A common orchid at altitudes of from 600 to 900 m in the southern half of the eastern tropics.

15. *Bulbophyllum bracteatum*

Plants growing in dense masses which are usually rather small but may grow to be quite extensive, the pseudobulbs packed close together. Pseudobulbs 7-12 mm diam., depressed globular and grooved. Leaves 15-30 x 7-11 mm, $\pm$ oblong. Inflorescences racemose, 5-10 cm long, containing up to 25 closely packed flowers. Flowers about 6 mm diam., widely opening, cream or yellow and rather densely mottled with purple. Top sepal 3-4 x 2-2.5 mm. Side sepals about the same length but very slightly broader. Petals about half the length of the sepals and only about 0.7-0.8 mm broad. Lip about 2 x 1 mm, tongue-like, extremely thick.



Photography by M. Hodge

BULBOPHYLLUM BRACTEATUM**16. *Bulbophyllum lilianae***

Plants usually growing on slender branches of trees (but occasionally on thicker branches or even rocks) in long strands with the pseudobulbs

spaced apart. Pseudobulbs 4-12 x 3-5 mm, varying from depressed egg-shaped and rhizome-embracing to erect and conical, usually but not always grooved and rough to varying degrees. Leaves 7-25 x 4-8 mm, often, but not always, bent at about right angles to the pseudobulb. Inflorescences 15-25 mm long, usually containing 2 flowers but may be 1-flowered or 3-flowered. Flowers only moderately spreading, reddish, the sepals and petals having 3 darker stripes. Top sepal 4.0-6.5 x 2.0-2.8 mm, side sepals slightly shorter but 3-4 mm broad at the base. Petals 2.5-4.0 x 1-2 mm. Lip 2.5-3.5 x 1.2-1.7 mm., tongue-like with a groove on top and rolled margins.

A species of the cloud forests (above 900 m.) S.E. Cape York Peninsula.

17. *Bulbophyllum exiguum*

Plants growing on either trees or rocks, forming quite extensive mats several metres square under suitable conditions. The pseudobulbs, however, are not crowded on the rhizomes. Pseudobulbs 4-10 x 3-8 mm, globular to egg-shaped, shallowly grooved. Leaves 15-50 x 5-9 mm, $\pm$ narrowly oblong. Inflorescences few-flowered. Flowers 8-10 mm diam., widely opening, pale green to creamy white. Top sepal 4-6 x 1-1.5 mm; side sepals about as long but 2.0-2.5 mm broad. Petals 2-3 x 1.5 mm $\pm$ oval. Lip about 3-4.5 x 1 mm, somewhat narrowly tongue-like but not very thick.

Widely distributed from south-eastern N.S.W. into the south eastern tropics.

18. *Bulbophyllum evasum*

Plants growing on trees or rocks into strands several metres long. The rhizomes are very brittle and the pseudobulbs not spaced close together. Pseudobulbs 4-7 x 3-4 x 1-2.5 mm, closely prostrate or fused to the rhizome and almost covered by 1 or 2 sheathing bracts so that their presence is often overlooked. Leaves 1.5-3.5 x 1-3 cm., circular, oval or oblong, usually about 2 mm thick, fleshy. Inflorescences 4-10 cm long, with 15-25 flowers congested at its tip. Flowers 3-3.5 mm long, not widely opening, pink with broad dark red nerves on the sepals and petals and the top sepal and petals often yellow tipped. Top sepal 3-3.5 x 1.5-1.8 mm, somewhat cap-like; side sepals about the same length but slightly broader at the base. Petals 2.5 x 1 mm., curved. Lip 1.5 x 1.1 mm somewhat tongue-like, densely warty.

Occurs in the southern half of the eastern tropics at alt. above 770 m.

19. *Bulbophyllum radicans*

Plants, which grow on trees or rocks, develop into bunches of strands (sympodia) up to 40 cm. long, which are pendulous but become upcurved, are rooted to the host or rock from near the base only but other roots may be rhizome-embracing.

Pseudobulbs not very widely spaced, prostrate or semiprostrate and partly obscured by bracts, 5-15 x 2-3 mm., cylindrical or egg-shaped with a cut off appearance on top. Leaves 3-8 x 0.7-1.8 cm., variable in shape, slightly thickish. Inflorescences 6-10 mm. long, not in bunches as in *B. wadsworthii*, partly obscured by bracts, 1-flowered. Flowers about 4 mm. long, 3-5 mm diam., not very widely opening, sepals and petals pinkish or cream with dark red margins and the sepals have three red stripes and the petals one and the lip red and yellow; sometimes, however, the whole flower is butter yellow. Sepals 4-5 x 1.5-2.5 mm. Petals much smaller than the sepals. Lip 2.5 x 3 x about 1 mm., $\pm$ tongue-like, hairy under.

A rather common species in the southern half of the eastern Tropics, in a variety of conditions at altitudes from almost sea level to 1100 m.

20. *Bulbophyllum wadsworthii*

Plants which grow on trees, or occasionally rocks, developing into a small bunch of pendulous sympodia up to 25 cm. long which are rooted to the host from near the base only, but other roots may be rhizome-embracing.

Pseudobulbs $\pm$ prostrate and partly obscured by bracts, about 5-6 x 3-4 mm.; $\pm$ cylindric with a cut-off appearance on top. Leaves without petioles, 20-60 x 5-8 x 3-6 mm., very thick and fleshy, the sides $\pm$ parallel and with a V-shaped groove on top. Inflorescences 1-3 in a group, 2-5 mm. long, 1-flowered. Flowers about 6 mm. long and the tips of the sepals

about 6 mm. apart, white, cream or pale green with a pale orange lip. Sepals $\pm$ similar, 5-7 x 1.5-2.0 mm, $\pm$ triangular or almost oblong and constricted to long, thick, tapering sharp points. Petals very much smaller than the sepals and they have blunt tips. Lip about 1.2 x 0.7 mm, $\pm$ tongue-like, bent at right angles at about 1/3rd the length from the tip.

Occurring in the southern half of the eastern tropics, mainly in cloud forests above 770 m.

21. *Bulbophyllum gadgarrense*

Plants growing on trees, or rarely rocks, developing into a bunch of pendulous and usually branched sympodia up to 20 cm long, which are rooted to the host only at the base but other roots may be rhizome-embracing; rhizomes covered by purple bracts.

Pseudobulbs $\pm$ prostrate, at least partly covered by bracts, 4-6 x 1-1.5 mm, cylindric. Leaves with short petioles, 15-30 x 3-4 x 2.5-4 mm, usually narrowly ovoid, deeply grooved on top. Inflorescences usually single, rarely in bunches, about 4-5 mm long, at least partly covered by bracts, 1-flowered. Flowers averaging about 5 mm long and the tips of the sepals spreading to about 5 mm apart, the sepals white with the third part nearest the tip orange or yellow. Sepals $\pm$ similar, 5-6 x 1-1.5 mm, narrowly triangular but only slightly constricted at about the middle and not tapering to sharp tips as in *B. wadsworthii*. Petals very small and not sharply pointed. Lip about 1.0 x 1.7 mm, $\pm$ tongue-like, bent at right angles at about the middle.

This species is apparently confined to the cloud forests at altitudes above 770 m in south-eastern Cape York Peninsula.

***Bulbophyllum* Orchids**

HOW I GROW THEM by Robert Deane, Cheltenham, N.S.W.

Of the very large number of *Bulbophyllum* species only 21 are found in Australia. Their habitat is confined to the east coast from southern New South Wales to northern Queensland. They extend inland to the ranges with isolated plants being found on the western slopes. They mainly favour reasonably heavy shade and dampness. They are usually protected from the hot, dry winds although the odd plant will be found in an extremely exposed position.

Under cultivation I find that they do best under about 50% shade with an easterly aspect, thus only being exposed to direct sunlight in the early morning. As none of the Australian species are suitable for pot culture I find a block of tree fern fibre very suitable. Natural logs, bark, etc., can also be used but break down too rapidly, thus necessitating the re-establishment of the plant.

Although some of the *Bulbophyllum* species grow in a relatively low rainfall area most come from the higher rainfall areas. I find that they like copious water, especially by application with a fog nozzle. This tends to compensate for the heavy dews and clouds which would keep them damp under natural conditions. Those found on the north Queensland tablelands are quite often either in rain or cloud for the complete summer and autumn, while those from the lower areas are in a 100-inch rainfall area.

A few weak applications of fertiliser during the growing season are beneficial although it is preferable to give too little rather than too much.

Bulbophyllum aurantiacum—This plant is very similar to *B. crassulifolium* but the leaves are usually much flatter and the plant does not grow as densely. The flowers are similar in shape but usually large, and are a deep orange colour. This plant extends from northern New South Wales to northern Queensland and also flowers in the spring.

Bulbophyllum baileyi—This is one of the largest of the Australian *Bulbophyllum*, with pseudobulbs 2-3 cm. high, on thick, creeping stems. The single leaf is broad, up to 10 cm. long, and heavy textured. The flowers are produced singly and are very variable in colour and also as to the extent to which the flower opens. The colour ranges from cream to yellow with varied amounts of purple spotting. The flower measures up to 4 cm. across, and appears in summer. It grows in north Queensland below 3,000 feet and requires a glasshouse for Sydney conditions.

Bulbophyllum bowkettiae—This is a small plant with the pseudobulbs 2 to 4 cm. apart, each with a single leaf 1 to 2 cm. long. A single flower up to 1 cm. is produced on a short stem. It is red to cream with pink stripes. Flowers are produced at any time but mainly in winter. It comes from north Queensland usually above 2,000 feet.

Bulbophyllum bracteatum—Small, 5-sided pseudobulbs, closely packed on a creeping stem. The single leaf is up to 2 cm. long. The flowers are on long, drooping racemes with large and numerous bracts. The flower is very small, cream to yellow, with fine red spotting, long lasting and flowers in spring and early summer. It is found in northern New South Wales and southern Queensland. Colour plate on page 217.

Bulbophyllum clavigerum—This is the only Australian species in the *Cirrhopetalum* group of *Bulbophyllum* and is extremely rare, being found only in the rain forest area of Cape York Peninsula, the northernmost part of Australia. It has conical pseudobulbs about 3 cm. high with a thick leaf to 10 cm. long. The flowers are produced in an umbel and are about 4 cm. long. They are a greenish-cream, with purple spots and a purple lip. Flowers are produced in late summer.

Bulbophyllum crassulifolium—This plant has creeping stems with very small pseudobulbs each bearing a very thick, fleshy leaf. The leaf habit is very variable and they range from 2 cm. to 6 cm. long. The flowers are crowded along the stem, coming from beneath the bracts. They are white to cream in colour with a darker lip. The flower does not open widely and is about 3 mm. long. This is the most widely distributed of our *Bulbophyllum* species and is found from southern New South Wales to northern Queensland. Flowers appear in spring.

Bulbophyllum elisae—This plant has rather large pseudobulbs, 2-3 cm. high. They are deeply wrinkled and furrowed and bear a single leaf about 10 cm. long. The flowers are quite variable in size, ranging from 1-2 cm. across. They are from pale to deep green, with rather narrow segments. The lip is almost black and contrasts with the rest of the flower. Flowering time is not constant—ranging from autumn to spring. The plant extends from Sydney to southern Queensland.

Bulbophyllum evasum—This species does not appear to have a pseudobulb as it is more a continuation of the creeping stem. The main feature is the thick, leathery leaves up to 3 cm. long which occur about every 2 cm. along the stem. This stem is very brittle and great care must be taken when handling the plant. The flowers are produced in a cluster of up to 10, on a stem 6 to 8 cm. long. The flowers are very minute and a very dark red in colour. The complete cluster of flowers is less than 1 cm. across. It grows in the rain forests of north Queensland above 2,500 feet, and must be kept moist at all times. It will, in its natural habitat, flower almost continuously but under cultivation I have found it rather shy.

Bulbophyllum exiguum—Although a small plant it is often found in large masses on rocks and trees. The pseudobulb is about 5 mm. in diameter but not closely packed on an extensive creeping stem. The short racemes, with 2 to 5 small, greenish-white flowers, appear in autumn. This species extends from southern New South Wales and southern Queensland.

Bulbophyllum gadgarrense—This plant has very small pseudobulbs each bearing a terete leaf up to 5 cm. long and quite fleshy. The pseudobulbs are well spaced on the stem and the flowers are produced from the bracts on the stem. The flowers, although small, are produced in mass; are cream to yellow; and appear in spring. It is found in north Queensland above 2,500 feet. Colour plate on page 209. Similar to *B. wadsworthii* below.

Bulbophyllum globuliforme—This is probably the smallest of the Australian orchids although it does not have the smallest flower. The plant has a creeping stem with globular pseudobulbs 1-2 mm. in size. The older pseudobulbs are usually flattened on the top. The single leaf is very minute. The flowers appear singly on a stem, 1 cm. long and are 2 to 3 times the size of the pseudobulbs. They are whitish and flower in late spring. It extends from northern New South Wales to southern Queensland.



Photography by R. Deane

BULBOPHYLLUM WADSWORTHII—A little larger than natural size

Plant is similar to *Bulbophyllum gadgarrense* on page 209.

Bulbophyllum johnsonii—The pseudobulbs of this species are rather flattened, up to 2 cm. long and well spaced on a creeping stem. They turn brown with age. The single leaf is up to 8 cm. long. Single flowers are borne on stems to 2 cm. long. They are quite variable and this has given rise to a number of names for the species such as *B. kirkwoodae* and *B. whitei*. The colour ranges from bright yellow to red-brown, the lip being very dark. The small lip is hinged and vibrates in the slightest breeze. It is found in north Queensland above 2,000 feet. In its natural habitat it will flower at any time of the year but under cultivation, mainly in autumn.

Bulbophyllum lageniforme—The pseudobulbs are closely packed, nearly conical, 5-sided and furrowed. They are about 1 cm. across and have a single leaf 6 cm. high. The flowers are borne on a long stem usually in pairs. They are very similar to *B. lilianae* but with the brownish stripes only on the petals. The lip is orange. The species flowers in summer and is found in North Queensland above 2,500 feet, but kept very damp under cultivation.

Bulbophyllum lilianae—Again somewhat resembling *B. exiguum* but the pseudobulbs are more elongated and the stem is a much deeper brown. One to 2 flowers, on short stems, appear in the spring. They are pale green with brownish stripes on the sepals and petals, the lip is orange. The flower is about 5 mm. across. It grows in North Queensland above 3,000 feet, and in cultivation must be kept very damp.

Bulbophyllum macphersonii—Has thick, fleshy leaves to 1 cm. long, coming from minute pseudobulbs closely packed on a creeping stem. The single flowers are held well above the foliage and although small they are produced in abundance. They are a dark red with an even darker lip. This species flowers summer and autumn. Nth. Queensland above 2,000 ft.

Bulbophyllum minutissimum—Very similar to *B. globuliforme* but definitely larger, the pseudobulbs reaching about 3 mm. in diameter. The flowers, however, are smaller and are a rosy red. This species extends from southern New South Wales to southern Queensland and also flowers in late spring.

Bulbophyllum nematopodum—Almost conical pseudobulbs to 1 cm. high, with a long, thick-textured leaf. The single flowers are held well away from the stem, are about 1 cm. long and are a pale yellow-green to cream colour. There is a little red spotting inside the flower and the lip is also red. It flowers in late spring. Although it comes from north Queensland above 2,000 feet I have found that it does not grow well under normal shade house conditions and that a glasshouse is required.

Bulbophyllum newportii—This plant is very similar to *B. exiguum* but much more robust. The pseudobulbs would be about 1 cm. diameter and probably more closely packed on the stem than with *B. exiguum*. The flowers are also similar but again more robust. It can be easily identified from the former as it flowers in spring. Nth. Qld. above 2,500 feet.

Bulbophyllum radicans—This plant has a pendulous stem with small pseudobulbs each bearing a relatively large leaf to 5 cm. long. The flowers are on short stems, from bracts on the stem, and are usually hidden by the leaf. They are pale translucent green with deep red stripes and are about 5 mm. across. The flowers are produced a few at a time at any time of the year. It is found in north Queensland, from the coastal belt up to 3,500 feet.

Bulbophyllum wadsworthii—This plant is similar to *B. gadgarrense* but only about half the size and the leaves are channelled rather than terete. The flowers are produced from the brownish bracts on the stem and are bright orange, flowering in late spring. It grows in Nth. Qld. above 2,500 feet.

Bulbophyllum weinthalii—Very crowded pseudobulbs about 1 cm. high, rather irregular in shape and covered with a downy sheath. The single leaves are up to 2 cm. high. The flowers are solitary, about 1.5 cm. across, white to light green and heavily marked with red to purple. The species flowers in autumn on the upper branches of the Hoop Pine in N.S.W. & Qld. It takes to tree fern fibre readily under cultivation.

BEES AND THEIR ROLE IN POLLINATION

Keith Doull, Linden Park, S.A. 5065

The process of pollination is simply the transfer of the male element of reproduction—pollen—from the anthers where it is produced to the stigma, the external receptive surface of the ovary. Once on the stigma, pollen grains germinate and pollen tubes grow down into the ovary and fertilise the ovules.

Fertilisation of the ovules and thus the production of fruit or seed, cannot normally occur without pollination, although in a few instances seedless fruits are produced parthenogenetically, i.e. without pollination and sexual union. Bananas are an example of this.

Broadly speaking, plants are divided into two groups on the basis of the method by which they are pollinated. Wind-pollinated plants produce pollen grains which are very small, light and smooth, and which are readily borne on the wind. Grasses, cereals and pine trees are examples of this group. These cause hay fever.

Entomophilous flowers produce sticky and often large pollen grains that are not usually wind-borne, and these plants are pollinated by insects. Within this group we should also recognise a smaller group of ornithophilous flowers that are usually pollinated by birds. Parrots and honeyeaters are probably responsible for the pollination of many Australian native flowers.

Generally speaking, we know remarkably little about pollinating mechanisms of Australian native flora. Even a major and well-studied group like the eucalypts has received little attention in this respect, and all we can say about them is that most of them are probably insect-pollinated, although birds act as pollinators of some species.

Yet if we are to carry out breeding, selection and hybridisation to make full use of our attractive and useful native flora, we must know all that we can about the ways in which they are pollinated. This lack of knowledge on the pollination of native flora was brought home to me last year, when I received an enquiry from an American colleague who is writing a book on pollination. He referred me to a textbook published in Europe in the last century in which it was stated that dryandras in Western Australia were pollinated by kangaroos. He wanted to know if the distribution of dryandras had been affected by the destruction of the kangaroos.

Our library located the book mentioned, and it turned out that the author, a European botanist, had not seen any birds or insects on the dryandra flowers, but noticed plenty of kangaroos, and concluded that "since the kangaroo has a small narrow head, it will undoubtedly pollinate the flowers when it inserts its muzzle to suck out the nectar!" In fact, as far as I could find out, dryandras in Australia are probably pollinated in the main by birds.

Many insects visit flowers, some to feed on pollen and nectar, others to lay eggs, but bees of one kind or another are the most important insect pollinators. Nectar is the sugary secretion produced by the flowers of many plants and in some species such as acacias from extra floral nectaries. The nectar of flowers varies from 5% to 60% sugars and is the food of honeybees and the basis of honey.

The reasons why some flowers do not produce nectar and others do so in copious amounts are not known. It is often argued that this is an evolutionary characteristic in that nectar attracts bees and other insects which pollinate the flowers. However some plants that produce large amounts of nectar are pollinated by wind and others are not pollinated by bees that visit them in search of nectar. It is probable that our Eucalypts which are frequently heavy nectar producers do not require pollination by bees.

In terms of physiology and the economy of the plant the secretion of nectar is a waste of sugars and water and can not readily be seen to benefit the plants.

(Continued on page 230)

THE MAGIC OF WILDFLOWERS

A SERIES FOR THE YOUNG IN SPIRIT by Nuri Mass

WHAT IT IS TO BE AN ORCHID

HAS it ever occurred to you that, as a human being, you have something in common with an orchid? Not in appearance, to be sure, but in the fact that humans are the highest of the animals—and orchids are the highest of the plants.



DENDROBIUM BIGIBBUM

Like a happy group of party girls or bridesmaids. The beautiful Cooktown Orchid is the flower emblem for Queensland, and it is one of the many orchids that live on the branches of trees—up in the air instead of in the ground.

Perhaps this is one reason why there is always a special kind of excitement about an orchid—although, of course, every flower on Earth is a thing of great wonder and beauty, no matter how small or shy it may be. And in fact some of our own little Australian orchids are amongst the smallest and shyest of all.



Photography by Eric Gordon

CALEANA MAJOR—The Duck Orchid

The orchid called the Flying Duck—and how easily it might be just that! The "duck" part of it is its labellum which—as you can see in the lower centre flower—snaps down to play "catching" games with any visiting bees.

Nearly always, an orchid has a "feeling" about it that is all its own—a special kind of quaintness, or fairy-like delicacy, or pixie-mischief. There's the funny little Bird's Mouth Orchid, that stretches two of its sepals around into all manner of "physical exercise" positions. The Duck Orchid looks very much like its name. The Double Tails often perch "cross-legged" with two of their sepals. The Bearded Orchids look for all the world like long red or purple-bearded gnomes. And some of the Spider Orchids might easily frighten Miss Muffet away.

Now, what is it about an orchid that makes it different from other flowers?

First—instead of having the usual ring of stamens with a pistil in the centre, and orchid has a “column” which carries upon it the important parts of both, while taking up much less room.

Next—in a great many orchids, one petal is so different from the others that it has a special name (labellum, or lip). And there seems to be no end to the ideas that orchids can get when it comes to their labellums. They have them either fringed, furry or bearded, beautifully coloured and decorated. Yet sometimes, for a change, the labellum can be quite a lot smaller than the other petals—almost like a little curved tube. And—again for a change—it can sometimes behave like a playful trap.

Along comes a bee looking for nectar—and the labellum immediately springs over and whacks him on the back, imprisoning him for just long enough to make sure that he brushes well up against the flower's all-important column. For, as we know, it is one of the laws of nature that bees should carry pollen from flower to flower in return for the nectar they drink.

Then, apart from the labellum, orchids have two other petals and three sepals; and often these are so alike that you can tell them apart only by the way they are placed—sepals on the outside, petals on the inside. So here again, orchids are different from most other flowers.

As well as all this, there is something very special about the way orchids live. Many of them grow in the earth, as plants usually do, only with an important difference which we'll talk about later. But lots of them prefer to grow on rocks, or perched way up on trees in rain-forests or along the banks of creeks and rivers. These types of orchids have long, thick, “blotting-paper” sort of roots which are clever at absorbing even tiny scraps of moisture from the air. And it's wonderful to realise how handsomely these plants manage to grow and flower on such an “airy-fairy” diet—like our famous Rock Lily orchid, with its large stems and leaves and all its masses of beautiful blooms.

Plants that live in this way—without robbing any food from the trees they rest upon—are called epiphytes: altogether different from the villains like Mistletoe, which do take food from their tree “hosts”, and are therefore called parasites.

As far as we know, among all the thousands of orchids that exist, here and in other parts of the world, there are no parasites whatever—and that's a very nice thing to be able to say about them.

Another very nice thing—about ground-dwelling orchids—is the “important difference” we mentioned just now. Usually, plants live and grow on their own, sharing nothing in particular with other plants. But—secretly, and all unknown to most people—orchids that live in the soil have formed a perfect “give-and-take” arrangement with certain little thread-like fungi, that also live in the soil.

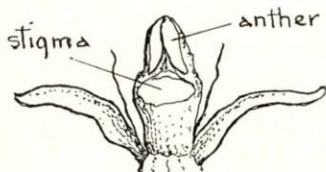
These fungi make their way into an orchid's roots, taking from the orchid some of the foods they need, while the orchid, in its turn, takes from the fungi some of the foods it needs—and everybody's happy. This kind of arrangement—equally good for both parties—is called symbiosis.

Mostly, when people speak of orchids, they have in mind those glamorous, brightly-coloured ones that grow in tropical climates—and they'd probably be surprised to hear that orchids can sometimes hide and become almost invisible in grassy places (like our tiny *Microtis* and shy *Greenhoods*), or among reedy marsh plants (like some of the *Prasophyllums*), or that you could even tread on a whole colony of them without realising it (like the tiny low-on-the-ground *Helmets*, or the delicate little *Ant Orchids*).

And maybe it's just because of this—because of their hiding-away elfishness—that I myself have a special fondness for these quaint little orchids of the Australian bush, and feel a particular thrill of excitement whenever I happen to find them.



Other flowers have
stamens and pistil...



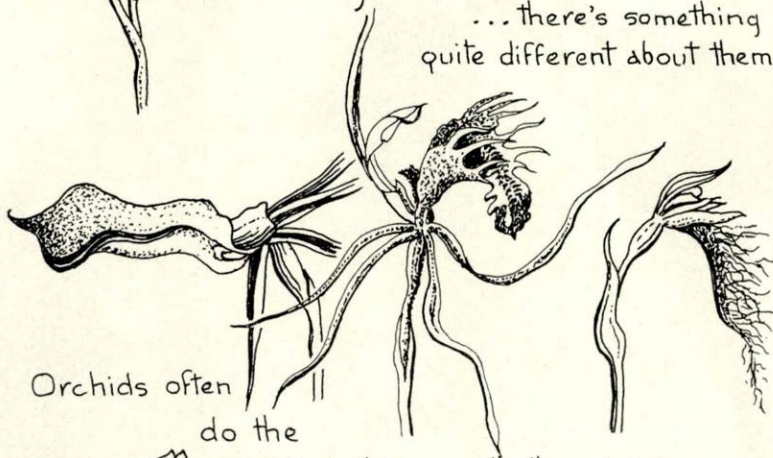
... orchids have a column,
which does the job of both.



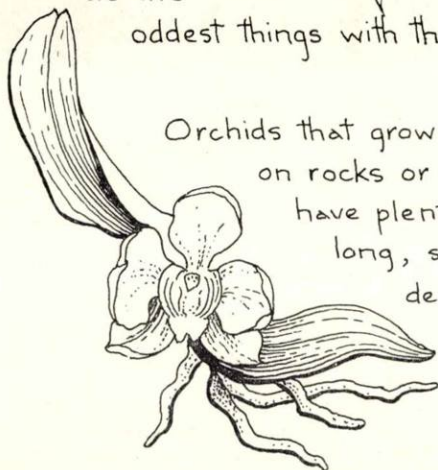
Orchids can
sometimes look
rather similar
to other flowers,
but usually...



... there's something
quite different about them.



Orchids often
do the
oddest things with their labellums



Orchids that grow
on rocks or trees
have plenty of
long, spongy,
dew-drinking
roots.

Of course, our bush orchids are not always hard to find. Often they bloom right out bravely in the loveliest colours—like the tall pink Hyacinth Orchid, the purple Glossodias, the wide-awake blue Sun Orchids, the mauve or yellow Double Tails, and all the many-coloured Spider Orchids. Also, a few of these are so “regular”-looking that they might easily be passed over as some other type of flower. But this doesn't often happen.



BEARDED ORCHIDS

Another odd thing about orchids is that they produce enormous numbers of the tiniest seeds imaginable—quite truthfully seeds by the million. But only very few of these ever get around to growing into new plants, for it's only touch-and-go as to whether the wind will carry any of them to the exact spot where there's the right kind of fungus waiting to help them—and of course to be helped by them in return. So nearly all of those millions of seeds keep going to waste.

Orchids in swamplands and way up on trees,
Orchids that feed off the air, if you please!
Hide-away orchids so tiny and green
That, mingling with grasses, they scarce can be seen.
And party-dress orchids like bush-fairies sweet—
Scraps of bright magic at play round my feet.

Helmet Orchids

CROUCHING down as close to the ground as it can get, is a dear little orchid that you might never see unless you look very specially. In fact the whole plant consists of nothing more than one leaf and a flower, and the flower is mostly a red-purple or perhaps greyish colour, not bright enough to stand out clearly amongst all the clutter of fallen leaves around it. And since it often likes to grow underneath shrubs and bracken, or in rock-crevices and such-like, it becomes even more "invisible" to ordinary mortal eyes. But when you do find it—oh, what a joy it is! For this is such a quaint, gnomish little flower.



Photography by Patricia Palmer

CORYBAS DILATATUS—Stately Helmet Orchid

A small group of Helmet Orchids growing happily on a patch of mossy ground.

Botanists call it *Corybas*, but its nickname is Helmet Orchid, and for a very good reason—that it looks for all the world like a helmet, like a big protective covering for the tiny plant.

Actually this helmet is one of the flower's sepals—the back one—while the little "face" underneath it, is that special front petal or labellum, often prettily decorated with furriness or fringes. But the other sepals and petals are so tiny that you can scarcely notice them.

Of course, there are quite a number of different kinds of Helmet Orchids, living in all manner of different places—in mossy gullies, among ferns, in open heathlands, even near the sea on sand-dunes. But wherever they decide upon, they grow many together in large colonies, their pretty little heart-shaped leaves sometimes forming quite a carpet over the ground—a carpet patterned with the reddish domes of their helmets, and all very flat against the earth most of the time.

Some Helmets do have slightly longer stems than others. But if you ever find any perched up on top of *quite* long stems, you can be sure of one thing—that the seeds of these Helmets are ready for ripening, and that their stems have grown tall so that when the seeds are ripe, the wind will be able to get to them easier, and scatter them far and wide.

It's a good thing that these tiny Helmet Orchids do grow together in large numbers, otherwise the bees that carry their pollen around for them might never notice them—and also, they'd be awfully lonely, considering that they flower in winter and very early spring, while most other orchids are still asleep.

A little green heart for a leaf,
As close to the earth as can be,
My flower a small helmet—and that
Is the story of little wee me!

BEES AND THEIR ROLE IN POLLINATION—continued from page 223

Other insects visit flowers only when they need food or when they are ready to lay eggs, so that not only do they visit flowers intermittently, but they visit only a very few flowers each time. Bees however, work continuously gathering nectar and pollen for food for their colonies. They move from flower to flower, and may visit up to five hundred flowers on a single foraging trip. Since a single bee may make up to eight to ten trips every day for three weeks, it can be seen that each bee is capable of pollinating up to 100,000 flowers in its foraging life. To put this in perspective, I may mention that an acre of lucerne may produce as many as 300 million flowers in three weeks, and 120,000 flowers must be pollinated for 1 Kg (2¼ lbs) of seed, and a yield of 450 Kg per acre requires the pollination of 50 million florets.

The bees are well equipped to transfer pollen, for their bodies carry many branched, almost fernlike hairs, that retain the pollen as it is shed on them when they alight on a flower. Bees are also equipped with pollen baskets on their hind legs into which they pack the pollen to carry it back to their hive. We have just recently been looking at pollen collection by honeybees, and we have found that a honeybee carries twelve to fifteen mgms of pollen from red gum—*E. camaldulensis*—and that this load contains 2½ to 3 million grains of pollen, and we have collected 1,360 gms (3 lbs) of red gum pollen from one hive in one day!

Incidentally, according to the man-made laws of aerodynamics, the honeybee, which weighs about 80 mgms and may carry 70 mgms of nectar, is unable to fly! Nevertheless, they will normally fly up 2,400 metres (1½ miles) in search of nectar, and three hundred bees in reasonable condition can gather enough nectar to produce 454 mg (1 lb) of honey in three weeks.

While on the subject of the honeybee, let me give you something to think about. It is this—the male of the honeybee, the drone, has a grandfather but it doesn't have a father.

Honeybees are not native to Australia, and the first hives were introduced in 1826. Prior to this, most native entomophilous plants must have been pollinated by native solitary bees. These are bees that do not live in colonies. Each female is fully reproductive, as distinct from the honeybee, in which

the queen is the only functionally reproductive female. The only social honeybees in Australia were the tiny stingless *Trigona* bees that inhabit the northern half of Australia. These were known to the Aborigines as "Koochee" or "Karbi", and to white settlers as "Mosquito Bees", and their honey and wax were much prized by the Aborigines.

Solitary bees utilise holes in wood, soil etc., for their nests, each female selecting or constructing a tunnel which she provisions with pollen and nectar. Then an egg is laid on the pollen mass, the cell is sealed, and another constructed, and so on. One quite common solitary bee in Adelaide gardens is the "Flower Bee", a fast-flying bee that makes a highpitched buzz as it darts from flower to flower. It is about the same size as a honeybee, and has five grey-blue bands across its abdomen.

Most solitary bees exhibit strong preference for the pollen of particular species of plants, and in general their life cycles are adapted to this, so that they are active at a time when their preferred food plants are in flower. For example, one native bee, *Nomia australica*, has a spring generation coinciding with the flowering of leptospermums, and a second generation which coincides with the flowering of xanthorrhoeas.

Many native bees are very small, with correspondingly reduced flight range, and their life cycles are even more highly adapted to the flowering of their food plants. For example, a species of small native bee collected in the Waite Arboretum lives in holes in the *Eucalyptus* sp. which is its major food plant, and the life cycle of the bee is apparently adapted to coincide closely with the flowering of the particular tree in which it nests.

As you will probably know, the major sources of honey and pollen for the honeybees now widespread in Australia are native flora of various kinds. Australian beekeepers hold the world record for honey production per hive, and our high yields are due to the tremendous nectar production of native flora, particularly the eucalypts. Unfortunately however, the fact that the plants are in flower does not necessarily mean that bees will visit them, or if they do, that the flowers will be pollinated.

The foraging behaviour of honeybees is the result of their innate and unavoidable responses to stimuli—signals or orders—from their environment. The world of insects is one in which they are virtually continually bombarded with orders—"go there"—"do this"—"don't do that"—"eat this"—"don't eat that". The activity that the insect exhibits will depend upon the strengths of the various stimuli, and its ability to respond to these stimuli.

In terms of pollination, foraging activity is influenced by a variety of factors that arise inside the hive, in the field and from the flowers themselves. The innate behaviour of bees, like that of all other insects, incorporates a number of safeguards that prevent the insect from undertaking useless activity, and from continuing endlessly some particular activity it has started. A particularly noteworthy example of this was shown during some studies on the feeding behaviour of a certain fly. Normally insects feed until some particular factor—for example, extension of the crop or gizzard—reaches a level at which a nerve impulse is generated and passes to the "brain", which then causes the insect to stop responding to the stimuli that cause them to feed. The nerve which transmits this impulse in this fly is known. If the nerve is cut, the fly does not know when to stop feeding, and will continue to imbibe food until it bursts.

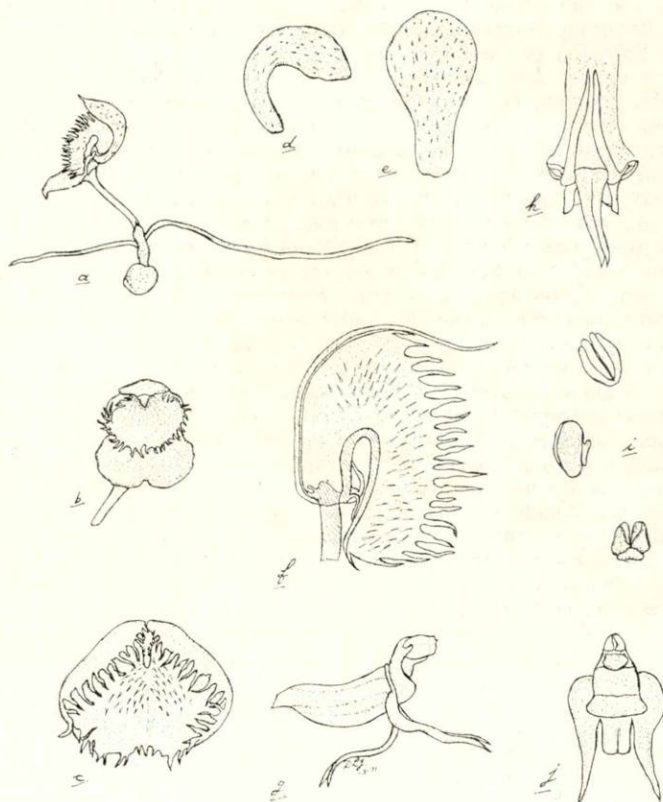
The signals that induce bees to forage for food, and thus accidentally to pollinate flowers, are firstly the information they receive in dances performed in the hive by scout bees that have been successful in locating a source of nectar. These dances tell them in broad terms the direction in which they must fly and the distance to the food source. At the same time, the odours of the plant and of the pollen from the plant cling to the body of the incoming forager, and the bees are thus made aware of these.

Once in the field, the amount of pollen and nectar the flowers contain, and the density of flowers will determine whether the bees continue to work them.

CORYBAS HISPIDUS

by David L. Jones

Corybas hispidus is a recently described Helmet Orchid from N.S.W. and Victoria. It seems in the past that collectors have confused this species with *C. fimbriatus* as superficially both have many similarities. Both have a deeply fringed labellum and this was probably the major factor which contributed to the confusion. *C. hispidus* can be readily recognised by the markedly hispid labellum with the mounded boss conspicuous, white and notched. The labellum of *C. fimbriatus* is smooth or shortly scabrous with the mounded boss entire and inconspicuous. A further difference easy to pick out is the peaked appearance of the dorsal sepal in *C. hispidus*.



- (a) Flowering plant from side full size.
- (b) Flowering plant from front, full size.
- (c) Labellum from front, full size x 2.
- (d) Dorsal sepal from side, full size x 2.
- (e) Dorsal sepal flattened out, full size x 2.
- (f) Longitudinal section of flower, full size x 3.
- (g) Column, lateral sepals and lateral petals from side, 5 times full size.
- (h) Base of labellum tube showing auricles, lateral sepals and lateral petals, from front, 5 times full size.
- (i) Pollinarium, 10 times full size.
- (j) Column, lateral sepals and lateral petals from front, 5 times full size.

From records so far checked it appears that *C. hispidus* is an inland species while *C. fimbriatus* is coastal. *C. hispidus* is the first member of the genus to flower in Victoria. In seasons of good summer rains the species is in full bloom by late March and is usually well finished by May when *C. fimbriatus* is just starting.

C. hispidus grows very easily in cultivation preferring cool moist conditions in a sandy mixture. Good results can be obtained by plunging the pot to the rim in moist sand and peat. It reproduces prolifically and quickly builds up to a nice potful. Applications of liquid manure are beneficial and the plants should be allowed to dry out over the dormant summer period.



Photography by A. Logan

CORYBAS HISPIDUS

SEED IS STILL NEEDED

Australia's unique flora could be promoted for use at home and abroad if we could be sure of supplies to meet orders. There is tremendous scope for wider use of the little known inland species, the Wattles, the Mallees, the Kennedias spp.

We would like to enrol many more observant local people as part-time collectors, even paying merely for information leading to legal acquisition of bulk lots by someone else.

This can be an interesting hobby and a remunerative side line operated from a knowledgeable person's own home. We have a special need now for collectors in the northern half of the continent, especially Central Queensland.

AUSTRALIAN SEED COMPANY, ROBERTSON, N.S.W. 2577
(Laurie Langley, Proprietor)

BEES AND THEIR ROLE IN POLLINATION—continued from page 231.

Thus for example, on some eucalypts a bee—or in fact several bees—may obtain a full load of nectar from a single flower, while in clover fields the bee may have to visit 500 to 1,000 flowers to obtain a full load. However, clover is a profitable crop for the bee because there are huge numbers of flowers per acre.

A second factor is the sugar concentration of the nectar. Nectar is processed by the bees to become honey, and this means among other things the evaporation of water to produce honey with a moisture content of 14 to 18%. Removal of water consumes a lot of energy. To produce 1 kg of honey, bees might need to evaporate 3 kg of water, and this would involve the use of about 1 kg of sugar as energy. On the other hand, if the nectar has a low moisture content, the production of 1 kg of honey might only require the elimination of 500 gms of water, and the use of only 130-200 gms of sugar. As a result, bees normally prefer the nectars with the highest sugar content.

They will not normally gather nectar when the sugar content is below 20%. Thus at times they will not visit some flowers if they are only seeking nectar. For example, pears which require cross-pollination by insects, produce nectar which may contain as little as 5% sugars, and pollination can be achieved only by bees seeking pollen. Very often too, with other plants, even eucalypts and banksias, weather conditions, particularly high humidity, result in thin nectars, and bees are just not interested in them until the weather warms up.

The collection of pollen by bees results from their responses to a complex series of stimuli, which originate with the presence of larvae in the hive requiring food. Incidentally, the pollen is not fed directly to the brood, but is eaten by bees five to fifteen days old. These bees use pollen as the raw material from which certain of their glands elaborate food for the larvae—the so-called royal jelly. A colony will use about 23 kg (50 lbs) of pollen in a year, the equivalent of about 4 billion pollen grains.

Pollen collection is particularly influenced by certain chemicals contained in the pollen. These act as triggers to release the specific behaviour that results in pollen collection. Bees collecting pollen may be readily recognised, for they scramble over the flower, biting at the anthers and dragging them in towards their bodies, and then, after leaving the flower, they hover in the air for a few seconds while with the fore and middle legs they scrape the pollen off their bodies and pack it into the pollen baskets on their back legs.

The collection of pollen is very closely related, as I said, to the presence of certain chemicals that release this collecting behaviour, and thus some plants are preferred to others as sources of pollen. One of the difficulties of achieving pollination of commercial crops is to ensure that there is no other competing flora that will be preferred by the bees.

However, the sources of pollen that bees will prefer is influenced also by the number of grubs that must be fed, and the amount of pollen in the hive. At times, and particularly in the autumn, when bees are normally breeding strongly, and flowering plants are often scarce, bees will collect useless materials such as coal dust, road dust and particles of stock food. On one occasion in Adelaide, bees seeking pollen had collected chocolate powder from a factory, and I was given a comb full of chocolate.

Basically, there are two groups of foraging bees. About 25% leave the hive to collect pollen, while the remaining 75% leave the hive to collect nectar. However about 15% of bees gather both nectar and pollen. Bees collecting nectar only do not normally attempt to carry back to their hives the pollen that collects on their bodies. Generally they scrape it off and discard it as they fly, but the 15% that are still capable of responding to the presence of pollen on their bodies will pack it into their pollen baskets and carry it back to their hives. Since bees often seek nectar from flowers that they do not normally visit to collect pollen, these nectar-pollen gatherers frequently bring back to the hives pollens that are unattractive to the bees that feed on the pollen. The pollen of *E. goniocalyx* ("Long Leaved Box") is one of these.

Such pollens are often not used by the bees and are thrown out of the hive at some later time. In fact, major problems for Australian beekeepers are associated with the apparent poor biological qualities of the pollens of some native flora.

Thus you can see that although in the right conditions, the honeybee is the ideal pollinator of entomophilous plants, there are many factors that affect its efficiency. In the U.S.A., in an attempt to overcome these problems, there has been developed a system of what is known as controlled pollination. This is simply a technique by which growers use different methods of scattering pollen among the flowers of their trees. Pollen is obtained by picking unopened flower buds and allowing these to mature and shed their pollen in controlled conditions. This pollen is sold to growers at a cost of up to \$60.00 an acre.

A standard technique for isolated trees is to use a small paint brush to dab the pollen on the flowers to be pollinated. However, for large scale areas, early techniques were to fill shotgun shells or small bombs with pollen and explode these to spread pollen about the trees. More recently, ground airblast machines are driven through the orchards and pollen is injected into the airblast. Most recently, aircraft are being used to pollinate orchards. A total of nearly 10,000 acres are now treated this way in the U.S.A., but out of over a million acres of fruit orchards in the U.S., this is quite a small proportion.

Now let us have a look at what little we do know about the pollination of eucalypts. These flowers are what we call protandrous. This is a common mechanism, and usually indicates that the flowers are cross-pollinated with pollen from another flower, usually from another plant of the same species. Most pollen from eucalypts is shed within twenty-four hours after the operculum falls. However, in some species, some of the inner row of anthers retain their pollen for a few days. As these anthers unfold they more or less brush the stigma and no doubt bring about some self-pollination if there has not already been cross-pollination. The stigma however is apparently not receptive to pollen until several days after the operculum falls, and then may remain receptive for four or five days. Receptivity of the stigma simply means that the surface becomes moist so that the pollen grains that come to rest on it will remain there and will germinate.

Thus in general terms pollination of eucalypts will occur only in flowers that are between four and ten days old. Since at this stage the flower does not have much pollen of its own, pollination must result from the activity of bees that visit flowers for nectar. In any tree at any time during flowering, there are flowers in all the different stages of development, so that cross-pollination may be readily accomplished. However, if conditions are such that the flowers are not producing nectar, they will not attract nectar-collecting bees, and so little seed will be set.

Controlled pollination of eucalypts is not exceptionally difficult in most species, and Pryor in Canberra has shown that it is possible to produce hybrids between a number of species by this process—for instance between *E. bicostata* ("Eurabbie") and *E. maidenii* ("Maiden's Gum"). The process involves emasculation of the flowers, i.e. removal of the anthers, and this is quite simply done in some Eucalypts just before the operculum falls, by cutting through the tissue just below the staminal ring, but above the ovary. The operculum and stamens come away freely, leaving the stigma undamaged. Treated flowers must be shaded to prevent burning and this process should be avoided during hot weather. After treatment the flowers should be enclosed in muslin bags; double muslin will reduce the chance of stray pollen grains falling on the stigma.

Pollination is effected by using fresh pollen from flowers opening at the right time, and in general the attempt should be made within twelve hours of the operculum falling from the pollen-parent flowers. A fine paint brush will be adequate for this job, and Pryor made two pollinations seven days apart.

Crosses between plants flowering at least a month apart are possible, if the pollen is stored in an airtight container at 2°C and 50% humidity. Pryor's paper on this gives more detail and is in *Proc. Linn. Soc. N.S.W.* 1951. Vol. 76, pp. 135+.

Finally let me stress the need for information on the pollination of native flora which I am sure some of you can provide. Methods of determining whether the flowers are cross- or self-pollinated are relatively simple. Flowers may be enclosed in paper bags. If they set fruit then they are readily self-pollinated. If not, then they must be pollinated by other means. Coarse weave cloth bags that exclude bees but allow wind through, will answer the question of wind or insect pollination. Emasculation and hand-pollination from flowers of other plants and comparison of numbers of seeds produced will show the significance or otherwise of cross-pollination.

Plants that are not visited by bees are likely to be wind or self-pollinated, but it is necessary to carry out many observations at different times of the day. Most flowers produce pollen at specific times of the day, and bees, with their well-developed time sense, visit them only at these times. Also, in many Australian flowers nectar and pollen production seems to occur at night, and in warm weather it is necessary to look for bee activity at dawn.

AN INTRODUCTION TO ORCHIDS—continued from page 206

Some are evergreen, (e.g. *Phaius*), and some are completely leafless (*Cryptanthemis*). Leaves of terrestrial orchids are extremely variable in form. They may be small bract-like structures, large rounded leaves such as *Nervilia* or tall and strap-like as in some *Thelymitra* spp.

The roots of *epiphytes* and *lithophytes* are adventitious, produced from the stem nodes. The structure of these roots is remarkable, being covered with a thick epidermis called the *velamen*. This velamen is a series of layers of spongy cells which enable the roots to absorb and retain large quantities of moisture. The centre is a very strong cord like structure which can hold the root to the host even after the velamen of that particular root has ceased to function. The colour of the growing or active root is usually a pale grey or greenish white while the root cap is often green or brownish green.

The leaves of the epiphytes are basically similar to the terrestrials.

Many possess very thick leaves and are covered by a waxy epidermis which reduces transpiration greatly. There are some leafless species of epiphytes among which is the Australian species *Chiloschista phyllorhiza*.

The flowers are borne in an inflorescence which may be a simple raceme spike, or a branching panicle (e.g. *Acriopsis javanica*). The number of flowers varies from species to species from one to many. The origin of the inflorescence is also varied; it may be terminal, lateral, basal, though these variations seldom occur in a genus or even a subtribe.

Individual flowers are very complex structures. One of their identifying features is that they are *zygomorphic*, meaning that they can be split in halves of equal size and shape on only one plane.

The majority of flowers are bisexual, that is possessing both male and female sexual parts. Exceptions to this are the unisexual flowers of the genus *Cycnoches* (a Central American genus). The ovary is inferior and consists of one to three cells called locules.

Mostly all Orchidaceous plants are generally grown for their flowers, large or small but a few such as the so called Jewell orchids are favoured for their unusual foliage.

The flower structure of Orchidaceous plants differs from that of other flowers in the fact that the sepals and petals are coloured. Most other flowers usually have green sepals and coloured petals.

The sepals are generally free though on occasions are joined to form a tube like structure, known as the *sepaline* tube. The upper or dorsal sepal usually differs in shape from the lateral sepals, although sometimes the difference is slight.

The three *corolla* segments form the most distinctive part of the flower. Two of these segments are identical to each other and are variable from species to species from the twisted petals of *Dendrobium johannis* to the extremely small petals of some *Bulbophyllum* species. It is, however, the third petal or *labellum* that is usually the most distinctive perianth segment of an Orchid flower.



DENDROBIUM JOHANNIS

The *labellum* may be simple, lobed, flattened, tubular or cup like. The margin may be entire, toothed, fringed or notched. Its upper surface called the *disc* is smooth or covered with various appendages, called *calli* or *papillae*. These structures are sometimes developed to remarkable degree. The base of the *labellum* may be elongated to great length to form a very showy part of the blossom.

The most recognizable difference in an Orchid flower from other flowers is the sexual structure. It is almost always borne on an elongated finger like structure called a column and is situated in the centre of the flower. At the top of the column, which is also variable in shape and size is found the *anther*, which is usually single. On the front or underside of the column is found the *stigma* or stigmas. The rostellum or cap on the column of most orchids is actually a modified stigma.

This easily moved structure serves mainly in attaching the pollinia onto visiting insects to aid pollination of the flower.

The anther or anthers are behind the rostellum in a recess known as the *clinandrium*. These anthers contain either a mass of powdery pollen or 2, 4, 6 or 8 distinct sacs of pollen called *pollinia*. The number of these masses is also an important taxonomic factor. The masses or grains vary in consistency, from powdery to waxy, and sometimes are hard.

The base of the column is often extended to form a foot, to which the labellum is often attached.

Seed capsules or fruits are usually dry when ripe and split along the longitudinal ribs releasing the seeds. The shape of the fruit varies from egg-shaped, ovoid to cylindrical, with prominent ribs from 3 to 12 in number. The seeds of the genus *Vanilla* are used commercially for Vanilla extract.

The seeds of most orchids are extremely small and light. Each capsule contains hundreds of thousands of individual seed. The seeds of *Cycnoches ventricosum* var. *chlorochilon* have been counted at 3,770,000 per capsule.

THE PRODUCTION OF SEED

It need take only seconds and a steady hand to pollinate or cross-pollinate an orchid flower in your glasshouse.

Nature has designed many intricate mechanisms in Orchid flowers that aid the pollination of the flower in its native state. All orchid flowers are equipped with a nectary of one kind or another, the primary function of which is to encourage various insects to visit the flower.

The relationship between orchids and their pollinators is a marvel of nature. Flowers are often uniquely designed to make visiting insects carry pollen from one flower to another. These mechanisms will work only if the right species of insect enters the flower. A flower may be visited by many insects before the right one comes along. The pollinia, or masses, of pollen, are brushed by the insect as it enters the flower and are almost placed by the flower, behind or on the head of the carrier. This insect then visits another flower and the nectar which enticed him to call then accepts by means of its sticky form, the pollinia from the preceding flower.

There are many forms of this plant pollinator relationship some of which are very delicate, trigger or balance like mechanisms. The fact is that bees, wasps, moths and even birds do this work in nature. The sleight of hand that humans can substitute for this natural process, is to remove the pollinia from its position and place it in another.

Nature provided for the production of thousands of seeds per seed pod of which only 2 or 3 may receive the position and cultural requirements that enable it to grow into a plant.

The seed being so small stores little food to supply nourishment during germination. Nature provides very few places where the falling seed may lodge, where perfect balanced growing conditions are present. Bacteria, fungus and mineral salts in precise quantities are needed, and very few situations exist where these growth inducing factors are in balanced harmony.

The first attempts at growing seed were hampered by imbalance and the only real success in early culture came when growers developed a technique of inoculating strains of fungi into the growing medium. The procedure was known as the symbiotic method. Even then, experts could not always obtain a balance, but at least it enabled many orchids to be grown.

It was not till 1922 when Dr. Lewis Knudson of Cornell University found a simple controlled method for germinating orchid seed. He found that seed germinated easily without the presence of fungi when sown in a nutrient solution on agar jelly in completely sterile conditions.

He devised a formula to which the seeds were added. These chemicals supplied the seed with the nutrients needed to germinate and grow. This method, still used today, is named after its discoverer and made the growing of seeds an easy task indeed. Today it is possible to produce thousands of seedlings from a single pod.

When the seed pod is ripe the pod is observed to develop splits down the flutings on the side of the pod. Seed should be gathered just prior to this happening. The period of time needed for a pod to mature from the time of pollination varies considerably from species to species, and can take from 4 weeks in the case of some terrestrials to 11 months in the case of *Cymbidium* spp. Care should be taken to record the dates of pollination and ripening and soon a fairly accurate idea of maturing time can be gained.

Seed can be stored successfully in cool, dry conditions, but is best used when fresh.

The seed is first sterilized by soaking it in an antiseptic solution and placing a little of it in each prepared flask of the growing solution, Knudsons formula. The flasks are then fitted with a stopper and the entire operation mentioned above should be carried out in a bio-clean work area.

Following the flasking of seeds it will be found that seeds germinate best at temperatures between 21°C and 24°C. A fluctuation of more than 5°C during the germination will retard growth. The flasks should be placed in a shady area where they receive 200 foot candles of light. They could be placed under artificial light where Gro-Lux tubes are quite acceptable.

About 2 weeks after sowing, the seeds begin to swell and about 4 weeks later the seeds turn green showing the development of chlorophyll. Root hairs soon cover the embryo and begin to absorb nutrients. Approximately 10 weeks after sowing the first sign of leaf development is observed. At this stage the seed is known as a protocorm. These protocorms continue to elongate and produce more leaves.

After about 6 months, if the germination rate is good it may be necessary to transplant some of the seedlings to other flasks. This depends largely on the growth rate of the seedlings.

In any case, after a period of from 9 to 12 months, the seedlings should be large enough to transplant either to community pots or single 5 cm. pots. The medium used may vary greatly but should be such that it is open, retentive of some moisture, but not too heavy. Fir bark, peat moss, charcoal, coke, coarse sand and osmunda fibre may be used, though there are many other media that may be used.

Seedlings benefit from a warm humid atmosphere at all times, but will not accept poor ventilation.

A regular feeding programme must be followed and there are many acceptable feeding formulae. Generally speaking, any liquid fertilizers can be applied at about half strength at weekly intervals. There are many chemical fertilizers readily available but in addition to these, experiments by leading orchid growers have shown that additional ingredients such as coconut milk, tomato puree and banana extract can be used with outstanding results.

There are some species of orchid seeds that are damaged seriously by the process of sterilizing the seed prior to flasking. This process can be avoided if the seed pod is detached from the plant prior to it becoming fully ripe. The seeds inside the pod are therefore quite clean and need no

immersion in antiseptic solution prior to flasking. This method is known as green pod culture and is widely practised. It should be pointed out that the age of a pod from pollination to ripening should be known if green pod culture is to be practised.

The reasons for loss of seedlings can be narrowed to three main regions: incorrect watering, incorrect amount of light, and contamination. The two former reasons must be gauged by the individual depending upon his growing medium, the feeding growth ratio, and the housing of the seedlings.

Contamination is usually in the form of fungal attack and regular spraying of an accepted fungicide is advised. The use of systemic fungicide such as Benlate is proving quite effective.

Only experience will supply the grower with the correct growing technique, and the more observant the grower is, the sooner will he establish cultural requirements suitable to his own situation. It would be fair to say that what suits one grower may not be suitable to another.

The methods mentioned above can be applied to the growing of all epiphytic orchids with variations from species to species. The growing of deciduous terrestrial species is another matter altogether.

A successful method of germination and cultivation of Australian terrestrial orchids has been developed and is described in the Proceedings of the Third Australian Orchid Conference, Adelaide, 1973.

CONTAINERS & HOSTS

When deciding whether an orchid should be placed in or on a particular medium, consider its needs. Where does it occur naturally? How does it grow, and on what? What are its water, shade and heat requirements? If you consider these requirements you may then decide if it is to be potted in a very coarse, open medium or mounted on a suitable host. The correct type of container or host is essential.

Terracotta or plastic pots have advantages or disadvantages depending on the species, the potting medium, and most particularly on your own growing conditions. The results of your experience can be the only guide to your choice of types of pots. The size of the pot is of importance, as small containers may dry out more quickly than the large ones. Most epiphytes grown in pots should be underpotted as a general rule and potted on only when the pot is completely full.

Medium for pots should be carefully chosen, for waterholding ability, rate of breakdown in the pot, and the size of the particles. Among the media in use by Orchid growers today are such things as Fir bark, peat moss, bluemetal, ricehusks, coke, charcoal, coarse sand, vermiculite, perlite, sphagnum moss, and casuarina bark. A good potting medium can be one of these substances or a mixture of several, depending on the species to be potted. Leaf mould, chopped up tree fern fibre and osmunda fibre can also be used, but are not always readily available.

Always ensure the drainage hole is large enough, if not, turn the pot upside down and tap the edges of the hole with a hammer until the desired size is reached. Shallow pots are successfully used by many growers and there can still be found the occasional supplier of special pots with open slits in the side, these are known as *Cattleya* pots. Some of the true epiphytes can also be grown by attaching to the sides or base of an up-turned pot.

Basket culture is most suited to orchids of pendulous habit. The baskets are best made out of a durable hardwood such as teak or tallowood. Line the inside with the paper-like bark of *Melaleuca*, then place a suitable drainage material in the bottom, and cover with the selected growing medium. Position the plant and fill the basket to within $\frac{1}{2}$ " of the top, working the medium in and around the roots and firm down, taking care that the crown of the plant is at the correct level. Plants may have to be tied or staked

in position till the roots grow and hold the plant. Baskets may be hung or stood on the bench.

Most species of epiphytes may be grown by attaching them firmly to a host. A host simply provides the plant with a place to which it may fasten its roots. Any number of substances may be used for a host, a piece of old hardwood, such as an old paling, cut to suitable length; a piece of branch taken from a tree with persistent bark, and only experience will enable the user to know which species are best. Some tree branches will start to flake or split off within weeks of cutting, while other species will



MOBILABIUM HAMATUM

persist for years. Suitable trees are found in most areas. Among these are most species of *Melaleuca*, which have a papery bark, and last for many years if the sawn ends are sealed with some waterproof substance soon after cutting. Branches or stems with a diameter from 4 cm to 10 cm are most suitable, depending on the type and size of the orchid to be mounted. Many of the rainforest trees are also suitable but not so readily obtained.

Many Orchid growers favour slabs of about 2 cm thickness of tree ferns. These slabs are comprised of the roots of the tree fern which form

the apparent trunk and are most durable, lasting many years. Since these ferns grow in acid soils it will be found that the slabs when cut are also very acid and should be allowed to weather for some months before use, to leech out some of the acidity. Dipping in a weak lime solution several times will prove helpful. Since these ferns are protected plants, their availability is limited and it is wise to purchase them from some of the large Orchid nurseries.

Orchids can also be mounted on hosts other than these mentioned above. Some of the more suitable are pieces of terracotta pipe, coconut shells, and pieces of polystyrene foam.

To affix the plant to any of these hosts one should use either fine copper wire or nylon fishing line. Most other tying agents tend to break down too quickly. The orchid should firstly be trimmed of any broken or old roots that may lead to rotting. Very few, if any of these old roots will continue to grow, so only leave sufficient to enable you to tie the plant firmly.

It is essential to tie firmly. If nylon fishing line is used, it is recommended that line with a breaking strain of 10kg. to 14kg. is used to ensure that suitable strain is applied when tying.

Many growers use a small wad of sphagnum moss underneath the orchid when fixing it to the host. This practice serves as a water retaining medium, which in most cases assists in establishing the orchid. Care and experience will be needed to use this aid, as some species will not tolerate any surplus moisture being held in or around the rooting area.

The growing of Australian terrestrial species does require careful attention to watering and growing medium, but is in fact very simple. A medium of clean sand and leaf mould mixed 4 parts to 1 is suitable for the successful culture of most species, providing adequate drainage is allowed.

The pot may be placed in a situation where it receives broken shade for most of the day and also receives rain as it falls. Pots should not be allowed to dry out while ever the orchid is in active growth. As the great majority of Australian terrestrial orchids are deciduous, or in some cases entirely leafless, the period of active growth is easily noticed by the fact of the emergence from the potting medium of either leaves or flower spikes. Some supplementary watering may be needed during the period of growth and should be tapered off after flowering.

During the dormant period little or no watering will be required, though it will prove beneficial if the medium is not allowed to overheat or become completely dried out for long periods, as such action could result in shrivelling of the tubers.

The use of a layer of mulch of bush litter, or old rotted woodshavings during the dormant period will prove helpful in keeping the potting medium cool and moist.

Most of the terrestrial species or orchids arise from underground tubers or rhizomes, which in nature can be found at depths ranging from 2.5 cm. to 10 cm., rarely deeper, so the need for large deep pots is unnecessary.

Azalea pots are most suitable and can be obtained readily from the larger suppliers of terracotta pots.

HOUSING

A very important factor in the growing of Orchids is their environment. Most of the orchids in cultivation today require some form of housing. In tropical areas, the majority of orchids can be grown outdoors with the main

requirement being the provision of shade in a varying degree suitable to the specific requirements of the species grown.

Numerous species of epiphytic orchids can be grown on the trunks and branches of trees or on rocks in the garden, but the greater the distance from the tropics, the more housing is needed.

Growers in colder climates who wish to grow tropical species find it necessary to provide heated glass houses while those in warmer areas may have to provide cool glass houses or bush houses, depending on the specific requirements of the species.

Orchids may, for convenience, be divided into three cultural groups that are determined by the minimum temperatures they require for successful flowering. Where as winter temperatures in a heated glass house can be controlled, summer temperatures are more difficult to control. The three groups are geared to the minimum winter temperature and are as follows:—"Cool"—between 10°C and 13°C, "Warm"—13°C and 16°C, "Hot"—16°C and 19°C.

The "Warm" group accommodates by far the greatest number of species and the intending grower should select orchids that fall within the group he chooses. Where heating is needed, the economics must be the factor determining the orchids to be grown. There are some species that are very critical in their requirements while others may be persuaded to grow and flower at various temperature ranges, since the upper range of one group is the lower range of the succeeding group. It is almost impossible to maintain the temperature constantly within the confines of any one of the particular groups, and while an orchid may grow and flower at a higher or lower temperature range than recommended, it will be found that better results are gained if the correct temperature is provided.

The house may be cooled in summer if necessary, but the provision of good ventilation and air circulation may suffice. Free air circulation to all corners of the glass house is essential for good culture but draughts must be avoided.

The shading of the house is very important and again will depend on the type of orchid to be grown. *Cymbidium* spp. can tolerate moderately poor shade providing that the leaves do not show signs of burning. It may be possible to grow them in as little as 25% shade, but 35% to 46% is much better. Most orchids species do best when shade is above 40% and upward to 60% though in some cases though when flowering, may require less shade than provided during the rest of the year.

Again experience is the only teacher, and the symptoms of either too much or too little shade will soon be evident in the colour of the leaf. Any interested grower will soon gain such knowledge by observation of his plants or discussion with other growers in the same area.

TYPES OF ORCHID HOUSES

These may range from simply constructed bush houses for warmer climates to expensive glass houses as used in cold areas.

Bush houses may be constructed from pipe or wooden frames covered by timber laths, or wire covered by branches, tea tree pieces or any of a number of materials. The structure should be sturdy and durable, and have some protection from winds on the western and southern sides. It may be necessary to provide glass siding for the entry of light into the house in some circumstances when the bush house can only be placed with a westerly or southerly aspect, but it is desirable if these aspects can be avoided.

Where glass houses are needed for successful growing, there are some very suitable prefabricated houses on the market. Most manufacturers have

a good range of sizes available and extra sections can be added to an existing glass house with very little work. They are of either aluminium or zinc anealed frame work and are very simple to construct. The intending orchid grower should consider the durability of the materials used in structures that are not made of a metal framework.

The maintenance of materials used must be considered and for this reason alone, the initial cost of a non corrosive metal is soon justified.

Most prefabricated glass houses are fitted with ventilators which are very important particularly during the hotter periods of the year.

Where heating is necessary for a glass house in domestic use, the heating costs should be considered and investigated prior to the erection of the glass house. There are many ways of heating a small house, and it may be possible to make use of the heating system used in the private residence if practical. Among the most commonly used methods are hot water piped through the glass house, warm air ducted through the floor, walls, or upper part of the glass house, or electric heating cables under the benches. Each of the systems has its benefits and advantages, and careful consideration should be given. Perhaps the most common means of heating in present day glass houses of a domestic size is the use of electric radiators with the inclusion of an electricity driven fan. These are reasonably economical to operate, and the installation cost is negligible.

To maintain an even temperature during the colder months a thermostat should be fitted in conjunction with the heater. The wiring of the thermostat is simple but should be done by a qualified tradesman.

In Canberra, a 2,000 watt turbo-radiator is sufficient to maintain a 5m. x 3m. glass house at 13°C, and this figure may be used as a guide for the average local winter.

The benches within the glass house should be of durable material and care must be taken to ensure free air circulation around the pots on the bench. A bench made of 2cm. or 3cm. galvanised pipe covered with weldmesh fabric is most suitable, but other materials may be used with good results.

The floor of the glass house can be of concrete, cinders or large aggregate blue metal or the like. Weeds on the floor can be a problem and can be an excellent hiding place for slugs, snails and insects. If a floor other than concrete is used, the grower would do well to keep the floor as clean as is practical at all times.

Humidity is also a factor that would have to be considered if tropical species are to be grown. The installation of misting systems are a bit expensive for the hobby grower, but are good investments for the commercial grower.

Relative humidity can be increased by wetting the floor 3 or 4 times daily during the warmer weather. The use of shallow trays filled with water and placed under the benches is also a good way of creating a humid atmosphere.

In areas where hail storms are possible, the glass house should be provided with a hail guard. This can be achieved by fixing 1.5cm. chicken wire on to a framework above the glass roof. This framework can also be used to attach shade cloth to, and thereby serve a dual function.

Shade cloth is a woven plastic material available in most large hardware stores. Its stated shade potential is varied by the size of the weave, and the life expectancy of the fabric is from 4-8 years depending on the climate of the area.

Of the many available shade variations, most orchids seem to favour a range from 40% shade to 65%, and experience will enable the grower to choose the right degree of shade for his orchids.

FEEDING AND RESTING OF ORCHIDS AND NOTES ON PROPAGATION

All orchids benefit from feeding. The amount and frequency of food required varies from plant to plant depending on its condition, size and species. Healthy growth may occur without feeding, but improved growth is ensured if a careful feeding programme is followed.

Both organic and inorganic fertilizers can be used. They may be used when potting up, as foliar sprays or placed on the surface of the growing medium.

The growing season is the safest time to feed, and this season extends from September to April for most species. Regular fortnightly feedings during this period will benefit the orchids greatly. Feeding during the resting period may result in forcing the orchid to make premature growth which can lead to the death of a plant if it is continued.

Never feed a sick plant, never apply fertilizer to a dry plant, water thoroughly first, don't feed unless the orchid is actively growing. It is a good idea to water well the following day to remove the excess salts from the plant.

Sheep or poultry manure can be used as a fertilizer, either applied as a solid to the medium, or watered on as a liquid. To prepare this, the manure is soaked in water at the rate of about three handfuls per large bucket, allowing it to stand for three weeks with an occasional stir. Then it should be strained and the liquid applied. It may be necessary to dilute the liquid till it is a light brown colour before applying.

Inorganic fertilizers can be purchased from most nurseries and appear to be all fairly well suited to Orchid culture. Perhaps the best of these are the foliar sprays, Zest, Thrive and Aquasol, and must not be used above the strength recommended by the manufacturer. In fact, $\frac{1}{2}$ to $\frac{3}{4}$ strength is most suitable if applied regularly.

Pellet form fertilizers must be used with caution, as burning of the roots may easily occur. Some success may be gained with larger vigorous plants in large containers, though the safest method of feeding is always a little food, often.

Resting of orchids is something to which too little attention is given. This is a pity because considerable benefit is derived by resting orchids, and in fact, as pointed out above, failure to allow for resting can result in death of the plant. Hybrid forms seem to have a shorter period of dormancy than do most species but they should be rested for at least some period.

The seasons are reasonably well defined in many areas where orchids occur naturally. Torrential rains occur during particular months, and dry periods during certain others. The orchids have adapted themselves to these conditions and have produced their own storage of food (pseudobulbs in epiphytes and underground tubers in terrestrials) conserving food and water to see them through the dry season.

The dormant period is mainly co-incidental with the winter months for Australian species of Epiphytes and mostly (with exceptions) the spring season for the Australian terrestrials.

When resting glass house species, the temperature should be kept below 16°C . If the minimum temperature is kept too high the plants will continue to grow and may produce growth and finally the possible exhaustion of the plant.

Watering during the dormant period will be dealt with in the following section.

Brief mention may be made here on propagation methods.

Most epiphytes prefer to be grown in pots that appear to be far too small for the plants, that is to say that they favour underpotting rather than being provided with a large root run. With this fact in mind, there will be no reason to repot regularly as with other plants.

Should the grower wish to make a number of plants from one parent, the method is by division.

The plant, once removed from the pot, should be trimmed of any damaged roots and a clean cut made between the pseudobulbs which are joined together by a usually short rhizome. Care should be taken to ensure that the new plants made by this method, should be of a minimum of two older pseudobulbs and one or two new ones, care being taken not to disturb the newer growths.

The pieces can then be repotted, using fresh medium or mounted onto a suitable host.

WATERING

Special attention should be given to watering of orchids, and incorrect watering is probably the most common cause of death of orchids.

The natural habitat of the orchid should be known as the seasonal variation of rainfall from area to area is considerable. Species occurring in Monsoonal areas cannot be treated the same as plants from the drier interior or the temperate coast regions.

The type of potting medium, the state of the plant (active or dormant) and the evaporation rate within the Orchid house are all important factors and careful observance of these points are your best guides. Plants should be watered individually and where possible plants requiring similar watering should be grouped together.

In the main, plants should be allowed to dry out between waterings, though not completely, except during the dormant period. During this period, the plants should be closely watched and if the pseudobulbs show signs of shrivelling, or the leaves become soft and flabby, then the plant needs water.

During the growing season, you can usually afford to be generous with water but again this depends on some of the factors mentioned above.

Water should not be allowed to be on the leaves during the heat of the day, as damage can result. Avoid watering too late in the day for water that lies near the roots may become too cold. In winter, water that is slightly warm may be used to advantage.

A plant in active growth should be continually receiving and transpiring water, and an occasional cleaning of the leaves will help the plant, as the dust particles are removed, thus aiding the transpiration.

PESTS & DISEASES OF ORCHIDS

There are many pests that can do harm to Orchids if not checked in the early stages. It is better to prevent them from getting a start by regular preventive measures.

Cleanliness within the Orchid house is of prime importance. Keep the floor and benches free of any rubbish, compost etc. If there are any wooden structures a coat of paint will help. Keep floors weed free and don't clutter the underbench space with unnecessary objects. A good air flow within the house is important though draughty places should be avoided.

Slugs and snails can be pests and if allowed to inhabit your Orchid house can cause serious damage. They are easily caught by hand at night, and disposed of in salty or hot water. Suitable snail baits may be used with safety in and around orchid pots. A product manufactured by Bayer called Mesural in pellet form seems to be an improvement on other lines, and lasts longer in the moist, humid atmosphere of an orchid house. A

light spraying of Captan or similar fungicide will prove worthwhile when applied to these pellets, and will ward off fungal growth for several weeks. These are toxic substances and care should be taken when handling them.

Aphids are small, soft bodied, sucking insects and reproduce very rapidly. They attack buds and new growth, and are controlled by sprays such as Malathion 50 at 1.25 ml. per litre, or Metasystox at 1 ml. per litre.

Mealy bugs are other soft bodied insects with a white mealy covering. They are closely related to scale insects, though they do not form a protective scale. They inhabit the leaf axils of plants and can be controlled by Malathion.

There are many types of scale insects in Australia, and several species have been found on orchids. Some are soft scale and other species are almost classified as hard scale. Most species have a relatively short active life and multiply freely. Control by using a mixture of Rogor 40 at 1 ml. per litre and White oil at 20 ml. per litre. Many scale insects can be controlled by using soap and water on a cloth and wiping over the affected area.

Red Spider can be a pest and due to their small size, they usually go undetected for some time after infestation. Signs of silver frosting under the leaves and numerous small white blotches on the upper surface will be evident, and can be controlled by Malathion, Rogor, or Metasystox.

Thrips are very small four-winged insects with sucking mouth parts, and they like dry conditions. They cause rusty patches on leaves, and discoloured and disfigured flowers, and may be controlled by Rogor or Malathion.

There are several other pests which affect orchids, including Dendrobium beetles, the larvae of some moths, and occasionally some woodboring insects which feed on the roots of orchids. This last pest is not easily controlled, and if allowed to persist can result in the death of plants. Where practical, an occasional treatment of the orchid house with a fumigant such as Vapona will keep their numbers in check.

It should be noted that many pests are known to develop resistance to groups of insecticide compounds, if used constantly and alternating with a spray from another group will be of great advantage.

All of these insecticides are harmful to the user though their toxicity is variable, and extreme care should be taken in using and storing them.

DISEASES

Though not as commonly found on orchids as pests, diseases including Mosaic blight, fungal attack and virus of several types are harmful to plants.

Mosaic is a virus that can be transferred by insect or touch. It causes mottling on the leaves and can spread rapidly through the Orchid house. Plants should be quarantined or destroyed.

Fungal diseases are caused by many factors including insect damage unsealed cuts or wounds, bruising etc. They are mostly man made and are greatly assisted in their development by allowing humidity to fluctuate to extremes. Use Benlate at 0.4 ml. per litre every 2 months as a control but clean handling of plants removing spent flowers from pots and plants and sealing of cuts with Bordeaux powder or Colgraft will help greatly.

Be careful of diseases and should you encounter anything you don't recognise seek advice.

A word of warning on the use of fungicides is required as most are toxic, some extremely so, and careful use is advised.

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GROW AUSTRALIAN ORCHIDS

This is a fascinating hobby for young and old and need not occupy a lot of space. Past issues give advice that should allow beginners to get a start. For those who would like some help and who would like to join our Study Group on orchids, please write to Mr. Brian Muffet, 23 Marulou St., Aranda, A.C.T. Other group members will be pleased to know that Brian has now taken over the organisation of the Orchid groups and he would like to hear from you. As with other Study Groups, most contact is by correspondence and the exchange of plants, seed, and information is arranged by mail. Country members are especially welcome.

BIRDS IN MY GARDEN

Saw a Spotted Pardalote in the garden a couple of days ago, busy eating the scale and lerps off a Murray Bridge form of *Eucalyptus leucoxylon rosea*. This was a great reward for planting natives as it is the first I have ever seen, and I have lived in the same house off and on since I was born.—Margaret Thornton, Surrey Hills, Victoria.

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SOCIETY FOR GROWING AUSTRALIAN PLANTS—CANBERRA REGION:

President: Mr. Henry Nix, 22 Syme Crescent, O'Connor, 2601.

Secretary: Mrs. N. Bell, P.O. Box 207 Civic Square, A.C.T. 2608.

WEST AUSTRALIAN WILDFLOWER SOC. (Inc.):

President: Mr. Barry Moss, 2 Wilson Place, Gooseberry Hill, W.A. 6076.

Secretary: Mrs. G. A. Oxnam, P.O. Box 64, Nedlands, W.A. 6009.

Seed is in very short supply—try the commercial seedsmen, not W.A. Society.

Membership is open to any person who wishes to grow Australian native plants. Contact the Secretary of the Society for your State for information without obligation.

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FACILITIES AVAILABLE TO MEMBERS

Meetings of members in local suburban or town groups. Regular meetings with illustrated addresses in capital cities and major regional centres, free supply of seed and advice on cultivation, field trips, flower shows, publications (*Australian Plants* as well as State news journals) and participation in Study Groups into cultivation of selected groups of plants such as Orchids, Ferns, Wattles, Grevillea, Hakea, Banksia, Native Irls and Lilies, Mint Bushes, Boronia, Pea-flowered Plants, etc. Enquiries to State Secretaries listed above by mail.

PAST ISSUES OF "AUSTRALIAN PLANTS" AVAILABLE

Because of the vast wealth of our flora there is very little repetition.

VOLUME No. 1 Issues 1-12, no longer available bound but Issues 5, 6, 7 & 9 are available at 45c each, \$1.85 incl. postage. However it is proposed to reprint Volume 1 as a fully bound book at a date in the future not yet decided upon.

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NEW BOOKS ON WILDFLOWERS AND GARDENING

The new books available for purchase by mail only from the Editor, 860 Henry Lawson Drive, Picnic Point, N.S.W. 2213, offer considerable value and interest on their subjects. Most people have gardens that include a wide range of plants of their choice, not just natives, and the books just released complement each other very well.

FLOWERS AND PLANTS OF WESTERN AUSTRALIA — Price \$16.95 plus 55c postage by Rica Erickson, M. K. Morcombe, A. S. George and N. G. Marchant.

As reviewed in our last issue the 500 colour plates make this book good value. The real treasure however is the descriptive sections by Alex George both as a guide to conditions these plants have survived in, and as a reference should you visit Western Australia.

FLOWERS AND PLANTS OF VICTORIA — Price \$15.95 plus 55c postage by J. H. Willis, C. R. Cochrane, B. A. Fuhrer, E. R. Rotherham.

Reprinted by demand, the breadth of coverage of the flora of the various regions in Victoria never ceases to amaze.

DESIGNING AUSTRALIAN BUSH GARDENS — Price \$1.50 plus 30c postage
MORE ABOUT BUSH GARDENS — also \$1.50 plus 30c postage

Two books by Betty Maloney & Jean Walker reprinted because of the urgent demand by those who want to build a little bit of the bush at home.

AQUATIC PLANTS OF AUSTRALIA by H. I. Aston — Price \$21.00 plus 50c postage

An expensive book but in the 362 pages all those plants recorded for Australia that are entirely dependent on the presence of permanent water or are never found far from it, are fully described. Omitted only are the sedges and grasses. The 222 species are clearly described and illustrated by 132 line drawings. Family and generic descriptions with simple keys are for layman as well as student use. Who wants to know and grow water lilies, etc.? By fortunate coincidence the following book is also now available.

WATER IN THE GARDEN by Suzanne Beedell — Price \$5.95 plus 45c postage

The use of water in the garden, decoratively and practically is a very old method to add interest and charm. It is only recently that small pools, waterfalls and miniature fountains have begun to take their place in the home garden landscape. This book describes how these can be constructed and maintained in clear simple practical descriptions in chapters headed 1. How to Make Garden Ponds & Pools, types, siting and design, measure and dig, drains and overflows, how to concrete, sheet liners, make glass fibre pools, paved surrounds, fountains and cascades, lighting; 2. Aquatic Plants, preparation, planting, pest control for all types of plants, but the plants listed are not Australian natives; 3. Moisture—Loving Plants for beside the stream or pool (not natives), forming moisture beds; 4. Fish and Other Aquatic Creatures; 5. Birds, waterfowl, geese, swans, bird baths and wild birds; 6. Soilless Gardening, containers, stands, aggregates and care of plants; 7. Swimming Pools, all factors of shapes, siting and care, paddling pools, dams and sluices; 8. Water. 176 pages of good practical stuff. Will readers please advise suitable Australian plants?

This leads us by further coincidence to the next new book . . .

KNOW YOUR ROCK GARDEN PLANTS & DWARF BULBS — Price \$5.95 plus 45c postage

This 104 page (10" x 7") book is really two books in one. In the first and major part of the book the author and obviously experienced rock gardener Ken Gillanders, reports on his efforts at establishing a rock garden in Victoria. The most suitable rock garden plants from all parts of the world are described in two sections, those really fat, clump or mat forming rock plants and these plants and conifers that form small bushes suitable for a rock garden. Seventy of the plants described are Australian natives and at least as many again are native to New Zealand, ranking among the choice exotics from all parts of the world that have been found suitable for Australian conditions.

Beautifully illustrated in 76 colour plates by Ted Rotherham, this book is ideal for anyone seeking to establish a rock garden in Australia. Many more natives could have been included but those chosen have proved suitable and complement the hundreds of exotics more widely grown.

The third section "Dwarf Bulbs" by Gladys Paterson, does not feature natives but describes all the small gems most suitable for small gardens.

FOLIAGE PLANTS by F. A. Boddy — Price \$6.95 plus 45c postage

No garden, great or small, can fail to benefit from as much thought being given to the use of foliage as to its adornment with flowers. Written for northern hemisphere gardens this 213 page book presents hundreds of exotic plants for use as foliage landscape under the headings—Unfurling Leaves, Shades of Green, Golden Glitter and Silver Foil, Silver to Grey, Variegated Foliage, Hues of Maroon, purple and bronze, form and texture, conifers, aiding floral colour, aromatic foliage, autumnal glory, changing to winter garments. Well written and full of interest—using this book as a guide would some readers undertake the task of classifying Australian natives for foliage? We have the world's treasure house of foliage plants.

THE MAGIC OF WILDFLOWERS

Each issue in the future will carry a series by Nuri Mass for those fresh minds to enter the wonderful world of wildflower charm. We have had a big upsurge of interest from young people who are wanting to know more of the world around them and this series will seek to help them glean more information from the other articles in the issue. Will readers throughout Australia help us by seeing the librarian at your school and bring this periodical to their attention. We need it to boost sales but even more, we owe it to the next generation to help them understand and preserve this world we live in.—Editor.



DIURIS PALACHILA

This colour plate was prepared for use in our No. 54 but did not turn out as well as expected. Our No. 54 issue has a very good article on the cultivation of the "Donkey Orchids", *Diuris*. Of special interest however are the two articles "Australian Terrestrial Orchids From Seed" and "A New Medium for Raising Australian Terrestrial Orchids From Seed".