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The 101 Issue — First of Volume 13.

In 1959 when we started, we were full of enthusiasm and high expectations. What we have achieved over 100 issues to date has exceeded all our dreams. The support of all has been sincerely appreciated — Bill Payne, Managing Editor.

Australian Cycads — The Subject of This Issue.

This issue is the work of the Cycad Study Group and in particular, that of Len Butt, the leader of the group. If you are interested in learning more about this unique group of plants, or of Australian palm trees, write to Len, 25 Ortive St, Yeronga, Qld 4104.

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COVER PLATE

Lepidozamia peroffskyana

Photograph by Tony Rodd

Photographed on North Brother Mountain, Camden Haven, N.S.W.; the amateur could be excused for thinking this magnificent plant was a great coarse leaved tree fern. Refer to the article opposite for further details.

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Cycads of Australia

by Len Butt

Our indigenous cycads are scattered throughout the Continent, but are absent from Victoria and South Australia. Strangely enough, the best known fossil beds of these ancient plants are in Victoria. Most have the physical appearance of palms and in the case of *Macrozamia* species such as *M. moorei*, could easily be mistaken for them. The *Bowenia* species have rather a fern-like appearance and indeed one of them has long been known as the "Byfield Fern".

Cycads are a group of ancient woody stemmed plants, some with thick columnar caudices or trunks, others with the caudex completely subterranean. The trunks consist of a central core of rather fleshy conducting tissues on the outside of which is a thick layer of row upon row of persistent leaf bases rising from base to crown. They are mostly unbranched, but multiple heads on mature *Cycas* and *Lepidozamia* are quite common.

The leaves can be called fronds, and in a few species even rise circinate (uncoiling) from the crown as in the true ferns. The beautiful crown of leaves is the primary attraction of these plants. The young fronds are very tender and delicate and susceptible to injury but soon become tough and strong with a glossy surface.

Cycads are living remnants of a very ancient flora which was once plentiful and probably dominated the vegetation of our world. They are Gymnosperms, plants that differ from the Angiosperms (flowering plants) by their ovules being borne naked on the scale of a cone, not enclosed in an ovary. Although other Gymnosperms, namely the conifers and the Ginkgo, have somewhat similar reproductive structures to the cycads, the relationship is not a close one. Indeed those who see them as similar to ferns are much nearer to the truth.

It has generally been accepted that they are descendants of a very ancient family of plants known as the Bennettitales which flourished in the Mesozoic age, approximately 200 million years ago. Fossil records indicate they may be linked with the most ancient of the Pteridosperms or seed bearing ferns which were the main flora of the late Paleozoic era, 300 million years ago. Some, especially those of the order Cycadofilicoides, showed resemblances to our present day cycads, at least in features of their foliage. There, great cycad-like plants were not only the main flora of the Devonian era but in the later Carboniferous era, laid down in swampy deposits, formed part of the carbon coalfields we know to-day.

In the next age, the Permian, they became extinct, but about this time there arose two groups of similar Pteridosperms, forms which were probably linked with the former plants. These new groups were the Bennettitales and the Cycadales which, fossil records indicate, began in the Mesozoic era (the Triassic age) and flourished right into and through the Jurassic age, another fifty million years. The Bennettitales became extinct in the Cretaceous age and only one branch of its companion Cycadales survived, ancestors of the cycads of to-day.

Cycads are dioecious. That is to say they consist of separate male and female plants. Males bear narrow pinelike cones which produce sporangia (pollen), and females in all genera except the *Cycas* produce seeds with a larger cone.



Macrozamia moorei (above)

Photograph by Merv Hodge

A moderately tall, palm-like plant to 8 metres high but more commonly 2-3 m with a spread to 5 m. The crown of fronds are on top of a thick trunk 60 to 80 cm in diameter. *Macrozamia* do not produce flowers. There are separate male and female plants which produce cones rather than flowers. Male cones are cylindrical, up to 45 cm long and 10 cm in diameter with between 15 and 100 cones borne on one plant. Female cones are cylindrical, 40 to 90 cm long and 12 to 19 cm in diameter with 1 to 8 cones per plant. See page 16, for details of those female (seed) cones and seed. The fronds are up to 3 m long and numerous, pinnate, glossy green, with reduced spine-like pinnae extending almost to the base of the frond.....An attractive pot plant can be achieved in 5 to 10 years from seed. These plants are well suited to pot culture and make excellent indoor plants if given adequate light and not overwatered. -Reprinted, photograph and text (abridged) from "A Horticultural Guide to Australian Plants", Set 6, Sheet 6. See page 44 for further details.

Macrozamia pauli-guilielmi (opposite)

Photograph by Merv Hodge

This species has a short trunk which is usually below ground level. The leaves arise from the apex are few in number, up to 1 metre long and are twisted through at least 360°. The pinnae are narrow or linear and arise from the margins of the leaf axis. Well suited to pot culture, extremely slow growing. The plant shown here is a male, the cones growing from 10-25 cm long, 4-6 cm diameter. The plant grows 0.5-1.0 m with a similar spread. Colour plate and caption (much abridged) reprinted from "A Horticultural Guide to Australian Plants", Set 3, Sheet 26.

A Horticultural Guide to Australian Plants

This comprises sets of large colour plates (larger than shown here and produced to a quality we can never hope to achieve in a periodical), one page per species of an Australian plant with a very adequate but simple description on the rear of the loose-leaf sheet. Produced with 32 full colour sheets per set with punched holes of a D-ring binder (also available) the "Horticultural Guide" is a magnificent production. See page 44 for further details.



***Macrozamia moorei*—The Magnificent Cycad**

Macrozamia moorei (F. Mueller) F. M. Bailey is a huge palm-like cycad. I have seen fine specimens west of Rockhampton in the Emerald, Springsure and Rolleston districts, in and around the incredible Carnarvon Gorge area and further south almost to Injune. Another area of note is the Clarence River district of northern New South Wales where it grows at the edge of rain forests. To see *Macrozamia moorei* in its natural state is to answer the question "Why grow or bother about Zamiaceae?". In the Carnarvon Gorge the *Macrozamia* dominates the scene from the entrance gates to the National Park, right through the established camping areas along the sides of the winding creek, and up both sides of the sloping gorge right up to the sheer cliffs. Even the other dominant plant in this area, an un-named *Livistona* fan palm, takes second place to the big showy grandeur that is this cycad. They stand like sentinel gate posts each side of one of the walking tracks in the gorge, the larger being easily four metres high at the apex of its trunk, with extra height added by the up-curving blue-green fronds up to 180 cm in length. See the photograph on page 4.

Many *Macrozamia* species do not have really clearly defined trunks or caudices, but this is not the case in *Macrozamia moorei* which has an extremely stout caudex in the mature plant, up to 80 cm in diameter, and has the leaf bases clearly defined by row on row of knobby projections of about 4.5 cm, the trunk being composed of these leaf bases much as bark encloses an ordinary tree.

To come suddenly on to a hill covered with this species gives the first impression that here is a forest grove of stout date palms. The colour of the fronds can only be described as blue-green, and the upright arching manner of their growth is very distinctive. The pinnae (leaflets) along the rachis extend right down almost to the frond bases. The female cone of *Macrozamia moorei* is the largest of the genus and can be from 45 cm to 80 cm in length and 19 cm in diameter. Although each pair of seed is covered by a green pad possessing a spine, the ripening cone reveals the bright orange seed, this very large attractive cone enhancing the beauty of a fascinating plant. There can be as many as eight large cones on a mature female plant and up to one hundred of the narrower cones on a male plant. A plant of *M. moorei* has been grown to maturity in fifty years, and some specimens two metres high in the caudex are reported to be less than one hundred years old. *Macrozamia moorei* has comparatively rapid growth for a member of the Cycadales.

The toxic poison associated with most parts of all the Cycadales is also present in *M. moorei*, but like all cycads it is not in the bright orange flesh of the seeds which is sought after by many marsupials as a food.

Macrozamia miquelii*—The Variable *Macrozamia

Macrozamia miquelii is a really handsome plant with bluish-green fronds upright initially but the lower circle of fronds soon arching outward, giving a symmetrical appearance. The trunk or caudex is nearly always subterranean and rarely evident. It probably reaches only about 60 cm tall and 50 cm thick in the oldest of plants. It occurs on the east coast from Northern New South Wales up to a little north of Rockhampton in Queensland. Well established stands we have studied are on hill slopes in the Upper Brookfield area near Brisbane, another west of Gympie and quite a hillside of this zamiad in a grazier's property at Glastonbury. The large colourful cones were ripening on the female plants about the month of November. Their male counterparts had multiple cones in the axils as do all *Macrozamia* species.

Off the Queensland coast north from Tin Can Bay lies the tip of one of our many lovely coastal islands, Fraser Island, where the variety *douglasii* occurs in rich profusion. In a semi-rainforest atmosphere amid *Angophora*, *Banksia*, *Eucalyptus* and tea tree it grows in groves and in single groupings. Growing on sandy wallum loam it must get quite a share of moisture from the fresh water lakes, creeks and springs that are prevalent on the island.

The largest plants we found were two metres tall at the apex of the centre fronds. Large heavy cones to 40 cm were quite well formed but immature in the January month that we found them. At Central Station, a beauty spot about the centre of the island, several plants had thickening established trunks 30 cm high growing with some large plants of the glorious primitive fern *Angiopteris*.

Macrozamia are becoming more and more well known in nurseries today, and every form of *M. miquelii* I have come across would make a beautiful specimen in selected home landscape features, or as a large ornamental tub plant on a patio.

On the mainland west of Bundaberg we again find *Macrozamia miquelii* on Mount Perry where it is referred to as the variety *mountperriensis*. It is small and not so prolific in its frond number. Another form, very similar to that of the Upper Brookfield areas, is found growing on Mount Archer at Rockhampton, and again at Bowenia National Park north of Yeppoon where it grows in profusion with the local *Bowenia*. A ripe cone of *Macrozamia miquelii* was given to me some years ago, and the rich beauty and form of it made me think at that time that here was the best cone type of our Australian cycads. Since then I have viewed other *Macrozamia* cones on various occasions and find them all to have individual merit and attractiveness. I have often thought this material would be ideal for plant exhibitors in the floral art sections. They would indeed far surpass the *Banksia* cones at present used in this way.

Because the variable *Macrozamia miquelii* grows in many types of soil and terrain, most forms will adapt well to garden culture, but those from the more arid hilly situations such as Mount Perry and Upper Brookfield require similar conditions if transplanted.

A report from a member of the Cycad Study Group, Margaret Telfer, will be of interest:-

"Plants of *Macrozamia miquelii* that grows in the Upper Brookfield area seldom have trunks more than half a metre long. Their long slender palm-like fronds are less coarse than *Macrozamia communis* and give a soft tropical appearance to the landscape. They have been seen growing in a variety of environments from dry scrubland to creek banks which run through rainforest areas, but all grow in areas that have at least a small amount of shade. The cones start to mature in January and can be harvested up to May. After this time most cones have split and the seeds scattered by wild animals and only the occasional seed can be found near the parent plant. The orange coating on the seed is eaten by possums, bandicoots, and dingoes causing the seeds to be readily distributed throughout the immediate areas. Toxic compounds are present within the seed proper, but can be removed by vigorous washing and pounding. Some seeds appear to be a light orange colour when mature, and others dark red although not fully mature.

"The cones of *Macrozamia miquelii* are approximately the size of a double fist. Most cones are well packed and some contain as many as sixty seeds, and most would have at least thirty seeds. Occasionally some young female plants produce a very small lightly seeded cone. Some female plants have been known to produce four cones in one season. These are usually the very large plants. Most display only one or two. Female plants do not bear cones every year.

"After the seeds have been harvested they are soaked in a bucket of water for two days. Those that float are supposed infertile and discarded. The remaining seeds are peeled with a sharp knife and then half buried on their sides in a mix of three parts sharp river sand to one part peat moss."



Macrozamia riedlei

Photography by Marion Blackwell

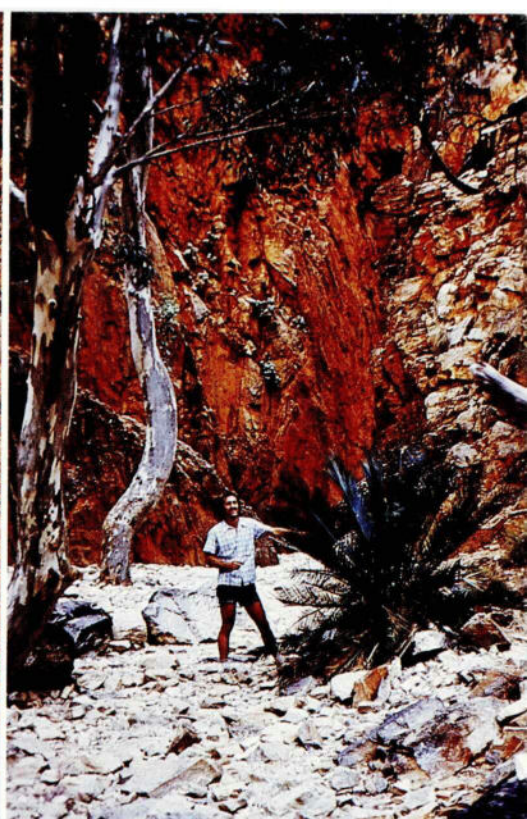
Found only in Western Australia from the Murchison River south, then east to Israelite Bay this beautiful *Macrozamia* can grow almost to 3 m high and 4 m across. The photograph shows a female plant with its fruiting cone fully matured and some seed on the ground. A close-up of an immature fruiting cone is shown in photograph F on page 16. At both the northern and southern limits of its range it has a bulbous trunk as shown whereas elsewhere it shows no trunk above ground level. Colour plate and much abridged description reprinted from "A Horticultural Guide to Australian Plants", Set 7, No. 45.

***Macrozamia macdonnellii* (two upper photographs opposite)**

The photograph on the upper left shows plants growing on the cliff side of Serpentine Gorge of the Macdonald Ranges, west of Alice Springs. The photograph on the upper right shows a plant growing in Stanley Chasm in the same area.

***Macrozamia communis* (two lower photographs opposite)**

The plant on the lower left is growing in a garden in South Australia and illustrates how well these magnificent plants grace the garden. The photograph on the lower right taken by Tony Rodd shows the male pollen cones of the species.



Macrozamia communis—The Burrawang

"Burrawang", the aboriginal name, seems synonymous in Australia with all of our cycads, and I have seen many *Macrozamia* and even one *Lepidozamia* labelled "Burrawang Palm" in nurseries.

Macrozamia communis forms subterranean caudices in deep sandy soils, but in shallow soils may occasionally form a trunk to two metres tall with diameter of up to 60 cm. Depending on size of mature plants and suitability of growth conditions, fronds can number from fifty to one hundred on a plant. Initially, the fronds grow erect from the trunk apex, spreading outwards eventually up to 200 cm in length. Cones form in the leaf axils among the fronds.

The male cones can be any number up to ten, and the female to about six. It is found in coastal and range areas, from Bega in the south up the New South Wales coast to almost Queensland. Particularly fine specimens can be seen in the Hawkesbury Sandstone areas around Sydney such as Ku-ring-gai Chase right up into the cliff country. Although it grows in communities on the deep sandy loam of our coast soils, it does equally as well in hilly country and seems to grow well among eucalypts such as the spotted gum.

Seed has proved to have a high viability and germinates well. *Macrozamia communis* does well as a potted plant and lives long in cultivation, the fronds having high ornamental value. Landscaping potential of this cycad is very high, and along with other species such as *M. miquelii* it should adapt well in any well-drained situation. The palm-like appearance of the dense circle of fronds lends itself well to garden situations, and the plant's longevity and hardiness is notable. The fleshy casing of the seed is sought after by marsupials and fruit eating bats and possums have been known to dig up and carry off seed planted with the flesh intact. The poisonous kernel of the seed is always left uneaten by our native fauna.

Macrozamia pauli-guilielmi

The type form of *M. pauli-guilielmi* occurs on sandy ridge country intermittently along the length of Tin Can Bay Road, and also in the country between Maryborough and Gympie. Some finds have also been made in the Rainbow Beach area. All specimens I have seen so far occur very close to the coast growing in the grey sandy wallum soil along with *Banksia robur*, *Hakea gibbosa*, and similar wallum plants.

Macrozamia pauli-guilielmi is one of a number of small *Macrozamia* species grouped in this Section *Parazamia*. The relatively few fronds (generally about three, but never more than about ten) measure only around 100 cm in mature plants, and although this plant is rather insignificant in its habitat the unusually pronounced spiral twisting of the rachis give the appearance that the pinnae radiate all around the frond. The pinnae are very slender, and under cultivation this feature could make this species a very desirable pot plant. Although the type subspecies is confined to south-east Queensland, there are two other subspecies of *Macrozamia pauli-guilielmi*. *Macrozamia pauli-guilielmi* subspecies *plurinervia*, the "Blackfellow's pineapple" is native to the northern New South Wales tablelands across to extreme southern Queensland. The petiole and rachis of every frond is spirally twisted but not as strongly as in the Queensland type form. The broader, stiffer, grey-green pinnae have reddish bases.

Macrozamia pauli-guilielmi subspecies *flexuosa*, the "Kangaroo nut" occurs on the New South Wales coast and in eucalypt forests from the west side of Lake Macquarie northward to the Manning River. The twist in the rachis is commonly two complete revolutions. With the subspecies *M. pauli-guilielmi* the white based pinnae are much more slender and longer than either of the other forms.

Although the distinctive spiralling of the rachis of *Macrozamia pauli-guilielmi* is quite marked (at least in the Queensland type form), there is quite a bit of variability. The form that occurs around the Elliot River near Bundaberg is different in structure. The *M. pauli-guilielmi* at Tin Can Bay has very linear pinnae, sometimes only about 3 mm wide, whereas the Bundaberg species has quite wide pinnae up to 5 mm. The spirals in the rachis are generally similar, but the number of fronds is about double the number of the Tin Can Bay form.

Macrozamia lucida—Brisbane's Local Cycad

Apart from *Lepidozamia*, the best known local cycad in south east Queensland is without doubt *Macrozamia lucida*. It is grouped in the Section *Parazamia* as it is a low-growing "spiralis" form of plant. However, *Macrozamia lucida* has very little twist in the mature frond rachis. It is known by local farmers as "pineapple zamia".

Macrozamia lucida has a subterranean caudex with fronds loosely arranged in a circle from the crown. The pinnae are narrow, shiny dark green in colour, and the bases of the petioles are clearly marked by prominent whitish markings. Length of the fronds I observed would be 90 cm long on the average at maturity. General width of plants from frond tip to frond tip would be 1.5 to 2.00 metres. Height of plants would be to 1.2 metres. As many as five to eight cones have been seen on male plants, and two cones generally to the female. This plant adapts well to cultivation and soon blends into the harmony of a garden whether kept as a pot plant on a patio or as part of a native plant rockery, for which it is well suited. The female cones are very attractive, and are comparable to other *Macrozamia* being roughly about the diameter of a closed male fist and about 13 cm long. Seeds are generally about 3 cm in length, and a marked dark orange in colour when ripe.

Sightings of *Macrozamia lucida* have occurred from Hervey Bay west to Carnarvon, then south in the low range areas into New South Wales. Around Brisbane it occurs on the slopes of Mount Coot-tha, Toowong and the Indooroopilly hilly areas. It is widely spread from Enoggera up through the D'Aguilar Range country, the Glasshouse Mountains vicinity, and Beerwah, Peachester to Maleny. Seedlings are easily obtained as the seed is generally viable if collected fresh. Mature plants for cultivation as ornamentals are generally easier to obtain in Brisbane than most other species.

SMALL MACROZAMIA OF NEW SOUTH WALES

Macrozamia species occur in dense colonies in many areas of New South Wales, principally the northern and central coastal areas. The most remarkable thing I have observed about these New South Wales species is the difference in the formation of the pinnae. In some, each pinnae divides into two lobes near the base, and in others the division is multiple. This feature appears to be only in the species from New South Wales as no plant in Queensland possesses this peculiarity to my knowledge.

Macrozamia diplomera

This *Macrozamia* of low stature has a degree of similarity to *Macrozamia communis*. The caudex is generally fully subterranean, about 40 cm diameter. Fronds of a mature plant can number up to forty or fifty, and the pinnae are often divided into two lobes. *M. diplomera* has a straighter and more angular rachis than the other species in its habitat, *M. heteromera* though in some respects they are rather similar. It is found on the north-west slopes of the Great Divide near Coonabarabran, and parts of the Warrumbungle Ranges, New South Wales. It seems to prefer sandy to stony soils.

Macrozamia heteromera

This cycad has also a similarity to both *Macrozamia communis* and *M. diplomera* but is a smaller plant than the former. The caudex at most would be 20 to 25 cm, and the fronds only up to ten in a mature crown. A single cone is usual on female plants, but up to four on males. The pinnae are often divided twice in rather divergent shapes, and in colour are rather glaucous (blue-green). This species occurs in the same habitat as *M. diplomera*, such as throughout the Warrumbungle Ranges, but spreads further into districts of Narrabri, Gunnedah and Wyallda.



***Lepidozamia peroffskyana* (above)**

Photography by Tony Rodd

A mature, in fact very old plant of this species is shown on the front cover. Above is the male pollen cone. It would be 50-60 cm long. As it reaches maturity the scales (sporophylls) separate into a spiral pattern as shown — a feature of *Lepidozamia* species.

***Lepidozamia hopei* (opposite)**

Photography by Bill Snewin

A palm-like plant from northern Queensland, *Lepidozamia hopei* is reputed to be the tallest living cycad. There are reports of specimens reaching twenty metres high.

Both of these colour plates are reprinted from "A Horticultural Guide to Australian Plants" *L. peroffskyana* being sheet 24 of Set 3, while *L. hopei* is Sheet 41 of Set 7. As can be seen from these photographs, the "Horticultural Guide" comprises sets of 36 magnificent colour plates with accompanying adequate, but easily read descriptions. See page 44 for further details.



Macrozamia stenomera

Being similar to *M. heteromera* this cycad has often been mistaken for it and has even been listed as a variety of it. The caudex is subterranean, fronds up to ten, and bases of pinnae a burnt yellow colour. These lines of colour where the pinnae meet the rachis are not noticeable through many *Macrozamia* species. The habitat is Northern Tablelands and the Nandewar Range of New South Wales, spilling over into districts where *M. heteromera* occurs.

Macrozamia spiralis

Previously known as *Macrozamia corralipes*. This is a small plant having a subterranean caudex with no visible trunk. The fronds up to twelve in number, and up to 90 cm long have been noted with the base of the petiole being bare and the rachis only 40 cm long. Pronounced spiralling is evident in the rachis. The seed cones measure approximately 20 cm, and the seed is orange-red rather than orange, deeper in colour than in other species. Habitat of the true "spiralis" is a restricted area of central New South Wales north-west of Sydney into the central west slopes of the Dividing Range. It's native to Port Jackson area. Other species overlap its territory, and it has been found growing with *Macrozamia communis* and related species.

Macrozamia secunda

Another small species, *Macrozamia secunda* is found growing around Mudgee and Gilgandra. Also found in areas with *M. spiralis*, it is very similar, a noted difference being the concave shape of the petiole and the crowded narrow pinnae along the rachis. The pinnae rise at an acute angle to each other and the fronds are often hidden among surrounding herbage.

Macrozamia pauli-guilielmi

Two of the subspecies of this *Macrozamia* occur in New South Wales. Both have pronounced spiral twisting throughout the rachis and few fronds from a subterranean caudex. Like all plants of *M. pauli-guilielmi*, the caudex is sometimes visible to 15 cm high. They occur on the central and north coast of New South Wales. The subspecies *flexuosa* is so similar to the Queensland type subspecies that it is often listed as the latter, but it may be distinguished by the petioles that are longer and narrower than the type. The common name given to both species is "kangaroo nut" or "blackfellow's pineapple".

Macrozamia fawcettii

From the far north coast of New South Wales *Macrozamia fawcettii* is closely related to *Macrozamia pauli-guilielmi* also. The pinnae, however, are much broader and more definitely toothed near their apex. The strongly spiralling rachis which is similar to the Queensland *M. pauli-guilielmi* has often caused it to be mistakenly identified as a form of it. Districts reported as habitats are Upper Richmond River, Grafton, and north west of Woolgoolga, New South Wales.

***Macrozamia platyrachis*—The Little Cycad**

The small but unique *Macrozamia platyrachis* has a completely subterranean caudex, and short, thick petioles, possibly only up to about twelve. Specimens examined had only four fronds. The pinnae are thick and falcate, extremely wide for this kind of plant, but typical of Section *Parazamia*.

This species may never really get into cultivation as its main area of occurrence is within a National Park. The female cones are cylindrical and about 15 cm long, the pinnae leathery, and the fronds semi-erect and slightly twisted. Living in a comparatively small habitat and often in the edge of rainforests, it is not listed as being dangerous to stock, but this would mainly be because it is inaccessible to them.

***Macrozamia riedlei*—Lone Zamia of the West**

Macrozamia riedlei is commonly called the "Zamia palm" by West Australians, and although it has some written history regarding the paralytic effect on early settler's cattle, the settlers also realised its potential as a source of starch. To this end they carefully shredded the pith of the trunk, soaking it in water for many hours, and filtering and washing the material many times before drying and powdering it into a starch.

This very variable *Macrozamia* occurs along the coastal regions of south-western Western Australia in a wide band, roughly from just south of Geraldton to the Esperance River. All specimens I have seen were quite trunkless, but there are reports of *zamia* growing in the south-east corner Karri forests, which have a caudex of about two metres. It appears that like *Macrozamia miquelii*, it does get a trunk at maturity, and one of good proportions. The arching fronds are at first erect, later spreading, and are numerous in the plant's crown. The female cone of red seeds is typical of the *Macrozamia* genus in other parts of Australia. The seed is similar in size to that of *M. miquelii*—5 cm long, and the cones are approximately 30 cm in length. Variability of this plant must be pronounced in cultivation as it occurs in sandy soils and also in red moist soils. The fact that these plants adapt well is also evident in the Eastern states. *M. miquelii* occurs on moist sandy loam (Fraser Island), and dry stony hills west of Gympie.

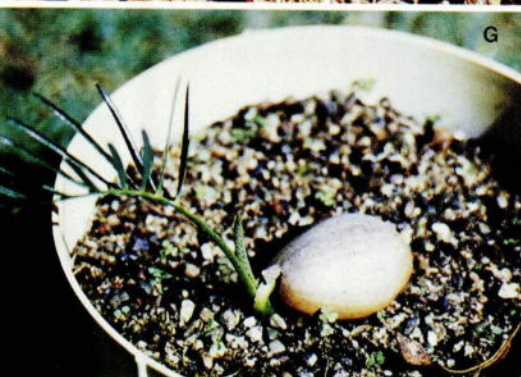
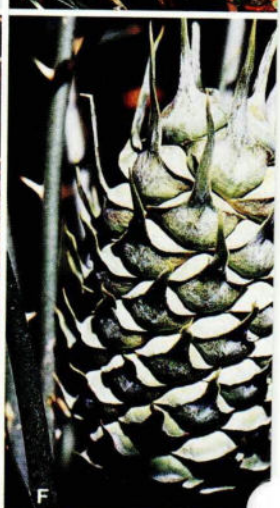
Macrozamia riedlei is prominent enough in appearance to warrant it being quite a likely plant for home garden or tub culture. It is to be hoped that the true ornamental value of this West Australian species will be realised in time to save it from eradication by certain authorities who always place the value of a plant by its value in commerce rather than by its botanical antiquity and value as a link to our past.

Macrozamia macdonnellii*—The Isolated *Macrozamia

This beautiful glaucous blue species, typical *Macrozamia* is separated from other species by some 1,500 kilometres of arid desert and boulder country. *Macrozamia macdonnellii* is confined to the rugged mountainous strip known as the Macdonnell Ranges which are situated between the Gibson Desert in the west and the Simpson Desert in the east. Alice Springs is situated in this range area, and probably the first specimens collected of this cycad were from around this area. Early across-Australia expeditionists must have marvelled at this impressive palm-like plant. In these ranges it could hardly be missed growing in association with some few eucalypts and, of course, in its Palm Valley habitat, with the lovely *Livistona mariae*, a fan palm with the peculiarity of having lovely bronze-red leaves while young. The *Macrozamia* occurs in bigger populations and is more widespread in Central Australia. The Macdonnell Range area is large and covers shallow rocky soils and also deep gorge country and the blue *Macrozamia* is found in these habitats, including the Stanley Chasm. The eye-catching blue fronds, the large and heavy female cones, and the outstanding large seeds of *M. macdonnellii* are quite distinct from most other *Macrozamia* and may have been a factor in its survival.

Female cones are up to 40 cm long and 27 cm diameter. Seeds can be 8 cm long by 4.5 cm wide. On large mature plants the caudex can be three metres high and have fronds from fifty up to a hundred in number.

Many of these plants have their fronds low or prostrate to the ground, so I imagine that like *M. moorei* and *M. miquelii* the caudex is long in forming. Also, like the other typical *Macrozamia*, the cones are on a short stalk. The great curved arches of the large fronds have stiff vee-shaped pinnae, again with slight similarities to *M. moorei*, but many other features are more suggestive of *Macrozamia riedlei*.



MACROZAMIA — THE REPRODUCTION CYCLE

This photographic study by Merv Hodge (opposite) provides a picture story of the plant to fruit, to seed, to plant cycle of these fascinating plants.

A — A *Macrozamia* Seed Cone Cut to Show Seed.

A ripe female seed cone cut across to show the red seed ready to harvest. The white capsules are immature seed that failed to develop. The sporophylls appear as the outer sections of the cone with a spike in the centre (see photograph C). Each contains two seeds, shown well in this photograph A with two immature white seeds. Not all seeds mature.

B — A *Macrozamia* Seed Cut To Show The Inside.

A seed cut across to show the outer sarcotesta (orange), the fleshy outer layer of the seed testa and the sclerotesta (the dark skin) enclosing the white endosperm or living core of the seed. The discolouration of the white endosperm is the result of damage white cutting the seed.

C — A *Macrozamia* seed (female) cone.

A female cone with mature seed ready for harvest. This is a female cone of *Macrozamia miquelii*. Previously green with a spike in the centre of each, the sporophylls have been forced apart as the maturing seeds have swollen. The orange seeds (see photograph A) may be seen forcing the sporophyll apart.

D — A male Pollen Cone of *Macrozamia*

A male cone has been cut across to show the pollen sacs (sporangia) on the underside of each sporophyll. The pollen sacs are open having released the pollen.

E — The root of a *Macrozamia*

This photograph of a *Macrozamia* seedling (that has been dug up) shows the development even at this early stage of *coralloid* (coral-like) roots. These are specialised upward-growing roots, emerging just above the soil surface, the spongy tissues of which contain blue-green algae (cyanobacteria) which are believed to have a symbiotic relationship with the cycad. Below is the thick taproot, and growing up from the centre is the stalk of the first frond.

F — The female cone of *Macrozamia riedlei*

A characteristic feature of this species is the shape of the spine in the centre of each sporophyll, each 1.5 to 6 cm long, broad at the base. This seed cone is not yet mature; as the seeds ripen and swell they will force the sporophyll segments apart revealing the orange seed as in C above.

G — Propagation of *Macrozamia* By Seed

A *Macrozamia* seed has germinated. For advice on how to germinate seed quite successfully see the chapter on propagation by seed. This photograph shows how the seed was placed on the surface, how the two cotyledons had emerged from the end of the seed and turned down into the soil. The shoot begins from this point below the soil where the two cotyledons join, and emerges from the soil with the first frond as shown.

H — *Macrozamia* in Horticulture

A superb plant of *Macrozamia* gracing the front lawn of this house. *Macrozamia moorei* or *M. communis*? Only a close examination after reference to the key presented in this issue will confirm which, but to many, who cares?. They are beautiful graceful plants.

The genus *Macrozamia* is one of four genera of cycads found in Australia. The others are equally magnificent. So that they may be adequately illustrated in colour they are described from page 28 at the rear of this issue to associate them more closely with colour plates. The article by Len Butt "Cycads of Australia" is continued on page 20 following a key to the species of *Macrozamia* by Dr. L. A. S. Johnson, Director of the Royal Botanic Gardens, Sydney.

Key to the Species of *Macrozamia*

Note: Juvenile plants of *Macrozamia* may differ considerably from the adult forms in details of the fronds; in particular the pinnae are usually toothed at the ends and the petioles are long and slender. The stomata of juvenile plants are confined to the lower pinna-surface. Only adult organs are described in the key and descriptions given here. Similarly, cone dimensions apply to mature cones (males at sporangial dehiscence, females at ripening of the seeds). *Petiole lengths do not include the woolly expanded base* and may be taken as the distance from the end of the tomentose portion to the lowest pinnae.

Section *Macrozamia*

Large plants with 15-150 fronds in the crown, aerial trunk present or absent, caudex 15-100 cm diam. Fronds 50-300 cm long; rhachis not strongly twisted, usually angled beneath (at least in petiolar portion) when dry, flat to angled and laterally 2-channelled (when dry) above, 6-30 mm broad at lowest pinnae. Pinnae straight for most of their length, spreading, nerves visible but narrow and not or scarcely raised on the lower surface when dry; bases markedly callous on the anterior margin ($\pm$ rugose when dry); the lowest pinnae usually progressively reduced and sometimes spine-like (not always so in *M. miquelii*). ♀ cones 15-90 cm long, 8-27 cm diam., longest sporophyll spines 1-10 cm long; seeds 2.5-8 cm long. ♂ cones 15-50 (-60?) cm long, longest sporophyll spines 1-5.5 cm long.

1. Reduced spine-like pinnae extending almost to the base of the frond (spine-free petiole, excluding swollen base, 0-10 cm long). Plants with massive trunks to 2-5 m tall, 60-80 cm diam. Fronds 150-300 cm long with 150-250 pinnae. Rhachis 12-30 mm broad at lowest pinnae. Stomata on both surfaces of pinnae. ♀ cones 40-90 cm long, ♂ cones 30-45 cm long. C. Queensland and N.S.W. Far N. Coast 1. *M. moorei*.
- 1'. Reduced pinnae not extending to near base of frond (petiole 12-60 cm). Aerial trunk present or absent. Fronds 50-220 cm long, with 60-170 pinnae. Stomata on both surfaces of pinnae or on lower surface only. Cones various.
2. Stomata on both upper and lower surfaces of pinnae. Pinnae simple. West and Central Australian species.
3. Fronds not or scarcely glaucous. Seeds 3-5 (-6?) cm long, 2-3.5 cm thick. Spines of uppermost ♀ sporophylls 1.5-6 (or more?) cm long, lower sporophylls usually with short broad spines. S.W. Australia 2. *M. riedlei*.
- 3'. Fronds markedly glaucous. Seeds 6-8 cm long, 4-5.5 cm thick. Spines of uppermost ♀ sporophylls ca. 1-2 cm long, lower sporophylls almost spineless. Central Australia 3. *M. macdonnellii*.
- 2'. Either stomata on lower surface of pinnae only and pinnae simple or stomata on both surfaces and most pinnae forked. Eastern species.
4. Pinnae simple, stomata on lower surface only.
5. Pinnae thin and rather lax, easily bent, shining above, often rather crowded along the rhachis. Most sporophylls of ♀ and ♂ cones short-spined; longest spines (♀) 2-3½ cm, (♂) 1-2 (2½) cm. Most of the ♀ sporophyll-ends less than twice as broad as high; spines of ♂ sporophylls slender, 2-5 mm broad at the base. Seeds 2.5-3.5 cm long. Eastern parts of C. and S. Queensland and Far N. Coast (Richmond R.) of N.S.W. 4. *M. miquelii*.
- 5'. Pinnae thicker and more rigid, rather dull, often rather widely separated along the rhachis. Many sporophylls of ♀ and ♂ cones long-spined; longest spines (♀) 4-10 cm, (♂) 2-5 cm. Most of the ♀ sporophyll-ends at least twice as broad as high (excl. spine); spines of ♂ sporophylls 5-12 mm broad at the base. Seeds 3-4.5 cm long. Macleay River to Bega, also Goulburn River Valley, eastern N.S.W. 5. *M. communis*.
- 4'. Most pinnae dichotomously once-divided. Stomata on both surfaces. Coonabarabran and country north of Liverpool Range, N.S.W. 6. *M. diplomera*.

Section *Parazamia*

Rather small plants with 2-12 (rarely up to ca. 40 in *M. lucida*?) fronds in the crown, caudex almost or wholly subterranean, 5-30 cm diam. (more in *M. platyrachis*?). Fronds 30-120 cm long; rhachis straight or twisted, rounded or angular beneath, rounded to flat or concave above (sometimes with two lateral grooves), 3-18 mm broad at lowest pinnae. Pinnae straight or falcate, spreading or erect, nerves thick and prominent on the lower surface (especially when dry); bases not or only slightly callous on the anterior margin (not rugose when dry); the lowest pinnae usually not much reduced ♀ cones (10-)15-25 cm long, 6-10 cm diam. longest sporophyll-spines 0.5-4 (-5?) cm long; seeds 2-3.5 cm long. ♂ cones 10-25 cm long, longest sporophyll-spines 0.2-1.5 cm long.

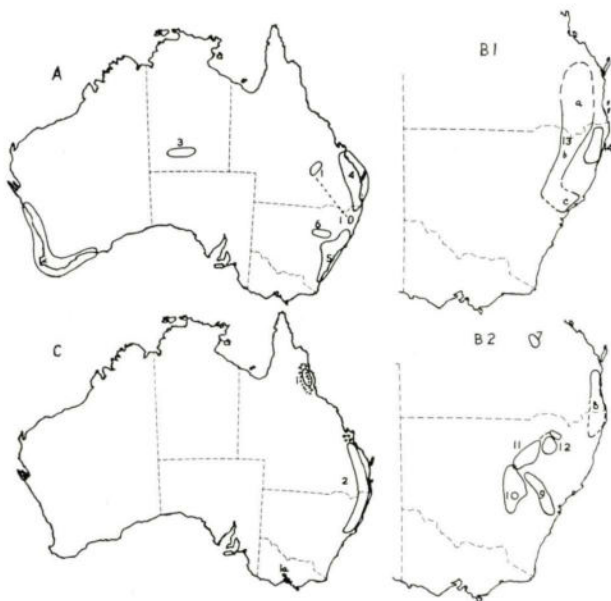
1. Rhachis not or moderately spirally twisted (0-180°, rarely to 360°, but if so petiole 20-40 cm long or pinnae divided) though sometimes recurved near the end. Pinnae simple or divided.
2. Pinnae simple. Stomata on lower surface only.
3. Broadest pinnae 15-20 mm broad, 15-18-nerved. Rhachis flat, 13-18 mm broad at lowest pinnae. C. Queensland 7. *M. platyrachis*.
3. Broadest pinnae 3-12 mm broad, 5-11-nerved. Rhachis rounded or $\pm$ flat or concave above, 3-9 mm broad at lowest pinnae.

The above key to the species of *Macrozamia* and the distribution maps opposite were taken from a paper "The Families of Cycads and the Zamiaceae of Australia" by Dr. L. A. S. Johnson, Director, Royal Botanic Gardens, Sydney, as published in the proceedings of the Linnean Society, of NSW, 1959, Vol. Pxxiv, Part 1. The paper was first read on 25th March 1959. It is still the authoritative reference on the subject although readers will appreciate that more recent research may introduce changes. The distribution maps opposite must be accepted with this reservation as more recent findings could increase the area of natural distribution. Perhaps readers could advise Len Butt of definite sightings outside the areas shown.

There are many scientific papers, published in scientific journals, that are not accessible to the interested non-scientist. The careful selection of sections of particular interest, such as on these two pages would appear to be a valuable service to readers. However, please be aware that the paper was accurate in 1959 and is subject to amendment following subsequent research, as yet unpublished.

4. Pinnae spreading in the living state. Rhachis scarcely to moderately (0° - 180° , rarely 360°) twisted; petiole rounded or flat above, 15-50 cm long. Broadest pinnae 6-12 mm broad 12-35 cm long, not or scarcely glaucous.
5. Pinnae glossy, $\pm$ falcate, whitish at the base when living, the longest ones 15-35 cm long, 7-12 mm broad. Petiole rounded, (20)25-50 cm long. S. Queensland 8. *M. lucida*.
- 5*. Pinnae rather dull, straight to $\pm$ falcate, pinkish to red or orange at the base when living, the longest ones 12-25 cm long, 5-10 mm broad. Petiole rounded or subangular, (15)20-40 cm long. N.S.W. (C. Coast to Goulburn R. Valley and Dunedoo) 9. *M. spiralis*.
- 4*. Pinnae secund, rising $\pm$ vertically from rhachis in living state. Rhachis not or slightly twisted, but recurved near the end; petiole concave above, 5-22 cm long, broadest pinnae 3-8 mm broad (8-20 cm long), often $\pm$ glaucous. N.S.W. (C.W. Slopes) 10. *M. secunda*.
- 2*. Pinnae once to thrice dichotomously divided. Stomata on lower or both surfaces. N.W. Slopes of N.S.W.
6. Stomata present on both surfaces of pinnae. Pinnae once or twice divided, rather stiff, dull above, often $\pm$ glaucous beneath. Rhachis little if at all twisted (0° - 90° - 180°). N.S.W. (Warrumbungles, Pilliga Scrub and Warialda-Howell, on sandy soil) 11. *M. heteromera*.
- 6*. Stomata confined to lower surface of pinnae. Longest pinnae usually 2-3 times divided (if only once divided segments nevertheless very narrow), rather lax, dark green above, not glaucous. Rhachis usually twisted near the end (90° - 180° - 360°). N.S.W. (Nandewars and surrounding district, on stony hillsides) 12. *M. stenomera*.
- 1*. Rhachis strongly twisted (360° or much more, rarely less in depauperate short fronds of *M. pauli-guilielmi* spp. *plurinervia* but if so then the petiole 5-15 cm long). Pinnae simple (but sometimes toothed).
7. Broadest pinnae 3-7 mm broad, 3-10-nerved, adult ones entire or closely 2-toothed at the apex. S. Queensland and N.S.W. (N. Tablelands, N.W. Slopes and Manning R.-Lake Macquarie) 13. *M. pauli-guilielmi*.
- 7*. Broadest pinnae 9-17 mm broad, 10-13-nerved, adult ones 2-7-toothed at the apex. N.S.W. (N. Coast: Richmond R.-Macleay R.) 14. *M. fawcettii*.

Distribution Maps of Australian Cycads



Map A — The species of *Macrozamia* in the section *Macrozamia* (see key opposite); 1: *M. moorei*; 2: *M. riedlei*; 3: *M. macdonnellii*; 4: *M. miquelii*; 5: *M. communis*; 6: *M. diplomera*.

Maps B1 and B2 — The species of *Macrozamia* in the section *Parazamia* (see key opposite); 7: *M. platyrachis*; 8: *M. lucida*; 9: *M. spiralis*; 10: *M. secunda*; 11: *M. heteromera*; 12: *M. stenomera*; 13: *M. pauli-guilielmi* (a: ssp. *pauli-guilielmi*, b: ssp. *plurinervia*, c: ssp. *flexuosa*); 14: *M. fawcettii*.

Map C — The species of *Lepidozamia* in circled areas; 1P: *L. hopei*; 1P(a): site of *L. hopeites* fossils; 2P: *L. peroffskyana*; and the species of *Bowenia* in the dot circled areas; B1: *B. spectabilis*; B2: *B. serrulata*.

This chapter is not written to water down or excuse the known fact that all the cycad family throughout our world carry poisons in their structure which will cause liver damage or paralysis in cattle if the opportunity presents itself that they are allowed to be in the vicinity in that period when the poison is accessible. This generally is after a bushfire during drought conditions. Tests have been carried out to prove that the toxic substances collectively referred to as M.A.M. occur in all parts of the plants at various stages of growth, and consist of four poisons, cycasin, neocycasin, macrozamin and pakoein. All of these contain the compound methalazoxymethanol, which is shortened to M.A.M. Most of these poisons are contained in the exterior of the seed, and let it be noted indigenous marsupials and other animals that readily eat cycad seed consume the non-toxic flesh of the fruit and leave the actual seed. The hard shiny fronds of the plants contain little or no poisons at maturity, so only at the period of the year when they are producing new centre fronds are they accessible to stock. Even then, this would only refer to the low growing species, as many species with trunk formations are well out of the physical reach of stock.

Unfortunately, it seems, most reports of stock poisoning come in Queensland from districts where the taller trunked species grow, the most maligned being *Macrozamia moorei* and *Cycas media*. As the mature leaves are non-toxic, and the new fronds out of reach, the only means of receiving this poison would be through eating new fronds of young seedlings, completely devouring fallen loose seeds, or eating fresh new tender shoots from a plant already burnt and blackened by bushfire.

Cycads as food

Although I have noted that Captain Cook's men became ill from eating unprepared seed, this has been a part of the diet of our aboriginal people for probably as long as they existed in Australia. The starch from seeds and trunk is processed by various methods including boiling, roasting, and continuous soaking and drying out and fermenting. I have read no evidence that the fresh young fronds are ever eaten by native peoples. The large peeled seeds of the Cycad genera in this country are dried in the sun and then soaked in running water for four to five days. The cleaned seed is then pounded into a paste between two rocks and baked under hot ashes to be eaten as cakes. Further information about the *Macrozamia* and *Lepidozamia* is that the process used by other tribes is similar except that the peeled and dried seed is crushed and pounded first, then processed in a "dilly bag" through running water, formed into cakes and eaten after roasting. *Bowenia spectabilis* also was used, but there is no mention as yet that *B. serrulata* was used. This is probably because of its habitats which are only two pockets of country which might not have been frequented by tribes that used it for culinary purposes.

Pollination—Propagation

Many cycad species have only a single caudex, and therefore the only means of reproduction is by seed. The viability of seed is variable and erratic to say the least. To date there is no evidence that any species of insect is involved in the pollination of cycads.

At pollination time the male cone elongates and the segments open up to reveal large quantities of pollen grains which fall on the fronds of the plant or just cover the cone, like thick fawn-coloured dust. The distribution of pollen is attributed to wind only, but as this method is chancy it would seem to me as likely that there are some carrying agents, such as insects, that do the job to help nature. The story does not end even when pollen grains are placed around and over the female cone. The whole process of fertilisation is quite complex in the gymnosperms. Great quantities of pollen are released during pollination periods. Male plants generally produce multiple cones while females are either single coned (as in *Cycas*), or produce relatively few cones in comparison with the males.

To describe the fertilization briefly: when the pollen arrives on the female cone, the unfertilized seeds develop small openings to admit the male spores. In turn, the enclosed seed produces a drop of moisture at its blunt end or micropyle allowing the pollen to adhere and be drawn into the interior. Once inside, the grains develop into tube-like structures which then penetrate the nucleus of the seed structure and a quantity of sperms are discharged which swim the remaining distance to the egg cell, and only then is complete fertilization achieved. The period between pollen penetration and fertilization can run into a few months, and only when the cone breaks up and discharges its fleshy seed can they be termed fertile.

Although many cycads are arid-growing plants, moisture does of necessity play a vital part in their survival. The fleshy fruit that covers all the seed is non-poisonous and attractively coloured, generally orange to orange-red. Nature has left nothing to chance in the survival of these remarkable plants, and relatively few seedlings are found around the parent considering the great quantity of seed expelled at one time. Distribution must be carried out by animals and birds. This, of course, has been proven to be the case in Australia, and, as in Africa where the *Encephalartos* relies on the baboons and thornbill birds, here we have the foraging marsupials and even introduced mammals to help in distribution. Possum and related species carry off the seed, eating the fleshy fruit and discarding the poison-bearing nut kernels. Even the larger marsupials aid in the distribution of the fallen seed.

In cultivation, hand pollination has successfully been carried out by only a few enthusiasts, generally using the exotic *Cycas revoluta* as their recipient. Seed from Australian cycads should be given the float test on receipt. That is to say fertile seed will sink if placed in water, but the infertile seed will float because a pocket of space exists between the outer shell and the withering seed core. Much speculation exists regarding the loss of viability of seed of the cycads. Local authorities tell us that only fresh seed is viable and must be kept so by storing in damp moss, and indeed, quite a lot of my germinating seed was planted successfully by adhering to this advice. However, according to Cynthia Giddy in her African cycad book, the opposite is the case, and once complete fertilization takes place the seed embryo will continue to develop without aid but storage of seed is preferable until the micropyle end protrudes or the seed splits longitudinally across the seed surface. Using seed I had discarded as too old of *Macrozamia*, *Lepidozamia*, and *Cycas*, I have found they will quite readily germinate if planted in the accepted way. The removal of seedlings from around a specimen is a quicker method, but one that must be done with care so as not to damage the tap root. The rather laborious job of lifting a more mature specimen requires plenty of patience and time and must be carried out with a lot of care so as not to break too much of the tap root. Some cycads have survived if only the top and caudex is secure, but others will develop rot easily if the tap root is severed.

Cycads in our Landscapes

Until such time that commonsense conservation of this family of plants becomes the primary function of our government authorities, the best that can be hoped for to preserve them is to utilize the plants in our landscape scene, and cultivation at nursery level seems the logical conclusion. Already in Australia there is a stirring of interest for the great palmlike curiosities that are such a tourist eye-catcher on some of our otherwise arid hillsides, and the exclamations of delight that greet us from the uninitiated on seeing their first "Byfield fern" or *Zamia* fern is like ambrosia to the lovers of the cycad family. Their potential as garden plants used as landscaping features is enormous, and because of their tenacity for survival the conditions for their growth are not confined. Local gardeners around Brisbane sometimes have used the exotic *Cycas revoluta* as a central frontispiece in their gardens as far back as fifty years ago. On odd occasions I have found large well grown plants of *Macrozamia communis* used, two in particular being a couple of lovely specimens, male and female, side by side on a lawn in Annerley, a suburb of Brisbane's southside. These plants have been there for at least thirty years to my knowledge.

The best place to make the public aware of any genus is to place it in prominent positions in our botanical gardens and parks and even as material for beautification among indigenous plants on freeways. South Australia and New South Wales already have good collections of the cycads, and the old Botanic Gardens in Brisbane sport quite a few specimens of such species as *Lepidozamia peroffskyana*, *L. hopei*, *Cycas circinalis* and *C. media* and perhaps an odd *Bowenia*.

Around Brisbane the feature palm *Phoenix roebelenii* (Pygmy date) has been used almost to abandon between Roma Street Station and King George Square, and the beautiful effect this gives makes it very evident that such cycads as *Cycas media*, *Macrozamia miquelii*, and *Macrozamia moorei* would look equally as outstanding in such situations. One has only to see the sheer dominant beauty of *M. moorei* on the hillslopes of Carnarvon Gorge, or the great stands of *Macrozamia miquelii* on the sandy terrains of Fraser Island, to realise the truth of this.

For any landscape project with an Australian flavour *Cycas* is adaptable, especially now that eucalypts are widely used in and around home garden areas. This genus blends well under the gum trees as also does the *Bowenia* which has a distinct fernlike appearance. Blended with the smaller true ferns such as *Adiantum* (maiden hair), *Pteris* (round fern), and *Davallia* (haresfoot) a very pleasant picture of the Australian bush is achieved. There should be enough tall cover to attain a mottled sunlight effect to really enhance this setting. *Cycas media* is a true coastal species and is now generally accepted as being a slim-trunked plant to about three metres high, the female seed appendages being very prominent and visible under the crown of fronds. In coastal situations or on land with a steep slope this cycad could be used successfully as a feature on terraced banks or surmounting a mound augmented with rocks, and hardier native plants not growing higher than the crown of the cycad could be used as surrounds. Actually, much the same effect is achieved with tree ferns as with cycads, but only a few types of tree fern will stand the sun successfully.

For large properties *Macrozamia moorei* can be used to advantage on eucalypt-dotted hill slopes or even as avenue trees up a large and spacious driveway. *M. moorei* has a thick solid trunk and is a very imposing plant. The fronds are erect and arching, the pinnae are blue and vee-channelled. On the whole this cycad is probably the most majestic of all the Australian genera. In north Queensland and the more tropical areas there are plenty of landscape types available in the many forms of *Cycas*. The smaller *Cycas armstrongii* which is fairly common in the Arnhem Land and Darwin areas would be ideal as a decorative subject in arid area gardens. One report I have of this from a Brisbane botanist is that this plant is deciduous. *Cycas calcicola* and *C. pruinosa* are both species of the far north and north-west, and should serve as excellent landscape material for the tropics. At Gloucester Park which is a coastal resort -cum-nursery just north of Dingo Beach, Whitsunday Coast, *Cycas normanbyana* grows in the vicinity. A row of large mature specimens is growing just outside the main wooden buildings in the nursery area. These are so picturesque, when I saw them I at first assumed they were *Cycas cairnsiana* that is a little more well known there.

There is always the situation where a lower plant is needed with the circular symmetry of the smaller grass trees or tree ferns. In these situations the ideal species would be *Macrozamia* mentioned as growing in thickets on the northern New South Wales coast, such as *M. fawcettii*, *M. heteromera*, or *M. stenomera*. While they grow on coastal areas west of Grafton they also occur around Gunnedah and Narrabri to the west. They would suit smaller gardens, in rockeries, possibly among top cover of eucalypts or similar trees.

In Queensland, the species *Macrozamia miquelii* grows in terrains consisting of shale rock hillsides, dense coastal scrub with foliage cover high up, moist sandy loam within a hundred yards of fresh water lakes, (as in Fraser Island) and on mountain terrain. The versatility of this plant led to the belief that there were several species. Such a type could be ideal in moist landscape situations, or even as a patio plant. *M. miquelii* only develops a trunk in its old age, and then only a short one. Continued on page 35, "Cycads In Horticulture".

Transforming a Property in New England

(N.S.W.)

by Maria Hitchcock

Twelve years ago, when Don and I decided to make our home in Armidale, we didn't realize that we would be embarking on a gardening adventure that would eventually challenge a number of horticultural myths in our pursuit of the successful growing of Australian plants.

We bought an 8 acre (3½ hectare) block on the western side of the district far enough from town to feel as though we were in the bush but close enough for Don to ride a bicycle to work. We named the property "Fangorn" after the forest of the Ents in "Lord of the Rings", hoping that one day, it too would be covered with beautiful trees, although we didn't anticipate that they would pick up their roots and march away!

Our patch of "bush" consisted of ex-grazing land, which had a stand of *Eucalyptus viminalis* (Ribbon Gum) and *Angophora floribunda* (Rough-barked Apple). There was no understorey apart from some Hawthorn and the ground was covered in a mixture of native grasses interspersed with a variety of weeds and grasses. All the properties around us were almost completely cleared with the occasional stands of spindly secondary growth *E. blakelyi* (Blakely's Red Gum). All this timber was to succumb eventually to the ravages of *Eucalyptus* dieback.

Being city slickers and S.G.A.P. members, we knew it all. We purchased a quantity of eucalypt and acacia seed from Kershaws and on one of our vacation visits to the property, we proceeded to spread seed all over the place. After all, native plants are adapted to coming up in the wild, aren't they? Little did we know that it would be years later before we would grow anything successfully on our land.

Subsequent visits revealed that the exercise had been a waste of both time and money for not one of our seeds had germinated. Our dreams of growing a forest were shattered and we decided that planting individual trees would have to be the tedious but unavoidable solution to the problem.

Eventually, the house went up and sheep were fenced out. It was time to start planting. There was no S.G.A.P. group here at the time so we relied on the Forestry Commission's Guide for selection of species. The Soil Conservation Service was giving away free trees to landowners in those halcyon days and we put in our order. The seedlings, in metal tubes, arrived in May and once again we grew enthusiastic about the prospects of growing that forest.

Unfortunately, the area to be planted was on floating basalt, very stony, practically no topsoil and the effort of digging each hole with a crowbar was almost sufficient to put us off trees for life. However, sheer persistence won the day and our fifty free trees were in, hidden by the tall grasses which surrounded them. A combination of hard frosts that winter, combined with the lack of moisture due to grass competition managed to kill off 94% of our prospective forest, the only survivors being three pine trees, which had been planted in a moist corner of the block.

Back to the drawing board!

Around that time the local S.G.A.P. group was formed and we met other members who had grown native plants successfully in the district. A visit to the Neighbourhood Park convinced me that the secret lay in using a thick sawdust mulch. (In fact, the park had only used a thin mulch over a raised bed, the technique giving the impression of being thicker than in actuality).

A site was chosen and a truckload of hardwood sawdust was dumped on top of the stony ground, which had been mown first. The sawdust was then spread in a circle until the load was levelled to a thickness of 9-12" (23-30 cm) all over. The sides were retained with softwood cores which were obtained very cheaply. Two months later, after the sawdust had obtained enough rain to become saturated, we planted into it, a number of *E. nicholii* and *Acacia dealbata* trees. The method used was rather radical but we were prepared to try anything.

Each hole was dug in the sawdust until the ground surface appeared at the bottom. The earth was scratched a little to loosen the surface and a teaspoon on 9mth Osmocote was dropped into the base of the hole and covered with a sprinkling of earth. The tube plant was then set into the hole and the sawdust replaced around it so that the rootball surface was level with the top of the sawdust. These plants were then watered regularly for two to three weeks and they started to grow.

And how they grew!

The Acacias took off first, the most vigorous one growing at the rate of a foot a week during summer. By the following winter, the acacias were large enough to protect the smaller eucalypts and they all came through the winter unscathed. What was even better, they didn't require any watering apart from natural rainfall, which kept the sawdust and soil saturated. Success at last!

Following this first attempt, we have now covered a large area with sawdust, using the same method. None of the ground was cultivated prior to dumping. Our only variation was to burn the long grass first before mowing and on some beds, we spread a thin layer of urea before dumping the sawdust on top. The urea was used to counteract the harmful effects of nitrogen deficiency due to sawdust breakdown — a horticultural myth which has tended to give sawdust a bad name. We also found that throwing urea around the bases of our eucalypts and acacias prior to a rainstorm, once or twice during the growing season, was enough to compensate for any loss in the system and we have rarely observed any signs of nitrogen deficiency in our trees and shrubs. I wouldn't recommend the wide scale use of urea for other types of plants as it may be toxic.

Species planted successfully using this method include:

		Height achieved in		Height achieved in	
		2 years	4 years	2 years	4 years
Acacia	<i>baileyana</i>		6m	<i>Eucalyptus acaciiformis</i>	4m
	<i>boormanii</i>	2m		<i>alpina</i>	3m
	<i>buxifolia</i>	2m		<i>camaldulensis</i>	6m
	<i>cardiophylla</i>		2m	<i>globulus</i>	6m
	<i>conferta</i>	1m		<i>linearis</i>	3m
	<i>cultriformis</i>	2m		<i>nicholii</i>	4m
	<i>dealbata</i>	5m		<i>pauciflora</i>	4m
	<i>decurrens</i>	6m		<i>perriniana</i>	4m
	<i>implexa</i>	6m		<i>sideroxylon</i>	4m
	<i>melanoxylon</i>	3m		<i>viminalis</i>	4m
	<i>rubida</i>		3m	<i>Grevillea</i>	
	<i>vermicillua</i>	2m		'Canberra Gem'	2m
	<i>collina</i>	1m		'Crosbie Morrison'	1m
	<i>integrifolia</i>		3m	'Poorinda Leanne'	1m
Banksia	<i>marginata</i>	3m		'Poorinda Constance'	2m
				<i>robusta</i>	4m
Casuarina	<i>distyla</i>	3m		<i>Hakea dactyloides</i>	1m
	<i>littoralis</i>	3m		<i>salicifolia</i>	2m
				<i>Jacksonia scoparia</i>	2m

Most of these trees were planted during our very severe drought and the only water they received, apart from rain was at planting time.

The method has many advantages, especially for country properties. It is a once-only task, in that, by the time the sawdust has completely broken down, the trees will have grown sufficiently to provide a heavy layer of leaf litter. There is no really hard work involved, the most tedious task being the spreading of sawdust. This should always be

done a few months before planting. Planting out is very easy — no more crowbars! It is completely maintenance-free. The weeds just don't seem to be able to fight their way through the thick sawdust and any that do are very easily pulled out. We have been pleasantly surprised to find that *Lomandras* and native lilies, such as *Dianella* and *Tricoryne* do manage to come through. Unwanted acacia seedlings, a problem in other gardens, don't occur because the sawdust seems to inhibit germination. None of the trees need watering, which is a great time-saver.

An unexpected result is the high incidence of malleeing. We're not sure if the hard frosts, which often tip-prune seedlings, are to blame or only the sawdust method or a combination of both. I'm particularly fond of our multi-stemmed snow-gums (*E. pauciflora*). As most of the trees are home-grown, they are well acclimatized before planting out.

Another horticultural myth which has been dispelled is that of stratification. It is widely believed that any addition to the soil should be dug in and blended so that there is no interface. Our mini-forest has knocked that idea. While there is some lateral root movement through the sawdust, most of the roots have gone down into the soil.

Our experiment has shown that native plants are remarkably adaptable and that rural properties present special problems to the tree-grower. Such problems can only be solved by individual trial and error until a successful solution is reached. I hope this article may be of assistance to any frustrated gardeners who are still searching for that solution.

I would add a special warning, however. If you decide to use sawdust on a grand scale — don't tell anyone or the cost of this material will rise dramatically as it has done in Armidale, due to unprecedented demand. Secondly, don't cheat! The method only works if the sawdust is a minimum of 9" (23 cm) all over. Use a stick to measure depth as you spread. If you are covering a slope, the sawdust will need to be covered with bark or woodchip to prevent run-off. Every drop of rain that falls is precious.

Happy tree-growing!

The Food Value of *Acacia* Seeds

by Dr. David R. Murray,
Biology Department,
The University of Wollongong.

Some exaggerated claims have been made recently about the potential value of *Acacia* seeds as a food. One article* stated that the seeds of some species had a protein content as high as meat. Considerable potential for bread making and oil production was also suggested.

Suitability for Bread-making

These days 'bread' is a term used to indicate a loaf that is leavened. The complex of prolamin and gluten proteins that permits the formation of a stable crumb structure is not widespread, even among cereal grains. Wheat is the best species for this purpose, and is unlikely to be supplanted.

The seed proteins of *Acacia* belong to the solubility categories known as 'albumins' and 'globulins'. This is true also of cultivated species of legumes such as pea, lentil, chick-pea, cowpea and common bean. The albumins are water-soluble proteins; the globulins are salt-soluble, and generally insoluble in water alone. These are not the appropriate kinds of protein for bread making. The reason wheat is useful for this purpose is that the major storage proteins of the wheat grain belong to the 'prolamin' (alcohol soluble) and glutenin (alkali- or acid-extractable) categories. These types of protein predominate in cereal grains, but occur only to a minor degree in the seeds of legumes. Even so, very few kinds of cereal grain have exactly the right combination of prolamins and glutenins that will enable a dough to rise.

It is certainly possible to make a damper from *Acacia* seed meal, as some aborigines are known to do, but it would be impossible to make bread.

Acacia Seeds as a Protein Source

The amount of protein that can be extracted from *Acacia* seed meal represents about 13% by weight of total seed material. This proportion is comparable to that of wheat grains, but considerably less than that of seeds of cultivated legumes, often 25% protein, or even more — up to 50% in soy bean.

It is not protein as such that we need in our diet, but about eight of the twenty common amino acids that form the building blocks from which proteins are assembled. These eight amino acids are termed 'essential' amino acids, although strictly it is beneficial for us to take in certain amounts of the 'non-essential' amino acids also. The quality of any given protein source is determined by the relative abundance of all of the essential amino acids.

The globulins of legume seeds are generally deficient in the sulphur-containing essential amino acids, methionine and cysteine. From the limited information available, this is probably true of the *Acacia* seed globulins. By comparison, the albumin fraction is sometimes a well-balanced source of all the essential amino acids, but comprises only about 30% of total seed protein. In the absence of information on the quality of *Acacia* seed proteins (i.e. the relative abundance of all the essential amino acids), it is difficult to draw conclusions about their relative merits compared to other seed sources.

Toxicity of *Acacia* Seeds

Some proteins present in nearly all kinds of legume seed are potentially toxic, but these are denatured by heating. This potential problem is overcome by one traditional method of utilizing *Acacia* seeds, roasting the green pods before they mature. Although the starch, oil and protein contents of immature seeds are much less than in mature seeds, another advantage in eating the immature seeds is that the seed coats have not yet hardened. The seed coats may represent up to 40% of seed weight at maturity, but provide no nutritive value.

Free amino compounds ('non-protein' amino acids) are present in the seeds of all species of *Acacia* so far examined. Certain of these compounds are neurotoxins and may cause paralysis ('lathyrism'). However, all of the Australian species of *Acacia* are free of the serious neurotoxins present in the seeds of African and Asian species. It has been suggested that Australian species should be introduced to countries where the indigenous species are toxic. Nor should it be overlooked that some of the non-protein amino acids contain sulphur, and these might compensate to some extent for deficiencies in essential sulphur-containing amino acids in seed proteins. At this stage it is not known whether humans can digest and assimilate these compounds. ■

*'The Australian', 27th June, 1984.

Australian Plant Cultivars

An official release by the Australian Cultivar Registration Authority

***Chamelaucium uncinatum* 'Dowell'**

Chamelaucium uncinatum 'Dowell' is a form of *Chamelaucium* selected and named by the late George Wilson, a part owner of Wilson and Johns nursery at Cannington in Perth, in honour of the late Oliver Dowell. Mr. Dowell was grounds curator at the University of Western Australia. It grows vigorously and at maturity attains a height of 2 metres with an equal spread. The flowers are large with full petals and measure ± 20 mm across. The petals are light purple in colour and recurve backwards as the flower ages. The staminal collar in this variety is also large.

***Chamelaucium uncinatum* 'Lullfitz Selection'**

Chamelaucium uncinatum 'Lullfitz Selection' is a form of *C. uncinatum* selected by George Lullfitz of Wanneroo, Western Australia. It is similar to other forms of *Chamelaucium uncinatum* but it can be readily distinguished by its early flowering habit which starts in June in Western Australia and is finishing when the other forms are at their peak in August-September.

The flowers are of average size, being ca 15 mm in diameter, opening a fresh pink with almost a brown tinge and deepening with age to dark pink. The small petals recurve as they age. Freshly opened flower petals are near purple group 78B; staminal collar — white group 155D; centre — greyed-purple group 184C. The mid-aged flower, petals are purple group 78B; staminal collar — white group 155D; centre — greyed-purple group 184C. Old flower petals are purple-violet group 81C; staminal collar — purple-violet group 81C; centre — violet group 86A.

***Chamelaucium uncinatum* 'Munns'**

Chamelaucium uncinatum 'Munns' is a naturally occurring form of *Chamelaucium uncinatum* Schau. Introduced to cultivation by Mr. George Munns, a former Curator of the gardens and grounds of the University of Western Australia. This cultivar was named in honour of his work with *C. uncinatum* in cultivation and in recognition of his devotion to duty and tireless work on the University grounds.

Of average vigour and erect habit, the leaves are ca. 20-25 mm long and much narrower than is normal for the species. The flowers are ca. 20 mm in diameter with a dark centre and a dark pink edge on the petals. This cultivar flowers from August to November in Western Australia and is the latest variety to flower.

This cultivar can be distinguished because of its narrower foliage and the flower colour. The freshly opened flower petals are near purple group 75A; stamen collar — white group 155A; centre — near yellow-green group 152A. In the mid-aged flower the outer petal is red purple group 71A; petal inner — white group 155D; stamen collar — near red-purple group 70C; centre — near red purple group 71A. The old flower outer petal is red-purple group 71A; petal inner — white group 155D; stamen colour — near red-purple group 70C; centre — near purple group 77A.

***Chamelaucium uncinatum* 'University'**

Chamelaucium uncinatum 'University' is a form of *Chamelaucium uncinatum* Schau. originally selected from plants growing at the University of Western Australia by the late Oliver Dowell. It has been grown commonly in cultivation since the early 1960's.

This is a low growing form of *Chamelaucium uncinatum*. It has an open habit and sparse, woody branches. Although flowering is less prolific than on most forms the individual flowers are a spectacular colour, opening deep pink and darkening with age to a deep purple. The flowers are ca. 20 mm in diameter with average to large petals.

Freshly opened flower petals are near purple group 75A; staminal collar — white group 155D but stamens distinctly deep pink; centre — greyed-green group 194B. The mid-aged flower, petals are purple-violet group 80A; staminal collar — white group 155D blushed deep pink; centre — near red-purple group 71A. Old flower petals are red-purple group 71A; staminal collar — red-purple group 71A; centre — purple group 79A. ■

Notes: The colour code is from the Royal Horticultural Society of England, 1966. The services of a typist, resident in Canberra, are needed to supply a vital service of a light infrequent work load at the convenience of the donor.

Bowenia—The Pseudo Fern

"Cycads of Australia" by Len Butt is continued from page 22.

Undoubtedly, the most unique and interesting genus of the Australian cycads is *Bowenia* from the eastern coastal areas of Queensland with two species, *Bowenia spectabilis*, and *Bowenia serrulata*. Both are fern-like in appearance, habitat and growth pattern.

The *Bowenia* species are low growing and often mistaken for ferns by people who come across them in their habitat. The most used common names bear evidence of this. *Bowenia spectabilis* is called "Zamia fern" and *Bowenia serrulata* is known as "Byfield fern". For many years the fronds were collected and sold in florist shops and also used on the walls of butcher shops as decoration. They have an added advantage over real ferns as they last much longer when cut. In appearance, *Bowenia* seem to have a closer relationship to the American *Zamia* and the African *Stangeria* than to any other genus.

Bowenia spectabilis—Zamia Fern

The type form of *Bowenia spectabilis* has a hidden or subterranean caudex which is no more than 10 cm long and elongate in shape. The tap root is also elongate and even in semi-mature specimens goes to depths of 60 cm. The fronds appear at the end of a long narrow petiole stem, the rachis branching fan-like, sometimes into as many as seven branches. Pinnules are arranged evenly along each branch of the rachis giving the appearance of a circular or semi-circular shiny green fan on a long stem. New fronds appear only once a year, and this pattern is only changed if fire damage, roving animals, or cultivation destroys the existing stems. Largest specimens I have seen are in the grounds of Paronella Park at Innisfail. The stems numbered seven, up to 1.5 metres in length, the branching fan of pinnae at the top having a diameter of approximately 1.25 metres. The stems had first risen erect then flattened out into a rough circle. In cleared spaces among the rainforest edges I found several plants with male cones emerging from the ground within 5 to 15 cm from petiole bases. Cones were ovate, green, and already opening to shed their pollen grains. There was no sign of female cones in the area.

What may also be a distinct form is reported from near Mission Beach. The plants have completely different pinnules, being longer and narrower than is usual for *B. spectabilis*, and the linear form of the pinnules is quite distinct from the usual wider pinnules of *B. spectabilis*. There were more pinnules to each side of the rachis, with the usual petiolate condition being present, and although the leaf was obovate-lanceolate, the falcate curve was more pronounced. This is a condition I have noticed in *B. serrulata*, but these pinnules were entire, not serrated as in *B. serrulata*.

Bowenia serrulata—The Byfield Fern

There would appear to be a number of distinct forms of *Bowenia serrulata*. A form described by Chamberlain in 1912, in "The Living Cycads" has marked differences. Firstly, the subterranean caudex is ovoid to roughly spherical (not elongate), and all of the pinnules on the branching rachis are serrate along the edges of the pinnae. These fine saw tooth edges are very distinctive. The stems are far more prolific than is the case with *B. spectabilis*, and the rough circle formed is much more flattened and fern-like. Differences of habitat are also very marked as *B. spectabilis* occurs on the edges of dense rainforest and does not form in great hedgelike stands in any area where it inhabits. *Bowenia serrulata* grows in open eucalypt forest along with some treefern species and stands of the Picca-been palms. It forms dense and extensive stands in and about Byfield and in the Bowenia National Park and grows bracken-like in density.

Bowenia serrulata (opposite top)

Photography by Tony Rodd

You would be excused for thinking this was a true fern.

Bowenia serrulata (opposite bottom)

The left hand photography by Merv Hodge shows the fruiting cone at ground level, typically green in colour. The seed is swelling as it matures. The photograph on the right hand side by Don Arien shows how the seed matures to a red/brown colour, thrusting the sporophylls aside.



Lepidozamia—The Scaly Zamia

"Cycads of Australia" by Len Butt is continued

The huge cones of the female plant of *Lepidozamia* have quite different sporophyll ends to *Macrozamia* species and the cone entirely encloses the seed so that the red seed cannot be seen until the cone bursts at maturity. There is no spine-like projection present on the cones as there is in *Macrozamia*. The oval cones can be 60 cm long and 30 to 40 cm diameter at the middle. The cone is generally solitary and is terminal on the trunk in the centre of fronds. The male pollen cone of *Lepidozamia peroffskyana* is shown in the beautiful colour plate on page 12. A female seed cone of *Lepidozamia* is shown in the colour plate on page 32. When the cone bursts two bright red seeds can be seen attached to every sporophyll, sitting side by side. The seed can be 6 cm long by 4 cm thick and a rich red flesh coats all seed. The highly polished gloss of the pinnae develops as soon as the frond hardens. Before this the new fronds are soft brownish-green and pubescent.

Lepidozamia species have a further peculiarity in the way the pinnae emerge from the rachis, or more specifically, the margins of its upper surface. This is noticeable, particularly at the maturity of each frond, when the margins come closer together as the diameter of the rachis increases. The tender young fronds are very similar to those of *Macrozamia* in the initial stages, but unlike *Macrozamia* have no serrations at the tips of the pinnae.

Lepidozamia peroffskyana

This "Scaly Zamia" is a subtropical palm-like plant found in northern New South Wales in coastal districts, on rainforest edges, through Lamington National Park and surrounding countryside to areas west and northwest of Brisbane. I have found it also around Peaches-ter, Mount Glorious, Maleny and vicinity. The thick stem enclosed by a smoothly patterned armour of old leaf bases is generally about three metres high in situations where it appears in large groves, like the park on the heights of Tamborine Mountain, or the slopes of eucalypt rainforest in the "Shipstern" Binna-Burra track. There have been reports of plants with trunks up to six metres in height. Press reports of the great age of the living cycads seem to have originated in Australia with this species, where one specimen in Tamborine is accredited with the age of over one thousand years. However, since several of the Zamiaceae have been grown to maturity in a period of one hundred years at botanical gardens, it would seem far more likely that the largest of the known plants of *Lepidozamia peroffskyana* would not be more than five hundred years old. It is, of course, possible that some few have reached the thousand year stage. The known antiquity of the cycads as a group and the amount of curiosity about them at various times seems to serve to embellish the stories of their great individual age.

Of all the indigenous cycads in Australia *Lepidozamia* stands out for the sheer beauty of its hard glossy fronds. In *L. peroffskyana* they first arise from the apex of the trunk, appearing soft, brown and pubescent, the pinnae curled and unfolding, fernlike. Initially, they are semi-erect, but as the pinnae harden the fronds flatten out in a big circle. Each year's circle of new fronds forms a new "hat" to the thickening crown already there. There are usually about six layers at any one time with the basal layer dying back and leaving only their bases, and so the caudex grows. Each beautiful frond is about two metres long, but the largest specimens would be three metres. As in *Macrozamia* male cones are longer and narrower. I find quite a similarity in actual appearance of the female cone of *L. peroffskyana* and *L. hopei* to those of the African cycad genus, *Encephalartos*.

The fine cover plate of this issue shows a magnificent old plant of *Lepidozamia peroffskyana*, on page 12 the male cone is beautifully pictured, and on page 36, a female cone is shown in colour.

Lepidozamia hopei

A palm-like plant from northern Queensland, *Lepidozamia hopei* is reputed to be the tallest living cycad. There are reports of specimens reaching twenty metres — more than sixty feet. In appearance, this giant of the Zamiaceae is equally dominating where it occurs. On specimens I examined, the caudex was more slender than that of *L. peroffskyana* at similar heights. The most distinguishing feature of difference would be the width of the pinnae which is twice as wide as in *L. peroffskyana*.

It is worth noting here that the ancient fossil *L. hopeites* found in Victorian coal fields could be most closely related to this species. What a great change of tropical climate this signifies. Although in botanical descriptions the cycads are always featured as single trunked plants, obviously this does not mean on all occasions this is so. One giant plant of *L. hopei*, growing near the base of a stairway at Paronella Park, Innisfail, had branched twice and has fronds of at least three metres in length. The branching trunks were about four metres high. This is the largest *L. hopei* I have seen. Other specimens in the Mission Beach and Babinda areas all had great length of fronds but were unbranched.

The species occurs in and around rainforests from the Rockingham Bay area (Cardwell) to north of the Daintree River, usually in rainforests or protected by overhead canopies of trees. Good stands of *L. hopei* are reported along the banks of the Dallachy and Bilyana Creeks, in the Cardwell area. They are ideal subjects for horticulture. A small National Park near Bingil Bay contains quite a number of very tall *Lepidozamia hopei*. The interesting part about this information from Mrs. Bosworth, a member of the S.G.A.P. zamiad study group, is that quite a few of these plants are branched and at about the same height. She suggests that perhaps the huge cyclone of 1918 which devastated this area may have caused this.

A key to the two species (published by L.A.S. Johnson "Families of Cycads and Zamiaceae of Australia", 1959) describes "*Lepidozamia hopei* as broadest pinnae 17-30 mm broad, 20-40 cm long, 17-30 nerved. Habitat - Northern Queensland and *Lepidozamia peroffskyana*, broadest pinnae 7-14 mm broad, 10-32 cm long, 7-14 cm nerved. Habitat - South Queensland and Northern New South Wales. *Lepidozamia* will yellow in the foliage and sometimes burn slightly in exposed sunlight - an indication of their preferred habitat".

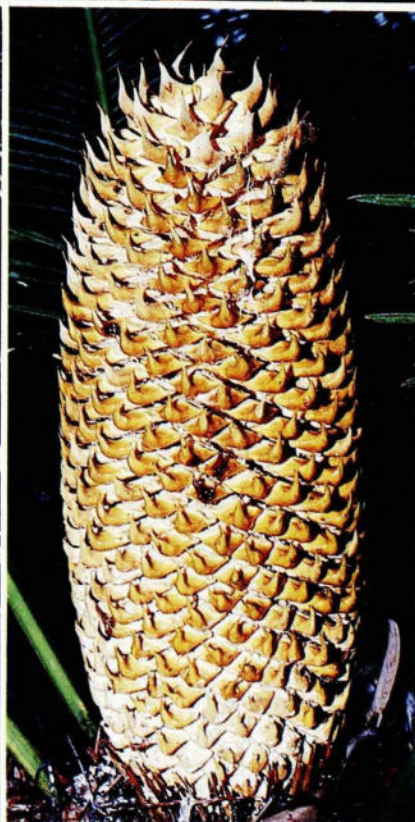
Cycas

"Cycads of Australia" by Len Butt is continued.

The peculiar manner in which the seeds of *Cycas* form around the margins of a spearhead-shaped appendage at the crown of the plant indicates a very primitive beginning and being very old in the evolutionary scale.

There are several sound methods of identifying *Cycas* - the quickest and surest being an examination of the leaf fronds. All the pinnae on each side of the rachis have a prominent vein or nerve running centrally along each surface. This does not occur in either the *Macrozamia* or *Lepidozamia* genera. Further, the male cone of some *Cycas* forms centrally from the crown and has a brilliant orange coloration. This I have observed in *Cycas media*, *C. normanbyana*, and *C. kennedyana*. So far, I have not found multiple male cones in these species. In *Cycas* the seeds are borne on the margins of megasporophylls which are incurved in a nest-like group at the crown of the plant or hang down between the bases of the fronds where they join the caudex. The soft buff coloured terminal appendage of each sporophyll is generally toothed along its edges, and the orange fleshy seeds fit around the margins between the tooth flanges. In the case of *Cycas media*, the circle of pendant seeds appear and hang just under the circle of fronds at the crown of the plant. See the beautiful colour plate on page 36.

Cycas media is the common *Cycas* of the east coast of central and northern Queensland, occurring in rainforest and in eucalypt forest. It is variable in height and form, and can vary so much that maybe natural crossing with other *Cycas* does occur. Near Cardwell, North Queensland, I found at least three variants growing within a twenty metre circle, fire-blackened, but with great healthy rejuvenation in the fronds. Colour variation of leaves was from powder blue, dark green to pea green. All leaf fronds were young and at the same stage of rejuvenation.





***Cycas cairnsiana* (above)**

Photography by Tony Rodd

A plant photographed at Pettford, North Queensland. The trunk would be one metre tall. It is a female plant and the sporophylls, standing upright above the plant when young, sag down on maturity, allowing the new season's fronds to emerge out the top. This is also shown on *Cycas media* on page 36.

***Cycas media* (opposite top and bottom right)**

Photography by Tony Rodd

The cover plate on our book *North Australian Plants* shows a male plant with the male cone on top. The male cone (30-40 cm long) of *Cycas media* is shown on the bottom right photograph. The upper photograph is of the top of this male cone and the underside of the scales (sporophylls) showing the sporangia or pollen sacs. Note also the spinous tip of each scale, upward pointing.

***Lepidozamia* (bottom left)**

Photography by Tony Rodd

A female seed cone before maturity. Note the downward slope of the scales (sporophylls) the velvety brown surface and lack of spine. The features shown distinguish *Macrozamia* (scales with spines -spikes), *Lepidozamia* and *Cycas*.

Cycas — in Australia

From the limited published data in scientific literature the following species are listed. J. R. Maconochie, the source of most recent literature, stated this data is provisional and will need further study.

Cycas angulata occurs on the islands of the Gulf of Carpentaria and the east coast of Arnhem Land (N.T.) in the eucalypt forests. Lower surfaces of pinnae not strongly pitted. Foliage mid to light green. Stomata surrounded by accessory cells with thickening only on inner cells.

Cycas armstrongii Miquel occurs around Darwin, the north coast of Arnhem Land, and the Kimberleys south of the Mitchell Plateau, (West Australia). Pinnae flexible, flat nerve equal on both sides. Leaves 62 (68-75) (87) cm long, 12-24 mm wide. Mature fruit orange.

Cycas basaltica C. A. Gardn. occurs on rocky hillslopes of the north-west area of the Kimberley Ranges. Pinnae rigid, nerve on upper surface sunken, channelled above, making margins slightly recurved. Lower surface of pinnae strongly pitted with pustule-like protuberances surrounding the stomata. Foliage grey-green. Leaves transversely horizontal. Megasporophyll 14-22 cm.

Cycas calcicola Maconochie occurs in the Katherine area Northern Territory mostly on limestone outcrops. Pinnae with revolute margins, 2-3 (-4) mm. Pinnae pubescent, or if glabrous above pubescent in channels below 2-3 wide.

Cycas cairnsiana is apparently a more distinct species than others. The strongly revolute pinnae are similar to those of the exotic *C. revoluta*. Megasporophyll short (160-210 mm). ferruginous, teeth weakly developed or none. Pinnae 3-4 mm wide.

Cycas furfuracea W.G. Fitzg. grows in the King Leopold Range in the southern portion of the Kimberleys (W.A.) at the base of steep rocky Bold Bluff and Mount Broome. Leaves transversely vee-shaped. Megasporophyll is 18-45 cm long.

Cycas kennedyana was originally described from the Normanby Range near Port Denison, which is on the coast near Bowen, Queensland, in a similar area to where I saw *C. normanbyana* growing. Microsporophyll without ascendant pointed apex.

Cycas media occurs from approximately Rockhampton to Cape York. Microsporophylls with ascendant sharp apex.

Cycas normanbyana is recorded as occurring near the estuary of the Burdekin River and into adjacent ranges. Reports indicate that it is also at Gloucester Park resort north of Dingo Beach in the Proserpine area. Leaves (90-150 cm) long and 25 cm wide. Mature fruit orange.

Cycas pruinosa Maconochie occurs in the Deception Ranges and associated areas to the north-east of the main Kimberley Ranges, again on rocky hillslopes. Pinnae glabrous above and below. Megasporophyll long (280-320) mm, ferruginous, with large well developed teeth (pinnatifid). Pinnae 2-3 mm wide.

One unidentified species with similar characteristics to *Cycas revoluta* occurs in the Newcastle Range which is roughly 250 kilometres west of the coast approximately between Townsville and Ingham.

The species known as *Cycas lane-poolei*, found in eucalyptus forests on the extreme top end of West Australia, is now believed to be synonymous with *Cycas armstrongii* which extends west from Darwin and its top central habitat.

Cycads In Horticulture

"Cycads of Australia" by Len Butt is concluded. This article is, in fact, continued from page 22.

When planting cycads in the garden simulate their natural habitat, and growing conditions. Large granite rocks, small boulders, sawn logs with the bark attached and careful use of ground foliage plants all go to make an ideal natural situation to give atmosphere to your particular plant. There are many of the smaller species ideally suited as potted plants to decorate interior courtyards, verandahs, along the front of houses, or as added beauty to the patio situation. So many people living in high rise units still like to have potted plants on their little balconies, and there are even a few types of cycad that could be placed in this position.

First the container! This should of necessity have depth to accommodate the long taproot, especially if your plants are seedling grown. I have always favoured terra-cotta pots because of their porosity, but these require ample drainage crocks in the bottom, and perhaps a strong piece of gauze over the hole to stop the entry of unwanted pests. The mixture for all of the plants should be friable, and a good example of this is the John Innes base mix. If the cycad is from firm sandy terrain, the addition of more sand in the medium is essential. As the great majority of these plants come from arid to semi-arid places, watering should be of a similar level to that given to cacti. That is to say, plentiful in the hot and windy periods, with a general easing off during winter. ■

The Cycad Study Group

Len Butt is the leader of the Cycad and Palm Study Group. Study groups comprise readers from all parts of Australia who correspond through the leader, exchange notes, seeds, etc. If you want to learn more about these magnificent plants or our palm trees, write to Len Butt, 25 Ortive Street, Yeronga Queensland 4104.

STUDY GROUPS

A study group consists of SGAP members with an interest in a particular genus or group of native plants. Each group has a leader who corresponds with members, sending seeds, cuttings, or advice. He or she also summarizes information received from members and prints it in the newsletters sent to members every few months.

Most groups have active and passive members. Passive members receive newsletters, information, etc., but do not actively participate in study. Active members study some aspect of the plants which interest them and report their observations.

Although some groups have members who possess specialist skills, this is not a prerequisite for joining a study group. All that is needed is an enthusiasm for a particular group of plants and a willingness to record and report observations.

Subscriptions, payable on joining, are \$2.00 to \$5.00 (The Stylidium Group has been re-organised in such a way that no subscriptions are payable.)

Study Groups that may interest you are:

PLANTS USEFUL AS FOOD	Mrs. C. Newton Smith, 21 Banksia Av., Beaumaris, Vic. 3193.
ACACIA	Mrs. Marion Simmons, P.O. Box 1148, Legana, Tas. 7251.
BANKSIA	Mr. Trevor Blake, 22 Vista Avenue, Ringwood East, Vic. 3135.
BRACHYSCOME & HELIPTERUM	Mrs. Maureen Schaumann, 88 Albany Drive, Mulgrave, Vic. 3170.
CALLISTEMON	Mr. Harry Infield, Demesne Farm, Coomba Road, Coomba Park 2428.
CYCAD AND ZAMIAD	Mr. Len Butt, 25 Ortive Street, Yeronga, Qld 4104
DRYANDRA	Mr. Tony Cavanagh, 16 Woodlands Drive, Ocean Grove, Vic. 3226.
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STYLIDIUM	Mr. Richard Davidson, P.O. Box 51, Melton South, Vic. 3338.

Anyone interested in starting a new study group or in taking over the Calytrix Group, which is at present in need of a leader, should contact: Miss Jo Walker, Study Group co-ordinator 16 Blundell Street, Queanbeyan N.S.W. 2620.



Cycas media

Photography by Mrs. F. B. Bosworth

A tree growing at Behana Creek, North Queensland. This is a female tree, the fruit approaching maturity, hanging like a collar around the top of the trunk. Prior to maturity, the fruit stands up on the top of the trunk as shown for *Cycas cairnsiana* on page 33. The male (pollen) cone of *Cycas media* is shown in colour on page 32. The male trees with these cones sitting on top are equally as impressive. See page 31.

Livistona

Notes taken by permission from "Palms" by Alec Blombery and Tony Rodd.

Livistona species make striking, robust landscape specimens. The genus has about 30 species of which more than half are native to Australia. Representative of these is *Livistona decipiens* shown opposite. Similar in growth-habit, trunk characteristics and colouring to *Livistona australis*, the Australian Cabbage-tree Palm but not growing quite as tall. The trunk is free of the old leaf bases at maturity, ringed but with fine vertical fissures.

(See book review on page 42)



Livistona decipiens

Photography by Alec Blombery

Livistona are known as fan palms and the most remarkable feature of *L. decipiens* is the very deep division of the leaves to over 2 m in length, each segment divided for more than half its length into two very fine-pointed lobes, all of which hang quite vertically from about the point of forking, producing a curtain-like effect. The masses of creamy to yellow flowers are similar to those of *L. australis* except that the flowers are in small clusters on stalks a few millimetres long arising from branchlets. These stalks lengthen in fruit (glossy black) to almost 1 cm, each appearing as the stalk of a single fruit.

Most *Livistona* are light-loving plants restricted to natural habitats where the soil is permanently moist, such as stream banks, swamps, soaks or seepage zones on cliffs. They are hardy enough to be grown in warmer temperate and subtropical climates with a few (*L. australis*, *L. decipiens*) enduring winter temperatures of a few degrees below freezing without damage.

Planted outdoors these plants make splendid landscape specimens, the effect of the pendulous segment tips being particularly graceful. Growth is generally rather slow in temperate climates but in very warm sheltered conditions with very moist soil, growth can be speeded up. A deep sandy soil is favoured. *Livistonas* may also be used to good effect as pot or tub plants, though their slow early growth and the "messiness" of their fibrous leaf-bases frequently make them less favoured for this purpose than feather palms. They require sufficiently deep containers for their strong root systems and reasonably good light.

Propagation is from seed, which can be stored in a dry state longer than that of many other palms and takes 6-12 weeks to germinate. Seedlings should be planted into deep containers and in early stages as they resent root disturbance.

On the rear cover is a colour plate of the Solitaire Palm, *Ptychosperma elegans*, another Australian Palm. ■

BOOKS ON WILDFLOWERS

We confine our reviews in this issue to three of the finest books available.

Palms

by Alec Blombery and Tony Rodd

A very well presented book with easily read, informative, interesting text. A feature of the book is the excellent colour plates showing the outstanding palms of the world, not just Australian palms, to perfection. One author, Alec Blombery, has kindly provided the slides for the colour plates on pages 37 and 44. The other author, Tony Rodd, has provided valuable assistance with the compilation of this issue on cycads, and much of the photography. The competence of these horticulturists and their love and understanding of living plants is self evident. The book "Palms" is extremely good value at \$25.95 post free from the Editor.

The Banksia Book

by Alex George

With modern printing technology we come to expect the best in the printing art with beautiful colour plates. We do not always get it but in this book *The Banksia Book* we have an excellent commercial production. In the competitive commercial world of today, publishers are forced to control costs by skimping presentation and colour printing. For such an important book to us all, the society has contributed substantially to the cost of production to ensure that the subject receives the presentation it deserves. Reproduced on the following pages 40 and 41 are two pages of the book. The page size of the book is larger than our page size so that the reproduced pages have had to be reduced but it is evident what a well presented and illustrated book this is. Every species of *Banksia* has, similarly, two pages, descriptions and sketches, and large quality colour plates.

The descriptive sections at the beginning introduce the subject with a very interesting text including notes on seed collection, preparation, germination and care of mature plants.

Available from the Editor, Australian Plants for \$29.95 post free.

Native Plants of Queensland

by Keith Williams

Volume 2 of this excellent colourful series on the wildflowers of Queensland is now available from the Editor — Australian Plants, for \$35.00 post free. Excellent value this is the only book worth having as a reference to Queensland's unique flora.

Casuarina *Allocasuarina*

Notes on published research by
Dr. L. A. S. Johnson and
Eleanor M. Bennett

Species of the plant family Casuarinaceae, commonly known as she-oaks are amongst the most widespread of Australian trees and shrubs. Dr. L. A. S. Johnson is revising the family and it will comprise four genera.

The genus *Casuarina* has been divided by the creation of a new genus *Allocasuarina* and this interim report is to record this development for the benefit of readers.

The differences between the three genera found in Australia are set out by L. A. S. Johnson and K. L. Wilson, in the book "Flowering Plants in Australia" by B. D. Morley and H. R. Toelken, page 66. *Allocasuarina* is readily distinguished from *Casuarina* by the colour of the seedlike winged fruits (samaras) which are dark and shining in *Allocasuarina* but pale and dull for species of *Casuarina*. Species of *Allocasuarina* have variously shaped protuberances on the bracteoles of the fruiting cones.

The West Australian species of *Allocasuarina* and *Casuarina* have been very well described and illustrated in a publication by the W. A. Naturalists Club, Vol. 15, No. 4, (author Eleanor Bennett), available on request to the Secretary, 8 Mariova Street, Nedlands, 6009, for \$4.00 including postage.

It is proposed to defer a detailed reference to these genera until the publication of the relevant section of The Australian Flora but the following brief notes are offered.

The new genus *Allocasuarina* has about 46 species and includes many that were well known as *Casuarina* species in the past including *Allocasuarina acutaria*, (formerly *Casuarina acutaria*), *A. acutivalvis* (*C. acutivalvis*), *A. acutivalvis* ssp. *prinsepiana* (*C. prinsepiana*), *A. campestris*, *A. corniculata*, *A. decaisneana*, *A. decussata*, *A. dielsiana*, *A. distyla*, *A. drummondiana*, *A. fibrosa*, *A. fraseriana*, *A. grevilleoides*, *A. helmsii*, *A. huegeliana*, *A. humilis*, *A. inophloia*, *A. lehmanniana*, *A. littoralis*, *A. luehmannii*, *A. microstachya*, *A. monilifera*, *A. muelleriana*, *A. nana*, *A. paludosa*, *A. paradoxa*, *A. pinaster*, *A. pusilla*, *A. ramosissima*, *A. rigida*, *A. robusta*, *A. scleroclada*, *A. striata*, *A. tessellata*, *A. thuyoides*, *A. torulosa*, *A. trichodon*, *A. verticillata*. *Allocasuarina verticillata* is based on *Casuarina verticillata*, the earliest name for that species more generally known as *Casuarina stricta*, to date.

The genus *Gymnostoma* is represented in Australia by only one species, the name for which has not yet been formally published.

This leaves the genus *Casuarina* with the following species in Australia: *Casuarina equisetifolia*, *C. cunninghamiana*, *C. glauca*, *C. obesa* and *C. cristata*. All of these are cultivated both in Australia and overseas. ■

*Paper by L. A. S. Johnson in the Journal, Adelaide Botanical Gardens 6: 73-87 (1982).

Sydney's New Botanic Garden of Wildflowers

The Director of the Royal Botanic Gardens, Sydney, Dr. L. A. S. Johnson and his staff are to be warmly complimented for the success of their efforts to establish a wildflower botanic garden in the western suburbs of Sydney near Campbelltown. Dr. Johnson has been an active supporter of your journal, Australian Plants, since the first issue and his support and encouragement is sincerely appreciated — Editor.

Banksia burdettii E. G. Baker (1934)

Burdett's Banksia

Named after the collector of the type, a South Australian grower of wildflowers.

Type collection from near Watheroo, Western Australia, collected by W. Burdett around 1930.

A shrub to 4 m without lignotuber, much-branched. *Branchlets* tomentose, at length glabrous. *Leaves* scattered, narrowly cuneate-oblong, truncate, 10-16 cm long, 15-25 mm wide, shortly dentate, the venation spreading, parallel; tomentose, the upper surface becoming glabrous. *Inflorescences* terminal, 6-10 cm long, 7-8 cm wide at flowering; bracts at base tomentose, mostly falling early. *Flowers* bright orange inside, pale outside with white hairs; styles orange. *Perianth* 34-35 mm long including limb of 5-6 mm, hirsute outside, glabrous inside. *Pistil* 35-38 mm long, curved, glabrous except a few hairs on ovary; pollen-presenter narrow with swelling at centre and constriction below, 4-5 mm long. Old flowers persistent. *Follicles* up to 20, narrowly elliptic, 20-25 mm long, 5-10 mm high, 8-10 mm wide, smooth, hirsute; usually opening with fire, split from styler point. *Seed* obliquely obovate, 14-16 mm long; seed body broadly elliptic, 9-10 mm long, 12 mm wide, shallowly pitted outside, muricate inside; wing 13-15 mm wide, notched.

DISTRIBUTION Western Australia, between Eneabba and Mogumber.

HABITAT In deep white or yellow sand, in tall shrubland; sometimes locally common. Annual rainfall 550-600 mm.

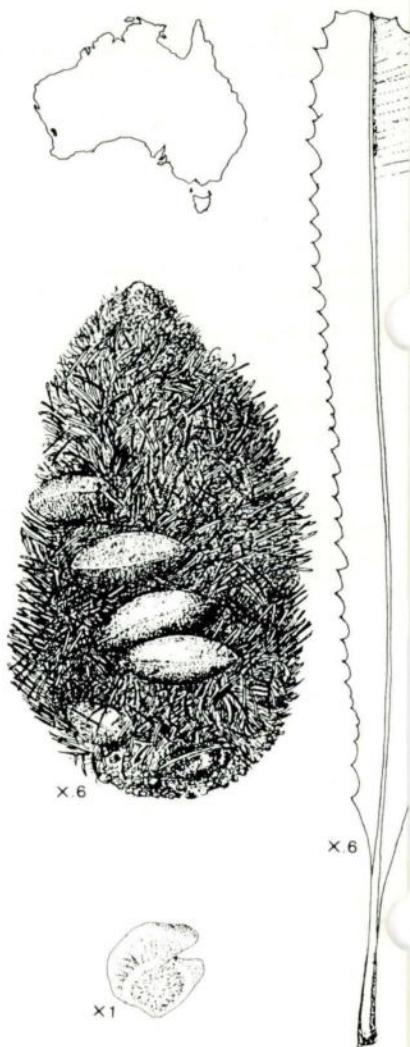
FLOWERING PERIOD Late January to May but mainly February-March.

RESPONSE TO FIRE Killed by fire and regenerates from seed.

NEW GROWTH Pale brown.

RELATED SPECIES *Banksia hookeriana* which has narrow leaves with many triangular lobes and which flowers in winter and spring. The leaves of *B. burdettii* resemble those of *B. menziesii*.

CULTIVATION Rather fast-growing bushy shrub; flowers in 4-5 years from seed. Leaves medium green. Flowers conspicuous; old flowers persistent. Fruit inconspicuous. Light pruning, not below green foliage. Sunny position in well-drained soil. An attractive species but with a short flowering season.



Above: *Banksia burdettii*. Fruit with unopened follicles; leaf; drawn by Charles Gardner. Seed, drawn by Alex George.

Opposite: *Banksia burdettii*, the bush growing NW of Moora, W.A. and above, the flowers and surrounding foliage.



Australian Plants — Your Wildflower Publication

Australian Plants is produced on a non-profit-making basis with honorary officers. It has prospered because of the support of a wide section of the community from all parts of Australia.

Len Butt, the principal author of this issue is typical of the dedicated horticulturalist who has pioneered the study and application of our Australian wildflowers and contributed articles based on years of careful observation and work. It is because of the "Len Butts" that thousands of Australians have given us the support that has enabled the publication to succeed so well. This issue is a real gem.

What is not so evident is the active support of the professional scientist, who provides initial research for the dedicated amateurs to build on, who carefully check the manuscripts and offer comments, and who contribute where they can. It is a healthy team effort by all producing an enjoyable product.

Most importantly we need the continued support of the reader. It is the number of copies sold that keeps us viable. Encourage your friends to be subscribers.

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***Ptychosperma elegans* — Solitaire Palm** Photography by Alec Blombery

Ptychosperma elegans, Solitaire Palm, belongs to a genus of tropical featherpalms comprising 28 species occurring chiefly in New Guinea. Solitaire Palm is found above the Tropic of Capricorn in Queensland and Northern Territory. The solitary greyish ringed trunk rises to above 12 m high and 6-8 cm in diameter. The compact crown has 7-11 leaves 1.5 to 2.5 m long. Flowers are greenish-white following by the bright red fruit, shown egg-shaped.