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Australian Plants — The Bad News

Editor

The Australian national estate is headed for disaster. Specifically, I am referring to the natural Australian flora but all creatures, birds, animals, lesser forms of life so vital to the chain of life, and even man, depend upon it. There is a fungus spreading through our soils, slowly devouring the root systems of a significant range of plants, and destroying them.

This is not being melodramatic. This is not a science fiction story about the dreaded alien, out of sight, beneath our feet. This is not panic mongering, after all who will get upset about a killer of life they cannot see. But this is a major problem, the devouring fungus is out of sight and its work is slow but death is certain.

On page 243 I examine this problem of the deadly fungus, *Phytophthora*. Alarmingly, frantic studies by competent scientists, as contained in a detailed report, have failed to find even a glimmer of hope for the containing, let alone elimination, of this alien fungus. Even more alarming is the apparent unwillingness of governments to attack the deadly fungus on a disaster plan basis being satisfied with "window dressing" by the work of a few scientists, severely under-funded.

Wake up Australia, we are under attack. The Federal Government is responsible for the defence of our land. We need a crusader to lead this battle with bureaucracy, to initiate a plan for survival. ■

Gardens In Shade

Many gardeners are faced with the problem of shade, desired or unavoidable, in their gardens. This issue reviews this problem with specific advice. Others only have a small area to plant and the garden described opposite has solved this by creating a pleasing setting requiring a minimum of maintenance.

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COVER PLATE

A Silver Elkhorn, *Platycerium veitchii*, plays host to a Ribbon Fern, *Ophioglossum pendulum*, a clumped epiphyte that grows naturally with its eye-catching host. The long green ribbon-like leaves can grow to one metre long. Reproduced, with permission, from "Plants of Central Queensland", by Steve and Alison Pearson, see page 280.

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An Outdoor Living Area in a Garden of Shade

My Garden — 5
by David Cheal

Living in a 6 m frontage Victorian terrace house in a Melbourne suburb, the garden area is very small. There was a need to have a garden that provided local interest points and not long vistas. From experience in the bush this seemed to happen in fern gullies and rainforest patches, so why not try the same in the small backyard?

Rather than a selection of plants for their landscape values, I found that as long as I kept to the "theme" (i.e., southern rainforest) the eventual effect had a consistency that plant "collections" often lacked. In short, the plants often looked good together, the garden is a whole. The colour photographs on the next page give some idea of what has been achieved from nothing four years ago, and, hopefully, a sense of the atmosphere that has created itself.

(i) A tall Red Cedar (*Toona australis*), in its 4th season only, provides the shelter for, from the right, a clump of *Dianella tasmanica*, *Clerodendrum tomentosum* and the herb pot, which is overshadowed by a Mountain Paw Paw (*Carica candamarcensis*) and a tree fern *Cyathea robusta*.

(ii) The bird bath helps provide summer humidity, as well as water for the honeyeaters and silvereyes, for (from the right) a young palm (*Livistona australis*), the tussock grass *Poa helmsii*, and the ferns *Adiantum formosum*, *Pellaea falcata*, *Pteris umbrosa*, *Blechnum cartilagineum* and *Polystichum proliferum*. The tall shelter is provided by *Ficus coronata* and *Solanum aviculare* (the latter supporting a clump of *Platyserium bifurcatum*).

(iii) The heavy shade cast by a *Ficus coronata* and a dense growth of the fern *Dennstaedtia davallioides* is limiting but here permits the fern *Adiantum hispidulum*, the tall lily *Astelia australiana* and the soft herb *Australina pusilla* to grow.

Garden Planning? — The only plant that was in the garden when I moved in, that I have retained, is a tall *Angophora costata*. All other plants were removed at once (it's important to start from scratch rather than to underplant and then gradually remove the unwanted taller plants). The *Ficus coronata* is approximately eight years old, the *Solanum aviculare* is about six years old but all the other plants are no older than four years. All planting was not done to a written plan. I know that this is anathema to many gardeners, but I just tried to imagine how big the plants would be later on and what conditions they liked. As a result, the garden has "grown" rather than completed a formal plan. This may sound a bit haphazard but as I've kept strictly to plants that are "in theme" (i.e., southern rainforest) and as I tried to have a "natural" balance of growth forms (some understorey ferns, some tall trees, some creepers and some lower herbs) the result has ended up looking reasonable.

The soil is a naturally fertile, basalt-derived, heavy loam. The drainage can be poor and the soils "bog down" in winter. The deep litter layer that has accumulated over the years prevents the surface from settling and allows the ferns to grow. As a result, I found it to be a waste of time to attempt to grow the "normal" garden natives such as most banksias, grevilleas and the like. No soil preparation was attempted.



Garden of Shade — 5. Above: Red Cedar tree, *Toona australis* provides shelter for (from left to right) *Dianella tasmanica*, *Clerodendrum tomentosum*, the herb pot which is overshadowed by a Mountain Paw Paw, *Carica candamarcensis*, and a tree fern *Cyathea robusta*. All photographs and comments by David Cheal.

The Bird Bath (opposite top), helps to provide summer humidity as well as water for my wild bird friends. The shelter is provided by a fig, *Ficus coronata* and *Solanum aviculare*, which supports an Elkhorn, *Platynerium bifurcatum*. From left to right we see a young palm, *Livistona australis*, the tussock grass, *Poa helmsii* and the ferns *Adiantum formosum*, *Pellaea falcata*, *Pteris umbrosa*, *Blechnum cartilagineum* and *Polystichum proliferum*.

A Shady Corner (opposite bottom), created by the fig *Ficus coronata* and the dense growth of the fern *Dennstaedtia davallioides* providing shelter for the fern *Adiantum hispidulum*, the tall lily *Astelia australiana* and the soft herb *Australina pusilla*.



Plants were put straight into the soil without any fertilizer. There had been over a century of unintentional soil preparation. The dunny carts were tipped here for a while last century. The area was a swamp on fertile soil.

Source of Plants — Perhaps the best piece of advice is to keep your eyes open and never assume that only specialist sources can be useful to you. For instance, I acquired *Lastreopsis decomposita* (a relatively rare fern) from my grandparents' backyard and even Coles Stores occasionally have odd plants.

A few specialist local nurseries provided a few ferns. Terania Rainforest Nursery, The Channon, New South Wales, kindly sent me down orders of plants via the banana train, twice. All arrived in good condition (though as they had to be picked up at 5 a.m. I'm not sure that the same could be said for me). This nursery provided a number of the important, "basic structure" plants. Fletchers Fern Nursery at Seville, Victoria, provided a number of the less common ferns (they have an excellent range, the biggest I know of anywhere). Friends and family provided both seeds for sprouting and pieces for propagating. The SGAP Seed Bank provided a few species.

The use of the same bricks for paving the yard as were used in the rear of the house (the bricks were laid by hand so as not to provide precise square lines and a perfectly flat surface) and the house trim and fences being painted the same colour all "tied in" the garden with the house and made it more of a coherent whole. There is no sharp division between the house and its garden.

Apart from snail pellets and occasional "Dipel" for caterpillars (both essential) chemical sprays were not used. At times there was almost irresistible need to control pests chemically but these were avoided. This meant that occasional plants were lost and others may have pest holes in their foliage. After all, the garden had been an artificial environment for probably more than a century. There is still not a complete balance but the pay-off from avoiding non-specific chemicals is already evident. There is a fascinating spider fauna found throughout the garden (I just wish that I could keep the neighbours' cats out). ■

Shade In The Garden

Shade is desirable, shade is a problem! In this issue we examine the situations where the gardeners here either created shade or welcomed what shade they have and do not wish to alleviate it. The above small shady garden in Victoria can easily be created with a collection of ferns and other rainforest plants to create a cool pleasing situation. The garden on page 257 is at Rockhampton where shade is often desirable and Ray Collins has converted his whole backyard to a giant fernery, a cool and beautiful haven.

On page 247 I have presented a situation that I feel is very commonly met. We try to create a small wildflower forest and from then on battle shade and competition for our thirsty, non-vigorous plants. The magnificent garden on page 263 appears to have overcome these problems and I critically examine the achievement as a guide to your own success in the future on page 266.

Building For The Garden

by Michael Green

Most complete gardening books have a chapter on construction work in the garden. This small book by Michael Green could be described as the best practical guidance in this area that I have ever seen. If you want to undertake paving, fencing, retaining walls, stairs, timber work such as fencing, decking, pergolas, etc., this book will show you how to do it. \$9.95 + \$2.40 postage.

The Stirling Range National Park

by W. H. Payne

A Disaster Area

For those who have been fortunate enough to visit the Stirling Range in Western Australia, it represents the pinnacle of wildflower excellence, a temple of beauty in a land of unique wildflowers. We have seen the nearby land ravaged by man, natural habitats of beautiful flowers that are yet to be revealed to the unknowing world, a treasure trove for all to enjoy. We are watching stunned as even more marginal land of Western Australia is being cleared because nature has lashed back and turned previously ravaged land into desert and useless salt lakes.

Recent years have seen a dramatic increase in the clearing of land by developers. It is as if they want to get in first before reason prevails and a responsible representative government heeds the warnings and cries of "for God's sake stop it, there is a tomorrow."

Dramatic rubbish? Well, many will think so but the next generation will not. Many of us have remained apathetic. Man must eat, work and develop his parcel of land. We have natural reserves — we have the Stirling Range!! Future generations will not have the Stirling Range.

They will have a range of spectacular mountains but without the floral spectacle handed down in trust to this generation. The plants of the Stirling Range are dying. The dreaded *Phytophthora* fungus is out of control. There is *Phytophthora* disease on top of Bluff Knoll, that shrine of beauty all should visit. What is to be done?

The Department of Conservation and Land Management of Western Australia has published a detailed report on the problem — Research Bulletin No. 3 deals with the problem in the jarrah forests but can reasonably be applied to the problems elsewhere with some adjustment. It is available from them at Hayman Road, Como, W.A. 6152. They have done a lot of work on the problem. With the natural world dying around them how could they not do this. The report is an excellent one but the predictions for the future are total disaster. This is my interpretation of a wordy, clearly politicalized conclusion. My first reaction was to castigate the Western Australian Government for not doing more as their land development policies and weak conservation initiatives have contributed towards the rapid extinction of their flora, but the problem is really a national one requiring major action and informed investment. Of the major national problems in the area of ecology and the nation's natural survival, this is by far the most critical. We need an action committee to alert the nation! ■

Wildflowers of the Stirling Range

A superb presentation of wildflowers in colour. This book is really a presentation of 144 colour photographs by Bruce Fuhrer with very brief captions by Neville Marchant. The Stirling Range is a very beautiful place to visit, magnificent scenery, interesting walks and a collection of the most beautiful wildflowers in the world. The skilful photography by Bruce Fuhrer makes this a valuable collection. Not really a book. The pages are large but there are only 24 of them. You can purchase a copy for \$7.00 plus \$1.50 postage from the Book Sales Officer, Field Naturalists Club of Victoria; c/- Herbarium, Birdwood Avenue, South Yarra, Victoria 3141.



Sylvan Grove — The Wildflower Garden of Bankstown City Council, Sydney.

Outstanding Reserves To Visit

All over Australia there are reserves and plantings that you would love to see. This is the first in a series on them. They are usually the result of the vision, the drive and the initiative of an outstanding Australian, often supported by a dedicated group. Go to Port Macquarie and take this circular walk. Marvel at the vision and work of Cathy le Page and her supports who transformed a weed infested, shunned area of land adjacent to the busy centre of the town, to a pleasant, tranquil forest. In addition there is a very young arboretum but we will refer to it in the future. — Editor.

Shady Gardens

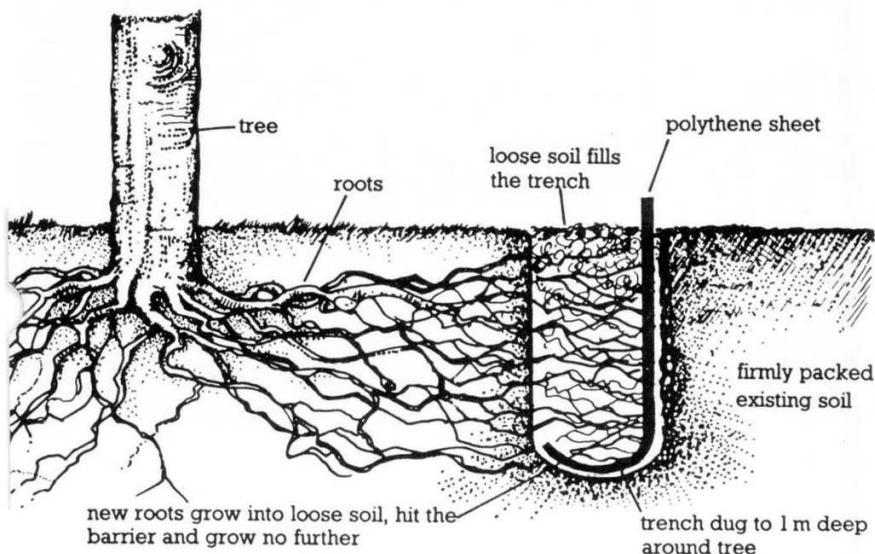
by Virginia Reed

If you are the owner of an established garden, full of shade and old trees, you will already know that shade can be a problem. You will have also realized this if you have tried (and failed) to grow certain plants in the small, still, sunless passage between two houses.

Beautiful, large trees may be one of the main reasons that a garden is shady but these trees also cause other problems. There is root competition for nutrients and water; matting roots under the trees restrict the growth of anything else; drip and splash from the foliage damage plants beneath; toxic effects of certain trees affect the growth of adjacent plants, and debris such as falling leaves, sticks and bark may cover understorey plants. Another problem may be a lack of air circulation in enclosed areas, such as between buildings or indoors, which leads to various fungal diseases becoming rampant.

Root Competition

A tree's roots nearly always spread below the soil to the area beyond the drip line of the tree and often grow to a depth just about the same as the height of the tree. The small roots which are constantly growing are the feeder roots, searching for nutrients and water. Consequently, if you plant anything within reach of these roots, they will grow into the area to tap any extra water and food that the plant is given. Thus the new plant may become starved from lack of food and choked by the new roots.



One method of checking this root competition is the use of polythene sheeting as a barrier between the trees and the smaller understorey plants.

A trench to about 1 m depth is dug around the trees, preferably not so close as to cut any large roots, the distance from the tree depending on the size of the trees¹. Thick polythene sheeting is used to line the trench, with the polythene hard against the undug soil away from the tree (on the wall of the trench) and lining the base of the trench. This is then filled with the good, loose, friable soil which was removed when the trench was dug. The positioning of the loose soil and polythene is important. The tree roots will grow through the soil until they come to the loose, newly filled area where they will multiply, as the soil is easy for the roots to penetrate. Then, when they strike the polythene barrier they will be deterred back to the loose soil. Even if very strong roots do break through the barrier, the theory is that the tree roots prefer the soft, recently tilled soil to the hard undug soil behind the sheeting. This is one method that has been tried by both the Sydney and Melbourne Botanic Gardens².

The alternative is to water and feed plants in problem areas more frequently. This may, however, encourage the growth of even more roots from the competing trees. A thick organic mulch may be used to reduce evaporation and add nutrients to the soil. In areas where roots are very thick, but do not mat on the surface, surface-rooting plants should be used, or low groundcovers which will not send down deep roots to compete even more with the trees. Plants naturally occurring in woodland areas are well adapted to cope with competition from tree roots. Woodland plants concentrate their own roots at levels where the competing tree has fewer roots and are therefore the best plants to use in such areas.

1. When we placed the barrier in Sydney, we had to be quite ruthless, severing all but the largest roots in order to dig the one metre trench and line it with polythene. It was installed along the perennial/main walk where root competition was a great problem. Plants previously never flourished. The results have been very rewarding. V. Reed.
2. (From Professor Carrick Chambers, Director, Royal Botanic Gardens, Sydney). It is true that the system was initially tried in the Royal Botanical Gardens, Melbourne, where it proved very successful even in controlling the most invasive bamboo species. I didn't originate it at Melbourne, indeed I don't know who did.

I have used it elsewhere in Melbourne in National Trust properties and the University and I have used it with success here in Sydney. The major use of it has been to separate roots of the herbaceous species from neighbouring trees such as in the newly planted herbaceous border on the north-south access not far from the Visitor Centre here at the Sydney Gardens and I intend to extend it to other axial beds as we plant these with other themes. It means that the smaller plants are not competing for water or nutrients with the large trees.

To make the system work it is most important that the heavy grade of polythene is put down to subsoil level on the hard firm side of the trench away from the tree so that when roots pass through the soft-fill they cannot penetrate the hard surface lined with the polythene. I understand these heavy polythenes last many years away from light. Indeed they are used as membranes for many concrete slab buildings. It is important, of course, that there are no breaks in the polythene, otherwise roots will gradually get through. It seems to me this is a good way of getting around the problems of over-mature gardens which otherwise suffer from the aggressive competition for water and nutrients from the large trees. It does of course require the removal of an occasional tree root prior to installation and this must be done cleanly and hygienically and preferably sealed so that soil borne fungi and bacteria don't penetrate.

Shady Gardens

by Virginia Reed

Some parts of the above article and the sketch are reproduced, with permission, from the book 'Shady Gardens'. Shade can be a serious problem or a welcome relief and Virginia has dealt with all aspects of this problem in a very competent manner. This is followed by descriptions of plants, both native and exotic, that will tolerate, even welcome shade and plants that can be used to create shade. A good book on the subject for the price, \$9.95 plus \$2.40 postage.

Matting of Roots

The matting of roots occurs under very old trees such as Camphor Laurel (*Cinnamomum camphora*) when the area around them has not been cultivated. The matting may be so tight that a fork or spade cannot be used. Although little can be done, one solution is to add a shallow layer of soil and mulch and try to establish a shallow-rooted groundcover. This soil layer must not be deep (15 cm maximum) as a build-up of soil around the tree trunk can kill the tree.

Another solution is to grow epiphytes — plants that use other plants as support and do not require soil. Epiphytes do not take the food directly from the host plant as parasites do, but may attach their roots firmly to a tree or a fallen branch. They grow well in a coarse, freely-draining mixture, such as wood chips, commercially produced orchid mix or even rough sandstone pebbles of the correct size (about 5 cm diameter).

Drip and Splash

When trees have a solid canopy, as many broad-leaved trees do, the area around the trunk is protected from all but heavy rain. Generally the rain accumulates at the edge of the canopy where large water droplets build up on the leaves, then fall with a splash to the ground. The area directly beneath the outermost leaves of the canopy, called the dripline, can be a dangerous place for small or delicate plants, as heavy water drops fall onto them. This dripping also compacts the surface of the soil. Only tough leafy plants should be grown on the dripline as they will break the fall of the large drops without being battered by the water. Palm-like *Cordyline* would be suitable. ■

The Wildflower Forest

Shade? Competition?

by W. H. Payne

There are many types of shady gardens all of which have their appeal. Some situations are of our own making and some are forced upon us. There are three main categories:

1. Deep shade created by buildings, high fences or nearby dense trees

This is the hardest to live with and is alleviated only by good drainage to reduce dampness, ventilation as distinct from draughts and the provision of as much light as possible. Perhaps readers could send a note and advise how they cope with the problem, turning a gloomy, dank corner or passage into a pleasant space. This type of situation will be the subject of a future issue.

2. Shade created by structures or large shrubs/trees

This is the easiest to live with as it is what you have created. The level of shade or protection can be changed at will to suit the plants, the season or your mood. There are two main types — shadehouses, verandas or enclosures, and the rainforest type situation. The creation of a rainforest usually requires space, the more available the better the effect. It can also be created in quite small areas and such a shady/rainforest garden constructed on a very small site is described on page 239 and illustrated on page 240 with a larger one on page 257. The establishment of a rainforest on a larger scale will be the subject of a future issue.

3. Shade because of trees you desire to keep — The Wildflower Forest

Do you want trees or do you want a garden? In the same area, you cannot have both. Trees are hungry for space, sunlight, moisture and nutrients and will continually try to rob other plant life of all these ingredients so essential for a healthy, attractive garden. We love trees and I have been fighting this problem for 30 years. My experience may be of interest to many.

To create a garden that is not sucked dry by tree roots, robbed of nourishment and with adequate sunshine so essential to most flowering plants, you do not want trees anywhere near it. In an area around the house we have informal gardens in which there are many attractive wildflowers but still a few trees for shade and effect. We do moderately well but the plants are not vigorous and always look thirsty and in need of nourishment. We feed the garden with compost and some fertilizer and pour on lots of water, the price we pay for the few trees we have in the area. Get the picture? You cannot have a vigorous garden and have any trees so we settle for what we can achieve.*

The remainder of our block is covered with many trees, especially the area between the house and the road and yet, at times, this area is quite colourful and attractive. The battle plan we have formulated over many years, to retain our light forest and still have wildflowers, is still evolving. You might say that, apart from the exposed heath areas, most natural areas, the home of wildflowers, have trees. Please take the trouble to look at this natural bush critically and you will see that it is an untidy array of fallen debris, grass with plants in all stages of vigour with, in some areas, attractive wildflowers. An attractive area this year could be just leggy, straggly plants next year. Nature has the space and we see what we prefer to see. A small, attractive forest area needs to be managed but appear natural.

Tree management. A large tree looks magnificent but requires space, a lot of it. Small trees in full vigour look attractive. When my *Eucalyptus* trees reach some 10 metres in height with a trunk width at ground level of 25-30 cm they are coppiced, i.e., cut off at ground level and allowed to sucker up again. Most *Eucalyptus* will do this but it should be done in midsummer when the new growth is at a peak. Each stump produces numerous suckers that soon become vigorous saplings with lush new growth. The trunk and branches become firewood and the leaves go into compost. We have fed an open house fire for 30 years from the timber we have grown. In this way the forest always looks mature and vigorous without dominance by a few large trees, and there is sunlight penetration for smaller plants.

Plants? The selection of plants has proven critical. Shallow rooted plants that can survive with tree roots and limited sunlight are not as easily obtained as you might think. In this situation it is easy to grow large shrubs reaching upwards for more sunshine but we do not like the thick shrubbery look. We like the leafy open forest look with small shrubs as unobtrusive as possible when not in flower so that we can admire the tree trunks. We also like colour, greedy wot?

*All this appears rather negative, it is deliberately so. We have been struggling with a starved garden for years and I have noticed many others where the nearby trees are sucking the garden dry. This is one reason for preparing this issue and taking so much space with my problems, others also have them. However, the garden on page 263 does not have this problem so there is a lesson to be learnt.

There is a tendency for a wildflower gardener to create a plant zoo, one of this, one of that, we must have one of those. We are like this but the whole blends to a pleasing sight by having numerous plants of a similar colour forming a backbone through the bush. The plants we use are also easy to propagate and grow. The dominant plant, because of its bright orange colour, though low in stature (to one half a metre unless it is allowed to scramble up through other shrubs) is *Chorizema cordatum*. A yellow-orange pea-flower (masses of long sprays of flower) it comes from Western Australia but loves the partial shade of the open forest. Planted along the edges of our long driveway through the forest, it creates a band of brilliant cover on either side for 50 metres. Scattered through the trees is our local *Gompholobium latifolium* with its much larger clear bright yellow pea-flowers. We are trying to establish the local *Gompholobium grandiflorum*, as while the flowers are almost as large and certainly as bright, the foliage is even more self-effacing. Other pea-flowers include the regal *Pultenaea stipularis*, a local plant but not as easy, as yet, to establish in numbers. If you are keen to create an open forest such as ours, use *Chorizema cordatum* and some of the pea-flowered plants from your area. Go out and collect some seed in late November, early December.

For a change of colour, the mauve/lilac flowered mint bushes love growing in a forest. Mint bushes come in all sizes and all flower well. Some can become very leafy, thick shrubs so again we are selective in our choice. My favourite is *Prostanthera discolor*. It seems to be just a cloud of mauve in flower and yet, when not in flower, does not seem to take visual space but softens the scene with delicate, slender foliage to less than two metres. *Prostanthera denticulata* is our choice for borders and scrambling ground cover. Try any of the mint bushes.

Grevillea, of course, are decorative plants for any situation. We prefer the bunched spider flowers local to the area, *Grevillea sericea* and the first choice *Grevillea speciosa*. Strangely, the most difficult plant to obtain and establish in numbers is *Grevillea speciosa*. Various others are treasured although none seem to stay with us very long. I shall be doing much more work on *Grevillea* over the next few years. To our joy six *Grevillea leucopteris* plants have done well along the driveway, their large cream blooms on long arching stems to two metres waving to visitors as they drive down. After five years they are beginning to die off so I will have to try another batch of seed.

The wattles are an important part of any bush scene. There are many to choose from. You will have noted the series of articles on small growing wattle in recent issues. We have been using *Acacia drummondii* var. *major*, *Acacia conferta* and some local species. So easy to grow from seed there is no excuse for anyone to do without them.

There is no other way to accentuate colour than to scatter among the flowering shrubs a white flowered plant. The gem of all is *Prostanthera* 'Poorinda'. There are various names such as 'Ballerina' or 'Leane' attached to the 'Poorinda' plant signature of Leo Hodge, but the ones I have seen all appear similar. They are small, compact shrubs to one half of a metre high that get completely covered in white, not just white, a white white. So many shrubs are supposed to have white flowers but are cream or off-white, or quickly age to brown. *Prostanthera* 'Poorinda' may grow larger, rarely above a metre high, but mine are always trimmed for cuttings that root readily.

Other white flowered shrubs that I use are *Eriostemon myoporoides* which requires heavy pruning each year, and the local *Eriostemon scaber*. Reliable hardy plants they grow on, flowering well, for many years. *Eriostemon myoporoides* is one of those plants that are so hardy that wildflower growers tend to ignore. There are many forms, the small leafed and slightly smaller flowered form seeming to be more floriferous and less leafy. Once again, prune them ruthlessly, even back to old wood, almost to the ground if you want, they will soon leaf up and cover with flowers in the next spring.

Those of you who are fortunate enough to see the series of articles by Rodger Elliott in Your Garden will remember one article "Beneath the Canopy". His recommendations agree with mine and I see he also mentions other plants that I use such as *Isopogon*, *Petrophile*, *Lomatia* and *Pomaderris*. He also mentions ground covers that, apart from prostrate mint bushes, I do not feel the need for. I certainly do not recommend *Viola* in any garden with other plants.

Cultivation Problems

There are problems and a price to pay. In my case it is a large excess-water bill. Living on top of a dry sandstone ridge, the ground is usually sucked even drier by tree roots. By selecting plants that are shallow rooted and used to competing with trees, we have some success but with a dry harsh look during dry periods. You can get the plants established by digging a wide hole to break up the fine fibrous roots of the trees, putting fertilizer in the bottom, using composted soil, and watering by hand after securing the young plant in place, but the tree roots will also rush into the freshly dug ground.

The problem is to provide enough nutrition and water for all to prosper. The leaf litter, so necessary to subdue the weed problem, tends to shed a large proportion of the rain that falls. I have found a series of hills and hollows at an angle to the natural fall has made a marked difference. Only in very heavy, prolonged rain is there any runoff. The plants like to live on the hills which no doubt provide depth of soil for the roots to go deeper, and to feed in the hollows.

Regardless of the type of garden or situation, it seems that the John Hunt method of gardening is the correct system. As described in some detail in his book "Creating a Wildflower Garden", a series of hills and hollows to trap all nature's gift of rain has a remarkable effect. He traps all the rain off his lawn, the house roof gutters and the driveway, into his series of hollows through the garden.

Feeding the forest garden is also a problem. I have tried composting with a leaf mulch. It is effective but before using trenches, it shed off too much water. I am fortunate in living near a trotting track and I can get plenty of horse stable manure. The blending of fresh manure into the hills whenever replanting appears to be giving results. For the first time I have a vigorous *Eucalyptus ficifolia* three metres high, in my open forest.

I forgot to tell you what appeals to us very much in our forest garden — the tree trunks of the scribbly gum, the Red River Gum, *Angophora costata* among others. My forest looks very similar to the photograph of the bush garden on page 13 of Volume 15 except that I have not yet been as successful with *Boronia*. Do you have a bush garden? Please advise of your experience. ■

Wahlenbergia

by Martin Witchard, Armidale, New South Wales

The genus *Wahlenbergia* is named in honour of the 19th century Swedish botanist Wahlenberg. There are around 22 species present in Australia, and 10 of these occur on the Northern Tablelands of New South Wales. All *Wahlenbergia* are characterized by being herbaceous and having blue to purple (and less commonly white) "bell-shaped" flowers. The genus belongs to the family Campanulaceae (campanulatus: bell-shaped). From spring to autumn the Tableland *Wahlenbergia* species create a magnificent show for motorists along the New England Highway and arterial roads.

Observing these plants, several questions spring to mind. Why are the plants so proliferant along the roadsides, and how do they survive in such inhospitable conditions? Why do they seem to form clumps? Indeed, I have seen such clumps clinging tenaciously to cracks in the bitumen along some of Armidale's main streets! How would you collect seed, germinate and get it established so that you could appreciate the beauty of these flowers in your own garden? Fortunately, I have some answers. And, while the majority of this article concerns *Wahlenbergia communis* (syn. *W. bicolor*), which I have studied, it is probably just as applicable to other such species in the genus. My colour slides were not of the quality necessary for this beautifully produced periodical but *Wahlenbergia communis* is similar in appearance to *Wahlenbergia ceracea* in the photograph on page 284.

Collection of Seed of *Wahlenbergia*

Wahlenbergia communis seed is extremely small (< 1mm) and light (av. wt. 0.0635 mg). Each seed is brown in colour, glossy and lozenge shaped without any surface roughness. If moistened the glossy coat assumes a type of stickiness which makes them difficult to handle.

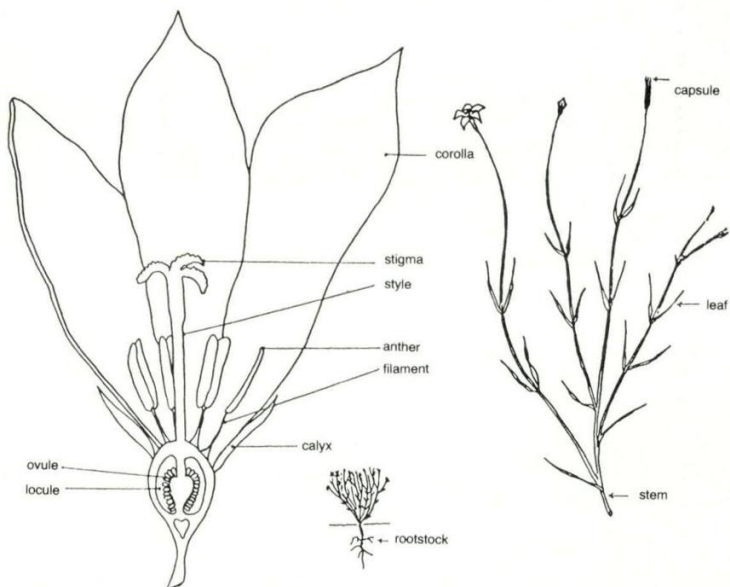
My technique for their collection is: The plants can start to flower in September but October to March is normal here. The seed is mature three to four weeks after flowering. Collect stems when the capsules are woody but not when the stem is also woody — this is too late. Place the cut stems upside down in a paper bag and in a warm, dry spot; allow to dry for several days. This will completely dry out the capsules whose terminal valves will open and release the seed to accumulate at the bottom of the bag. Following this, hang the bag by one of its top corners. Gently snip off the tip of the bottom corner, and a fine stream of seed should emerge. Tap the bag occasionally to assist the flow which should be quite free if everything has dried out sufficiently. When the flow stops, fold and paperclip the corner closed. After another few days open the corner up again and you should get some more seed. To store the seed I have found that 60×110 mm sealable paper packets are ideal.

Germination of Seed

From seed to seedling is a big step. I have found that seed of the Tableland *Wahlenbergia* must undergo a period of stratification before it will germinate. Stratification subjects the seed to low temperatures for an extended period to break its dormancy. I used a refrigerator at 1°C, and kept seeds on germination

plates¹ there for one or two months. After one month, and transferral to an incubator at 25°C, a few seeds germinated. After two months refrigeration, a few more seeds germinated but, in both cases, this represented about 5% of the whole sample. After three months, 90% of the sample germinated!

The seedling, like the seed, is small and lightweight; a hair-thin stem supports two minute cotyledons. Seeds stayed on the plates until the cotyledons emerged. They are too fragile to handle before this but might suffer damage if allowed to develop any further before transplanting. Transferral was a delicate operation. I flooded the plates and used a large needle to prise the seedling away from the blue paper. I first attempted to pot them up into a very fine brown soil so as not to damage the root. The fine brown soil crusted quickly and needed frequent watering to prevent it doing so. Subsequent experiments have used loam:sand (3:1) and the seedlings have thrived. I am sure any soil will do if it is free draining.



A *Wahlenbergia communis* flower and its habit of growth.

Colin Woolcock — A Great Australian

Vale by W. H. Payne

We have lost a man of considerable talent and honourable humility. For many years readers of Australian Plants have savoured the competent photography by Colin, one of his photographs being shown opposite. To take these photographs that have given us so much pleasure, requires not only technical skill, but a love of plants. Even greater than his photographic skills is his artistic ability. The botanical sketches we have used to illustrate Australian Plants for many years, have been by Colin. He despatched them by return mail to me following a brief request, sketchy in detail. His most recent book, 'A Field Guide to Native Peaflowers of Victoria and South-eastern Australia' (see page 235 of No. 121 issue for how to buy a copy), features sketches and photographs of all the pea-flowered plants of the area. His series of articles on *Pultenaea* in this journal have been avidly sought after. We have two major books nearly ready for publication that rely heavily on his talented sketches.

One could write pages on his many achievements, especially with the Field Naturalists Club of Victoria, but those who knew him will honour his memory as a magnificent Australian and a very valued friend.



Wahlenbergia gloriosa △ Photography by Colin Woolcock ▽ *Wahlenbergia gracilis*



In a recent experiment seed was sown directly on to a loam/sand mix through a salt shaker (in which seed and sand were mixed). This has produced a very even cover of seedlings which are all healthy. From seed-seedling the pot was covered with shadecloth (black; 50% (?)) and bottom watered throughout. Seedlings took about 3-4 weeks to emerge. The seed had been stratified in the refrigerator at about 1°C for three months previously.

Watering was a nightmare! Even misting caused the seedlings to collapse under the weight of water. Growers could saturate the soil and seal the pot in a plastic bag to completely eliminate watering until the seedlings are sturdy enough to cope. The subsequent use of bottom watering did the job for me. It encouraged downward growth of the roots rather than lateral spread near the surface as with other watering methods.

Plants are slow starters but grow quickly once about 15 cm high. To this point may take 4-5 months. Will flower in next flowering season if plants are beyond the 15 cm size otherwise the following year must be waited for. Flowers last (i.e., an individual flower) about 5-7 days, opening and closing in response to light. Fertilizer: weak Aquasol, or better still, Osmocote at the recommended rate when they approach flowering. My plants in younger stages are quite happy without fertilizer but I have not experimented to see if I can accelerate their growth with fertilizer at this stage².

General Ecology

Wahlenbergia communis is a perennial which persists during winter by utilizing its extensive rhizome system. Where plants grow along roadsides they must tolerate a number of environmental stresses. These include: low nutrient/free draining soils, comparatively low rainfall, freezing temperatures in winter and buffeting by wind generated by passing traffic.

Where *Wahlenbergia communis* seems to proliferate is on the yellow podzols to the east of Armidale. These soils are inherently low in nutrients and are exceptionally free draining (thus a low water holding capacity). And with rainfall about 796 mm (Armidale), the problem of water uptake is compounded. In winter, temperatures frequently fall below freezing, which could damage the underground rhizome system. Occasionally burial under snow is possible. Finally, by the roadside, passing traffic generates fast moving air which buffets the plants and could increase evaporative losses in summer.

Wahlenbergia communis does branch but not extensively. En masse the clumps of plants can give the appearance of being extensively branched. Tip pruning plants at the 6" (q.v.) stage may bush them out but I have found this unnecessary with my plants. As a pot plant it is interesting. For much of the time it appears as a compact collection of green stems. During winter the plants die back to their rootstock. Once the stems begin growing again (around September), flowering can be expected soon after. Many flowers are produced by a single plant over a season and their size and colour are eye catching. Unless seed is required it would be worthwhile cutting out dead stems to maintain the flowering for its full season. Definitely an outdoor pot plant.

Plants will survive more than one year (at least *W. communis* will — there are other annual species e.g., some forms of *W. gracilis*). How many years is unknown, possibly up to five. Remember, though, they die-back in winter.

Based on observation, the most likely dispersal mechanism for *Wahlenbergia* in a roadside situation, is by passing traffic. As a vehicle passes, the ensuing rush of air allows propulsion of the seed away from the plant. And, since the capsule dehisces (opens) in a vertical (upward) direction, seeds could be propelled many metres, further than if they were propelled horizontally (side-ways) from the capsule. And, this is where I believe the connection between the sticky seed coating and the clump forming habit of the plant may be found. Within the capsule the hygroscopic nature of the seed coating causes them to aggregate (stick together). At dispersal, a clump of seeds is propelled en masse to a nearby site. From many hundreds of seed from an individual capsule, probably only less than 10% of the original seed population germinates in the following season.

The remainder may be inviable or succumb to environmental stresses, become predated or diseased or remain in the soil seed bank still dormant, to germinate in a future season. Despite this, *Wahlenbergia* continually produces an attractive show of flowers during the warmer months.

The hardiness of this species in the environment described should encourage others to cultivate *Wahlenbergia*, especially in cool climate gardens. ■

¹A germination plate is a clear plastic square container 10 cm square and 1.5 cm deep with a lid. A piece of blue absorbent paper is placed on top of a cottonwool pad. Both are moistened (but not waterlogged) and the seed set out on the blue paper. A similar set-up could be achieved using a rectangular Chinese take-away food container with lid. The plate, with the cover on, is replaced in an incubator and maintained at 25°C. This is probably not critical and a cold frame, water heater, straw bedding, etc. could be tried.

²Cultivation of Bluebells, *Wahlenbergia*. Will readers please advise of their experience in cultivation of these dainty plants. The book "Shady Gardens", see page 246, lists *Wahlenbergia gloriosa*, the floral emblem of the Australian Capital Territory, photograph on page 253, as "it grows well in a well drained position such as a rock garden, where it likes sun or partial shade. It spreads by means of underground creeping stems".

Bush Regeneration — Recovering Australian Landscapes

by Robin A. Buchanan

You might describe this book as detailed notes for a college course covering a number of years, at a Horticultural College, Further Education College, or even a University giving due weight to ecology. This should not discourage people who are concerned about their previous educational opportunities or a complete lack of knowledge of botany. If you can read, you can learn and understand at the highest academic level on this subject.

This is not meant to divert from the basic aim and practical objective of the book, the imparting of knowledge on all aspects of restoring areas of land to a level approaching their previous wild, native state. The very latest techniques developed by dedicated enthusiasts over many years and thousands of hours of labour, are presented in such a manner that reading these chapters of the book alone will enable anyone to proceed with confidence and a sense of achievement. With further reading you will enjoy the chapters on the requirements of plants, identification of plants, the more aggressive weeds and their identification and control, and propagation techniques.

What is unique and makes this book of practical value in all parts of Australia is that chapters deal with all areas of concern: Mangrove-swamps, saltmarshes, wetlands, sand dunes, heathland, the various *Eucalyptus* forests, rainforest and arid areas. That area near your home that you are concerned about is covered giving practical achievable objectives and detailed instructions on how to go about it, the only resource needed being energy and a few basic garden tools.

Anybody associated with the reclamation of an area ruined by man's "development" or indifference will know that the principal requirement is energy, hard work and persistence. It is also nice to know that you are doing the right thing and your efforts are being applied in the most productive manner possible. If you want to do something to improve the world you live in, you need a copy of this book. It is available for \$22.45 plus post, \$5.00 NSW, \$8.00 interstate.





Ray Collins in His Backyard Rainforest (above)

Photography by W. H. Payne

The canopy comprises *Omalanthus populifolius* (Bleeding Heart), *Macaranga tanarius*, the palms, *Normanbya normanbyi*, *Carpentaria acuminata*, *Ptychosperma elegans* and the tree fern *Cyathea cooperi*. The understorey includes the tree ferns *Cyathea rebecca* and *Cyathea australis*, the Fan Palm *Lucuala grandis* and *Marattia salicina*. The path is roughly an oval through the forest, other sections of the path being: The Fern Garden (opposite top) has a canopy formed by the palm, *Carpentaria acuminata*, the tree-fern, *Cyathea cooperi* with *Cananga odorata* and *Euodia elleryana*. The understorey includes the tree-fern, *Cyathea rebecca* and the basket fern *Drynaria rigidula*.

The Fern Garden (opposite bottom) has a canopy of *Macaranga tanarius*, the tree-fern, *Cyathea cooperi* and the palm *Archontophoenix cunninghamiana*. The understorey includes *Marattia salicina*, the Giant Tree-fern *Angiopteris evecta* and the fern *Asplenium nidus*.

My Rainforest Garden

My Garden — 6
by Ray Collins

We moved from Tully, North Queensland, to Rockhampton, into a house on a normal suburban block where the yard was all lawn and had no trees. I set up a typical native garden of the 70's using bottlebrushes, *Melaleuca* and *Grevillea*. As the plants grew, so did the problems of scraggly growth. You never seem to get around to pruning at the right time and suddenly the plants are beyond it. The children grew and the need for space in the backyard lessened.

Longing for the atmosphere of a rainforest we decided to take advantage of the existing trees and turn the backyard into one. The photographs show what we have created. For others who may wish to do this, a number of suggestions will prevent you making the same mistakes.

Most importantly, start out with an overall plan. Start with the natural drainage areas for the site and change flat lawn areas to create elevated beds and gullies such that excess water can get away freely without annoying the neighbours. Locate paths winding through the, as yet, imaginary jungle so that as you walk around a bend screened by shrubbery, you come upon a new vista of plants. There may be a small bridge across a stream bed. You do not need water in the stream, a pattern of leaves, stones and plants will soon create the illusion of a dry creek bed recently carrying water after a storm.

Abundant mulch and leaf litter to a depth of 10-15 cm over a friable soil is preferred. However, if it is clay, a dressing of gypsum will help break up the clay. Adequate planning of the drainage will prevent waterlogging.

For best results, a sprinkler system with sprinklers both elevated and at ground level, would prove a wise investment. It will maintain moisture and humidity levels.

The rough plan must position a number of larger permanent trees to the best advantage. For Rockhampton these would include *Xanthostemon chrysanthus* 'Expo Gold', *Eugenia* and *Syzygium* species such as *S. moorei*, *S. coolminianum* or *S. leuhmanii*, especially *Syzygium tierneyanum* which is one of the few trees to keep foliage to ground level in a rainforest; *Phaleria clerodendron* which has a curious habit of flowering from old wood with a beautiful perfume; *Grevillea pinnatifida*, *Grevillea venusta* which is Central Queensland's own and *Barklya syringifolia*. An average-sized allotment could accommodate one of each of these beautiful large shrubs. Do not plant too close, a minimum of distance between them being four metres.

Palms are a highlight of a rainforest and give character to the garden. To supplement the permanent trees, I suggest you plant the single slender-trunked species such as *Archontophoenix cunninghamiana*, *Carpentaria acuminata*, *Normanbya normanbyii*, *Licuala ramsayi* and *Ptychosperma elegans* with the small multi-stemmed species for the under plantings such as *Laccospadix australasica* and *Ptychosperma macarthurii*. Underplantings such as *Linosyris monostachya* and *L. minor* complete the palm planting.

Tree ferns are always a feature of a rainforest. The hardiest species for Rockhampton is *Cyathea cooperii*. It does not relish dense shade, preferring

some sun, but not full western sun. It can be used to contribute to the shade canopy. Other tree ferns would be *Cyathea rebecca*, *Cyathea robertsiana*, and *Cyathea woollsiana*.

Once the plan is finalized and the permanent trees located, it is necessary to provide a leafy canopy as quickly as possible. The first plantings should be the so called pioneer species such as *Macaranga tanarius*, *Omalanthus populifolius*, the bleeding heart tree and *Euodia elleryana*. They drop lots of leaves to form a forest floor. As the large leaves of *Macaranga* drop they form saucers to hold water which helps keep up the humidity level. As the plantings grow these have to be culled out. They make excellent mulch. The secret to establishing a rainforest is lots and lots of mulch. Scrounge lawn clippings etc. from your neighbours.

The watering system can be important, especially in a climate such as Rockhampton. Here the sprinkling hours are 8-10 a.m. and 7-10 p.m. During the morning session I have the yard divided into four areas. Each area gets 30 minutes from microjet sprinklers or risers 50 cm high. For the evening session the yard is divided into six areas. Commercial irrigation sprinklers (of a type which can be adjusted for a selected quadrant) located high in trees or on risers of 2.5 cm waterpipe are used. Location of the sprinklers will depend on your layout and the available water pressure and will require some experimentation. In summertime, with normal rainfall, we have found the full five hours per day is required, reducing to five hours every third day during winter.

The two systems are controlled by separate electronic controllers with a total of 10 valves. Shop around for "specials". Do not be overawed by the instructions; read carefully and follow them step by step. There are a number of different valves available, operated electrically from the controller, some with an arrangement for manual operation if required. I have used 13 mm (thin wall) polythene piping but others recommend 20 mm piping which is not significantly dearer. The whole is easy to instal.

The eventual plant selection for a rainforest is unlimited. This is where your individuality can be given full reign with a wide selection of ferns, orchids and shrubs. You will enjoy making the selection and seeing them grow. Settle back and enjoy the lush environment in your own backyard. ■

Kooloonbung Creek Nature Park

by Trevor Batty

Kooloonbung Creek flows from Lake Innes, south west of Port Macquarie New South Wales, through swampy country practically through the centre of the city entering the Hastings River less than 200 metres from Port Macquarie Post Office. Much of the area surrounding Kooloonbung and Wrights Creek is wetland, badly infested with weeds, herbaceous and woody climbers, camphor laurel and coral trees. A landfill scheme by Hastings Council involving the tipping of debris and fill, indicates the regard the local authority had for the area. There was a good nucleus of native trees that include *Melaleuca quinquenervia*, *Casuarina glauca*, *Alphitonia excelsa* (Red Ash) and some herbaceous plants. A historic cemetery is located on a hill on a frontage to the town.

Of course land developers were looking covetously at the fringes of this natural but badly infested lowland forest but most of the area was a natural



Kooloonbung Creek Nature Park — As above, you may enter the area down a flight of wooden stairs from a public park and historic cemetery. This is in the centre of town at one end of the main business street of Port Macquarie, New South Wales. The area adjacent to the creek was often so soft, an extensive boardwalk has been built down one side as shown below, where it crosses the creek at the upper end. Photography by W. H. Payne.





The seaward end is a pleasant stretch of water previously enjoyed by water birds. You can now sneak up to a bird observation hide along this section of boardwalk and share nature. There have been extensive plantings of species native to the area which could make an interesting report in the future. The return track along the creek is a path meandering through a paper bark forest or along the bank as shown below.



drainage system right in the centre of Port Macquarie. The vision of the Port Macquarie Conservation Society and incredible hard work by a charming lady, Cath le Page, and a few helpers which included an SGAP Group, and a development plan by John Wrigley, has transformed the area.

Four years of hard work have seen a transformation. The funding came from a Bi-centennial grant of \$100 000, two Community Employment Programme grants, a small grant from the National Tree Programme and funds generated by the "Friends" in the form of subscriptions and donations from individual and community organizations. Eight thousand hours of unpaid labour have gone into the development of the park by the Friends of Kooloonbung Creek Nature Park, SGAP members and Community Service workers.

Half of the nominated plants were obtained either from seed, cuttings or by potting up seedlings from gardens of friends and members. The small plants at members' homes were potted into 200 mm pots or bags and transferred to Geoff and Sue Agnew's Pecan Nursery, where they received regular watering and grew into strong, hardy plants. Other truly indigenous Hastings plants were acquired from local rainforest enthusiasts either at no cost or at greatly discounted prices. The Nicholsons at Terania Creek, John Ross at Springbrook and the Fairhill Nursery at Yandina were able to supply the missing species.

The contentious question of potting mix had then to be addressed. Whereas many nurseries use soil-less mixes of sand and peat moss, it was decided to incorporate 50% garden loam because of the less than ideal conditions in the arboretum. The 60 cm of soil placed on the arboretum area to combat salinity was not good quality, as \$30 000 could not be spared for good topsoil, so we had to accept what was given to us free.

The actual method of planting is worth mentioning, particularly the use of six thicknesses of paper around each plant to an area of one square metre, covered by 10 cm of leaf mulch (shredded tree loppings) or woodchip. The newspaper and mulch retain moisture, suppress weed growth and stop overzealous "whipper snipper" operators from ringbarking trees.

Inevitably, there have been a few losses. Some plants were destroyed by vandals, whilst *Dicksonia antarctica* were stolen. In most cases the losses were suffered in silence in the belief that publicity pleases and encourages vandals. Moreover, Kooloonbung is a park for the people. The area is not fenced, has many entrances, and restrictions on playing and cycling could not be enforced even if one so wished. We have had to move some plants to less vulnerable positions, and others, like *Callicoma serratifolia*, to a more suited spot. We used *Acacia rubida* to provide protection for broad leaved species of *Anopterus*, *Sloanea* and *Diploglottis*.

The use of "GrowTubes" has been most successful with trees that were struggling in the arboretum. The rainforest trees in the Wrights Creek area, with more protection and better soil, have done much better. In hindsight, and with more money, it would have been helpful to have "GrowTubes" on all trees.

Most trees have engraved labels identifying them and many species have more detailed photometal plates. We regard the Park not just as a place for passive recreation, but as an educational facility. It is being used regularly by school groups. Information on the ecology of the area is displayed in an information hut to assist all visitors to the Park. ■

A Wildflower Garden

My Garden — 7
by R. G. Cooke

The garden, about one acre in area, is on land sloping down from west to east and about one kilometre from the sea. The area is frost-free but we get a good deal of rain during most of the year. The soil is shallow over a base of dense clay but as the block has been thickly wooded for at least 60 years, the soil has been well composted with a natural mulch of fallen leaves and bark. This, together with the slope, makes the soil drain fairly easily.

When I acquired the block in 1966 it already carried a considerable number of *Eucalyptus*, *Acacia* and *Pittosporum* trees, together with some other species of native plants including *Casuarina*, *Leptospermum*, *Exocarpus*, *Myoporum* and *Angophora*. As well there was exotic infestation including Pines and Cypress and a thick cover of the weeds Blackberry, Bracken and Boneseed. I removed some trees to make room for a house and planted more, mostly *Eucalyptus* and *Acacia* to provide shade and shelter. Having eliminated the weeds, I began planting shrubs.

The natural soil was built up in terraces over most of the block using logs and rocks to retain the soil and improve drainage. Even when individual plants are placed in natural locations, I always mound up the soil at least a few centimetres and place logs or stones on the downhill side to keep things stable. Many of the longest surviving specimens have grown under these conditions.

General Planting

Most of my plants are growing in the natural soil of the area, some for many years as shown by the date of the planting: *Acacia podalyriifolia* (1967), *Kunzea parvifolia* (1967), *Lambertia formosa* (1969), *Hakea verrucosa* (1967), *Hypocalymma angustifolia* (1967), *Melaleuca decussata* (1967), *Eucalyptus citriodora* (1966), *Eucalyptus calophylla* (1967), *Crotalaria laburnifolia* (1969), *Banksia serrata* (1967), *Adenanthos obovata* (1968), *Eupomatia laurina* (1969), *Leptospermum petersonii* (1969), *Regelia velutina* (1968), *Hakea corymbosa* (1969), *Hovea elliptica* (1968), *Zieria arborescens* (1969) and many more since 1970.

An Island Garden Bed

This is in the centre of a lawn as shown in the photographs on the next page. This garden bed is six years old, the only maintenance is weeding and occasional addition of natural mulch and compost of leaves and bark. Plantings, made in May 1984, include: *Adenanthos obovata*, *Isopogon formosus*, *Eriostemon nodiflorus*, *Hibbertia obtusifolia*, *Hardenbergia violacea*, *Calytrix tetragona*, *Thysanotus multiflorus* and *Dampiera rosmarinifolia*; in September 1984 include: *Thryptomene saxicola*, *Thomasia pygmaea*; in December 1984: *Calothamnus quadrifidus*; in February 1985: *Anigozanthus hybrid*, *Pultenaea capitellata*; in March 1985: *Scaevola nitida*, *Boronia denticulata*; in November 1986: *Boronia serrulata*; in January 1987: *Prostanthera calycina*; and in January 1988: *Kunzea pulchella*, *Sollya heterophylla* and *Lechenaultia biloba*. With these plants still doing well this is a successful wildflower garden. Some river sand was dug in at some places, particularly where the *Lechenaultia* are planted.



The Small Sand Bed (above). Enclosed by bluestone pitches and logs, this garden bed of fine bush sand to 25 cm deep on top of the natural soil with a dense clay base. See page 266 for details.

Island Garden Bed in a Lawn (opposite page — top). From left to right we see *Eriostemon nodiflorus* (pink/red), *Calytrix tetragona* (pale pink), *Boronia denticulata*, its pink flowers among the foliage, *Lechenaultia biloba* (blue) on the extreme right, with a small plant of *Kunzea pulchella* in the front. *Lechenaultia formosa* the orange/pink flowered plant at the rear is growing in a wooden tub supported by an old tree stump. It has been there for two years as it is the sunniest spot in the garden and the best for ventilation and drainage.

This is the same garden on the other side (opposite page — bottom). It is made of natural soil mixed with some river sand and retained by logs of wood, arranged around an old tree stump. From left to right the plants visible are *Lechenaultia formosa* (small, orange flowered), *Thysanotus multiflorus* (the mauve fringe lilies on top of stalks), *Hibbertia obtusifolia* (small, yellow, in front), *Helichrysum bracteatum* (orange) and an *Anigozanthos* hybrid in the rear, with *Thomasia pygmaea* (pink), *Eriostemon nodiflorus* on the front left. Other plants in this bed include *Boronia denticulata*, *Boronia serrulata*, *Calytrix tetragona*, *Lechenaultia biloba*, *Thryptomene saxicola* and *Acacia gracillifolia*.



The Sand Garden

From the beginning I wished to grow a wide range of plants so I constructed the built-up beds of fine bush sand enclosed by blue stone pitches and logs, as shown in the photographs. The sand varies in depth from 25 cm to 40 cm because of the natural slope of the ground. An agricultural drain pipe was also dug below the bed to aid the removal of excess water. The plants in this bed have changed from time to time through losses or because I have pulled plants out when they became too large or because the space was required for more desirable plants. The following are plants growing well at present, some for a long time, but most have been there for two or three years. *Actinodium cunninghamii*, *Boronia spathulata*, *Brachycome pilligaensis*, *Calectasia intermedia*, *Celmisia asteliifolia*, *Dampiera diversifolia* (1974), *Dampiera linearis*, *Dillwynia sericea*, *Epacris reclinata*, *Eremaea pauciflora* (1975), *Halganina preissiana*, *Hemiandra pungens* (1975), *Hibbertia microphylla*, *Hibbertia stellaris*, *Hypocalymma robustum*, *Isopogon petiolaris*, *Lechenaultia acutiloba*, *Lechenaultia floribunda*, *Pimelea spectabilis*, *Platytheca verticillata*, *Sowerbaea juncea*, *Stylidium graminifolium*, *Telopea speciosissima*.

Another built-up bed of coarser river sand to a depth of 50 cm has well grown plants in it, some planted as far back as 1976. *Dampiera purpurea*, *Billardiera erubescens*, *Billardiera variifolia*, *Conostylis* (several species), *Hakea bucculenta*, *Hakea multilineata*, *Dryandra drummondii*, *Dryandra formosa*, *Rhododendron lochae*, *Calectasia intermedia*, *Anigozanthos pulcherrimus*, *Astroloma ciliata*, *Hemiandra pungens*, *Isopogon dubius*, *Verticordia plumosa*, *Verticordia mitchelliana*, *Hibbertia pedunculata*, *Goodenia varia*, *Cheiranthra filifolia*.

It must be stressed that plants placed in these sand beds must already be growing in a very light sandy soil. If not the water will simply flow around the root ball and the plant will strangle in a hard dry ball of soil. Also, some compost and potting mix should be worked into the sand at the bottom of the hole before planting to encourage the roots to grow downwards.

Because of the many large trees, the garden is rather shady and few parts get direct sunshine for more than a few hours. One general rule I try to follow is to put plants with fine foliage in the sunniest places and those with broad leaves in the shadier spots. ■

The Cooke Garden — Shade? Competition?

Comments by the Editor

The garden by Dr Cooke is clearly a successful garden. You will appreciate my concern over the presence of large trees and of shade and the effect on a flowering garden, if you have read the previous articles in this issue. I was naturally suspicious when I received his notes and replies to my never ending queries. How can he grow so successfully when I am having so much trouble? I asked him again, "I presume you cleared an area near the house of trees to establish the flowering garden and that you water and fertilize it". He replied as follows.

"As stated previously, I only cleared the area where the house now stands. Then I began planting more major trees over most of the block, mainly *Eucalyptus*, *Acacia*, *Melaleuca*, *Leptospermum*, *Agonis*, *Grevillea*, *Hakea*, *Hibiscus*, *Banksia*, etc. I did not clear a space for the garden, the whole block is the garden and I tried to keep it, as much as possible, like natural bushland. There are very dense areas of tall shrubs and trees and more open places with tall trees with tall, unbranched trunks and high canopies. There are tall shrubs and trees around the sand beds. The roots are no problem because the trees were well established with deep roots before the sand beds were built up and the roots stay well down in the natural soil.

I water as little as possible and only in dry periods. Every drop of water used in the house eventually runs into agricultural drains laid under the lawn. The water, therefore, continually seeps down the hill and irrigates the plants at the lower levels. Above the drains, plants requiring less water can be planted. I water with an ordinary hose and sprinkler, but only in the areas with small shrubs, especially the raised beds. As we get very heavy rain at times, I have a shallow trench across the upper part of the block to divert excess run-off over to the road. (Properly located this trench can also be a water soak).

Fertilizer? I sometimes use some slow release granules around small plants in the sand beds. Otherwise only containers are fertilized."

So what have I learned from this? Dr Cooke has found the secret to most success with wildflower gardens — do not water on top but use any water available to the best advantage below ground level. The roots of the plants in the sand gardens are encouraged to go deep for water, as they do in the wild especially Western Australia, and the roots of the trees do not need to go up into the sand garden, as the water is deep down, not in the garden at all.

If you have a well-drained garden on a slope and can water it, say in a trench on the high side, you will save water and grow better plants. Then what is the sand for? There will be some moisture forced up by capillary action to entice the newly planted plants to send their roots down but the sand provides

- (a) something to hold the plants up — you may need rocks or some support to relieve wind damage. Better still, locate large shrubs to form a windbreak. In Dr Cooke's case his large block is ringed by large trees with further wind abatement by other shrubs.
- (b) a deep mulch so that the sand is warm to hot on top but cool and moist deep down. There is no need for wog-infested litter as a mulch.
- (c) any fertilizer on the top is leached down to a "drinkable" form by the time it gets to the deep feeding roots.
- (d) a barrier against root pests that flourish in the warm surface soil and attack any surface roots or ringbark the stem at the point of entry to the soil.

I have deduced this, who says I am wrong? For my forest garden as described earlier, I wish I had the natural rainfall enjoyed by Dr Cooke and/or my house was on the high end of the block and not at the downhill, bottom end. Still there is much more I intend to do such as collecting the rainwater off my driveway instead of using it, as designed, to take the rainwater away. ■



Billardiera erubescens, the flower △

(Photography John Simmons)

▽ the plant



Growing *Billardiera*

At Maranoa Gardens
Balwyn, Victoria
By Lisa Booth

A report on the cultivation of species of *Billardiera* in Maranoa Gardens, Balwyn, Victoria, may be of interest.

Billardiera bicolor — spindly growth on a fence with northerly aspect. After two and a half years the plant has climbed to the top of the fence and along the top — you can barely see that the fence is there. When planted with nothing to climb on it forms a little bush as it grows in on itself.

This bushy plant is 30 cm high by 45 cm and is growing in dappled shade. The plants are very prone to scale and to aphids on new growth. See photograph on page 277.

Billardiera drummondiana. We have been unsuccessful with several plants of the variety *collina* of this species. All died within six months of planting. All were planted in clay loam, mulched with 12 mm gravel screenings, along a wire mesh fence on a north-facing slope. Inadequate drainage and heavy soil may have been the problem.

Billardiera erubescens. One plant had poor growth and eventually died when planted on a fence in dappled shade under established eucalypts. Growth was sparse and spindly. However, another plant had excellent growth on north-facing slope in full sun.

In 2½ years this plant has formed a dense cover on a wire mesh fence (2 m high) and flowers for most of the year. This plant is in a similar position to the *B. drummondiana* which died, but is higher up the slope. It has covered the fence to a width of 2 m. Unfortunately, the dense growth provides cover for thrip and aphids, particularly on the lush new growth.

Billardiera ringens is growing in a similar position to *B. erubescens*, with similar results, but growth is slower overall.

Billardiera variifolia is slow growing relative to *B. erubescens* and *B. ringens*, growing in a similar position. It seems prone to twine in on itself instead of climbing on the fence. Plants are growing in clayey loam, sand, and in a clayey bed suspected of *Phytophthora cinnamomi* infection, equally happily. All are in full sun. No pest problems have been observed.

Billardiera cymosa is growing quite well in heavy soil in dappled shade under trees. It is a reasonable fence cover. In one year it has reached the top of the fence and is spreading. The flower is shown in colour on page 277.

Billardiera scandens is a good fence cover in dappled shade. A plant has covered a 2 m high wire mesh fence to a width of 0.5 m in one year. There are no pest problems as yet. It is growing in heavy soil with no problems.

Generally, we are happy with our efforts in growing *Billardiera*, except for *B. drummondiana*. *B. erubescens* and *B. ringens* have done particularly well as fence covers. They all seem hardy and require little care, except for occasional problems with sucking pests.

All except *B. cymosa* are flowering now, in May, and seem to have a flower or two at most times of the year. ■

Billardiera in Tasmania

by Marjorie Wall

"New taxa and new combinations in Australian Pittosporaceae", published by Eleanor M. Bennett, has given Tasmania an increased number of species and varieties in the *Billardiera* genus.

Billardiera longiflora, the type variety, is the most common growing from sea level to the mountains, in all weather and soil conditions. The common name is Climbing Blue Berry but occasionally the berries may be white.

Billardiera longiflora var. *alpina* was described by Rodway from specimens from Ironstone Range. Now this small climber has been found again on Wombat Moor in Mt Field National Park. I have it growing well in my garden. This has red berries and many seedlings come up underneath it. The plants that have matured have produced blue berries. I have had no luck growing plants from the blue berry seeds; only cuttings grow well from the vine.

Billardiera longiflora var. *ovalis* grows on the coast and has slight variations in the leaves from the type form. It has pink to red berries. It grows well on South Bruny Island and Partridge Island.

Billardiera scandens is a twining plant like *Billardiera longiflora*, but is common in the north part of the state only. The berry is green, yellow or sometimes red. Jeanette Closs has a plant of *B. scandens* in her Austins Ferry garden that is clinging so tightly to a pine tree she is afraid some limbs will be choked by the strong vines.

Billardiera alpina (previously *Marianthus alpina*) is a very small plant that has recently been discovered on the Middlesex Plains.

Billardiera procumbens (previously *Marianthus procumbens*) is common in sandy heaths and dry sclerophyll forests in many parts of the state as an undershrub, not a twiner. ■

Billardiera

The Genus by Eleanor Bennett

Billardiera commemorates a French botanist Jacques-Julien Houton de la Billardiere (1755-1830), who visited Western Australia and Tasmania in 1792-1793, and described many new species. This genus is endemic to Australia and includes 25 species in all Australian states except the Northern Territory. *Billardiera* now includes those species previously included in *Marianthus* and *Rhytidosporum*. The main distinguishing character between *Marianthus* and *Billardiera* was the fruit, the first having a dehiscent capsule and the latter a berry. From flower structure alone it was impossible to separate the genera, as some species have united petals, others have free petals. These species are mainly climbers or twiners but do include a few low woody shrubs. Some species show an interesting colour change in the flowers with maturity. *Billardiera coriacea* opens a white to cream colour but matures to a deep purple.

Billardiera belong to the plant family Pittosporaceae and all the other genera (and plant species) in this family were described and illustrated in Volume 15, pages 20-36. All *Billardiera* species are distinguished by the five free stamens with ovate or oblong, versatile anthers which open by longitudinal slits. The petals are free or joined at the base or into a distinct tube, but eventually become free. The ovary is sessile or occasionally stipitate, glabrous to densely pubescent, two or three celled and the fruit is a berry or a coriaceous, slightly flattened, ovoid or oblong capsule splitting loculicidally or both loculicidally and septicidally. The seeds are numerous, ovoid or globular, dark brown or black.

There are 26 species occurring in all states except the Northern Territory and each of these are described here. To assist in identification, these species may be grouped as follows. For those who require more precise identification, a botanical key to all species is given at the conclusion of the article.

Section I: *Marianthus* — The fruit is a capsule.

Series 1: Pictae. Twiners or flexuose shrubs. Flowers solitary to corymbose. Petals free, linear or spatulate. Capsule septicidally and loculicidally dehiscent. *Billardiera erubescens*, *B. bicolor*, *B. candida*, *B. mollis*.

Series 2: Bignoniae. A twiner with solitary flowers. Corolla tubular, contracted above ovary, pubescent outside, eventually petals free towards base. Capsule loculicidally dehiscent, cylindrical, puberulous. *B. bignoniacea*.

Series 3: Calopetalae. A twiner. Inflorescence densely corymbose. Petals at first connate, but eventually free. Anther filaments dilated for 3/4 of length then abruptly contracted with a sharp subulate point. Capsule loculicidally dehiscent, chartaceous. *B. ringens*.

Series 4: Procumbentes. Small, erect subshrubs or prostrate shrubs. Flowers solitary or few and corymbose. Petals lanceolate to linear. Capsule loculicidally dehiscent, ovoid or shortly cylindrical. *B. villosa*, *B. procumbens*, *B. prostrata*, *B. alpina*.

Series 5: Oncosporeae. Twiners, flowers solitary or in few-flowered corymbs. Petals free, lanceolate or linear. Capsule loculicidally dehiscent, ovoid or cylindrical, glabrous. *B. granulata*, *B. drummondiana*, *B. coeruleo-punctata*.

Series 6: Parviflorae. A slender twiner. Inflorescence corymbose with up to five flowers. Petals free, linear. Capsule loculicidally dehiscent with fibrous compartments in which the seeds are embedded. *B. parviflora*.

Section II: *Billardiera* — The fruit is a berry.

Series 1: Biloculares. Berry 2-celled, style short 5 mm long. Seeds embedded in pithy endocarp. *B. scandens*, *B. coriacea*, *B. floribunda*, *B. variifolia*, *B. sericea*, *B. laxiflora*, *B. lehmanniana*, *B. sericophora*, *B. cymosa*, *B. versicolor*, *B. uniflora*.

Series 2: Uniloculares. berry 1-celled without pith, *B. longiflora*.

1. *Billardiera erubescens* (Putterl.) E. M. Bennett

Twinner, with leaves 22-80 mm long and 3-29 mm wide with the upper surface glabrous and the lower surface with scattered hairs. The inflorescence is a terminal corymb with a peduncle 5-25 mm long, and pedicels 4-9 mm long. The glabrous sepals are green becoming red, 2-4 mm long and 1-1.5 mm wide, glabrous with hyaline margins. The petals are red, connate but eventually free, 17-26 mm long and 2.5-3.5 mm wide. The anthers are white, 1.5-2 mm long with filaments slightly shorter than the petals. The fruit is a glabrous capsule, 5-12 mm long and 4-6 mm wide, purple becoming brown. Flowering: August to December. Distribution: W.A., between Morawa, Merredin, Stirling Ranges and Cape Naturaliste.

2. *Billardiera bicolor* (Putterl.) E. M. Bennett

An erect shrub or semi-twiner, with alternate, glabrous, sessile or shortly petiolate leaves, 10-60 mm long and 1-20 mm wide, entire or dentate. The leaves of the type form var. *bicolor* vary considerably in length while the margin varies from being entire to distinctly and many toothed, while those of the variety *lineatus* are entire. The inflorescence is a terminal corymb with a peduncle 2-8 mm long, and pedicel 2-7 mm long. The sepals are 1-1.5 mm long and ca. 0.5 mm wide, pale brown and ciliate. The petals are white or cream with prominent crimson markings on and between the veins, 11-20 mm long and 4-5.5 mm wide. The anthers are 1-1.5 mm long with curved filaments 7-9 mm long. The capsule is 7-15 mm long and 5-8 mm wide, brown. Flowering: December to March. There are two varieties:

var. *bicolor* Leaves toothed. Corymbs exceeding leaves. Capsule crustaceous. Widespread from Cockleshell Gully to York, east to Zanthus and south-west to Ravensthorpe, W.A.
var. *lineatus* Leaves entire. Corymbs not exceeding leaves. Capsule cartilaginous. W.A., from Kalbarri south to Cockleshell Gully. Photo by P. Armstrong on page 277.

3. *Billardiera candida* (Hueg. ex Endl.) E. M. Bennett

A twinner with alternate leaves, 25-90 mm long and 3-16 mm wide with the upper surface glabrous and the lower surface sericeous. The inflorescence is a terminal corymb with a peduncle 40-80 mm long and pedicel 3-8 mm long. The sepals are 1.5-4 mm long and 0.5-1 mm wide. The petals are white, 7-15 mm long and 3-6 mm wide. The anthers are blue, 0.5 mm long, and the glabrous filaments are 6-7 mm long. The fruit is a capsule, 6-12 mm long and 5-7 mm wide, becoming pale brown. Flowering: October to January. Distribution: W.A., in the Darling Ranges and south-west coast to Augusta.

4. *Billardiera bignoniacea* (F. Muell.) E. M. Bennett

Orange Bell Creeper

A slender twinner with leaves which are cordate at the base, 12-87 mm long and 3-30 mm wide, with scattered pubescence on both surfaces especially along the veins. The pendent flowers are solitary, on a pedicel 3-6 mm long. The villous sepals are united at the base, 3.5-5 mm long and 1-2 mm wide. The petals are greenish-yellow to red, sparsely pubescent and fused into a tube 15-19 mm long (becoming free with age), the free lobes are 2-5 mm long and 2-3.5 mm wide. The anthers are 1-5 mm long, and the filaments are 15-17 mm long. The pubescent capsule is 10-12 mm long. Flowering: October-March. S.A. and Vic., on the Mt Lofty Range, Kangaroo Is. and the Grampians.

5. *Billardiera ringens* (Drumm. Ex Harv.) E. M. Bennett

Orange Creeper

Also known as the Chapman River Bell Flower, this is a coarse twinner, with leaves 54-100 mm long and 11-30 mm wide, both surfaces with scattered long white hairs. The inflorescence is a dense terminal corymb with a hirsute peduncle 20-80 mm long, and hirsute pedicels 2-4 mm long. The petals are orange, or red with an orange throat, at first tubular but partially splitting from base with age, 12-21 mm long, with broad lobes.

The anthers are 1.5-2 mm long, and the filaments 10-17 mm long winged for $\frac{2}{5}$ of their length from the base and then abruptly contracted into a narrow filament. The glabrous capsule is 7-9 mm long and 3-4 mm wide maturing to brown. Flowering: August to November. Distribution: W.A., between Dongara and the Murchison River.

6. *Billardiera villosa* (Turcz.) E. M. Bennett

A diffuse, much branched, semi-spinescent shrub to 45 cm high with sessile, scattered or fasciculate leaves, 2-10 mm long and 1-2 mm wide, sparsely villous on both surfaces. The flowers are solitary, terminal or arising from a fascicle of leaves on villous pedicels 4-11 mm long. The sepals are 2-4 mm long and 0.5-1 mm wide, villous on the outer surface but glabrous on inner surface. The petals are blue, 8-16 mm long and 2-3 mm wide. The blue anthers are 1-1.5 mm long with filaments 4-6 mm long. The capsule is 4-9 mm long and 4.5-5 mm wide, purple, becoming brown when mature. Flowering: September to November. Distribution: W.A., between Bremer Bay and Mt Maxwell, also in the Frank Hann National Park.

7. *Billardiera mollis* E. M. Bennett

A low spreading shrub to 50 cm high with alternate, petiolate leaves, 10-20 mm long and 7-11 mm wide. The leaves have long white hairs on both surfaces when young but become glabrous with age. The axillary flowers are solitary, rarely two on peduncles 15-25 cm long. The dark blue, hirsute sepals are free and the blue petals are 12-15 mm long and 3-6 mm wide. The anthers are 0.75-1 mm long and the whitish filaments, which are dilated at the base, are 6-8(10) mm long. The hairy capsule is 7-14 mm long and 5-7 mm wide. Flowering: August to September. Distribution: W.A., on the Ravensthorpe Range and to the east.

8. *Billardiera procumbens* (Hook) E. M. Bennett

Sweet Marianth

A low, prostrate to semi-erect, much branched shrub, with scattered or clustered glabrous leaves 4-14 mm long and 0.5-3 mm wide. Depending on the habitat there is wide variation in the size and shape of the leaves. The number of flowers per peduncle varies considerably. The flowers are solitary or two or three together on a glabrous to sparsely pubescent or sericeous pedicel, 1-5.5 mm long. The glabrous sepals are 2-4 mm long and the petals are 3-6 mm long and 0.5-2 mm wide, white with purple tips. The anthers are less than 0.5 mm long with the filament 2-3 mm long, widening in the lower half. The smooth or finely rugose capsule is 3.5-6 mm long and 4.5-7 mm wide, becoming recurved. Flowering: September to December (March). Distribution: South-eastern Qld, NSW to Vic. and Tasmania.

9. *Billardiera prostrata* (D. McGillivray) E. M. Bennett

A semi-prostrate shrub, branching from the swollen rootstock with glabrous leaves 4-15 mm long and 2-6 mm wide, entire or serrate in the upper half. The inflorescence is a (1-)3-5-flowered terminal corymb, with the vegetative growth continuing, with a hirsute pedicel 9-12 mm long. The sepals are hirsute, ca. 2 mm long and the petals are white within and pale mauve on the outside, 3.5-4 mm long and 1-1.5 mm wide. The anthers are less than 0.5 mm long and the filaments are 2.5-3 mm long. The glabrous, sessile capsule is ca. 2 mm long and ca. 3 mm wide. Flowering: December to February. Distribution: NSW, near Robertson and at Currockbilly.

10. *Billardiera alpina* (D. McGillivray) E. M. Bennett

A spreading shrub up to 10 cm high with a well developed rhizome, the plant often forming a mat. The glabrous leaves are (2-)6-12(-15) mm long and (2-)3-5 mm wide, entire or with serrulations in the upper half, occasionally along whole length. The flowers

are solitary and terminal on short, sparsely pubescent pedicels, 2-5 mm long. The sepals are 2.5-4 mm long and ca. 1 mm wide and the petals are white, purplish on outside, 4.5-7 mm long and 1.5-2 mm wide. The anthers are 0.5-1 mm long and the filaments 3-4.5 mm long. The rounded to flattened capsule is 5 mm long and 5-6 mm wide. Flowering: Dec. to Feb. On the Southern Tableland of NSW above 1,250 metres.

11. *Billardiera granulata* (Turcz.) E. M. Bennett

A slender twiner with alternate, petiolate leaves 6-39 mm long and 3-11 mm wide, with long white hairs on both surfaces but more abundant on the lower surface. The inflorescence is a terminal or axillary corymb with the peduncle 2-21 mm long and a filamentous pedicel 4-14 mm long, both with white spreading hairs. The sepals are 2-3 mm long and 0.5 mm wide, dark blue with long white hairs scattered over the surface. The petals are white or pale blue with dark blue spots on inner surface, 5-6 mm long and 2-2.5 mm wide. The anthers are blue, 0.5-0.75 mm long and the filament is 3-3.5 mm long. The ovate capsule is 3-7 mm long, thin, blue but drying brown. Flowering: Oct. to Dec. Distribution: W.A., where it is found only on the Porongorup Range.

12. *Billardiera drummondiana* (Putterl.) E. M. Bennett

A delicate twiner, with clustered leaves 5-23 mm long and 1.5-10 mm wide, with the upper surface glabrous and the lower surface with scattered long white hairs. The flowers are solitary or up to four together in the axils of a leaf cluster on glabrous or sparsely to densely pubescent pedicels, 4-25 mm long. The dark blue, sparsely pilose sepals are 4-5 mm long and ca. 0.5 mm wide. The pale blue petals are 2-16 mm long and 2-3 mm wide. The white anthers are ca. 1 mm long and the filaments 5-7 mm long. The inflated capsule is 9-12 mm long, pale brown. Flowering August to October. There are two varieties:

- var. *drummondiana* Pedicel 18-25 mm long, hairs all long.
 Distribution: W.A., between Mt Barker, Porongorups and Manjimup.
 var. *collina* Pedicel 4-10 mm long, hairs both short and long.
 Distribution: W.A., on the Darling Range east of Perth.

13. *Billardiera coeruleo-punctata* (Klotzch) E. M. Bennett

A twiner with sparsely pubescent, alternate leaves 30-60 mm long and 5-9 mm wide. The inflorescence is a terminal corymb with pubescent peduncles 60-105 mm long and densely puberulous pedicels 3-15 mm long. The blue sericeous sepals are 3-6 mm long and the blue petals are 11-16 mm long and 2.5-4 mm wide. The pale blue anthers are 1-1.5 mm long and the glabrous filaments are 6-8 mm long. The capsule is 6-7 mm long and 3-4 mm wide, green becoming brown. Flowering: October to November. Distribution: W.A., Pingelly north to Mount Peron.

14. *Billardiera parviflora* D.C.

A slender twiner with alternate, sessile leaves 5-42 mm long and 3-13 mm wide, with the upper surface sparsely pilose and the lower surface densely villous. The inflorescence is an axillary or terminal corymb with up to five flowers, and densely villous pedicels less than 1 cm long. The hirsute sepals are 3-5 mm long and the pale blue petals are 7-12 mm long, expanded in upper third sometimes with blue spots in the throat. The anthers are 0.5 mm long on filaments 4-5 mm long. The thin-walled ovoid capsule is 8-9 mm long and 3-5 mm wide, green becoming brown, with distinct dry pithy cells for the seeds. Flowering: April to June. There are two varieties:

- var. *parviflora* Petals without spots in throat.
 Distribution: W.A., Cape Naturaliste to Augusta.
 var. *guttata* Petals with dark-blue spots in throat.
 Distribution: W.A., Serpentine on Darling Range.

15. *Billardiera sericea* (Turcz.) E. M. Bennett

A twiner with shortly petiolate leaves, 2.5-25 mm long and 1-5 mm wide, with an uncinat apex and a smooth, densely pubescent lower surface and tuberculate or sparsely to densely pubescent upper surface. The terminal inflorescence is a corymb with a peduncle 10 mm or less long and densely short hirsute pedicel 3-10 mm long. The hirsute sepals are 5-9 mm long and 1-1.5 mm wide and the yellow to dull mauve petals are 7-10 mm long and 2.5-3 mm wide. The anthers are white, 1 mm long and the glabrous filaments are 4-5 mm long. The glabrous or sparsely pubescent berry is 12-17 mm long and 5-6 mm wide. Flowering: December to February (June). Distribution: W.A., from Gillingarra south to Esperance.

16. *Billardiera floribunda* (Putterl.) F. Muell.

White-flowered *Billardiera*

A twiner with alternate, shortly petiolate, leaves 44-117 mm long and 4-60 mm wide. Some collections have narrow-lanceolate leaves although the typical and more common variant has ovate leaves. The terminal inflorescence is a corymb with a glabrous peduncle 10-14 mm long, and a glabrous pedicel is 7-11 mm long. The green to brown, glabrous sepals are 4-10 mm long and 1-1.5 mm wide. The white petals are 17-27 mm long and 5-8 mm wide. The white anthers are 1-1.25 mm long, and the glabrous filaments 6-8 mm long. The berry is 18-25 mm long and 5-8 mm wide, green turning brown with maturity. Flowering: December to February. Distribution: W.A., on the Darling Range east of Perth, south to Augusta and east to Albany. See the photograph on page 281.

17. *Billardiera lehmanniana* F. Muell.

A semi-twining bush to 1 m tall with alternate, subsessile, leaves 7-30 mm long and 1.5-2.5 mm wide, glabrous or sparsely pilose. The inflorescence is a terminal corymb with a pubescent peduncle 6-21 mm long, and a pubescent pedicel 2-4 mm long. The brown, villous sepals are 3-9.5 mm long and 0.5-1 mm wide and the petals are 8-12 mm long and 2-4 mm wide with a few hairs on the upper edge. The anthers are 0.5 mm long and the glabrous filaments are 3-4 mm long. The berry is ovoid to elongate, 3-6 mm long and 2.5-5 mm wide. Flowering: September to October. Distribution: W.A., in southern coastal areas from Wagin to Esperance and Cunderdin to Norseman.

18. *Billardiera laxiflora* (Benth.) E. M. Bennett

A slender twiner with alternate, spreading or reflexed, shortly petiolate leaves 9-20 mm long and 1-4 mm wide with the upper leaves narrower than lower leaves. The inflorescence is a terminal corymb with a brown, densely hirsute peduncle 3-30 mm long, and densely hirsute pedicel 4-13 mm long. The densely pubescent sepals are 2-5 mm long and the petals are 7-10 mm long and 1.5-2 mm wide. The anthers are 0.5 mm long, and the glabrous filaments 5 mm long. The berry is sparsely pubescent, 10-14 mm long and 2-3 mm wide. Flowering: January to March (July). Distribution: W.A., Margaret River to the Stirling Ranges and Albany.

19. *Billardiera coriacea* Benth.

A twiner with sessile, glabrous leaves, 31-66 mm long and 2.5-22 mm wide. The flowers are solitary or up to three together occurring terminal to the short branches on a glabrous pedicel 3-7 mm long. The glabrous, sparsely ciliate sepals are white or fawn with a darker brown venation, 3-5 mm long and 1.5-2 mm wide. The petals are white but turn purple with age, tubular at first but separating after anthesis, 9-14 mm long and 2-4 mm wide. The anthers are 1.5-2 mm long and the glabrous filaments are 7-9 mm long. The green berry is 15-30 mm long and 5-10 mm wide. Flowering: May to October. Distribution: W.A., from Manmanning to Cunderdin, south-east to Peak Charles and east to Mt Ragged.

20. *Billardiera varifolia* DC.

A twiner with subsessile leaves, 5-40 mm long and 2-10 mm wide with the upper surface sparsely pilose or tuberculate and the lower surface densely pubescent and revolute with entire or toothed margins. The terminal inflorescence is a corymb with a densely white pubescent peduncle 1-1.5 mm long and pedicels 2-6 mm long. The dark blue, pilose sepals are 4-8 mm long and 0.5-1 mm wide. The blue petals are 7-12 mm long and 3-4 mm wide and the blue or white anthers are less than 1 mm long and the glabrous filaments 5-6 mm long. The glabrous or sparsely pubescent berry is 14-24 mm long and 4-7 mm wide. Flowering: December to March. This plant shows a considerable amount of variation in the colour of the flowers and the shape of the leaves. Some plants are very delicate compared with the normal form and these have fewer and smaller flowers. Distribution: W.A., between Pickering Brook, Augusta east to Albany.

21. *Billardiera uniflora* E. M. Bennett

Twiner or creeper up to 1 m high, with alternate, glabrous to sparsely pubescent, shortly petiolate leaves 14-50 mm long and 1-9 mm wide. The flowers are solitary or occasionally two to three, drooping or erect, with a glabrous, slender pedicel, 9-14 mm long. The glabrous sepals are (2)4-6 mm long and 0.5-1 mm wide. The free, cream or white (occasionally suffused with purple) petals are 12-16 mm long. The anthers are 1.5-2 mm long and the filaments are 8-9 mm long. The glabrous to sparsely pubescent berry is 30-40 mm long and 9-13 mm wide. Flowering: Sept. to Nov. Distribution: S.A., Port Lincoln, Kangaroo Is. and up to 60 km to the south and south-east of Adelaide.

22. *Billardiera scandens* Sm.

Common Apple Berry

A scrambling plant to 3 m tall with alternate, sessile or shortly petiolate leaves 12-60 mm long and 2-15 mm wide, entire or crenate, $\pm$ lobed, with the upper surface glabrous to scattered pubescent and the lower surface sparsely to densely pubescent. The pendent flowers are solitary or occasionally two to three together with a glabrous or sparsely pilose pedicel 5-25(50) mm long. The sparsely pilose sepals are 6-10 mm long and the free petals are 12-22 mm long, greenish-yellow to cream becoming purple with age. The anthers are 1 mm long and the filaments 7-9 mm long. The glabrous to densely pubescent berry is dark green, 13-40 mm long and 5-13 mm wide. Flowering: August to December. There are two varieties:

- var. *scandens* Leaves glabrous to sparsely pubescent on both surfaces.
Distribution: South-eastern Qld, eastern and coastal NSW, eastern and southern Vic. and Tas.
var. *sericata* Lower surface of leaves sericeous.
Distribution: Coastal areas of NSW and Qld, extending from Nerang to Twofold Bay.

23. *Billardiera cymosa* F. Muell.

Sweet Apple Berry; Love Fruit

A twiner or spreading shrub with sessile leaves, 18-65 mm long and 2-10 mm wide, both leaf surfaces glabrous or with scattered hairs, with softly white ciliate margins. There is considerable variation in the flower size, the number of flowers in the inflorescence and in the leaf size and texture. The inflorescence is a terminal corymb with a sparsely pilose peduncle 3-12 mm long and pedicels 2-5 mm long. The brown sepals are 4-6 mm long and 1-1.5 mm wide, villous along the margins and centre of the outer surface, densely so on the inner surface. The petals are 11-20 mm long and 4-5 mm wide, glabrous except for a few hairs at the apex and towards the base. The anthers are 1 mm or less long with the filaments 5-7 mm long and winged in the lower half. The glabrous or sparsely pubescent berry is 8-13 mm long and 6-7 mm wide. Flowering: (September) Nov. to Jan. (April). Distribution: Western Vic. and eastern S.A. Photograph opposite by N. Marriott.



Billardiera bicolor △

▽ *Billardiera cymosa*



24. *Billardiera sericophora* F. Muell.

A spreading shrub with subsessile leaves, 25-50(70) mm long and 5-15(45) mm wide with the upper surface sparsely to densely pubescent and the lower surface sericeous. The terminal inflorescence is a sessile corymb or umbel of one to five flowers with a pedicel 5-9(20) mm long. The petals are 10-17 mm long and 3-4 mm wide with scattered hairs along the margins and at the apex. The anthers are 1-1.25 mm long and the glabrous filaments are 7-8 mm long, winged at the base but tapering to the apex. The glabrous or sparsely pubescent berry is shortly cylindrical, 24-25 mm long and 7-9 mm wide. Flowering: Aug. to Oct. (Dec.). On the Eyre and Yorke Pen., S.A.

The name *B. sericophora* var. *megaphylla* was given by Mueller to a large leaved variant which has been collected near Port Lincoln. It differs from the typical form (which is also found at Port Lincoln) in having larger leaves (45-70 mm long and 20-45 mm wide) and longer pedicels (up to 20 mm long).

25. *Billardiera versicolor* F. Muell. ex Klatt

Sweet Apple Berry

A twiner with leaves 35-62 mm long and 6-17 mm wide with a glabrous upper surface and sparsely pilose lower surface. The inflorescence is a sessile, terminal corymb or umbel of up to 12 flowers with a villous pedicel 3-7 mm long. The sepals are 2-3 mm long and 1-1.5 mm wide, ciliate to densely short hirsute outside. The purple, yellow or yellow diffused purple petals are 8-12 mm long with scattered hairs along the margins and apex. The anthers are 1-1.5 mm long and the glabrous filaments are 5-7 mm long. The glabrous to sparsely pubescent berry is 18-25 mm long and ca. 8 mm wide. Flowering: (August) Sept.-Dec. S.A. From eastern Eyre Pen., S.A., to Vic. and central NSW.

Variation: There is a lot of variation in the pubescence of the ovary and calyx. In the New South Wales plants the ovary is glabrous and the calyx ciliate; in the Victorian plants the ovary is pubescent and the calyx ciliate; in the plants from Kangaroo Island the ovary is pubescent and the calyx ciliate, whilst those from other areas of South Australia have a pubescent ovary and pubescent calyx. These variants do not appear to warrant recognition and are completely unrelated to another character.

26. *Billardiera longiflora* Labill.

Purple Apple Berry; Sweet Apple Berry

A slender twiner to 3 m, with shortly petiolate, alternate, sometimes clustered leaves 7-62 mm long and 1-17 mm wide. The solitary, pendent flowers are terminal to the short branches on a pedicel 10-25 mm long. The sepals are 2-7 mm long and 0.5-2 mm wide, ciliate, glabrous to densely hirsute outside, pubescent within. The greenish yellow petals are tipped with purple and are connate at first into a tube but eventually become free. They are (6-)15-40 mm long and glabrous or sparsely pubescent on the outside. The stamens are $\pm$ equal to the petals and the blue anthers are 2-3 mm long. The deep violet blue berry is shortly cylindrical or globular, (2-)8-30 mm long and (1.5-)7-17 mm wide, glabrous to sparsely pubescent with a white flesh. Flowering: October to January. There are three varieties. Distribution: Eastern NSW, Vic. and Tas.

1. Petals over 8 mm long.
2. Leaves ovate to broadly lanceolate, margins revolute. Sepals densely ciliate b. var. *ovalis*
2. Leaves narrowly lanceolate, margin flat. Sepals glabrous or sparsely pubescent a. var. *longifolia*
1. Petals ca. 6 mm long. Leaves spatulate c. var. *alpina*

Key to Species of *Billardiera*

1. Corolla with petals united in the young flower but often separating into individual petals in the older flower.
2. Flower greenish-yellow, orange or red, fruit a dehiscent capsule.
3. Corolla tube separating with age from the base up to 1/3 of the length. Capsule pubescent. 4. *B. bignoniacea*
3. Corolla lobes becoming free with age. Capsule glabrous.
4. Corolla red. Staminal filaments distinctly winged in lower half. Upper surface of leaves glabrous. 1. *B. erubescens*
4. Corolla orange, tipped red. Staminal filaments winged from base for 2/5 length, then abruptly contracted. Leaves with long white hairs scattered on both surfaces. 5. *B. ringens*

2. Flowers at first white, turning deep purple with age, or white with purple tips. Fruit a berry.
 5. Sepals glabrous. Flowers less than 15 mm long. Seeds embedded in pith. 19. *B. coriacea*
 5. Sepals ciliate $\pm$ pubescent inside. Flowers more than 15 mm long. Seeds not embedded in pith. 26. *B. longiflora*
1. Corolla with free petals.
 6. Flowers solitary or in sessile cymes.
 7. Flowers solitary.
 8. Shrub with twining or flexuose stems. Flowers blue, cream or purple.
 9. Flowers blue. Leaves $\pm$ toothed. 12. *B. drummondiana*
 9. Flowers yellowish-cream sometimes fading to purple. Leaves entire, margins $\pm$ crenate.
 10. Sepals ovate to lanceolate, glabrous, margins ciliate, 6 mm or less long. 21. *B. uniflora*
 10. Sepals lanceolate to linear, scattered pubescent on outer surface. 22. *B. scandens*
 8. Shrubs with stems erect or prostrate. Flowers blue or white.
 11. Flowers blue. A low, much branched spreading shrub, with $\pm$ flexuose branches.
 12. Ovary and capsule glabrous. 6. *B. villosa*
 12. Ovary and capsule hirsute. 7. *B. mollis*
 11. Flowers white. Stems procumbent to erect.
 13. Leaves 2 mm or less wide. Stems rarely subterranean. 8. *B. procumbens*
 13. Leaves more than 2 mm wide. Stems commonly subterranean 10. *B. alpina*
 7. Flowers in sessile cymes.
 14. Leaves densely grey to fawn pubescent on both surfaces sometimes rubbing off with age.
 15. Leaves more than 25 mm long. Corolla cream to yellow or pale purple, 10 mm or more long. 24. *B. sericophora*
 15. Leaves 25 mm or less long. Corolla cream to dull mauve, less than 9 mm long. 15. *B. sericea*
 14. Leaves with scattered hairs on upper and lower surfaces.
 16. Corolla pink to purple. Leaves often toothed. Sepals 4-8 mm long with long white hairs. 20. *B. variifolia*
 16. Corolla cream to yellow, suffused purple or entirely purple.
 17. Sepals 2-3 mm. Leaves all entire. 25. *B. versicolor*
 17. Sepals 6-10 mm. Leaves entire, crenate or lobed. 22. *B. scandens*
 6. Flowers in cymes with a distinct common peduncle.
 18. Corolla white or cream with or without maroon stripes.
 19. Ovary pubescent to densely hirsute.
 20. Plant densely white to grey pubescent. 15. *B. sericea*
 20. Plant glabrous or $\pm$ scattered pubescent.
 21. Delicate, sparsely pubescent creeper. Upper leaves narrower than lower leaves. 18. *B. laxiflora*
 21. Small shrub or semi-twiner, stems and leaves with scattered hairs, all leaves $\pm$ same width. 17. *B. lehmanniana*
 19. Ovary glabrous.
 22. Plant with scattered pubescence on stems and leaves, particularly on lower surface. Petals 7-15 mm long.
 23. Lower surface of leaves with white hairs. Anthers blue. 3. *B. candida*
 23. Leaves with scattered hairs on both surfaces. Anthers yellow.
 24. Leaf apex commonly tridentate. Fruit a capsule. 9. *B. prostrata*
 24. Leaf apex acute. Fruit a berry. 17. *B. lehmanniana*
 22. Plant completely glabrous. Petals 11-21 mm long.
 25. Petals with maroon stripes. Fruit a capsule. 2. *B. bicolor*
 25. Petals white. Fruit a berry. 16. *B. floribunda*
 18. Corolla blue.
 26. Petals blue to mauve with dark spots in throat.
 27. Five or fewer flowers to a cyme.
 28. Leaves petiolate, entire 11. *B. granulata*
 28. Leaves sessile, dentate 14. *B. parviflora*
 27. More than five flowers to a cyme. 13. *B. coeruleo-punctata*
 26. Petals pink to mauve or deep purple without spots.
 29. Ovary glabrous 14. *B. parviflora*
 29. Ovary pubescent.
 30. Petals 7-10 mm long, yellow to dull mauve. 15. *B. sericea*
 30. Petals 11-20 mm long, pale blue to purple. 23. *B. cymosa* ■



Citriobatus spinescens

Reproduced from "Plants of Central Queensland"

The Orange Thorn is a shrub to 3 m. The leaves are 10 mm in length, the flower petals to 10 mm form a tube as shown in our No. 117 issue on page 21. All four species of *Citriobatus* are described in that issue on page 25. Aborigines ate the ripe fruit.

Plants of Central Queensland

by Steve and Alison Pearson

This issue should sharpen interest in the plants of the tropical north. The 400-page book "Plants of Central Queensland", illustrates all the plants of the Central Queensland area, hundreds of them, all in beautiful colour photographs similar to that above. The large number of botanical names in this issue must be daunting to the ordinary gardener. Buy this book, see them in full colour, and relate the name to a living plant. The book is available by mail from Shirley Hopkins, 9 Risien Street, North Rockhampton, Queensland 4701, for the special price of \$40.00 plus \$8.00 postage, possibly for the last time.



Billardiera floribunda △

▽ *Billardiera sericophora*



Prepared by experienced horticulturists in the Cairns-Atherton area of Northern Queensland, this book was produced to present the ground rules for gardening in the tropics and to show how the plants of North Queensland can be used to advantage. It is a very practical book going back to basic requirements such as planting, fertilizing and potting mix. It is really an essential reference for anyone wishing to garden in areas north of Brisbane and for anyone interested in the unique plants of Northern Queensland for their rainforest. Details of purchase by mail are given opposite.

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Wahlenbergia ceracea, an Australian Bluebell. See page 251.