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Much of the Australian flora has evolved in isolation from the evolutionary patterns of the rest of the world's flora. It is unique in many respects and rivals, as a spectacle, that of the flora from anywhere else in the world. The garden plants used in horticulture have evolved by careful breeding and selection by horticulturalists in other countries and what a good job they have made of it. The most unique flora of the world has hardly been touched, as yet, by horticulturalists and the treasure is largely unexplored.

Strangely, for a flora that has evolved in such harsh conditions, our wildflowers have proven difficult to domesticate. Beginners are urged to stick to those plants that have been trialled, selected and proven and the best place to seek guidance is your local nurseryman, especially the native plant specialist. For the more adventuresome who are prepared to accept unexpected losses, other growers in the Society, and especially the Study Groups, will help this fascinating adventure.

Fortunately, the Australian scientist is now more aware of the great benefits they can contribute to our society by selective research into problem areas such as outlined in this issue. They need your help and encouragement. We also need to stir ourselves and do something. I make no apology for the way the crisis is presented in this issue nor for the demands on your purse and time. Hopefully those who can help will heed this call for action. Meanwhile, do not be put off by the apparent technical nature of this issue or the way it dwells on some of the less spectacular wildflowers, grow the plants you can get and enjoy the garden. —Editor.

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COVER PLATE

Phebalium glandulosum

Photography by Merv Hodge

A beautiful wildflower for the garden, see article opposite.

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Phebalium

East Coastal — 9*

by Brian Walters

It's probably not unreasonable to say that, of all of the families of Australian flowering plants, the Rutaceae (which includes *Boronia*) has been responsible for more than its fair share of head-banging and garment-rending.

I've lost count of the *Boronia* that I've killed. And I've managed to dispose of reasonable numbers of *Correa*, *Crowea* and *Eriostemon* as well! Now I may not have the greenest thumb in the world but I'm not *that* bad!

Which brings me to *Phebalium*. Yes, I've killed a reasonable number of these, too. But several species are proving very successful, in spite of me.

Phebalium squamulosum probably needs little introduction as it is widely available. Unfortunately, there are a number of forms and some are harder than others. The only answer here is to try one form and, if it fails, try another. The form that I have is a medium shrub, reaching 2 m in height, dense to ground level with narrow leaves to 6 cm long, and clusters of light yellow flowers. The flowers are shown in colour on page 48. In full flower it is a sight to behold. I have it doing well in a dry position with some overhead protection.

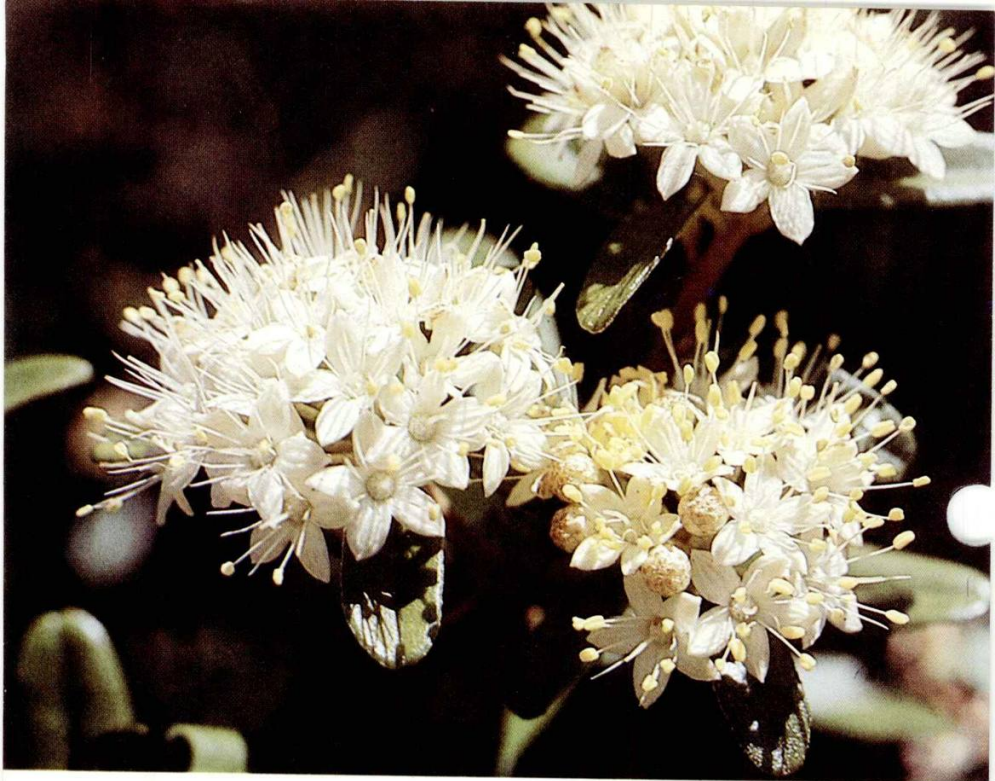
Phebalium dentatum is similar. This is a plant from sandstone gullies around Sydney and it also occurs in Victoria. The leaves are narrow with finely toothed margins. Unlike *Phebalium squamulosum* it is rarely encountered in nurseries, which is difficult to understand as it is easy to propagate and very attractive. My plants are growing in a similar position to the previous species but most situations should be acceptable provided drainage is OK. The flowers are creamy-yellow in massed clusters as shown in colour on page 48.

Phebalium glandulosum is slightly more difficult. This is a smaller plant from drier areas of south-eastern Australia. The leaves are small (about 1 cm long and 1 to 2 mm wide), very aromatic with prominent oil glands. Flower colour can vary from cream to bright yellow (the latter being the most commonly available). This species must have excellent drainage and, unlike most of this group, it just loves sun. Like most *Phebalium* the individual flowers are quite small but they are produced in masses as shown in the cover photograph.

Phebalium elatius ssp. *beckleri* is a superb plant! Wonderful as the previous three are, I've saved the best until last! It is a dense, rounded bush to 2 m high and, with its glossy foliage, it is attractive all year round. The massed clusters of white flowers appear in July/August and are guaranteed to dispel the most virulent mid-winter depression (a condition to which I am particularly prone). The plants look like they are covered in snow . . . it's enough to turn the neighbours into gibbering wrecks as they beg me to give them a plant. This species is so successful for me that seedlings are appearing at various places throughout the garden. *P. elatius* is not easily obtained but, hopefully, the situation will change in the future . . . it's certainly in my top 20! ■

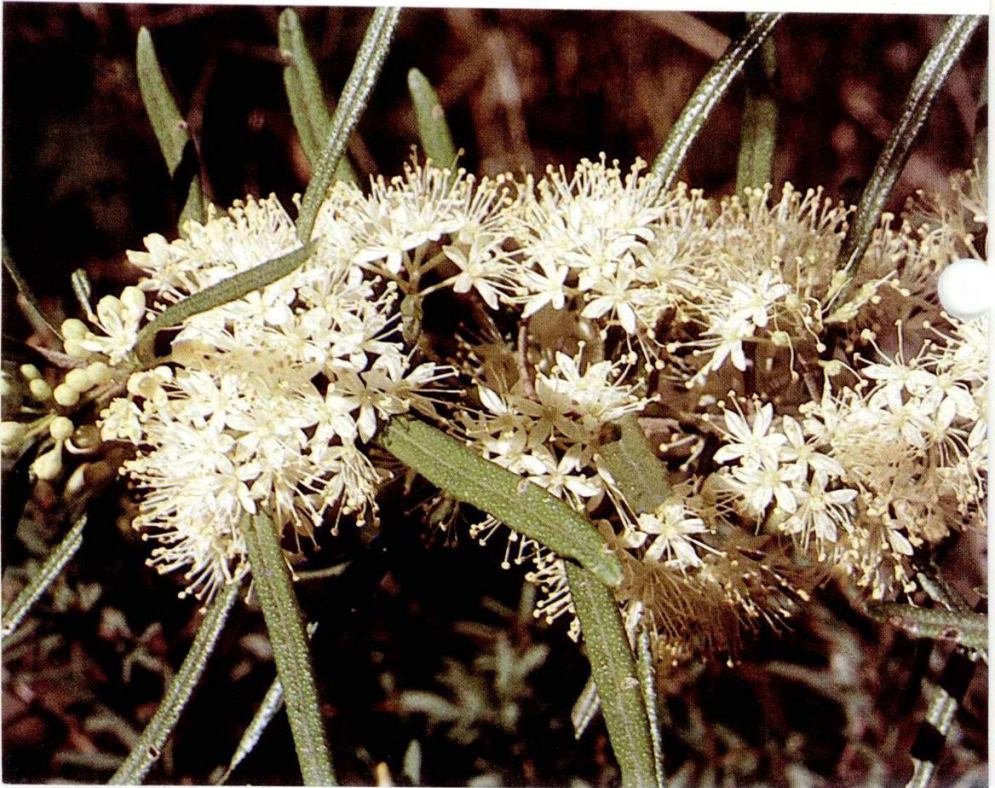
*Wildflowers For Beginners

New readers of this periodical may be discouraged by the use of botanical names. Please persevere. The Australian flora is so vast, that this is the only way to prevent confusion. This article on *Phebalium* (pronounced phe-ba-li-um) is one of a series on plants that have proven reliable in 'East Coastal' gardens. Why not grow some?



Phebalium squamulosum △

▽ *Phebalium dentatum*





***Phebalium* as Garden Plants**

Photography by F. Hatfield

The garden above features two *Phebalium* in the front, *Phebalium stenophyllum* (yellow) and *P. squamulosum* (yellow/white), with the showy *Chorizema cordatum* (orange). All *Phebalium* species are excellent garden plants. Some species will grow to two metres and make ideal specimen or screen plants. Others can be kept small as shown above.

***Phebalium squamulosum* (top left)**

Photography by Brian Walters

An attractive shrub to two metres high, it displays masses of these flowers to be quite a spectacle.

***Phebalium dentatum* (bottom left)**

Photography by Brian Walters

These beautiful heads of flower would be six centimetres across, displayed in masses all over the bush. This is a hardy plant that is most attractive when not in flower.

***Phebalium* — The Genus**

This is a group of plants that has considerable potential in horticulture. Will readers please advise of their experiences in growing the many beautiful species and forward any colour slides. Please help me to prepare a beautiful issue with a wide coverage of interest to all throughout Australia. — Editor.

Know and Grow Our *Acacia* (Wattle)

by W. H. Payne

To most of us an *Acacia* is a wattle, is a wattle, is a wattle. To the general public they are all the same, though when you think of it, rarely if ever, do some look a bit different from others. There is a feeling of national pride for our wattles; like the kangaroos they are there as part of Australia, all over, wherever you travel.

It is when you see good specimens in horticulture that you may stop and think "say that is a good idea, a hardy reliable shrub or tree that covers itself with yellow blossom, maybe I will grow one". This is when you start to waver, tree or shrub, which one, where do I get it? There are so many species. To save confusion, go to the nurseryman and tell him what you want, how high and how wide. A good nurseryman will have a few species.

If you are a serious gardener you will look into the matter more closely. There are some really magnificent trees; some are dense screen shrubs, in fact, shrubs of all sizes; and some form low compact bushes for the rockery; some are even prostrate. Although they are not easy to obtain at the nursery because of the infrequent demand for them, they are very easy to grow from seed. Directions are given in the book mentioned below and in this issue of Australian Plants. What is more, seed remains viable for long periods and can be obtained for 60 cents a packet from seed suppliers listed in this journal.

Now, what species shall I grow? This is where total confusion sets in. We find there are, probably, 800 species and these may be found in all areas of our vast continent. We have had a reference book, "*Acacia of New South Wales*", for some years. It is still available, see the inside cover of this issue. However, this is not enough. The following books are what we have been waiting for.

Acacias of Australia

by Marion Simmons

We now have a very clear simple reference to 300 *Acacia* in two volumes of a book by the Leader of the *Acacia* Study Group, Marion Simmons. One hundred and fifty species were described and illustrated in Volume 1 and a further 150 species in the recently published Volume 2. Each volume is, in fact, a complete book on *Acacia* in the sense that the 150 species in either volume have been carefully selected to include interesting plants from all regions of Australia. The species are grouped, plants with similar leaf shape and flowers being together. There is, of course, a very simple key to help you name each species but this is not necessary. The outstanding feature is the presentation of each species in a full-page sketch of a flowering branch drawn to full life size. To name a plant, flick through the pages until you get to a group with a similar leafy branch and then identify the plant from the sketches. No botanical knowledge is needed, no understanding of botanical mumbo-jumbo, no prior interest in plants whatever, just use your eyes. Each species has a map of Australia indicating where it occurs naturally.

So we only have full size sketches of 300 out of a probable 800 species. However, these will give a name to a plant that will be close enough for us until volumes 3 and 4 are published. Who cares if we identify our plant from the full size sketch as *Acacia argyraea* when in fact it is *Acacia limbata*, a plant that is practically identical. We will correct it, if you wish, when volumes 3 and 4 are published. In the meantime we have a valid acceptable name.

So we are interested in species for horticulture and are not fussy about the scientific name. Flick through the sketches until you find a group of plants that you like the look of. Check the description opposite each to choose a species with the height and spread you want. There will probably still be a choice of a number of species. Reduce the choice to species from similar climatic conditions to your own and with this final short list, check which species has seed listed in the seed suppliers' catalogue. Now go to it, grow some.

"Acacias of Australia" Vol. 1 — \$29.95

"Acacias of Australia" Vol. 2 — \$50.00

I Choose an *Acacia* from "Acacias of Australia" — Vol. 2.

I find that the type of *Acacia* that fits best into my wildflower landscape is one that is not obtrusive when not in flower. I do not want leafy shrubs that tend to crowd-in or dominate the landscape. Possibly most importantly, in my natural bush setting, sunlight or the limiting of shade is vital. Hence I want a wattle that is not too large with narrow leaves to limit sunshade. Flicking through the book I find that species in Groups 7 and 9 all have long narrow leaves (phyllodes). I will quote from the book in a much abbreviated form, mentioning characters of most interest to me.

Acacia phasmoides — A slender, spindly, open shrub 1-4 m tall with smooth silvery-grey bark. A spectacular shrub in flower with great potential for gardens in cool to cold temperate regions in semi-shade to full sun. I want this.

Acacia anfractuosa — An open, spindly shrub or small tree to 4 m x 1-3 m. A decorative striking shrub. The sketch clearly shows its decorative "artistry". I will try this.

Acacia eremophila — Often a mound-like shrub 0.3-2 m x 1-2.5 m. A beautiful ornamental shrub; drought and frost tolerant in semi-arid to warm temperate regions. See the colour photo on page 52.

Acacia filifolia — A spreading, fairly dense, mound-like shrub. Hardy ornamental shrub for well-drained soils in hot, dry areas.

Acacia assimilis — Dense, rounded shrub or small tree 2-4 m x 1-4 m. Photograph, page 53.

Acacia rigens — Bushy, spreading 2-3 m. I already grow and enjoy this plant.

Acacia havilandii — Erect or spreading shrub or small tree 2-3 m tall. Similar to *A. rigens*.

Acacia gracilifolia — Slender, fine-leaved shrub 1-2 m x 2-3 m with slender arching branches. Masses of dense, bright yellow ball-flowers. Ornamental shrub for light, well-drained soils in full sun or some shade in temperate regions.

Acacia loderi — Umbrella-shaped, dense, multi-stemmed shrub or small spreading tree 3-7 m tall. Ornamental shrub for light shade, shelter and windbreaks in hot, dry inland areas. Grows in neutral to alkaline soils. See the colour photograph on page 53.

Acacia papyrocarpa — Spreading, silvery-grey foliaged shrub or small tree 3-7 m tall. A handsome, long-lived, slow-growing shade and shelter tree for arid to semi-arid zones in most soils.

Seed of six of these species is available from Nindethana Seed Service for instance. The Society in each state has an extensive seed list and all feature *Acacia* seed freely available to members. ■

Acacia from seed

The propagation of our wattles from seed is featured in many previous issues. They are the easiest of all plants to grow. Briefly, place the seed in a cup, pour on boiling water and leave to soak for a week. Then just cover them in a pot of coarse sand (almost any material will do) and keep moist by putting the whole pot in a dish of water for a few minutes every third day.



Acacia eremophila, plant and flower

Photography by John Simmons

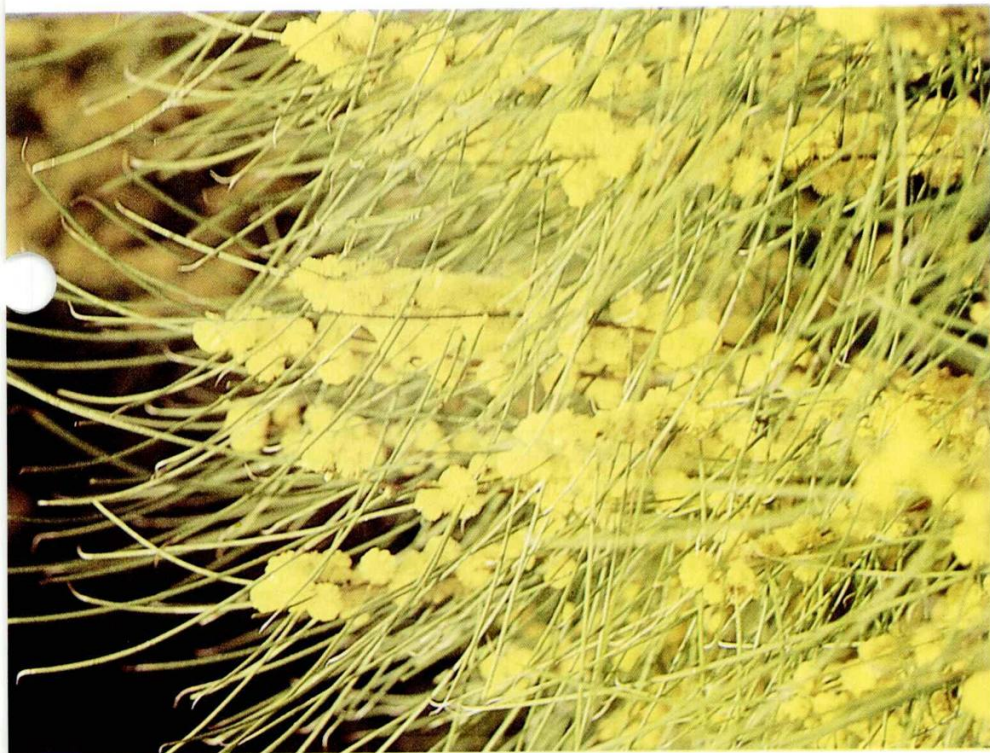




Acacia loderi △

Photography by John Simmons

▽ *Acacia assimilis*



Milkmaids

Burchardia

by P. E. Bailey

Perennial plants whose buds are buried in the soil (geophytes) with 1-5 linear, basal leaves. The flowerheads are composed of from 1-22 flowers held above the leaves on a scape which can be divided or undivided and has 1-4 scape leaves. A sketch of flower parts is shown on page 65. Each flower has six tepals (petals and sepals that are similar) in one whorl, free and caducous (fall off early), sometimes with a sub-basal nectary (gland that secretes nectar). The six stamens are inserted on the base of each tepal and the anthers are dorsifixed (attached at or by the back) and extrorse (open away from the flower centre). The ovary is superior (attached above the tepals) and the style is short and three branched. An endemic genus of five species.

***Burchardia bairdiae* Keighery**

A plant 40-120 cm tall with 2-4 basal leaves. Scape with 1-4 branches or sometimes unbranched. The usual three or four scape leaves are broad at the base and taper evenly to an acute or obtuse apex, the uppermost one 8-30 mm long. Flowerhead composed of 5-22 flowers with small bracts, the longest being 4-12 mm long or rarely to 20 mm. Flower buds pink or pinkish-white on pedicels, the longest being 4-12 mm long at maturity. Tepals white with nectaries. Anthers yellow and 2-3.5 mm long.

It occurs in south-western Western Australia from Cataby to Forrestdale in seasonally wet peaty and sandy soils, flowering from August to November. Distinguished from *B. umbellata* in having scape usually 1-4 branched or sometimes unbranched (not usually unbranched or rarely one branched), scape leaves three or four (not one or two).

***Burchardia monantha* Domin.**

A plant 20-34 cm tall with one basal leaf. Scape unbranched with usually three scape leaves, the lowest rather small, broad and obtuse, the upper two shorter, 5-10 mm long, opposite, somewhat opposite or to 10 mm apart, the apex somewhat acute, pink or pinkish-green. A solitary pink bud is held 30-65 mm above the uppermost bract. Tepals pale pink with a deeper pink abaxial (surface toward the flower axis) mid-stripe. Anthers yellow and 3.5-4.5 mm long.

It occurs in south-western Western Australia between Manjimur, Bridgetown, Kojonup and Cranbrook in eucalypt woodland and occasional, swampy sites, flowering from September to November. It is distinguished from all other species in having a single flower.

***Burchardia multiflora* Lindley**

A plant 4.5-27 cm tall with usually two basal leaves. Scape unbranched or with one or two branches and one or two scape leaves, the lower often almost basal and dilated at the base, the upper similar and 35-160 mm long. Flowerhead composed of 3-8 or sometimes to 20 flowers with rather large outer bracts, the longest 15-45 mm long or rarely only to 9 mm long. Flower buds deep pink on pedicels, the longest being 20-60 mm long at maturity. Tepals pinkish-white with a deep pink abaxial mid-stripe and nectaries. Anthers purple and 1.5-2.5 mm long. See the colour photograph on page 56.

It occurs in south-western Western Australia from Jurien to Albany in swamps, near streams, around granite outcrops, shallow soil and moss over rock, flowering from July to September. Distinguished from *B. umbellata* in having tepals pinkish-white with a deep pink mid-stripe (not white sometimes with a faint pink abaxial mid-stripe), uppermost scape leaf 35-160 mm long (not 7-40 mm long) and the longest flower bract usually 15-45 mm long (not 4-12 mm long) and from all other species in having purple anthers (not yellow).

***Burchardia rosea* Keighery**

A plant 20-50 cm tall with four or five basal leaves. Scape unbranched or with 1-3 branches and two or three scape leaves with the lowest either similar to the basal leaves or to the upper scape leaf which is usually 9-14 mm long, occasionally to 40 mm long, broad and tapering evenly to a point, the base sometimes dilated. Flowerhead composed of 3-8 flowers with relatively short bracts, the longest 4-10 mm long. Flower buds pink on pedicels, the longest 18-50 mm long at maturity. Tepals almost uniformly pink. Anthers yellow and 2.5-4.2 mm long.

It occurs in Western Australia from the lower Murchison River to Port Gregory in seasonally wet low-lying and seepage sites and shallow soil over rock, flowering from August to October. Distinguished from *B. monantha* in having flowerhead of 3-8 flowers (not solitary) and all other yellow anthered species in having nectaries absent.

***Burchardia umbellata* R. Br.**

A plant 10-65 cm tall with one or two basal leaves. Scape unbranched or occasionally with one branch and one or two scape leaves, the lower either resembling the basal leaves or the upper scape leaf which is 7-40 mm long, broad and tapers evenly or abruptly to a short, acute or obtuse tip. Flowerhead composed of 2-9 flowers with relatively small bracts, the longest 4-12 mm long. Flower buds greenish to white with pink markings that are usually faint, each flower on a pedicel, the longest 8-28 or rarely to 40 mm long at maturity. Tepals white with nectaries and a faint pink abaxial mid-rib. Anthers purple and 1.2-4 mm long. The western race differs in having yellow anthers and fruit capsules with conspicuously glossy thickenings on the angles. Photograph, page 56.

It occurs from Fraser Island and south-eastern Queensland to Tasmania, South Australia on the Eyre Peninsula and the western race in south-western Western Australia from Northampton to the Porongurup Ranges, all in a variety of soils ranging from dry woodland to swamps, flowering from August to October. Distinguished from *B. multiflora* in having white tepals sometimes with a faint pink abaxial mid-stripe (not pinkish-white with deep pink abaxial mid-stripe). ■

The Lily-type Plants of Australia

We will be featuring plants of the Australian flora in issues in preparation. Will readers please help me to make them informative, colourful issues. Who has grown *Burchardia* (above), *Blandfordia*, the Christmas Bells, *Johnsonia*, *Dianella*, *Stypandra*, *Chamaecilla*, *Borya*, *Milligania*, and all other bulbous/rhizomous plants that belong to the plant family Liliaceae and related families. There must be many readers with good colour slides, let me see them. I cannot produce your journal without your help. — Editor.



Burchardia multiflora (Photo by Fred Lullfitz) △

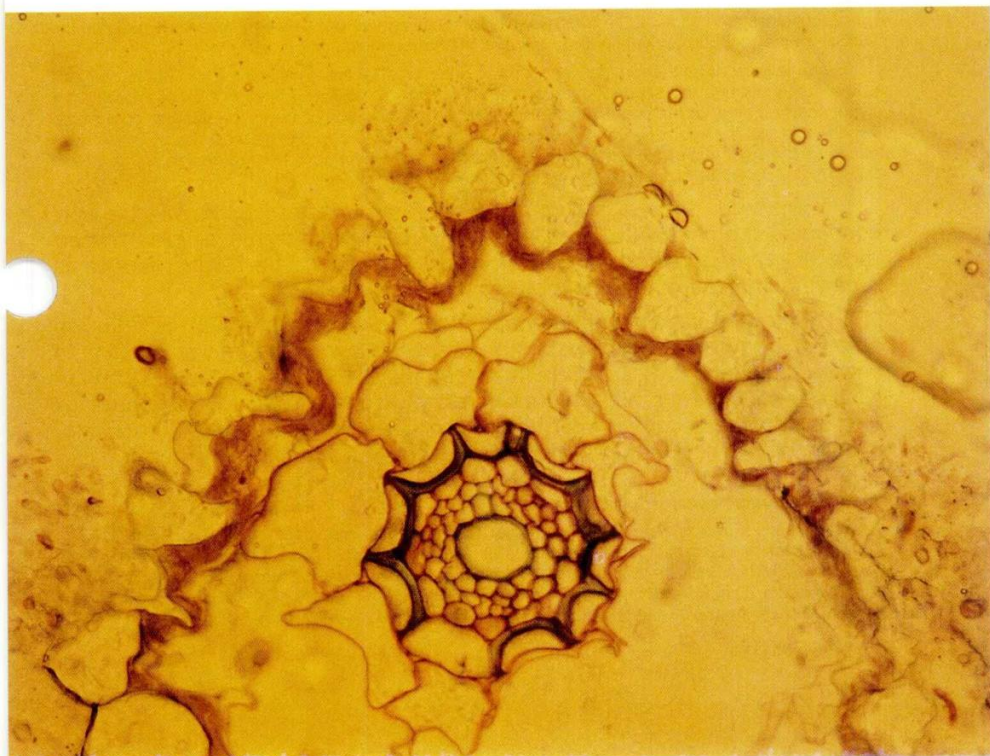
▽ *Burchardia umbellata* (P. Codd)





Thysanotus manglesianus (caption on page 58) △

▽ Fig. 1 (see article on page 61)



Thysanotus

Their Cultivation and
Mycorrhizal Association
by Peter McGee

I started working with *Thysanotus* because some species have interesting flowers and some have potential as pot plants. My first tubers came from a roadside where they had been dug over by a grader. I put them in sterile soil in a pot and waited for the resultant crop of flowers. The plant regrew slowly and then slowly died. When I examined the roots, the tubers had completely shrivelled but no new tubers had grown. The first I expected, for *Thysanotus* replaces its tubers each year. The latter I did not expect. I had the same result with both *T. patersonii* and *T. tenellus*. I finally collected seed of *T. juncifolius* and *T. fractiflexus* and bought seed of *T. multiflorus*. Only in these rhizomatous *Thysanotus* could I get the seedlings to maturity without mycorrhizas and then only with very careful control of application of fertilizers. The plants grew slowly, and never looked healthy. On the other hand, when I used mycorrhizal companion plants with either tuberous or rhizomatous transplants or seedlings, the plant regrew quickly, appeared healthy (in some cases despite rather harsh treatment) and appeared just like plants in the wild. I could also fertilize the companion plant and see an obvious growth response in the *Thysanotus*.

Mycorrhiza — what is this?

Mycorrhizas are associations between soil borne fungi and the roots of plants. My article on page 61 briefly describes the general types. Two groups of mycorrhiza can form in *Thysanotus*. Ectomycorrhizas are typically sheaths of filaments or hyphae surrounding the young short lateral roots. The hyphae may also penetrate the root between the outer cells but they do not penetrate into cells. Vesicular-arbuscular (VA) mycorrhizas have brush-like growth of hyphae (called arbuscules) within cells of the cortex of the root.

Arbuscules are connected to hyphae which grow along the root between cells, to hyphae on the surface of the root and to hyphae that grow into the surrounding soil.

Hyphae grow down the root between the two outer most layers of cells of the root (the outer layer is the epidermis and the second layer is the outer layer of the cortex and in this case is called a hypodermis). Fungi do not penetrate into the hypodermis and do not cover the transfer cells of the hypodermis. As the root ages, the epidermis is shed and the hypodermis covered by mycorrhiza becomes the outer layer of the root. A large proportion of the hyphae in the mycorrhiza are dead and they are constantly being replaced by fresh hyphae.

In the wild, there is a huge amount of mycorrhizal inoculum in the soil, connected to other plants. Even in the absence of other plants, a typical mycorrhiza will spread down to the root system of a plant. The fungus obtains its organic nutrients from the host plant and thus thrives.

By growing seedlings in the laboratory and inoculating them with known amounts of hyphae and known fungi, we can follow the pattern of infection to better understand the association between plant and fungus. When we inoculated seedlings of *Thysanotus* in the laboratory two things occurred. First, seedlings died unless they became mycorrhizal. Second, mycorrhizas did not spread after infection from a single unit of inoculum and fungi quickly died in the mycorrhiza.

Thysanotus manglesianus (photograph on page 57)

Photography by John Simmons

This species from the west is very similar to *Thysanotus patersonii* of eastern Australia. The above species has dissimilar length of anthers, three long and three short, whereas *T. patersonii* has six equal anthers, usually smaller. It also has a more or less spherical capsule as large as the perianth parts, whereas *T. manglesianus* has a remnant of the perianth projecting from the apex of a smaller capsule. For photographs and descriptions of other species, refer to our No. 94 issue.

In the laboratory, when we grew *Thysanotus* with a companion plant, mycorrhizas spread down the roots of *Thysanotus* and the companion plant. There were always living hyphae present in the mycorrhizas of *Thysanotus* along with moribund hyphae. While much more experimental work is required, I believe that *Thysanotus* obtains its mineral nutrients through its mycorrhizal fungus, but gives little in return.

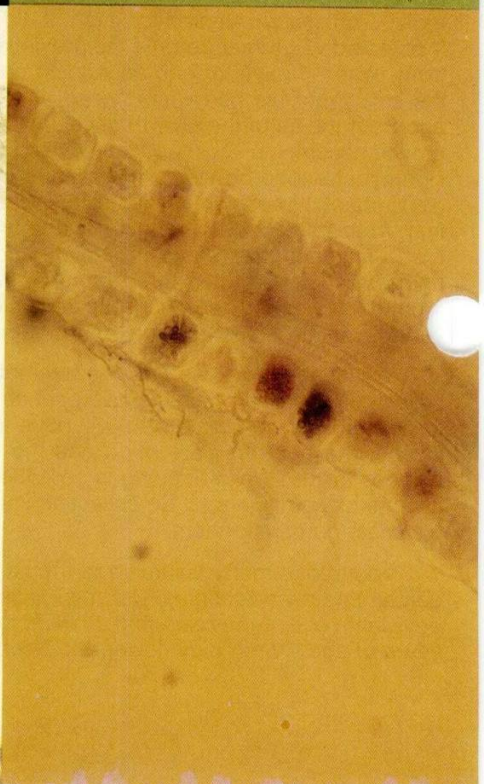
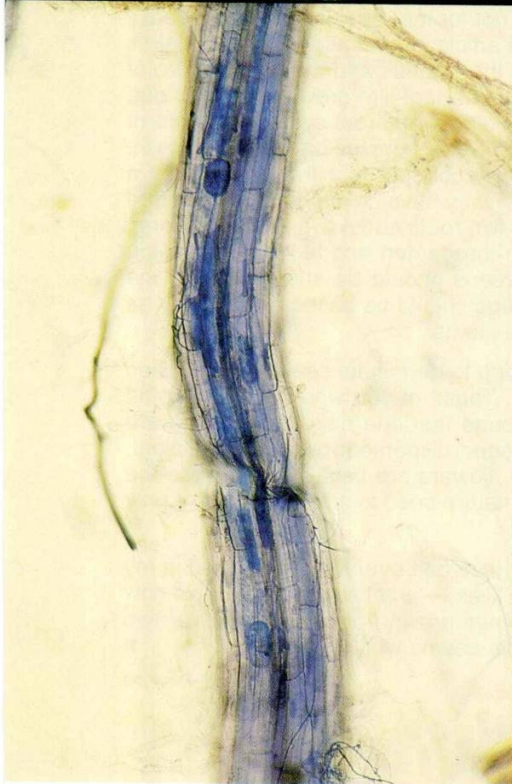
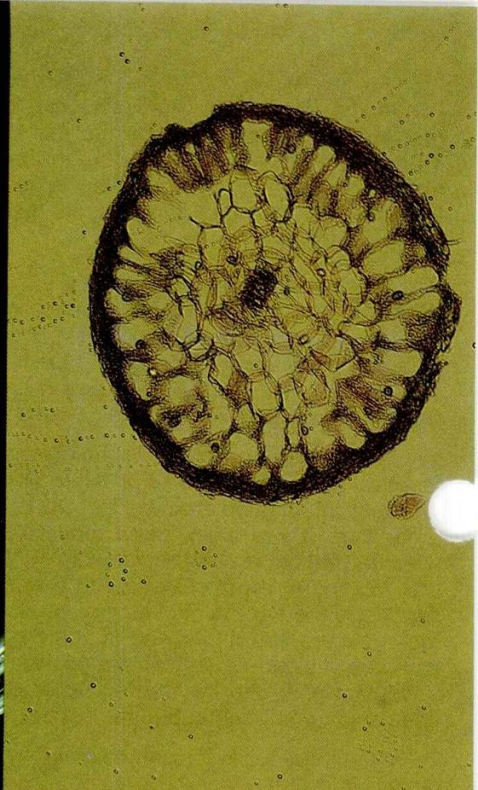
There is still an enormous amount of work to be done in the laboratory. Because of my peripatetic lifestyle, because of the difficulty in collecting seed and because I do not like collecting plants from the wild unless they are likely to die, we need a system of propagating plants. We are attempting to grow various *Thysanotus* in tissue culture. The project has only just started. If we can get them to grow, we should be able to inoculate the plantlets in culture with a mycorrhizal fungus.

So how do you grow *Thysanotus* when you do not have access to the facilities available to me? For those who have not been discouraged by the previous information (I knew I could rely on you mum), I suggest a simple procedure. If you have found tubers dug up by a grader (or one of those wretched fishermen who dig for worms), bring them in with some of the adjacent soil. Mix the soil with coarse sand (I would use about 20% soil to about 80% sand) and then pot (a minimum of 10 cm deep and wide) the tubers in the soil mix. I always add a seedling of something like a small daisy or clover as my companion plant. When both are established (from two to four months), I would transplant both into the garden. After about another two weeks, pull out the companion plant and hope that mycorrhizal connections have been made.

An alternative is to use seedlings. Some hardy souls have scattered seed directly into litter under the drip line of larger shrubs and trees and kept the soil moist. The system worked for them, it did not for me. Seed germinates readily if collected when mature (see the previous article in *Australian Plants*). It takes from 14 to 35 days for me, depending on the species and the temperature of the soil. From the germinated seed emerges a leaf-like growth that arcs out, and from the tip of the growth develops the shoot and root system. The arc of growth becomes a shoot and the first leaf emerges from the base of the growth. I germinate seed on sterile moist sand in a cool spot in a tray covered by a glass sheet. I transplant my seedlings when they have developed their first true leaf. At this stage there are usually one or two roots about two to four cm long. I then suggest you transplant straight into the garden and leave the seedling undisturbed for at least three months. Weeds should be sheared off at the ground level, not pulled out. Snails and slugs should be baited assiduously as they devastate both seedlings and mature plants.

In the laboratory, we are also attempting to germinate seed that has been collected before the capsule has opened. Those of you who have attempted to collect seed of *Thysanotus* will have found that one day the capsules are closed, the next they are open and the seed dispersed: great for the plant, useless for us. While bagging is possible, flowers are usually open while the seed is being dispersed. So collecting immature seed is advantageous, if only we could germinate them.

I have had many failures and I must have had every slug and snail in my garden and my neighbours, visit my Fringe lilies — and I still persist. I have now pot plants of *T. tuberosus* and *T. dichotomus* grown from seed and over two years of age. When they flower, the trouble seems well worthwhile. ■



Mycorrhizas and Native Plants

by Peter McGee

A number of myths have developed in this, and several other journals, concerning mycorrhizal fungi, concerning their supposed interactions with plants and their supposed function and morphological characteristics. While some of the articles are accurate in part, there are many points that need to be corrected. I hope to correct some of the inaccuracies here.

Mycorrhizas are associations between soil borne fungi and the roots of plants. The fungi function as extensions of the root system, their filaments or hyphae exploring the soil far more economically than the roots of plants. The fungi transport mineral nutrients to the plant and obtain photosynthates from their host. The association is beneficial in that:

1. There is an increase in the uptake of non labile nutrients, particularly phosphate, from poor soils such that the growth of plants is markedly improved upon formation of mycorrhizas.
2. There is an increased protection against plant pathogens and pests.
3. There is a change in water relations of the host plant such that survival characteristics and drought tolerance are improved in some circumstances.
4. There is an increased tolerance of heavy metals by the plant.
5. The hormonal and metabolic processes within the plant are altered.

Mycorrhizas have really only been studied in depth in the last 40 years. Up until recently only two main types of mycorrhiza were recognized. They were ectomycorrhizas (ecto — meaning outside) and endomycorrhizas (endo — meaning inside). The endomycorrhizas were further divided up into three groups: those found on orchids called orchid mycorrhizas, those found in ericoid and epacrid plants called ericoid mycorrhizas and, most importantly, those which form a curious tree or brush-like structure within some root cells called vesicular-arbuscular mycorrhizas (arbuscule — meaning tree-like) or VA mycorrhizas for convenience.

Ectomycorrhizas (Figs 1, 2 and 3) are found in the northern hemisphere mainly on trees such as the oak, beech, birch and pine. The fungi that form

Fig. 1 — (on page 57). A cross section of a stained root of *Thysanotus juncifolius* infected with a mycorrhizal fungus that forms VAM on other plants. Note that the fungal hyphae are contained between the outer two layers of the root and are also found in the soil surrounding the root. Some cells of the outer layer of the root have collapsed and are in the process of being shed. Roots of *Thysanotus* are very flexible, and the outer layer separates easily from the rest.

Fig. 2. — (opposite, top left). Ectomycorrhizae on a seedling of the Australian composite, *Podolepis rugata*. The fat roots towards the top of the root system are enclosed by fungal sheath.

Fig. 3. — (opposite, top right). A stained section of the ectomycorrhizal root from Figure 2 showing the fungal mantle in red with fungal penetration between the outer layer of cells of the root.

Fig. 4. — (opposite, bottom left). VAM in stained roots of the Australian annual, *Wahlenbergia* sp. Vesicles are blue sac-like structures and the blue smears are arbuscules. Arbuscules are easier to see at higher magnification.

Fig. 5. — (opposite, bottom right). Stained roots of *Epacris impressa* infected with an ericoid mycorrhizal fungus. Note that the root is very fine and that the infected cells of the root may contain tightly coiled fungi (old mycorrhizas) or few coils (young mycorrhizas).

ectomycorrhizas are mainly the common mushrooms and toadstools that you see under such trees in Europe and America, and less frequently in Australia. There are many thousands of species of fungi, far in excess of the numbers of tree species, and little specialization of association between plant host and fungus. Their association with plants was first observed in some pine seedlings in Northern Europe. The fungus both grows into and around the cells of the outer root. Ectomycorrhiza associated with Australian plants are discussed below.

Orchid mycorrhizas are confined to orchids. The fungus in this association is a member of a group of pathogenic fungi called *Rhizoctonia*. The relationship is curious in that the fungus and the plant are in a constant balancing act. The fungus penetrates the seed or protocorm and provides nearly everything needed by the orchid at this stage. The orchid obtains its nutrients by digesting the fungal coils. If the fungus gains nutrients such that it grows faster than the orchid can digest the coils, the fungus will kill the orchid. If the orchid digests the fungus faster than the fungus can grow into the protocorm, then the fungus is killed. In those orchids that survive, a balance between invasion and digestion has occurred. At any moment, however, either the orchid or the fungus may gain the upper hand, to the detriment of the partner. The orchid requires the presence of the fungus at least at some stages of its life but the fungus may exist in the absence of the orchid.

Some Australian orchids also have an interesting difference from typical orchid mycorrhizas. The Western Australian underground orchid associates with a fungus that forms an ectomycorrhiza on *Melaleuca uncinata*. It is believed that photosynthate is transferred from the *Melaleuca* host along the interconnecting fungus to nourish the fungus and the orchid. While similar achlorophyllous orchids are found in the northern hemisphere, none have been examined in the same detail as *Rhizanthella*.

Ericoid mycorrhizas (Fig. 5) are the least studied of the major groups. The fungus is thought to belong to the fungi which form small cup shaped fruiting bodies. In these mycorrhizas, the fungus only penetrates the fine roots formed when the plant is actively growing. This association is different from the others in that there is evidence to suggest that the fungus also transports nitrogenous nutrients to the plant. Thus epacrids can survive in the poorest soils because of the phosphate and nitrogen supplied by their mycorrhizal partner.

VA mycorrhizas (Fig. 4) are, by far, the commonest mycorrhiza. They are found in about 90% of all plant species. It is easier to list the important plant families in which they are not found, than to list all those in which they occur. For Australia, the Proteaceae, Brassicaceae, Zygophyllaceae, Crassulaceae, Droseraceae, Cyperaceae, Juncaceae and Caryophyllaceae are some families in which VA mycorrhizas are rarely found. You will note that all those families have some other mechanism to conserve either moisture (succulents) or obtain nutrients (proteoid and extensive root system and insectivorous plants). The symbionts are in a small group of microscopic fungi that are distinguished mainly because, even though they are probably the most common fungi in soil, scientists have not yet learnt to culture them in the laboratory in the absence of plants. The fungi are ubiquitous in soil, being found in sand dunes, garden beds, cultivated fields and rainforest. Only where plant life is absent, where the

soil has been sterilized or the rare isolated patch of soil such as a few coral cays, will you not find VA mycorrhizal fungi.

Mycorrhizas of the Australian Flora

In plant families such as the Myrtaceae there are classical ectomycorrhizas. However, fungi that form classical ectomycorrhizas on *Eucalyptus* also form patches of sheath or even ectomycorrhizas over one cell of the root in other plant species. The variations are found, for instance, in some members of the Asteraceae, Casuarinaceae, Euphorbiaceae, Goodeniaceae, Fabaceae, Polygalaceae, Rhamnaceae, Sterculiaceae and Thymelaeaceae. These variations function in just the same way as classical ectomycorrhizas. In Australia, the fungi related to the truffles are far more common formers of ectomycorrhizas than in Europe, perhaps because of our harsher climate.

Another variant of interest is that found in *Pisonia* (Nyctaginaceae). The fungus appears to be a mushroom forming type. The mycorrhiza is an ectomycorrhiza, but there is a series of transfer cells on the interface between the host and fungus. *Pisonia* occurs on coral islands and is the nesting place of large numbers of birds, thus the increased uptake of phosphate must certainly *not* occur in this association. The function of mycorrhizas in this plant is not yet clear.

Finally, there is the association between *Thysanotus* and fungi that form ectomycorrhizas or VA mycorrhizas on other plants.

It has often been claimed that mycorrhizal fungi have magical properties. By collecting soil from specially selected sites, mixing it with the special batch of nursery soil, waving a magic wand and saying "Hey presto", wonderful things ensued. Such nonsense does have a basis in fact; there is no magic but there is a certain amount of risk. All reputable nurseries treat their potting soil to remove pathogens, weed seeds and insect eggs. They use aerated steam or chemicals. The treatment unfortunately also removes most ectomycorrhizal fungi and all VA and orchid mycorrhizal fungi. It also removes a lot of the beneficial bacteria found in natural soil. By mixing untreated soil with the treated soil, some or most of the beneficial microorganisms are added back into the soil. Also added back into the soil are pathogens and insect pests. While some benefit may result from the additions, potential disaster can also ensue as was found by some gardeners who purchased seedlings from a nursery that had unwittingly added *Phytophthora cinnamomi* to their nursery soil. Reputable nurseries will never add untreated soil to their potting mix. As a consequence, they have to monitor their nutrient additions to nursery stock very carefully. It is on exposure to your garden soil that the plants then become associated with beneficial microorganisms, including mycorrhizal fungi.

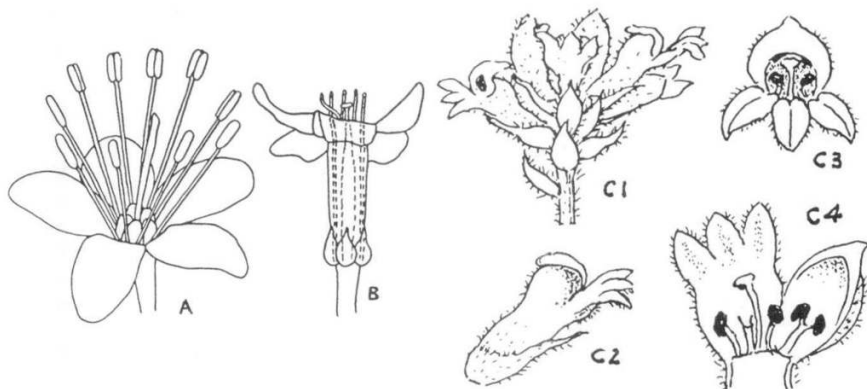
There is a lot to learn yet about these interesting and valuable fungi. Eventually you will be able to buy plants that have been inoculated with an appropriate mycorrhizal fungus, knowing that you are not also buying a pathogen infested nightmare as well. The resultant plant should survive the shock of transplantation better, should require less fertilizer to grow satisfactorily and should be able to grow in slightly poorer soil. Even further into the future, scientists should be able to genetically engineer these fungi such that your plants will be able to better withstand the rigours of drought, disease and pollution in soil. It will be an interesting future. ■

The Flower — Part 5

by Peter Bailey
and W. H. Payne

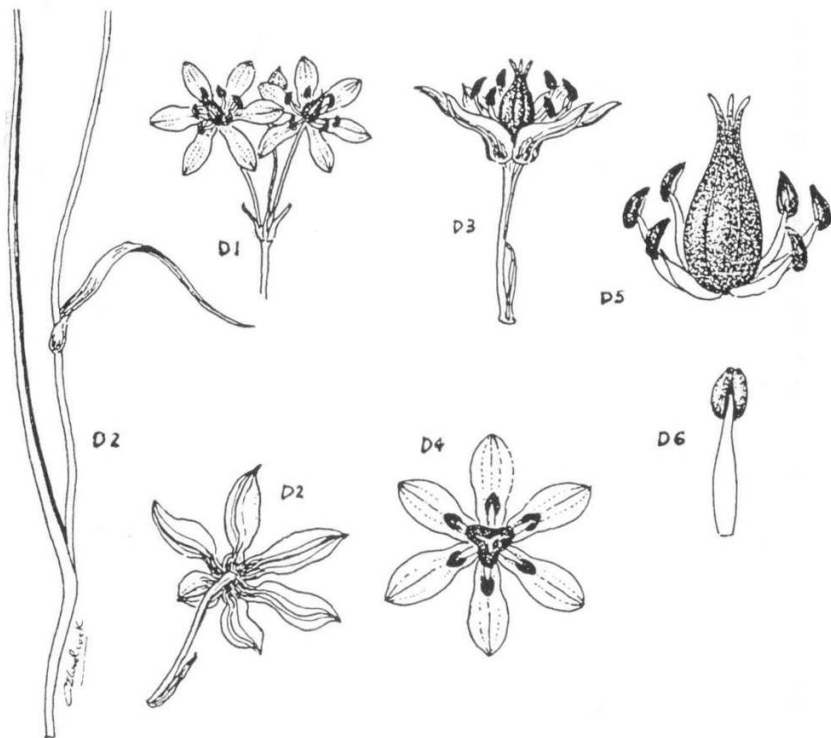
As shown in previous parts in this series flower segments are often arranged in layers or whorls around the female or seed producing part (which may also be a whorl of components) usually in the centre of the flower. The male or pollen producing stamens usually form the innermost whorl. The next two outer whorls are the ring of petals collectively called the corolla, followed by the ring of sepals collectively called the calyx, both whorls together being known as the perianth. These parts are supported on a swelling at the end of a stalk (pedicel) called the receptacle. Flowers often have an outer ring of leaf-like bracts. Here we will look only at the stamens collectively called the androecium. We will illustrate these points using the plants described in this issue.

***Phebalium* — Sketch A.** A typical flower with the style in the centre with a small stigma at the apex. Surrounding the style is the ovary which is known as superior because it is inserted above the level of the petals. The ovary is composed of five carpels that are free or slightly united at the base. The 10 spreading stamens are placed evenly around the ovary and the anthers sometimes have a terminal gland. The fertile parts are surrounded by five spreading petals that in some species have five sepals below them.



***Conospermum* — Sketches C.** A head of flower comprises many individual flowers. Each flower has a perianth, the name given to the petals and sepals collectively, and comprises four segments fused in a tube for about half of their length, then becoming free to form four lobes at the end. In one group they are equal and spreading while the majority of species have the upper limb larger and concave (as shown here) over the style and stamens, which may be seen "peeping" out in the upper detail. The three remaining slender lobes are united to form the lower limb. The arrangement of the four stamens is unusual, as shown in the next sketch where the upper limb has been cut and opened out. The upper stamen, shown sitting in the middle of the upper limb, is the only one to have two perfect anther cells. The two lateral stamens each have one perfect and one abortive cell and the lower stamen, shown almost behind the style, has two abortive cells. The style in the centre is filiform at the base and then more or less thickened and longer than the stamens. The next illustration shows a flower with a single floral bract clasping the lower part of the flower.

The colour plates that follow show a variety of form of flower. There is a small group that differ from the above in having lobes nearly equal and spreading and these include *C. capitatum*, *C. petiolare*, *C. teretifolium* (photograph on page 84) and *C. flexuosum*. The remainder have the two-lipped perianth as in the sketch below but one group have densely woolly flowers as shown for *C. incurvum* (page 81) and *C. distichum* (page 85). The remainder do not have the woolly flowers. Some carry them in heads on long stalks such as *C. brownii* (page 80) and *C. densiflorum* (page 84) or along the stem as for *C. ephedroides* (page 85). Much prized are the blue Smoke Bush, short stemmed as with *C. amoenum* (page 77) or long stemmed as with *C. dorrienii* (page 80).



Burchardia — Sketches D. The flower heads comprise 1-22 flowers (D1) held above the ground on a scape (D2) which can be divided or undivided with 1-4 scape leaves. The female components in the centre are a prominent feature of the flower. The ovary sits on top of the flower and the colour photographs on page 56 show these as red with three compartments. The style is short with three stigmatic lobes or branches. The six "petals" placed around the flower in a ring are each separately attached at the base and are hence called free. They are also caducous, that is they fall off early following maturity. As the botanists cannot separate the petals from the sepals, they are referred to as tepals. The six stamens are attached to the base of the tepals and the ovary. The anthers, which are the pollen-bearing part of the stamens, are attached to the end of the filament at the back and are referred to as being dorsifixed.

Pittosporaceae — Sketch B. *Hymenosporum flavum*. Our last issue featured the eight genera in the family Pittosporaceae. Refer to the excellent sketches on page 21 which illustrate that plants in this family have five sepals cupping five petals. They are usually united to form a tube for about half of their length and enclose five alternating stamens. The captions to these detailed sketches of the flowers of each genus are so good this beginners series on the flower rested with the illustrated botany lesson provided.

The Flower and its Parts

A typical stamen comprises a stalk (called the filament) which carries a pollen producing anther. Usually the anther is composed of two lobes or parts which are separated by tissue called the connective. Each anther lobe normally has two sections or pollen sacs that are separated by a septum. At maturity the anthers split open (dehiscence) to release the pollen, sometimes through pores and sometimes by small valves.

The internationally accepted method of classification of plants is principally based on the differences in the arrangement of the sexual or reproductive parts. Botanists have developed a whole new language to define even minor differences. The meaning of these terms are given in our book "The Language of Botany" and you should obtain a copy. There is no way anyone other than a botanist regularly working on plant classification can be familiar with all the terms; even the experts sometimes need a reference. For your convenience the following terms are often used. Do not attempt to read them but use them as a reference when trying to understand a botanical description.

The Filament — the part of a stamen that supports the anther. In the sketches above the filaments are free. In *Hibiscus* the filaments are united in a staminal tube.

epipetalous — the filaments are attached to the petals, e.g. *Epacris* and *Conostylis* of our previous issue. Probably by evolution filaments have become attached to the petals and the anthers appear to be attached to the upper part of the petal with little (as in *Epacris*) or no filament as in some Proteaceae such as *Telopea* and *Grevillea*.

The anther — the part of the stamen that is attached to the top of the filament and produces the pollen.

one-celled — the anther has only one lobe as in *Hibiscus*.

two-celled — anthers are usually composed of two lobes.

connective — the tissue that separates the two lobes of the anther.

pollen sac — each anther lobe normally consists of two pollen sacs that release pollen on maturity.

septum — the tissue between the two pollen sacs of an anther lobe.

basifixed — attached to the filament near the base of the anther lobes, e.g. *Solanum*.

dorsifixed — the filament is attached at the back of the anther, e.g. *Burchardia*.

versatile — an anther which moves freely on the end of the filament (usually dorsifixed) e.g. grasses.

divergent — a two-celled anther where the lobes are not parallel to each other, e.g. *Pandorea*.

dehiscence — at maturity the anthers split open to release their pollen.

extrorse — on dehiscence the anthers open on the side facing outwards (towards petals).

introrse — on dehiscence the anthers open on the side facing inwards.

longitudinal dehiscence — the line of the split is parallel to the connective, e.g. *Epacris*.

transverse dehiscence — the line of the split is at right angles to the connective, e.g. *Hibiscus*.

dehiscence by pores — pollen is shed through pores at the apices of the anther lobes.

dehiscence by valves — pollen is shed through small valves.

staminodes — the anther is reduced to a knob or flap of tissue and is no longer pollen producing.

syngenesious — the stamens are united by their anthers, e.g. family Compositae (*Helichrysum* etc).

monadelphous — the filaments are united in a single bundle or ring e.g. some species of *Verticordia* such as *V. monadelpha*.

polydelphous — the filaments are grouped into three or more bundles.

Save Our Flora

A Mickey Mouse Research Project

by W. H. Payne

They are exporting our flora! Great! They are tearing it up out of the native scrub and soon it will be gone. What are you, an Australian proud of our national heritage, going to do about it. We can take the negative way of the past and stop them tearing up our bush. But, it is probably only a matter of time before we (another more commercial we) tear it all up ourselves to get a few years of wheat harvest or to fatten a few lambs before it turns to desert and the hard working farmer faces bankruptcy. Or we can grow fields of wildflowers, selected for yield and beauty and increase our exports a hundred-fold. With our prosperity and a growing realization of the value of our irreplaceable flora we could then competently guard and manage our natural areas.

A dream? It is unless you, the Australian, are prepared to do something about it. One of the plants being plundered is the Smoke Bush of Western Australia. The last half of this issue describes our native smoke bushes. What is so great about the Smoke Bush? It looks drab and uninspiring in the colour photographs. It is one of those unique plants that is ideal for decoration as a cut flower and flower arranging and is highly prized overseas. It does not photograph well but is one of those plants that you feel you must touch, it is intriguing, woolly, ephemeral. Being white, many with that vague touch of blue, it is almost impossible to reproduce in colour, but a stand of it in the wild or in a garden seems to add life, tranquility, almost a mood music to a scene., Every garden and every flower arrangement needs a good white to accentuate the colour and to do this with soft woolly mystery is to complete the picture.

What can you do to save our flora? At last we have got the leading scientists of Australia to take notice. You did this with your journal, Australian Plants. Your officers created the Australian Flora Foundation and after getting it through the trauma of establishing it on a firm basis with national recognition, we said to it, to the scientists, "It is your foundation to run as you wish without any ties of interference from us, the lowly gardener and taxpayer; all we ask is that you use all the resources available solely on 'research into the biology and cultivation of the Australian flora'" (quoted from the sole objective listed in the charter of the foundation). Now the scientists are going to tackle the problems that concern us most and the least you can do is contribute \$100 (tax deductible) and become a Research Donor. It also entitles you to enjoy the privilege of membership and receive their publications, etc.

Mickey Mouse Research? We can initiate our own level of research:

- (a) Go out in the field and find the very best forms of the Smoke Bush. As anyone who has tramped the bush knows, now and again you come across a really spectacular plant, more flowers, larger flowers, better colour, more robust or compact bush, or whatever takes your eye. Mark the spot so that you can locate them again and report, initially, to the editor. It is from these plants that the scientists of the Australian Flora Foundation and our own competent members, will propagate.
- (b) We have competent propagators in the Society. Will those wishing to join this activity contact the editor. The Foundation will be carrying out their own propagation research.
- (c) Selected people will grow on plants under supervised conditions. Please understand that the Foundation will be conducting their own growing research projects under scientifically controlled conditions, and our own "Mickey Mouse" project in no way replaces or competes with the more scientific study by the Foundation. Who knows, we may stumble across some factors that will aid the scientists. Who would like to to involved in these growing trials — contact the editor. ■

Smoke Bush

A threatened Australian plant
with unrealized commercial potential
by The Australian Flora Foundation

Smoke Bush (*Conospermum* spp.) is an Australian plant found predominantly in south western Western Australia. Smoke Bushes have long attracted horticulturists for their value as cut flowers and their commercial significance can best be judged by noting that almost half a million stems are harvested from the wild each year by wildflower pickers for the international florist trade. Since Smoke Bushes are notoriously difficult to propagate vegetatively, their greatest threat is from exploitation by commercial pickers. The pressure of continued harvesting is threatening many species with extinction.

A recent Commonwealth Government sponsored review valued the projected Australian floricultural export industry at A\$100 million per annum. The amenity horticultural industry is continually seeking new lines and the unfamiliar Australian native plants are in great demand. The challenge is to successfully domesticate the more unusual Australian plants such as Smoke Bush to provide consistent quality and regular product supply.

Domestication of *Conospermum* species has not been successful due to their dormant seeds and the great difficulty in clonally propagating the plants by conventional means. *In-vitro* propagation appears to be the most promising technique to develop but much research is needed before this biotechnological approach can be applied commercially.

The Australian Flora Foundation has decided to make this a high priority project and research funds are needed to:

1. Develop propagation protocols to facilitate commercial production.
2. Select superior wild clones for assessment under field conditions.
3. Assess the most promising clones under controlled growing conditions and select those that perform best (viz. foliage deterioration, leaf drop, flower longevity and consumer appeal) for intensive breeding experiments.
4. Through breeding systems, research develop "improved" commercial species for cut flower production.
5. Seek plant patents to protect the "improved" plant types with plant protection legislation.

The Australian Flora Foundation is your research organization and needs your help. You can have a direct stake in the conservation of the Australian flora by becoming a Research Donor. Support Australia through your pocket. Send \$100 (fully tax deductible) to the Secretary, the Australian Flora Foundation, 28 Buderin Avenue, Kareela, NSW 2232. ■

Smoke Bush

Research for survival

Let us be clear on where we stand. The Mickey Mouse Research Project on the previous page is for those keen to be directly involved. It is, by no means, a substitute for the competently co-ordinated scientific research proposed by The Australian Flora Foundation and this is where our major contribution should be made. We desperately need the scientific community to be involved in research on our Australian flora in a serious way if, in years to come, we hope to have retained for all to see, even a portion of our magnificent flora. We have many calls on our limited savings and donating money comes 'very hard'. But! When a unique plant is dead, vanished for all time from this planet it will be too late. Now is the time. — Editor.

Conospermum

Smoke Bushes

The Genus by John W. Wrigley

Type Species: *Conospermum longifolium* Sm.

Meaning of genus name: From Greek, *konos*, a cone, and *sperma*, seed; refers to the shape of the fruit.

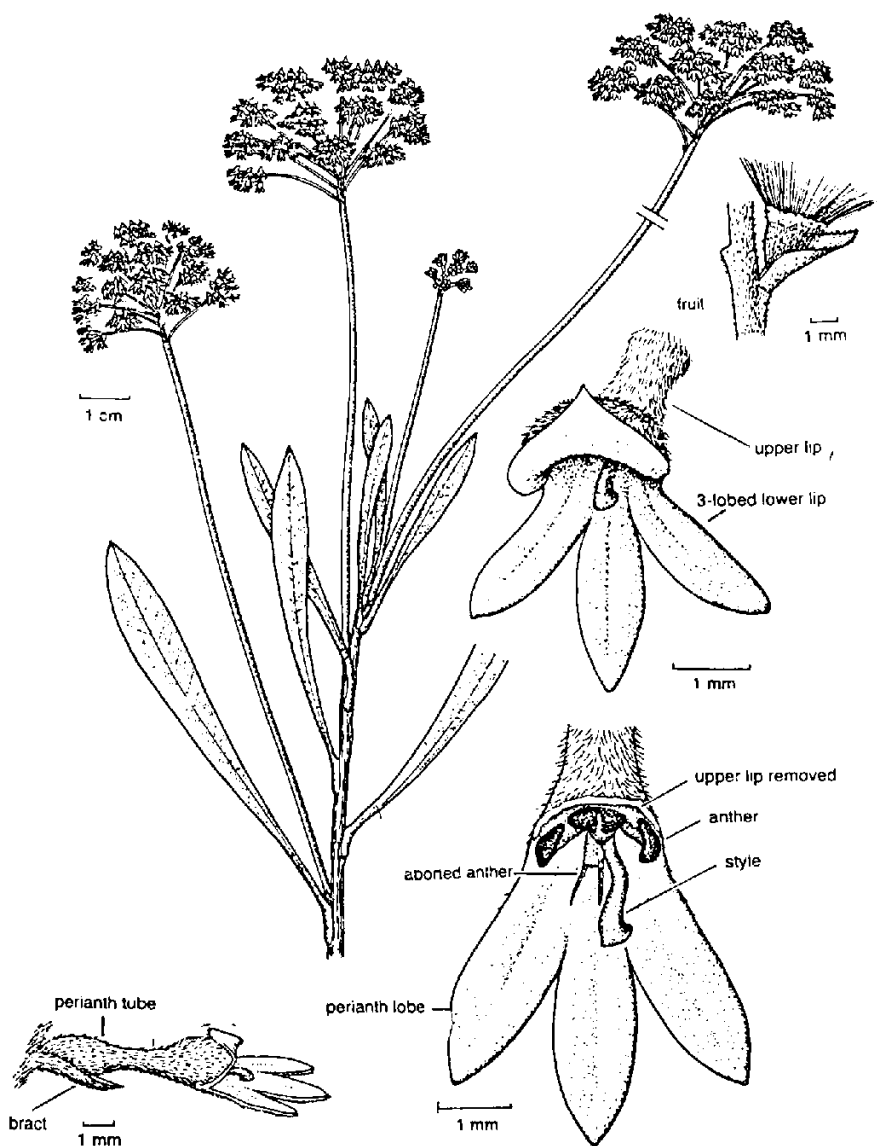
Common names: Many species are referred to as smoke-bushes, usually with a qualifying name. The name is derived from the appearance of several of the W.A. grey-flowered species, which resemble dense clouds of smoke, when viewed en masse from a distance.

Distribution: Of the 36 species, 29 occur in south-western Australia and seven in the eastern states.

Ecology: The genus generally grows in well-drained soils, often on the deep sands of the western sand plains among other shrubs. Some species are dominant members of these communities. A few grow as undershrubs in woodland or among tall shrubs, others on lateritic soils or among rocks, on the slopes of the Stirling Range. There are one or two species that occur in slightly damper locations. In eastern Australia several species are found on sandstone, often in shallow soils in woodland or in heath.

Description: The genus *Conospermum* includes small to medium-sized shrubs and undershrubs. Some develop lignotubers and resprout after fire, others grow long, thick tap roots as food storage organs. Leaves are always entire, often greyish, sometimes borne along the stems and in other cases appearing as rosettes at the base of the shrub. Most species are insignificant when not in flower. Flowers are usually white, often with a greyish shade, but several blue species occur and, more rarely, cream flowers are found (never bright yellow as in the related *Synaphea*). The flowers of some species are woolly, others are smooth and hairless. Most are spring flowering but a few flower into summer. Arrangement of flowers varies greatly from tight dense heads to loose flimsy panicles. In some species the flowers are borne on robust stems well above the foliage. Flowers have male and female parts. The perianth tube is straight, in some cases with four more or less equal spreading lobes or, as in most species, two-lipped, the upper lip being broad and concave and the lower divided into three small lobes. Although each perianth lobe begins to develop an anther, the lower centre one aborts (in *Synaphea* the upper anther aborts). A bract, which may or may not be conspicuous, is borne below each flower. The fruit is a cone-shaped nut with a ring of hairs around the broader end, and is attached at the narrow end. *Conospermum* is insect-pollinated, the pollen being released by an explosive action within the flower. It shares the subtribe Conosperminae with *Synaphea* in the tribe Conospermeae.

Cultivation: The first *Conospermum* was introduced into cultivation in the U.K. in 1823. It was *C. taxifolium*, the only species to extend to Tasmania, and was grown from seed collected in that state. The eastern species have attracted little attention in Australia from horticulturists as they have little to offer the general gardener or the professional cut-flower grower. A few have been grown in botanic gardens. Some of the W.A. species, on the other hand, are in great demand for the cut-flower trade and the genus was tenth on the list of most exploited species in the 1980-81 statistics.



***Conospermum longifolium* Sm.** The type species of the genus.

Four species, *C. crassinervium*, *C. incurvum*, *C. stoechadis* and *C. triplinervium*, figured particularly highly in these figures. Unfortunately, they have not proved easy to cultivate and much research is still required to enable these beautiful plants to be farmed rather than harvested from natural areas.

As mentioned earlier, the W.A. members of the genus have proven very difficult to cultivate. There are several reasons for this. Good viable seed appears to be infrequently formed, although fruit develops commonly. When seed does germinate it is prone to damping-off fungus. Its root development is faster than its leaf growth and it requires early planting out into a deep container.

There is, in fact, an urgent need of research to examine the reasons for poor seed setting. It should also investigate possible grafting onto eastern species, which have proved easier to grow, and the possibility of using tissue culture techniques for propagation. There are sound commercial reasons for undertaking this work as several species are outstanding as long-lasting cut flowers, both fresh and dried. Also many species would make charming garden and container plants.

If successful propagation techniques are developed, most species would probably respond to well-drained soil and a sunny situation, and, unless grafted, the W.A. species would probably only grow in winter rainfall areas.

***Conospermum acerosum* Lindl.**

From Latin, *acerosus*, needle-shaped; refers to the terete, sharply pointed leaves.

This is an open, often straggly shrub up to 1.5 m high with long, arching stems. Dull green leaves up to 50 mm long are terete, sharply pointed and sometimes curve upwards. Flowers are borne on crowded short spikes in the upper leaf axils. Spikes are shorter than the leaves but as many flowers are produced they are quite well displayed. Flowers are white with a reddish centre, quite hairless and with the perianth tube opening to half its length to display the two-lipped flower. Individual blooms are quite large. Not known in cultivation but if this species were lightly pruned it would be a useful medium-size rockery plant. It grows in deep sand, sometimes in sand over laterite, with shrubs or in open woodland. Colour photograph in "Banksias . . .", see page 88.



***Conospermum amoenum* Meissner**

Blue Smoke-bush

From Latin, *amoenus*, beautiful, pleasing; refers to the flowers, Syn. *C. croninae* Diels, *C. suaveolente* D. A. Herbert.

A small shrub up to 70 cm high by 50 cm across, often with open habit. Leaves are terete, up to 20 mm long, pointed and swelling slightly at the base. Flowers are borne either singly or in groups of two or three in leaf axils towards the ends of branches. They are usually blue, although white forms are found. Flowers are usually softly hairy but not woolly, and are seen in spring. The perianth tube is about 5 mm long and two-lipped, barely opening when mature. Not seen in cultivation, this is one of several blue flowered *Conospermum* spp. which show considerable potential for horticultural use. It has been harvested from the wild for cut-flower use, although not extensively. It grows in gravelly sand in heath and retains the blue colour on drying. Photograph on page 77.



***Conospermum brachyphyllum* Lindl.**

From Latin, *brachy-*, a prefix meaning short, and *phyllum*, a leaf. The name is confusing as the leaves of this species are longer than the closely related *C. incurvum*. They are, however, shorter than *C. stoechadis* which Endlicher described in 1838 and of which presumably Lindley was aware. Syn. *C. filifolium* Meissner.

A rounded shrub up to 1 m high by 1.5 m across. Leaves very narrowly linear and up to 70 mm long. The branching panicles of woolly white flowers are borne terminally in spring, covering the shrub. Flowers are two-lipped, about 8 mm long and barely opening, but the smooth top lip is more conspicuous than the related *C. incurvum*. This species is often confused in the field with the better known *C. incurvum* and its uses are the same. It would make an attractive garden plant and has potential as a cut flower, being one of the true smoke-bushes. The apparently disjunct distribution is unusual.



***Conospermum bracteosum* Meissner**

From Latin, *bracteosus*, possessing bracts; refers to the bract-like leaves of the upper stems.

A small plant with a basal rosette of round to spathulate leaves and one or several stiff, erect stems up to 50 cm high, bearing the flowers. Stems are sometimes branched. The basal leaves may be 30 mm long but the stems are clothed in small, stem-clasping, bract-like leaves about 10 mm long. These upper leaves are softly hairy and appear grey. On ageing the rosette often dies away, and it is not seen on old plants. The woolly flowers are borne on short zig-zag spikes, 50-70 mm long, in the upper leaf axils. Flowers are well spaced on their woolly stems and the perianth tube is only about 5 mm long, opening to about half its length; the two lips do not spread. This unusual plant probably has potential as a cut-flower, but does not appear to have been exploited to date. It is said to germinate prolifically after fire and this may be a lead to its propagation. This plant would make an interesting rockery plant. Grows in deep sand in heath.



***Conospermum brownii* Meissner**

Blue-eyed Smoke-bush

Named after Robert Brown.

A rounded shrub 30 cm high by 50 cm across; the height doubles when the plant is in flower. The grey-green leaves are oblanceolate, up to 60 mm long, tapering markedly towards the stem and often slightly twisted. The hairless white flowers are borne on long smooth stems 30 cm above the leaves. The flower head is known as a corymbose panicle, where all flowers are more or less in the one plane. Younger flowers are concealed by a blue bract, giving rise to the common name. Individual flowers are two-lipped, the lower three-lobed lip being larger than the top lip. Perianth tube is about 8 mm long. This is a most attractive small shrub when in flower, although inconspicuous at other times. The long flower stems are ideal for picking fresh, but it is doubtful whether the flowers would dry well as they are quite succulent. It occurs in sandy or gravelly heaths. Photograph on page 80 is by John Simmons.



***Conospermum burgessiorum* L. Johnson & McGillivray**

Named after the Rev. Colin Burgess and his son Peter Burgess, who recognized this species as distinct. After retiring from the clergy, Colin worked as a botanist at the Australian National Botanic Gardens, Canberra, for a number of years. Peter is a forester with the NSW Forestry Commission.

An erect, sometimes spreading, small to medium-sized shrub up to 3 m high, usually of straggly habit. Leaves are narrowly elliptical, up to 20 cm long, tapering towards the base and usually slightly twisted. Panicles of smooth white flowers are borne terminally and in the upper leaf axils in spring and early summer. Young buds are covered with small blue bracts. The panicles are more or less as long as the leaves. The perianth tube is 6-8 mm long and two-lipped, with the lower three-lobed lip being more prominent. This species is related to *C. mitchellii* which has shorter and narrower leaves and less conspicuous leaf venation. It is also a less robust shrub. This species has probably little to offer as a horticultural subject but may have possible use as a rootstock for W.A. species. It is generally an untidy shrub but should be grown in botanic gardens as it is of comparatively limited distribution. It grows in shrubby, low woodland on soils derived from siliceous granites.



***Conospermum caeruleum* R. Br.**

From Latin, *caeruleus*, blue; refers to the flower colour. Syn. *C. marginatum* Meissner.

A low, weak shrub up to 60 cm high with thickened base. Long, narrow elliptical basal leaves up to 80 mm long are present, with a leaf stalk of similar length. Smaller, narrow leaves are borne on the lower parts of the many stems that hold the flowers. These bright green, often branched stems form the bulk of the plant and are leafless for most of their length. They perform most of the photosynthesizing activities for the plant. The bright blue flowers are borne in short spikes at the end of the stems in spring. The perianth tube is minutely hairy and slightly curved. It is two-lipped, the shorter top lip ending in a small swollen tip and the longer, lower lip deeply divided in three spreading lobes. The spike is less than 20 mm long. This species would be almost impossible to grow from cuttings because of the habit of the plant. Tissue culture using material from the woody base may be a possibility if sterile material could be obtained. Its bright blue flowers would make this a most useful rockery plant. It grows as an undershrub in deep sand with taller shrubs and small trees between Jerrimungup and Albany.



***Conospermum capitatum* R. Br.**

From Latin, *capitatus*, capitate or with a knob-like head; refers to the arrangement of the flowers.

A small, somewhat tangled shrub with short woody stems and long, twisted linear leaves up to 30 cm long. Flowers tend to be hidden among the foliage. The scented flowers are a dull cream-fawn colour in dense terminal heads. Each flower has four equal spreading lobes to the perianth tube, which is about 15 mm long. This species is closely related to *C. petiolare* and differs in having smaller flowers and narrower leaves. This species is in cultivation at the Australian National Botanic Gardens, where its intricate mass of curling leaves makes an interesting



foliage plant. Propagation is from cuttings and excellent drainage in a sunny rockery is recommended. An undershrub on sandy gravel in woodland.

***Conospermum crassinervium* Meissner**

Summer Smoke-bush

From Latin, *crassus*, thick, and *-nervius*, nerved or veined; refers to the heavily veined leaves.

A small shrub with short, thick woody stems up to 20 cm long, from which the long slender flowering stalk arises. The long, leathery linear leaves, up to 30 cm long, crowd the basal stems. They are markedly thickened around the margins and the mid-rib, and prominent cross veins are also noticeable. Colour is greyish-green. The erect flowering stems rise 80 cm-1 m above the leafy portion and the white, woolly flowers are borne in a large compact corymb at the top, 10-15 cm in diameter. Flowering is usually in summer, but occasional earlier flowers are seen. The perianth tube is two-lipped, splitting to half its length on opening. The lower three-lobed lip has spreading, hairy segments. This is a most favoured species for cut flowers and is heavily exploited by pickers. Its long rigid stems and hairy flowers dry well. It would also make an excellent rockery plant. It grows in open sandy woodland and heaths, usually not far from the coast.



***Conospermum debile* Kipp. ex Meissner**

From Latin, *debilis*, weak; referring to the stature of the plant.

A weak subshrub with slender stems, tending to trail on the ground. Basal linear to linear-lanceolate leaves, up to 80 mm long, have long leaf stalks. The lower stem leaves are much shorter. The leafless stems are sometimes branched and the blue, almost hairless flowers, are borne on short spikes at the end. The species has been compared to *C. polycephalum* and *C. caeruleum* but differs in having broader leaves than the former and narrower than the latter. The species would make a suitable rockery plant.



***Conospermum densiflorum* Lindl.**

From Latin, *densus*, dense and *flos*, a flower; refers to the compact heads of flowers.

A low woody shrub up to 25 cm high, leafy at the base and with long flowering stalks held above the foliage. Narrow linear leaves, up to 50 mm long, clothed in dense white hairs, crowd the lower stems. The compact flower head, a corymb, is borne on a leafless stem 40 cm long, in spring. The buds are covered by hairy blue bracts which blacken but remain among the open flowers. The perianth tube is slightly hairy on the outside, about 10 mm long and two-lipped. The top lip is reflexed and the three segments of the lower lip spreading and longer than the top. This is a delightful little plant which would enhance a rockery. Unlike most *Conospermum* spp. the foliage is interesting. If old flower spikes are removed the plant is neat all the year. It grows in laterite in open woodland. See the colour photograph on page 84.



***Conospermum diffusum* Benth.**

From Latin, *diffusus*, diffuse or broadly spreading; refers to the habit of the plant.

A much-branched open shrub, often with spreading habit. The terete leaves, up to 50 mm long, have a groove along the top and usually terminate with a small point. The globular blue flower spikes are borne on short stems in the upper leaf axils or at the ends of short branches. The spikes are usually less than 50 mm long. The perianth tube is hairless, about 6 mm long and two-lipped. The upper lip is concave with turned-back margins, and the lower lip has three short lobes. It could be of use as a rockery plant.



***Conospermum distichum* R. Br.**

From Latin, *distichus*; "distichous" is a botanical term meaning "arranged in two opposite rows". Robert Brown used this term in relation to the leaves that he said were "subdistichis" or somewhat distichous. Syn. *C. procerum* F. Muell.

A medium-sized rounded shrub up to 1.5 m high by 2 m across, with many branches. Leaves are narrow-linear or terete, up to 80 mm long and curving upwards. They tend to be arranged in two opposite rows but this is not always the case. The woolly flowers are arranged in short spikes up to 50 mm long in the upper leaf axils. Flowers, which appear in spring, may be white with two dark blue lips, or pale blue with deeper blue towards the end of the perianth tube and with blue lips. The lips are very small, noticeable only as a dark spot at the end of the flower. This is a beautiful species for the garden, particularly those forms with blue flowers that are seen in the Tarin Rock area. It would probably also be useful for the cut-flower trade but to date does not appear to have been exploited. It grows in sandy or gravelly soil over laterite, with medium and tall shrubs. See the colour photograph on page 85.



***Conospermum dorrienii* Domin**

Stirling Range Smoke-bush

Named after Major Arthur Algernon Dorrien-Smith, DSO, DL, JP (d. 1955), an acknowledged authority on botany and horticulture who was awarded the Victorian Medal of Honour by the Royal Horticultural Society.

A small, stiff, erect shrub up to 60 cm high. The small terete leaves are about 20 mm long and curve upwards. Flowers are borne in spring in short spikes in the upper leaf axils. The spikes are longer at the extreme ends of the branches, where they may be twice as long as the leaves. Flowers are bright blue, almost hairless, the two lips of the perianth tube barely opening. This species would make a beautiful little rockery plant. It should be pruned to maintain a rounded shape. Flower colour is particularly bright. It is endemic to the Stirling Range and nearby sand plain, where it grows in sandy soil or among rocks with taller shrubs. Photograph is on page 80, photography by Neil Marriott.



***Conospermum eatoniae* E. Pritzel**

Named after Miss Alice Eaton, who first collected the species.

A small, erect, smooth shrub up to about 40 cm high with a woody base. Obovate basal leaves, about 50 mm long, with a petiole 20 mm long are occasionally present. Stem leaves are scale-like and only about 4 mm long. The shrub is a mass of intricate branches resembling *C. flexuosum*, but the flowers are quite different. The flowers are blue, borne in spring, in small heads of four to six blooms at the ends of the zig-zag branches. Each flower has a noticeable bract at its base and the smooth perianth, 4 mm long, is divided almost to the base into two lips. The three segments of the lower lip are deeply divided. This species would make an interesting rockery plant with unusual form. Grows in sandy soil with other small shrubs.



***Conospermum ephedroides* Kipp. ex Meissner**

Named for its similarity to *Ephedra*, a genus of almost leafless gymnosperms, similar to horsetails.

A many-branched weak undershrub up to 40 cm high by 60 cm across. Long narrow radical leaves disappear as plants mature; the many leafless, bright green branches then perform the photosynthetic processes for the plant. Some small scale leaves are present along the stem. The white hairless flowers are produced in more or less globular headlike spikes along the stems, 12-15 flowers in each group. Flowering time is spring. The perianth tube is two-lipped, opening widely to almost half its length to reveal the dark-tipped style rather more obviously than most species. The top lip reflexes and the three segments of the lower lip spread widely. An interesting rockery plant, as the weak stems tend to trail and many flowers are produced. It grows in gravelly soil with tall shrubs. See the colour photograph on page 85.



***Conospermum flexuosum* R. Br.**

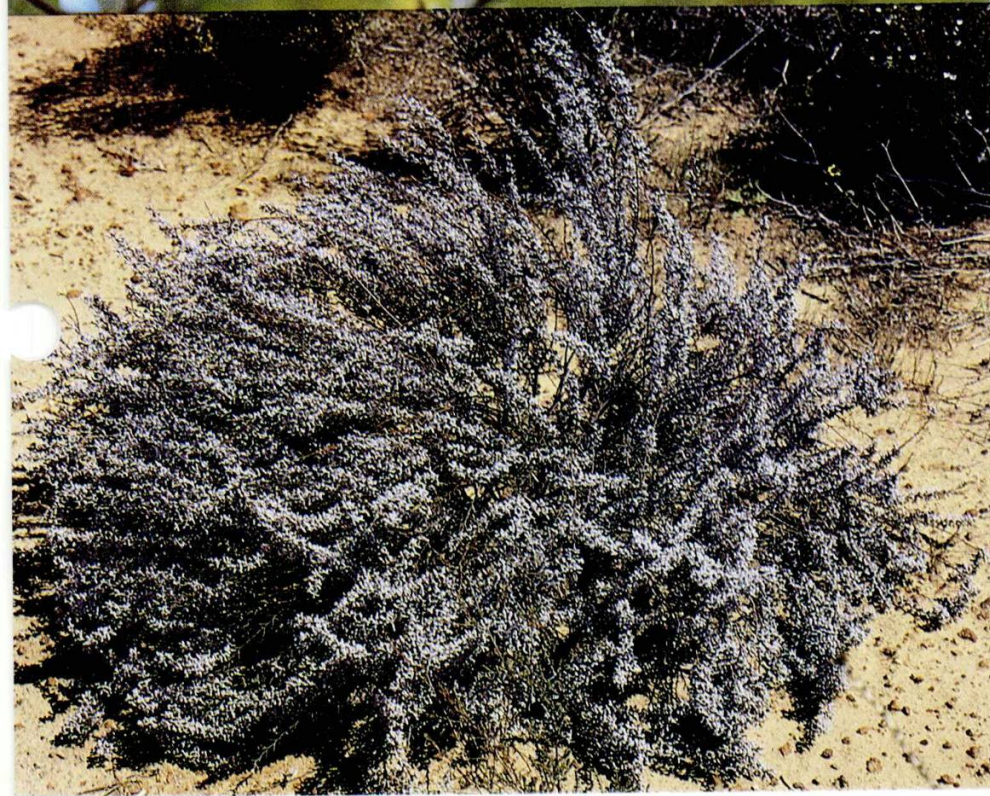
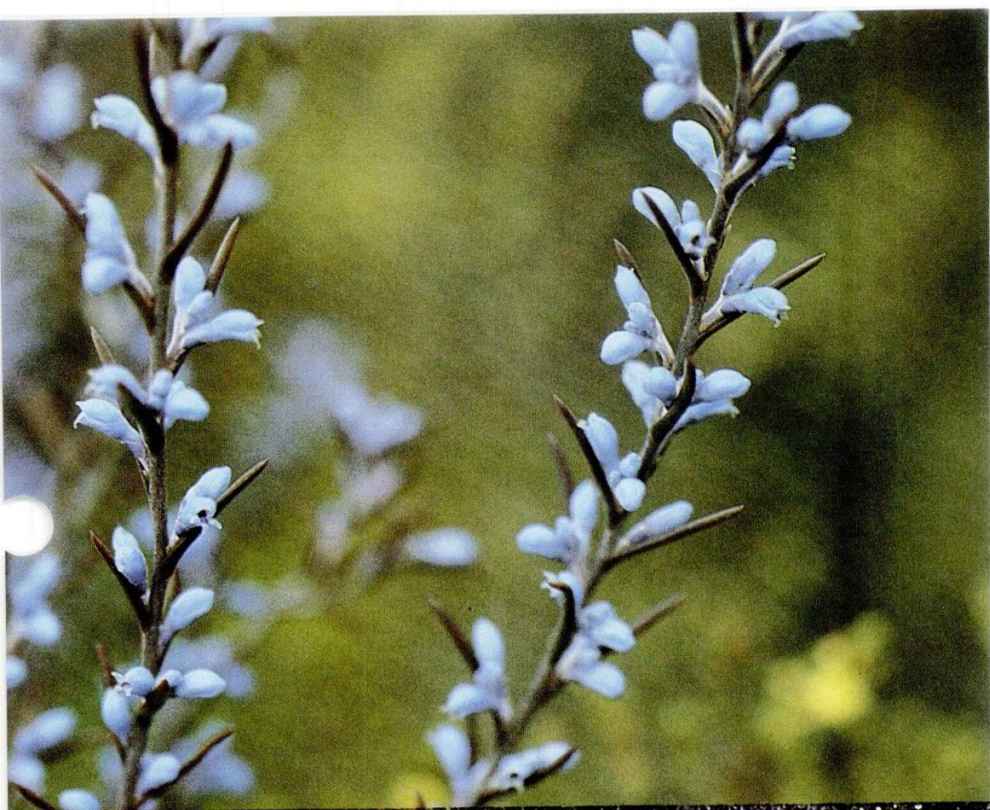
Tangled Smoke-bush

From Latin, *flexuosus*, full of bends; refers to the intricate zig-zag branches.

A rounded shrub up to 80 cm high with some narrow-oblong leaves on the lower branches. Some lateral roots have small tuberous growths used for nutrient storage. The bulk of the plant consists of an intricate maze of green zig-zag branches, which perform the photosynthetic activity for the plant. Flowers are borne in small heads of two to six individual hairless flowers on the ends of short branches, from late winter to spring. The perianth is divided into four equal linear segments which spread widely on opening. Each flower is about 6 mm long. A unique plant that would be a fine rockery novelty with its strange tangled branches. Flowers, although small, are very numerous and the shrub in flower is attractive. It occurs on sand or gravelly sand in heath, tall shrubland and woodland. Colour photograph in "Banksias . . .", see page 88.



Conospermum amoenum — Opposite is the plants and flower. This is one of the best blue Smoke Bush. It has been harvested in the wild for the cut-flower trade and the desperate need for research into its commercial propagation and cultivation has become critical. See page 68 for details on how you can help. The photography is by D. E. M. Bennett for the flower head and J. W. Wrigley for the well formed, abundant flowering bush. The plant grows to 70 cm high and wide; what a beauty!



***Conospermum floribundum* Benth.**

From Latin, *floribundus*, profusely flowering; for obvious reasons. Syn. *C. distichum* Meissner (not R. Br.).

A bushy shrub up to 1 m high. The crowded silvery-grey leaves are narrow, almost terete, curving upwards and about 10-18 mm long. Flowers are borne on spikes in the upper leaf axils, each spike being about 50 mm long. Flowers are woolly and grey-white in appearance with the buds concealed by dark coloured bracts. These fall as the flowers mature. Perianth tube is about 8 mm long, two-lipped and barely opening. It is similar to Robert Brown's *C. distichum* which has much longer leaves. It would be an attractive species as a garden plant or for the cut-flower trade, although to date it does not appear to have been exploited. It occurs in the Stirling Range, almost certainly in well-drained soils.



***Conospermum glumaceum* Lindl.**

Hooded Smoke-bush

From Latin, *glumaceus*, like the glumes of grasses. A glume is a bract or leaf-like organ held below the flowers of grasses and some sedges. Lindley used the term to refer to the very large bracts of this species. Syn. *C. lupulinum* Endl.

An erect shrub up to 1.5 m high, sometimes rounded, sometimes sparsely branched. Leaves are linear to narrow-oblongate, dull green and with a small point. They may be up to 60 mm long. The tiny cream flowers, seen in spring, have an almost black base and are concealed by the thin, cream lanceolate bracts up to 12 mm long. These are the noticeable part of the pendulous flower spike which is borne on a slender branching stem, 10 cm or more above the foliage. The flowers are two-lipped and only about 3 mm long, with the perianth tube splitting to form a short broad upper lip and a longer lower lip with three spreading segments. This is one of the most unusual *Conospermum* spp. and probably not recognized as such by the casual observer. The cream, nodding flower heads are attractive and it would make a delightful garden subject. It grows on lateritic gravel in woodlands of the Darling Range, often with other Proteaceae plants, and on ironstone hills in heath further north.



***Conospermum huegelii* R. Br.**

Slender Smoke-bush

Named after the Austrian, Baron von Hügel (1796-1870), who collected plants in Australia in 1833.

A low, rounded undershrub up to 50 cm long with long linear or terete twisted leaves only around the base and lower stems. Leaves may be 15 cm long. The many bright green stems perform most of the photosynthetic functions for the plant. Flowers, which may be a medium blue to very pale blue, are borne in spring on short terminal spikes, globular when young but lengthening with age. Each flower is two-lipped, with a perianth tube about 7 mm long and splitting to about one-third its length. The lower lip is more prominent with the three thick segments moderately spreading. This species would make a pretty rockery plant for a small pocket. It may be more tolerant than other species as it grows in seasonally wet areas of the coastal plain or among granite rocks of the Darling scarp, with small to medium-sized shrubs.



***Conospermum incurvum* Lindl.**

Plume Smoke-bush

From Latin, *incurvus*, curving inwards; refers to upward curving leaves.

A much-branched shrub up to 1 m high by 1.5 m across. Some roots develop small tubers as food storage organs. Leaves are narrow-linear to terete and about 50 mm long, curving upwards. The soft feathery panicle of flowers is borne on the 20 cm long stem at the end of each branch. Flowers are woolly, grey-white and two-lipped but the 10 mm long perianth tube barely opens. The lips are noticed only by a dark blue spot at the end of the tube. Flowers are produced in spring. The species is very similar to *C. brachyphyllum* but has much shorter leaves. This is among the best known true smoke-bushes; its waving plumes of soft grey flowers are spectacular north of Perth in the peak of the wildflower season. It is heavily exploited for cut flowers by pickers as it dries well in addition to its use as a fresh cut flower. It is also potentially, an excellent garden plant. It grows in deep sand and gravelly sand in woodland and heaths, often associated with other Proteaceae. Photographs on page 81 by C. M. Bennett and J. Simmons.



***Conospermum leianthum* E. Pritzl**

From Latin, *leianthus*, smooth-flowered; refers to the hairless blooms. Syn. *C. polycephalum* Meissner var. *leianthum* Benth.

An erect shrub up to 1 m high. Leaves are terete, up to 15 cm long and slightly curving. Flowers are borne in spring in rounded heads. They are usually white with perianth tube split into two lips and with a blackish bract at the base. The perianth is about 8 mm long. This species is similar to *C. polycephalum*, differing in flower colour and with shorter flower stems. It grows in sandy soils with heath.



***Conospermum longifolium* Sm.**

Longleaf Smoke-bush

From Latin, *longus*, long, and *folium*, a leaf; refers to the long leaves. Syn. *C. smithii* Pers., *C. longifolium* Sm. subsp. *lingulatum* Meissner, *C. longifolium* Sm. subsp. *intermedium* Meissner, *C. scolopendrinum* Gandoger.

The type form, subsp. *longifolium* is a low shrub, the leafy parts usually less than 1 m high and often less than 30 cm. Usually few branches are present. The bright green leaves are oblanceolate to spatulate, up to 25 cm long and more than 8 mm wide, often with wavy margins. The corymb of flowers is borne at the end of a stem 30 cm long, held erect above the leaves. Flowers are almost hairless, white and two-lipped; the upper lip is reflexed and the three segments of the lower lip are more or less elliptical and spreading. The perianth tube is about 8 mm long, splitting to about half its length. Flowers are seen in spring. Hybrids are known between this species and *C. taxifolium*. This species is rare in cultivation, mainly because it is not a very spectacular plant. It can be propagated from cuttings taken when new growth from the base of the plant has begun to harden, probably in late summer, depending on rain. It may also be successful from seed. It responds to rockery culture, preferring a little shade and the good drainage that a rockery affords. A good mulch is also important as the roots should not be allowed to dry out. It is found in shallow sand among sandstone, in heath and open forest north of Port Jackson.

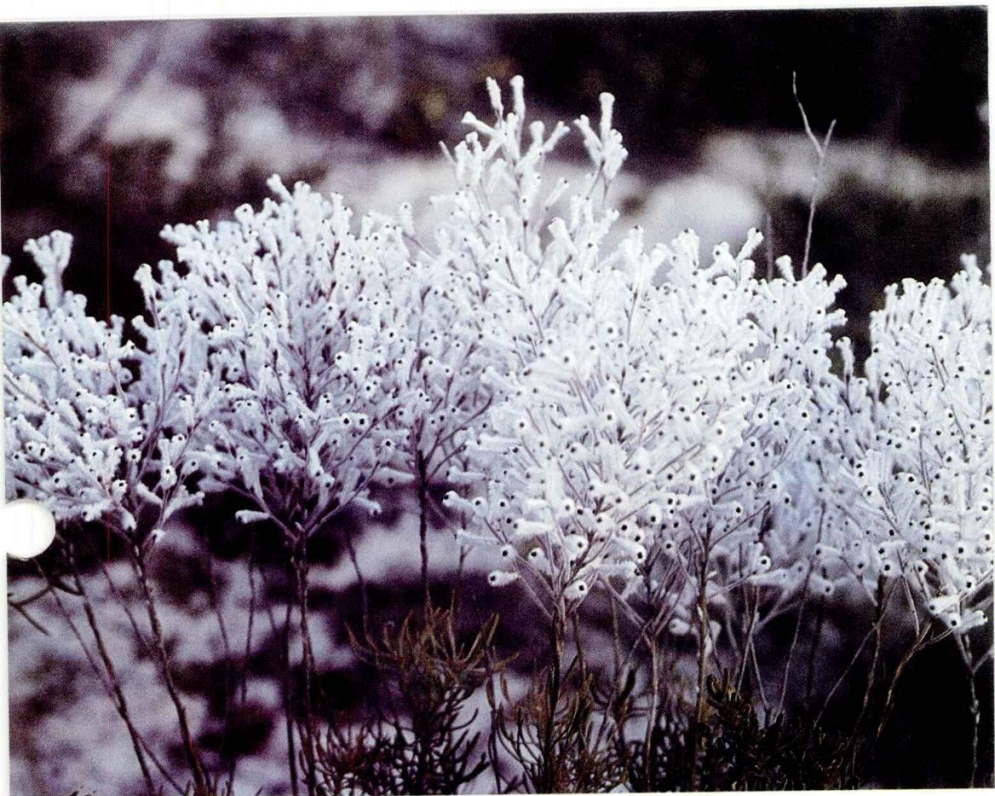




Conospermum brownii △ Blue/black bracts conceal flowers yet to open.

Conospermum dorrienii ▽ A beautiful rockery plant to 60 cm high.





Conospermum incorvum Flower heads△ The bush in flower ▽



Conospermum longifolium subsp. *angustifolium* is similar to type but with linear leaves 1-3 mm wide. It occurs south of Port Jackson.

Conospermum longifolium subsp. *mediale* has a leaf width, which is intermediate between the other two subspecies. It is found more inland, occurring from Putty to the Blue Mts and south to the coast at Jervis Bay, N.S.W.

***Conospermum mitchellii* Meissner**

Victorian Smoke-bush

Named after Sir Thomas Livingstone Mitchell (1791-1855), noted explorer and Surveyor-General for NSW. Syn. *C. dallachyi* F. Muell., *C. mitchellii* Meissner var. *dallachii* Meissner.

An erect shrub up to 2 m high by 1 m across with few branches. Rigid linear leaves up to 15 cm long, often less, sloping upwards from the stem. Flowers are borne in spring in terminal corymbs about 15 cm in diameter. Each white or pale cream flower has a perianth tube about 6 mm long, covered with minute hairs and splitting about halfway to form two lips. The top lip is slightly reflexed and the three segments of the lower lip are slightly spreading. This species has large heads of flowers but often tends to become untidy. Regular pruning may help to remedy this. It grows on sandy lowland heaths and forests, as well as on the slopes of the Grampians and an outlying population in the Otway Ranges. The S.A. occurrence needs to be confirmed. Photograph on page 89.



***Conospermum nervosum* Meissner**

From Latin. *nervosus*, nerved; refers to the prominent leaf veins.

A small, rounded, woody shrub up to 50 cm high. Stiff leaves are oblong to elliptical with a sharp point and a very prominent marginal vein. Shrub leaves are about 50 mm long and basal leaves considerably longer. These latter leaves tend to die off on older plants. Flowers are blue and held terminally or in the upper axils in small, more or less globular spikes, during spring. The perianth tube is about 7 mm long, minutely hairy and splitting to about halfway into two lips. The lips are about equal size and do not spread markedly. It could be an interesting little rockery plant with bright blue flowers. It is found on gravelly hills with small shrubs.



***Conospermum patens* Schltdl.**

Slender Smoke-bush

From Latin, *patens*, spreading; refers to the leaves, which spread widely from the stem. Syn. *C. cucullatum* Gandoger, *C. helichrysoides* Gandoger.

A small, erect shrub up to 50 cm high. Leaves are variable throughout its range, with Victorian populations tending to have narrow linear leaves up to 40 mm long and S.A. populations tending to have shorter, broader leaves. They always tend to be crowded and spread more or less at right angles to the stem. Flowers are borne in corymbs, about 7 cm in diameter, rising from the upper leaf axils on slender stems above the foliage. Flower colour is blue to lilac and the perianth tube is about 6 mm long, minutely hairy and split to a little less than halfway into two lips. All lobes tend to be slightly reflexed. It may be of value as a rockery plant for drier areas. It grows in dry heaths. Photo, page 92.



***Conospermum petiolare* R. Br.**

From Latin, *petiolaris*, borne on a petiole; refers to the long petioles of the leaves.

A small, woody shrub up to 30 cm high with short branches and long, curled lanceolate leaves up to 25 cm long, with a long petiole. The flower heads are fawn to cream in colour and hidden in the maze of leaves. The individual flowers are the largest of the genus, being 25 mm long, scented and with the perianth tube split into four equal segments. The species is related to *C. capitatum* but has larger flowers and wider leaves. Sandy gravel in heath and woodland.



***Conospermum polycephalum* Meissner**

From Greek prefix, *poly-* many, and *-cephalus* headed; refers to the many heads of flowers.

A weak undershrub up to 50 cm high with many branching, almost leafless, stems. Some terete leaves present towards the base of the stems, sometimes reaching 15 cm in length. The bright green stems perform the photosynthetic activities for the plant. The blue flowers are borne in spring in compact, globular spikes at the ends of the many-branched stems. Individual flowers have a slightly swollen perianth tube constricted at the point where the two lips split open. Flowers are hairless, with lips equal in length and reflexing slightly. It would be a useful rockery plant with bright flowers. Gravelly soil, woodland and with taller shrubs. You may see a colour photograph in "Banksia . . .", see page 88.



***Conospermum scaposum* Benth.**

From Latin, *scaposus*, having a well-developed scape. A scape is the stem-like flowering stalk of a plant with basal leaves. Syn. *C. sericeum* C. A. Gardner.

An undershrub with leafless stems up to 40 cm long rising from a rosette of leaves. Leaves are lanceolate and up to 40 mm long with a thickened tip and marginal vein. A long leaf stalk of similar length to the leaf joins it to the basal stem. Blue flowers are borne in a compact spike at the apex of the usually branched stems. The perianth tube is hairy, about 5 mm long and two-lipped. A bract longer than the flower subtends each bloom. Flowering is said to occur in summer. An extremely rare plant, the rarest of the genus, found in sand in coastal heath.



***Conospermum sphacelatum* Hook.**

From Latin, *sphacelatus*, with brown or black speckling; possibly refers to the darker bracts seen between the white flowers.

A low shrub up to 70 cm high, with few branches. Leaves slope upwards and vary from narrowly linear to narrow-obovate. They may be 5-10 cm long and are usually covered with dense, fine, short hairs, particularly when young. The mid-vein is conspicuous. The white flowers are borne in a compact corymb from stems rising terminally or near terminally. The stems may be up to 15 cm long. The perianth tube is minutely hairy, up to 10 mm long and two-lipped, splitting to about





Conospermum densiflorum △ Photography by J. W. Wrigley ▽ *C. teretifolium*





Conospermum distichum △ Photography by J. W. Wrigley ▽ *C. ephedroides*



halfway on opening; the three segments of the lower lip spread widely. This species is similar to *C. longifolium* but differs in having slightly hairy leaves and a shorter flower spike. Found in stony situations on sandstone.

***Conospermum stoechadis* Endl.**

Common Smoke-bush

From the old genus name, *Stoechas*, which used to be applied to French lavender. This plant is known as *Lavandula stoechas*. Endlicher used this name because of the supposed resemblance of the *Conospermum* to French lavender. Syn. *C. sclerophyllum* Lindl., *C. canaliculatum* Meissner, *C. elegantulum* Gandoger, *C. proximum* Gandoger.

Usually a bushy shrub up to 1 m high by 1.5 m across, with a lignotuber. In areas which have remained unburnt for many years plants may reach 3 m in height. Adult leaves are terete, up to 10 cm long and curving upwards. Juvenile leaves are linear-lanceolate. The grey-white woolly flowers are held in loose panicles on stems 15-20 cm above the foliage in spring. The perianth tube is about 8 mm long, two-lipped and barely opening, the lips noticeable only by a dark spot at the end of each flower. This species is similar to *C. incurvum* and *C. brachyphyllum* but the leaves are longer. As with *C. incurvum*, it is one of the most heavily exploited species in the wild for cut flowers, fresh and dried, and would make an outstanding garden plant. Many hectares of this species can be seen flowering in spring in the Kalbarri National Park, north of Geraldton. A very widespread and common species of sand plain, heath and woodland.



***Conospermum taxifolium* Sm.**

Paint Brushes

From the genus, *Taxus*, the yew, and the Latin, *folium*, a leaf; refers to the resemblance of the leaves to the yew tree. Syn. *C. ellipticum* Sm., *C. ericifolium* Sm., *C. falcifolium* Knight, *C. rigidum* Knight, *C. imbricatum* Sieber ex Spreng., *C. ellipticum* Sm. var. *imbricatum* (Sieber ex Spreng.) Benth., *C. affine* Schultes and Schultes f., *C. erectum* R. Grah., *C. lanceolatum* R. Br., *C. taxifolium* Sm. var. *lanceolatum* (R. Br.) Benth., *C. propinquum* R. Br., *C. spicatum* R. Br., *C. lavandulifolium* A. Cunn. ex Meissner, *C. taxifolium* Sm. var. *lavandulifolium* (A. Cunn. ex Meissner) Domin, *C. linifolium* A. Cunn. ex Meissner, *C. taxifolium* Sm. var. *linifolium* (A. Cunn. ex Meissner) Benth., *C. taxifolium* Sm. var. *brownii* Meissner, *C. taxifolium* Sm. var. *hookeri* Meissner, *C. taxifolium* Sm. var. *leianthum* Benth.

An erect shrub with few or many branches. In shallow soils it may become bushy and only reach 60 cm in height, in other areas it may reach 1.5 m. Leaves are always crowded but leaf shape varies from narrow-linear to narrow-obovate to elliptical. Length also varies from about 6 mm to 30 mm. Flowers are borne in spikes in the upper leaf axils, forming a more or less corymbose panicle. They appear in spring and each flower has a minutely hairy perianth tube which splits about halfway on opening to form two lips. The upper lip is broad and the longer lower lip is divided into three spreading segments. This most variable of all smoke-bushes is widespread and common, mostly occurring in heaths on sandy soils but also found in woodland. Occasionally it occurs in swampy areas.



Hybrids are commonly found with *C. longifolium*, which make certain identification even more difficult. The six forms as defined by Johnson and McGillivray (*Teloepa* 1, 1, 1975) are as follows:

1. *The narrow-leaved form* occurs from Port Jackson north to Toukley and is common in Ku-ring-gai Chase. This form was known as *C. ericifolium*.
2. *The broad-leaved form* was known as *C. ellipticum* and usually has leaves broader than 4 mm. It has a scattered occurrence in coastal areas from Jervis Bay to north of Broken Bay on the NSW central coast and several other isolated locations.

3. *The Tasmanian form* has narrow-obovate leaves 1-2 mm wide.
- 4 *The type form* occurs in coastal heaths from Port Jackson south to La Perouse (Sydney). It has linear to narrow-obovate leaves about 2 mm wide and is roughly intermediate between 1 and 2.
5. *The Blue Mountains form* has linear to narrowly elliptical leaves 1-1.5 mm wide.
6. *The "common form"* includes all other forms, many intermediate between the above.

Some of the above forms have been introduced into cultivation. In fact, the Tasmanian form was introduced into the U.K. in 1823, presumably grown from seed. Cuttings of the narrow-leaved form strike readily and cultivation is comparatively easy in a well-drained rockery. Coastal forms are resistant to salt spray. It is suggested that this taxon should be fully examined to determine the hardiest forms and then to consider the use of the selected form as a rootstock for the important and difficult to grow W.A. species. The narrow-leaved form is probably the most suitable form to grow as a garden plant because of its compact and floriferous habit. It will grow in full sun or partial shade and flowers for several weeks.

***Conospermum tenuifolium* R. Br.**

Sprawling Smoke-bush

From Latin, *tenui*-, slender or thin, and *folium*, a leaf; refers to the long thin leaves. Syn. *C. repens* Sieber ex Schultes and Schultes f.

A sprawling, untidy plant 30 cm high by 1 m across. The long, thin, linear to terete leaves are channelled above, crowded, and up to 15 cm long. They curl markedly to form an intricate tangle. Flowers are pale blue and borne in compact heads on thin stems usually about 20 cm long. Flowers are seen in spring. The perianth tube is minutely hairy and only about 4 mm long. It is two-lipped, each lip more or less of equal length and the lower one with three short lobes.



Usually found in woodland on sandstone soils and often in damp places, this unusual plant is not commonly cultivated but can be grown easily from cuttings. It is adaptable to rockery culture and should not be allowed to dry out. A mulch should prevent this. It tends to lose leaves from the lower stems, and because of the tangled nature of the shrub, the leaves become caught among the stems and give the shrub an untidy appearance. It makes an interesting rockery plant with its pale blue flowers. It is likely that this species could be used as rootstock for some of the western species. Photograph on page 84.

***Conospermum teretifolium* R. Br.**

Spider Smoke-bush

From Latin, *tereti*-, terete or needle-shaped, and *folium*, a leaf; refers to long needle-like leaves.

An open shrub up to 1 m high and spreading to 1.5 m. Leaves are light green, terete and curving upwards, often reaching 30 cm in length. The shrub develops a lignotuber and reshoots after fire. Flowers are hairless and smooth and borne on stems rising from the upper leaf axils. Stems are up to 20 cm long and flowers are arranged in a loose panicle. Individual flowers are large, the perianth tube being 15 mm long, splitting into four equal linear segments that spread, giving rise to its common name of Spider Smoke-bush. This plant would make an excellent garden plant as the foliage is interesting as well as the flowers. It would require excellent drainage. It grows in deep sand in heath and with taller shrubs.



***Conospermum toddii* F. Muell.**

Named after Charles Todd, a telegraph worker and plant collector.

A leafy shrub. Leaves are up to 18 cm long, very fine, 1-2 mm thick. The white flowers are in small dense spikes on smooth stems about 50 mm long. The hairy perianth tube is about 6 mm long, divided into two unequal lips, the top lip long and slender, the lower lip twice as wide.



***Conospermum triplinervium* R. Br.**

From Latin, *triplinervius*, triple nerved; refers to the three-veined leaves. Syn. *C. laniflorum* Endl., *C. undulatum* Lindl.

A tall shrub up to 3.5 m high with open habit. This is the tallest of the *Conospermum* spp. Leaves are variable, from linear to lanceolate in shape, from 4 cm to 10 cm long and usually greyish in colour. The woolly grey-white flowers are borne on stems 20-30 cm long, rising from the upper leaf axils. Flowers are in open panicles. Perianth tube is small, about 6 mm long, barely opening, the two lips being noticed only by a dark spot at the tip. This is a somewhat untidy shrub but regular pruning would encourage a more compact habit. Flowers are suitable for cutting and many stems have been harvested from the wild. It grows in sandy or gravelly soils in woodland or with shrubs.



Banksias, Waratahs and Grevilleas

Book Review — Editor

There have been many books on Australia's wildflowers over the years. Only a few have survived as being a major contribution to our floral heritage, and because of demand, have been up-dated and reprinted many times. One of the books of exceptional value, "Australian Native Plants" by John Wrigley and Murray Fagg, has again sold out. However, a third edition is now available. It includes over 350 new entries, many name changes and more colour plates and will again be one of the three major references to our flora that I recommend. The same authors of this best seller have now produced another major work of equal value, to be available on 1st April, 1989, for \$75.00.

"Banksias, Waratahs and Grevilleas" will be a major reference to our flora. It is difficult to adequately describe the outstanding value of such a book as this, so, the publishers have given permission to reproduce the chapter on "*Conospermum* — The Smoke Bush" to enable you to judge for yourself. *Conospermum* belongs to the plant family Proteaceae.

Australian Proteaceae. This is perhaps a more accurate title for the book as far as I am concerned but commercial minds have judged that this title will not attract sales to the general public. The book covers all Australian plants belonging to the plant family Proteaceae which, as well as *Banksia*, *Telopea* (Waratah) and *Grevillea*, includes another 38 genera such as *Dryandra*, *Hakea*, *Isopogon*, *Lambertia* and all the fascinating tropical genera such as *Athertonia*, *Darlingia*, *Hicksbeachia*, etc. Now you will appreciate why I am so excited about this new book.

Conospermum, the Smoke Bush genus, also belongs to the plant family Proteaceae and the above article, prepared especially for Australian Plants by John Wrigley, gives an indication of the thoroughness and competence that goes into his books.

We chose to present the genus *Conospermum*, the Smoke Bush, in Australian Plants, for your assessment of the book mainly for selfish reasons. The Australian Flora Foundation proposes to initiate major research programmes to foster the commercial growing of these unusual plants. Half a million stems of the Smoke Bush are harvested from the wild each year for the international florist trade. This destruction of our native flora cannot continue if we listen to our national conscience. To rephrase this into terms that people will heed, there is good money to be made by the commercial cultivation of Smoke Bush for an assured international market. The presentation of the Smoke Bush is the first salvo in this project.

In fact, *Conospermum*, the Smoke Bush, could have been a poor choice to encourage people to purchase the book as its real-life splendour does not show well in photographs, and the section on propagation and cultivation is short due to ignorance. However, I ask you to picture how well all the species of *Banksia*, *Grevillea* and all the other Australian Proteaceae will be presented by such competent authors. The advice on propagation and cultivation of these spectacular plants will be of exceptional value.

Murray Fagg, a leader in wildflower photography and an excellent artist. While the value in the book is in the manuscript, the bonus is in the nearly 300 colour photographs and many line drawings. Every genus is illustrated in great detail to assist in identification. An example of his line drawings, considerably reduced, is shown in the article. ■



Conospermum mitchellii (see page 82).

Photography by J. B. Fanning.

Australian Plants Needs YOUR Help

Without your help Australian Plants will not survive. How strongly do you feel that it should? I need comments from readers and good colour slides of the following plants that will be featured in issues in preparation. Plants in the family Liliaceae and related genera; this includes *Blandfordia* (Christmas Bells), *Arnocrinum*, *Johnsonia*, *Chamaescilla*, *Dianella*, *Stypandra*, *Bulbine*, *Hypoxis*. Most Myrtaceae but especially *Calytrix* and *Leptospermum*. Plants in the plant family Sapindaceae, especially *Dodonaea*, *Euphorbia*, etc. Plants in the plant family Rutaceae, especially *Eriostemon*.

Most importantly, I need colour slides of native gardens — Editor.

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Conospermum patens

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