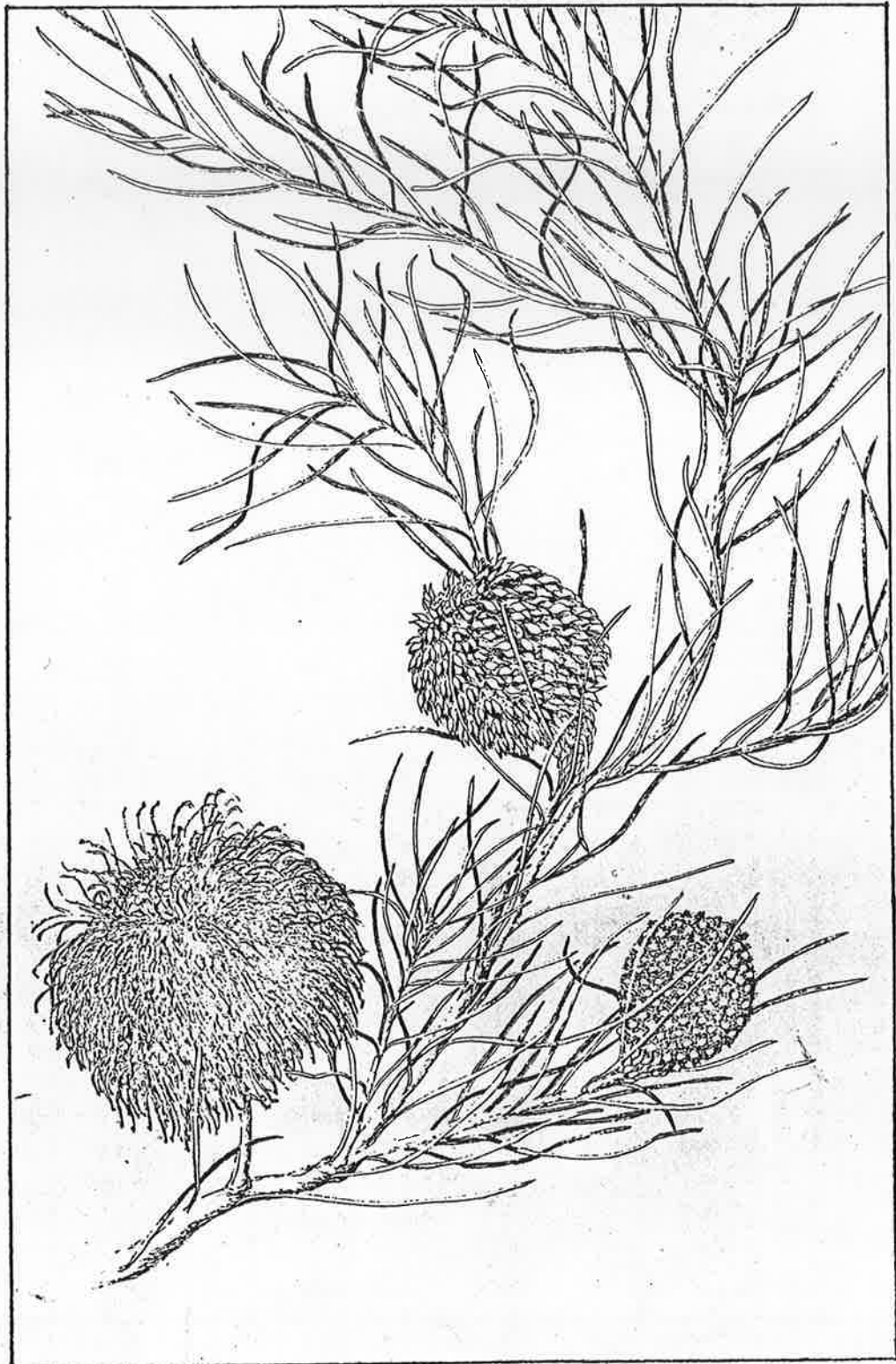


BANKSIA STUDY



REPORT 5

BANKSIA STUDY

With Report 5 of the Banksia Study Group we have endeavoured to clarify some of the uncertainties within the genus. For so long it has been recognized that there were forms or undescribed species. Confusion has always existed with some of the eastern species - *B. spinulosa/collina* and *B. canei/marginata* complexes. Findings of recent studies are included on these groups.

New Western Australian species which add to the long list from that state have been collected and described in laymans' terms so that they are easily recognizable, most of the names mentioned are believed to be manuscript names (indicated by M.S. next to them) which hopefully will soon be published by the W. A. Herbarium. Further information is welcomed on any of these species.

Considerable concern is felt regarding species that are restricted and possibly endangered. To give specific locations of these is often jeopardising their survival chances. I refer to the 'collectors' who must have a sample regardless of the consequences - occasionally seed is available for as much as \$1.50 each. It has been reported that even green fruits are taken when ripe ones are absent. This I know comes back to the individuals conscience and interest in conservation. The point is often made by genuine enthusiasts that cultivation may be the means of allowing a species to survive. The choice then comes back to how much we should publicise locations of rare species.

It was recognised in earlier reports the need for trial plantings of the genus. This is being accomplished in two ways :-

- (i) the establishment of the commercial group Proteaflora
- (ii) plantings at the Annexe of the Royal Botanic Gardens at Cranbourne, Vic.

The following Banksia species have been planted recently at the Annex at Cranbourne.

Banksia ashbyi ; 7 planted, B. baueri 4
B. baxteri 2, B. benthamiana 3, B. browni 1
B. caleyi 6, B. coccinea 3, B. elderiana 1
B. grandis 2, B. hookerana 1, B. ilicifolia 1
B. laevigata 3 B. lemannii 3, B. littoralis 6
B. media, 5, B. menziesii 7, B. nutans 1
B. occidentalis 5, B. petiolaris, 1, B. prionotes, 1
B. pilostylis 3, B. quer cifolia 1, B. repens, 1
B. solandri 3, B. sphaerocarpa 2
B. tricuspis 4, B. verticillata, 3, B. victoriae, 1
B. violacea 4, B. lullfitzii 4

All eastern banksias have been planted (some for as long as 3 years). This includes all new species including the as yet undescribed Queensland sp.affin. B. integrifolia. The Blue Mts. tree form of B. paludosa from Mt. Darcy and Glen Davis. All topodemes of B. canei are represented as are hybrids between B. robur x B. asplenifolia, B. paludosa x B. integrifolia : B. marginata x B. integrifolia, B. spinulosa x B. ericifolia, B. cunninghamii x B. ericifolia.

We would be grateful if any member could grow and donate small plants of species not listed or in short supply. Dryandras too are being grown in this way. Contact Alf Salkin 232 6213 (Melb.)

Since Report 4, most species have been collected and illustrated in pen and ink, so all we need now is some further inspiration. Of the scores of data sheets sent out with reports, only 2% are ever returned which makes data collection very slow. We need information if we are to disseminate useful reports in the future.

The group's operations are not like a lot of other study groups. We do not ask for a yearly subscription, but ask for \$2 for this latest report, \$1.50 for Reports 3 and 4 and \$1 each for Reports 1 and 2 (now out of print). In this way, we hope to cover printing, postage, correspondence and freight on specimens. We do not issue regular newsletters but try to follow up correspondence which can be included in future reports.

I look forward to your continued interest in the group and hope that you can contribute in some way to its success.

Yours sincerely,

Trevor L. Blake.

TREVOR L. BLAKE

*
THE ONCOSTYLIS IN EASTERN AUSTRALIA - By Alf Salkin

The *Oncostylis* in eastern Australia consist of a group of plants which have in the last few million years hybridized from three main parental stocks. Much of the confusion that exists about the identity of the so called *Banksia spinulosa* complex is due to a wide range of variation characteristic of hybrids.

The first *Oncostylis* species to be described in Europe was from material brought from Botany Bay by Sir Joseph Banks. This material though collected in 1770 was not described until 1781 and was named by the son of the famous botanist Linnaeus, *Banksia ericifolia*. The species is still common at the Cook landing site at Kurnell.

Cultivation experiments with this population show that it has genetic material from the *Banksia spinulosa* complex. Juvenile leaves are longer than adult leaves and also have dentations on the upper half of the leaves.

The pure or ancestral form of this species is restricted to northern NSW in the vicinity of Ballina the most northern occurrence being at Byron Bay. Juvenile leaves of this species are the same as adult leaves and the flower colour is darker being maroon rather than orange. *Banksia ericifolia* does not develop a lignotuber but the southern form can regenerate from the base. I have seen colonies at Jervis Bay, which appear to be the southern limit of the species, that had regenerated after fire.

At Jervis Bay where *Banksia spinulosa* also occurs clinal variants between the two species can be detected. The second *Oncostylis* *Banksia* sp. to be described was sent from Australia during the period of the first settlement by the Surgeon General of the colony John White. The material was described and illustrated in 'A Specimen of the Botany of New Holland' written in 1793 by Sir James Edward Smith the founder of the Linnean Society. The plant had very revolute leaves with small spines pointing towards the mid rib and was called *Banksia spinulosa*. The collection was made in the Sydney region and this type of plant is common from south of the Hawkesbury River to just north of the Victorian border. It is uncommon north of the Hawkesbury but has been recorded in Queensland on dry heaths and a form has been collected from as far north as the Atherton Tablelands. The plant seldom reaches a height of more than 1 metre mainly because the branches originate from a ligno-tuber. Experiments at cutting off all branches or burning show that the plant readily recovers from this treatment.

The third *Oncostylis* species to be described from eastern Australia was described by one of the most notable botanists to visit Australia. Robert Brown collected in 1805 a plant specimen in the vicinity of the penal settlement at Newcastle. Unlike *B. spinulosa* which loses its flat juvenile leaves and has very revolute adult leaves this plant retained its flat leaves throughout its adult life. Brown named this plant *Banksia collina* and published this name in his 'Prodromus Florae Novae Hollandiae' in 1810. Brown whose interest lay in plant geography as well as taxonomy was aware of the concept if not the name of an ecotype - a plant adapted to a particular environment, hence the name "Hill *Banksia*" distinguishing it from the species south of the Hawkesbury which grew mainly in swamps and on heaths. *Banksia collina* like *B. spinulosa* also invariably has a lignotuber.

Fran Sieber collected in Australia mainly in the Blue Mountains in 1823. One of his collections is of a specimen somewhat similar to *B. collina* but Sieber correctly distinguished it from the former species presumably

* Bentham in his *Flora Australiensis* divided *Banksia* species into a number of what he called sections those which had hooked styles are referred to as the section *Oncostylis*.

because he had seen both in the field. Sieber was a professional botanist and earned his living by selling sets of herbarium specimens. The set in which this new species appears is called the 'Flora of New Holland' and Number 6 is Banksia cunninghamii named after Alan Cunningham one of Joseph Banks' collectors who was working in Australia at the same time.

One of the 'Flora of New Holland' sets is in the Linnean Herbarium and sheet No. 6 has an annotation by Bentham indicating that he could not distinguish it from B. collina. This is not surprising as the distinguishing feature is the lignotuber, B. cunninghamii having no lignotuber.

Another herbarian to purchase Sieber's collection was that of Otto Sonder of Hamburg. This was one of the largest collections in private hands. The collection was eventually purchased by the Victorian Government in 1883 at the insistence of Ferdinand Mueller. I have seen this collection and have collected this species from the Blue Mountains and have no doubt that Sieber collected the plant without a lignotuber. This plant generally attains small tree stature and is not a divaricate shrub as is B. collina.

When Ferdinand Mueller took over the directorship of the Botanical Gardens in Melbourne in 1852 he made four very long collecting trips. On a number of these trips he collected the only Oncostylis that grows in Victoria. He first described this as a new species giving it the name of Banksia prionophylla. At a later date he decided that the species was synonymous with B. cunninghamii and later collections were named thus. Having grown B. prionophylla and B. cunninghamii from seed there are apparent differences in seedlings and this can be accounted for by the isolation of the two colonies. Victorian populations have a distance of at least 500km between them and NSW populations in the Blue Mountains.

The nomenclatural confusion concerning Victorian Oncostylis populations did not end there. Ewart in his "Flora of Victoria" followed Bentham and called Victorian populations B. collina. Galbraith in an article in the Victorian Naturalist used the term complex to refer to all populations other than B. ericifolia of the Oncostylis in the eastern states. This notion of an interbreeding group was so strong that Willis in his second volume of "Plants in Victoria" referred Victorian populations back to the original species to be described - B. spinulosa.

Much of this confusion is due to looking at herbarium specimens rather than whole plants B. collina and B. spinulosa both have prominent lignotubers. B. cunninghamii and B. prionophylla do not. Whether Alex George in his revision of the Banksia species will use the original names remains to be seen, my own opinion is that there should be some way of distinguishing all populations and whether we do this by using species names or sub species names or refer to them as geographic ecotypes such as Victorian populations of the Banksia spinulosa complex is less important than knowing if we are going to grow a 5 metre tree or a 1 metre shrub. One other thing that needs to be discussed is flower colour. Nearly all Victorian Oncostylis have black styles but a small population from a heath on French Island have lemon styles. Colour variations also occur in B. collina and B. spinulosa and a range of colours from black through red and orange to pale yellow have been observed. This colour is of course the final colour of the style when it has freed itself from the limb. As far as I have been able to ascertain B. cunninghamii has black styles.

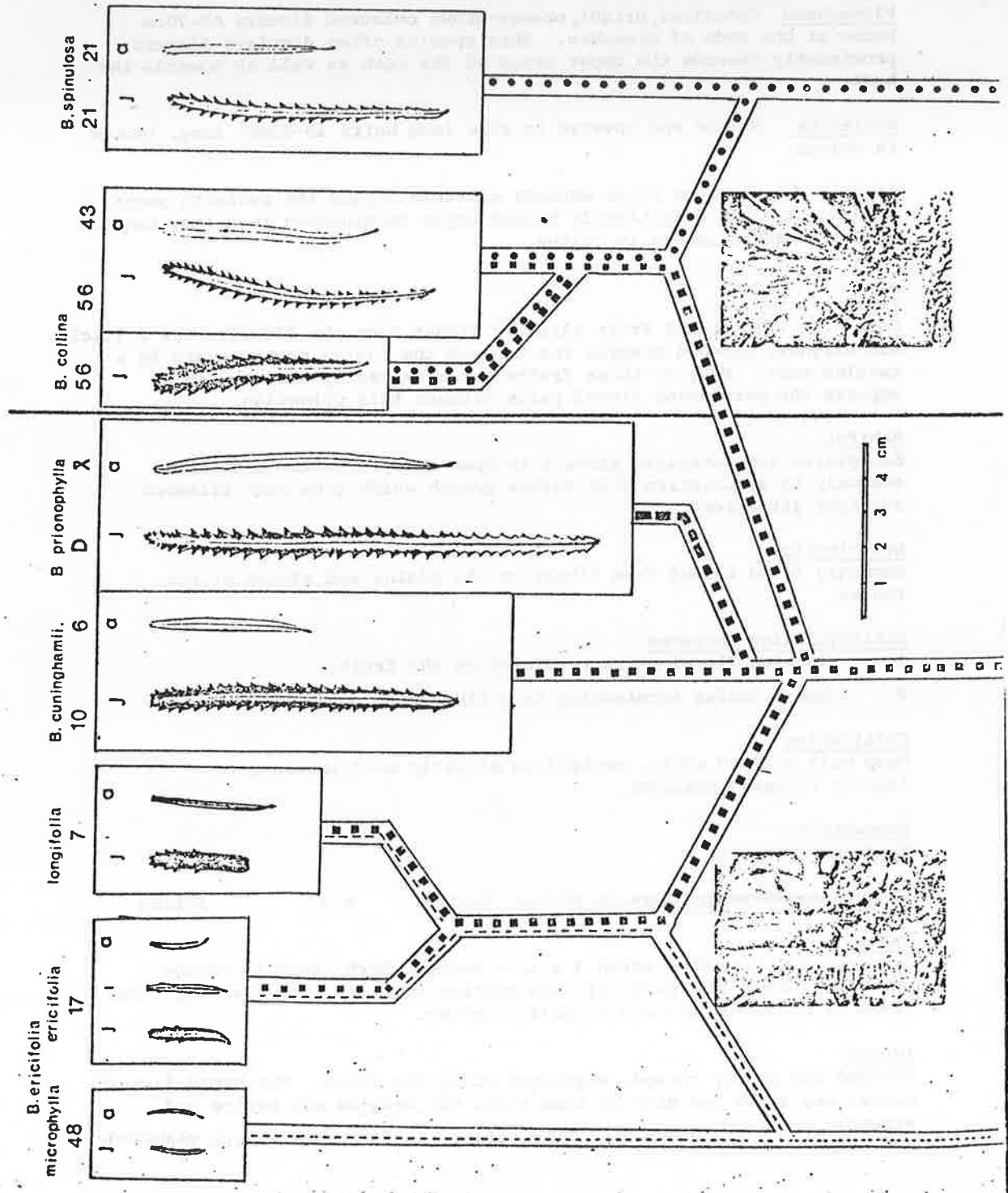
Hybridization in the Oncostylis.

Where B. ericifolia occurs with either B. cunninghamii or B. spinulosa hybrids occur. These plants have leaves that are intermediate to those of the two parent plants. The occurrence of these hybrids supports the hypothesis that the species at present known as B. collina is in fact a hybrid between B. cunninghamii and B. spinulosa. The hybridization may have taken place a long time before even aboriginal settlement and the more northern distribution of B. collina indicates that the hybrid is better adapted for these areas than either of the parent plants.

The diagram illustrates the possible gene flow in the *Oncostylis* in eastern Australia. The forms with lignotubers and those without are separated by a vertical line. *B. ericifolia* has been given 3 sub species names to indicate the form of variation. Juvenile and adult leaves are shown for all species. The numbers and letters shown are collection symbols and the locations are.

- 48 Byron Bay, N.S.W.
- 17 Gordon Smith Pass, Bl. Mts., N.S.W.
- 7 Blackheath " "
- 10 Narrow Neck " "
- D Triangle Rd. Nr. Gembrook Vic.
- X Wilsons Promontory.
- 56 Blue Mts. N.S.W.
- 43 Mt. Beerwah, Qld.
- 21 Beecroft Pen., N.S.W.

It should be noted that the leaves of *B. cunninghamii* are generally shorter than those of *B. prionophylla*. Variation also occurs in the juvenile leaves of *B. collina* but generally it is difficult to tell if a seedling is *B. collina* or *B. spinulosa* until the plant is 3-5 years old.



THE UN-NAMED BANKSIA SPECIES - By Trevor Blake

Banksia sphaerocarpa v. sphaerocarpa R. Br. W.A. Spring/Summer

Habit

A compact bushy shrub 1m x 1m which has a lignotuber, a feature which helps distinguish it from B. violacea.

Leaves

Short, scattered and tightly packed with a tiny petiole, 2mm, long attaching it to the plant. The margins are entire and revolute ending in a sharp tip. The overall length of this narrow linear leaf is 35mm x 1 to 1.5 mm.

Flowerhead. Bud

Ovoid with the upper florets maturing first.

Bracts several rows of tiny fine bracts 2-3mm long, brown in colour.

Flowerhead Spherical, bright, orange-brown coloured flowers 60-70cm borne at the ends of branches. This species often displays flowers prominently towards the upper areas of the bush as well as towards the base.

Perianths Narrow and covered in fine long hairs 20-23mm. long. Orange in colour.

Style The glabrous style extends a little beyond the perianth parts 8-10 mm. and has a distinctly hooked style terminating in a tiny conical stigma. Reddish brown in colour.

Fruit

Dark brown, spherical fruit slightly larger than the flower. The follicles are slightly pinched towards the top and the floral parts remain in a tangled mass. Many of these fruits are attacked by insects and it appears the persistent floral parts attract this attention.

Habitat

Sandplains and lateritic gravels in open sunny situations or more commonly in association with taller growth which give some filtered sunlight situations.

Distribution

Commonly found inland from Albany on the plains and slopes of the ranges.

Distinguishing Features

1. Tangled floral parts remaining on the fruit.
2. Short leaves terminating in a tiny sharp point.

Cultivation

Deep well drained soils, neutral to slightly acid, in sunny to lightly filtered sunlight.

Propagation

Seed and cuttings.

Banksia ~~sphaerocarpa form no.~~ grossa George. W.A. Spring

Habit

A coarse low spreading shrub 1 x 1.5m across which tends to become woody with age. All parts of this species contrast with the many other forms by being thicker and visually heavier.

Leaves

Crowded and gently curved, scattered along the stems. The broad linear leaves are up to 3mm wide by 85mm long. The margins are entire and strongly revolute ending in a tiny point. Surfaces are almost glabrous.

The young stems of the shrub are covered in fine indumentum.

Flowerheads

Buds

Cylindrical with the upper florets maturing first.

Bracts

Large 15mm long with all but the long arms covered with a dense velvet of rich, matted, deep, rusty hairs.

Flowerhead

Reddish bronze, 120 mm long x 90 mm diameter with a metallic sheen on the perianths, created by the dense covering of long hairs. The entire florets are imbedded between rich rust coloured velvet of the central core.

Perianths

Covered entirely by long copper-coloured hairs, 40mm long.

Style

Glabrous, strongly curved at the tip with a conical stigma. The style does not protrude beyond the perianth parts.

Fruit

Large cylindrical fruit which sheds old floral parts with age.

Follicles protrude from the cone.

Seed is almost half as large again as that from other forms 35mm with wing.

Habitat

Northern sand plains on deep white sand of dunes. Also on lateritic gravel on Mt. Leseuer in open well drained conditions receiving full sun to partial shade.

Distribution

East of Cervantes and north to Mt. Leseuer on the northern sandplains.

Distinguishing Features

1. Coarse foliage linear 3mm x 85 mm long.
2. Coarse floral parts, covered with long hairs.
3. Styles do not protrude beyond perianths.
4. Large flowers and cylindrical fruits.

Cultivation

This form is not known in cultivation.

Propagation

Seed.

leptophylla
Banksia sphaerocarpa form

W.A.

Spring

Habit

Dense, low branching, spreading shrub 2 x 3m with flowers generally partly covered by the thicker foliage.

Leaves

Narrow, linear, variable in length, from 50-80mm by 1mm. wide. Margins are entire and recurved, almost sessile at the point of contact with the branches.

Flowerheads

Buds

Elongated, globular conical, deep rusty brown bracteoles cover the undeveloped florets.

Bracts

Many layers of rusty, brown bracts, 10mm. wide at the base and tapering to long recurved awns to 10 mm. Subtend each flower head.

Flowerhead

Very large slightly elongated globular heads are found on the ends of short lateral branches. The upper florets mature first and develop into rusty brown flowerheads.

Perianths

The closely haired perianth is relatively fine for its size 40 - 45 mm. long.

Style

The long glabrous style with its hooked conical stigma extends 55mm. which is 10 - 15 mm. beyond the perianth parts.

Fruit

The very large fruits with packed follicles are partly covered with the old floral parts. Fruits can be 100-120 mm. in diameter.

Habitat

The northern sandplains in deep well drained sites in open sunny or partly shaded conditions.

Distribution

Widespread from Perth to Geraldton on sandplain and lateritic gravels.

Distinguishing Features

1. Long narrow leaves.
2. Very large flowers and cones.

Cultivation

Has been widely cultivated in deep well drained acid soils in open, sunny conditions.

Propagation

Seed and cuttings.

Banksia sphaerocarpa var. caesia
peruana

George W.A.

Spring

Habit

Low bushy shrub to 1m high by 1m in width. The blue/grey leaves are extremely attractive with the flowers being well displayed on terminal branchlets and contrasting with the foliage.

Leaves

Blue/grey, leaves 1mm x 80 mm long. entire margins which are revolute and terminate in a tapered point.

Flowerheads

Buds

Short and cylindrical with the top florets maturing first 30mm long x 20mm wide.

Bracts

Very tiny 3mm long tapering to a long awn. Generally only a single layer of bracts around each flowerhead.

Flowerhead

Globular 60-70mm in diameter with an orange-brown colour.

Perianths

25mm long and densely covered in fine hairs.

Style

Glabrous, 35mm long, extending 10mm beyond the floral parts. The hooked style terminates in a conical stigma.

Fruit

Globular 60-70mm in diameter with a tangled mass of old floral parts remaining and hiding the many prominent, flat-topped follicles.

Habitat

Sand heaths to dry sclerophyll forest on deep sands to lateritic gravel in open or semi-sheltered situations.

Distribution

The southern sandplains and ranges of the Darlings, Stirlings and Porongorups.

Distinguishing Features

1. Blue/grey leaves
2. Tangled floral parts persistent on the cones.

Cultivation

Well drained sandy to gravelly soils in sunny situations.

Propagation

Seed and cuttings

incana
Banksia ~~sphaerocarpa form~~ M.S. ~~sculeata~~ George W.A.

Habit

Compact growing woody with age.

Leaves

Broad, glabrous, linear, and very short 15-25 mm. long x 2mm wide
The leaf margins are entire, recurved and thickened, ending
in a sharp point. Petioles are 2mm. long.

Flowerheads

Buds

Elongated, 12 x 25mm long, maturing at the top first.

Bracts

Minute 3mm. long and semi deciduous. 1 or 2 layers below
each flower head.

Flowerhead

Small, bright yellow, globular, 65mm in diameter.
Not profuse, but well displayed on lateral branchlets.

Perianths

Densely and finely haired 20-22mm long.

Style

Glabrous, distinctly hooked, 30mm long with a tiny conical
stigma. The style extends 10 mm. beyond the floral parts.

Fruit

Globular, 55mm diameter with very large broad, squat grey follicles
with no trace of old floral parts.

Habitat

Open sandplains country in sunny to semi-shaded situations in deep well
drained soils.

Distribution

Found between Badgingarra and Perth on sandplains.

Distinguishing Features

1. Very short broad leaves
2. Spherical, grey cones with broad, squat follicles and no old
floral parts.
3. Small, yellow spherical flowers.

Cultivation

Unknown in cultivation but naturally requiring well drained
deep sandy soils.

Propagation

Seed.

lanata
~~Banksia sphaerocarpa form~~ MS ~~leptophylla~~ George W.A. Spring

Habit

Dense shrub 1.0-1.5 m high x 3m wide. Vigorous growth with prolific flowers on small lateral branchlets and terminal shoots over the entire bush. Much of the newer growth is covered by fine matted hairs.

Leaves

Long, glabrous, linear leaves 45 -80mm x 1mm, fairly densely scattered along branches. Margins entire and revolute ending in a fine soft spine.

Flowerhead

Buds

Oval 60-80mm across with distinctly white undeveloped flower parts.

Bracts

Distinctly white bud tapered to a fine awn-like point to 8mm long.

Flowerhead

7cm. diameter, globular, pale bronze.

Perianth

Parts lightly covered in hairs and 25-30 mm. long.

Style

Glabrous extends 5-8mm beyond the perianth segments and is distinctly hooked 25-35mm long. Stigma fine and conical.

Fruit

A spherical cone generally larger than the flower heads. Many prominent follicles appear on the cone which sheds the flower parts well.

Habitat

Tolerant to high temperatures with occasional storms. This species should prove adaptable to well drained soils in sunny situations.

Distribution

This undescribed species is found in the northern sandplain country from Eneabba and is associated with other heathland species.

Distinguishing Features

1. White bracts at the base of the flowers.
2. Leaves very narrow 1mm and of medium length 4.5-7.5cm within this group.
3. White, matted indumentum over the new growth.

Cultivation

This species grows well and rapidly in deep sands, forming a dense bush in a couple of years. It is drought resistant under cultivation and will tolerate frosts and temperatures of up to 42°C. This species does need a well drained sunny position.

Propagation

From seed, if the species can avoid being confused by collectors. As this species is little known propagation from cuttings is far more reliable.

Banksia sphaerocarpa form ~~var.~~ scabrella George W.A. Spring

Habit

A dense shrub with arching branches that often rest on the ground. 1-1.5m x 1.5m wide. A prostrate form of this has been found with an open straggly habit with flowers upright on terminal branchlets. 150mm high by 2m wide.

Leaves

Very short, sickle-shaped to straight, 30mm x 1mm wide, strongly recurved with entire margins. The surface is glabrous with tiny glands which give a rough feel. Fresh leaf growth is very fine and covered in dense fine hairs. The stems are also covered with dense fine hairs.

Flowerheads

Buds

Elongated, wider and more mature at the top. The entire bud has a distinctly hirsute appearance with the fine bracteoles and all floral parts entirely covered with dense, fine hair.

Bracts

Profuse, fine, hair-like bracts subtend the flower heads and are covered in minute matted tomentum. The bracts taper quickly into long fine arrows 7-12 mm long.

Flowerhead

Pale purple in the advanced bud stage, to pale purple and cream in the mature flowers. Elongated to almost spherical to 80mm diameter. Prolific and well displayed.

Perianths

Very fine to 25mm long, covered with minute indumentum, the stamens being exceptionally small.

Style

Glabrous and extending 35mm long with a distinctly curved but almost imperceptible stigma. It extends 8-10mm beyond the perianth parts.

Fruit

Spherical, similar size to the flowers 60mm. Many protruding follicles which stand out against the cone that has shed spent floral parts, particularly in older fruits.

Habitat

Deep sands and lateritic gravels in open heathlands with occasional partial shade-giving species.

Distribution

East of Walkaway, for 30km.

Distinguishing Features

1. Short foliage with exceptionally fine, hair-covered new growth.
2. Purple and cream flowers.
3. Abundant and extremely fine bracts at the base of the flower heads.
4. Buds extremely fine hairy appearance.

Cultivation

Not known, but requiring well drained deep sandy soils with a sunny aspect.

Propagation

Seed.

Banksia sphaerocarpa form NS telmatiaea. George W.A. Winter/Spring

Habit

Low, compact bush 1m x 1-1.5m wide with flowers and cones on short lateral branches, well displayed on older material.

Leaves

Short, narrow, linear and fairly short, 15.30mm x 1mm wide. Straight or gently curving and quite compact in a scattered arrangement along the stems. Margins are entire but strongly revolute.

Flowerheads

Buds

Cylindrical 50mm x 25mm wide a rich rusty brown in colour. The upper florets mature first.

Bracts

Three rows of pale brown bracts tapering to a point.

Flowerhead

Pale brown 85mm long x 75mm wide slightly elongated.

Perianths

Thickly covered in fine hairs. 27-30 mm long.

Style

Gently curved, 35mm long with a prominently hooked stigma which is conical. The style extends 5-8mm. beyond the perianth parts.

Fruit

Ovoid up to 95 x 75mm with persistent spent floral parts. The crowded follicles are somewhat pinched compared with other species in the complex.

Habitat

This form occurs in moister areas often around swampy tracts. In open to semi-open heathland associations it will tolerate heavier soils that can have prolonged periods of moisture.

Distribution

From the Moore River north of Perth to suburban Perth at Orange Grove.

Distinguishing Features

1. Moist swampy habitat
2. Cylindrical flowers
3. Pinched follicles

Cultivation

Virtually unknown owing to the confusion within the complex. Obviously will take heavier moist sands that are more acidic in full sun to partial shade.

Propagation

Seeds or cuttings.

Banksia integrifolia Mt. William ~~M.S. saxicola~~ George Vic. Summer/
Autumn

Habit

A spreading tall bush to small tree, which can be dense when young, and woody with age.

Leaves

Are arranged in whorls of up to 6 and are up to 140mm long x 35mm wide. The leaves are broadly elliptic to obovate with a small mucrone at the tip of the prominent mid-rib. Margins are entire to gently serrated, slightly undulate and quite strongly recurved. The underside of the leaf is white with a dense mat of minute hairs and the central vein sparsely covered with rusty-brown hairs. The under leaf surface has lateral veins and distinct reticulate venation. The upper surface is glabrous and dark green.

Flowerheads

Bud

Elongated with a pinkish tinge.

Bracts Covered with a layer of dense, rusty-brown, velvet-like hairs. Flowers are subtended by a several layers of bracts that taper sharply into awns 8-12 mm long.

Flowerhead

Lime green to yellow. 110 x 55 mm wide usually on older wood at the junction of new seasons' branchlet growth.

Perianth suffused with purple tints. 20-25 mm. long.

Style Strong yellow, not pale like coastal form. Extends beyond the outer parts by up to 10 mm.

Fruit

Cylindrical and of similar size to the flowers 90 x 50mm. The young cones have follicles densely covered with matted, fine hairs which turn brown with age and wear off the lips making them less conspicuous. The follicles can protrude prominently or be slightly recessed in the cone. And they do not open for at least 3-4 years as does B. integrifolia. The smaller cones of the Wilson's Promontory form do not open. Both forms require stratification.*

Habitat

Open and exposed areas on the Grampians peaks in sandy soils that can dry out. At Wilson's Promontory it grows in conjunction with the true B. integrifolia without appearing to hybridize. It is growing close to the coast in tall protected forest conditions receiving a fair amount of shade.

Distribution

Higher peaks in the Grampians - Major Mitchell Plateau, Mt. William, Mt. Rosea, Mt. Difficult Range, Victorian Range, etc. and Wilson's Promontory at Sealers Cover and Refuge Bay.

Distinguishing Features

1. Broad leaf.
2. Seed cones that retain their seed. B. integrifolia sheds its seed when ripe.
3. Buds have a distinctive pinkish tinge prior to opening.

Cultivation

Hardy, tolerating heavy clay or sandy soils that can be quite moist or dry for long periods.

Propagation

Seed. Seed needs a prolonged cold period before germination will take place (stratification) as the species is generally a mountain dweller. Place in the refrigerator (+5° C) for 8 weeks and then sow. High germination.

should take place. If this is not done there is usually poor germination or it may take 12 months i.e. after the winter cold triggers off the growth mechanism.

var. aquiloria
Banksia integrifolia ~~form MS. var. compar.~~ George Qld. Autumn

Habit

Upright to 4-5m high in dry sclerophyll forest. A moderately dense bush.

Leaves

Long, crowded, narrow lanceolate leaves arranged in whorls around the stem and scattered at times. Leaves are up to 250 mm long by 6-8mm wide, towards the apex, tapering into a long fine petiole. The upper surface is glabrous and the under surface white with minute matted tomentum. The midrib stands out with the very fine, rusty, brown hairs that create contrast. The margins are entire but revolute slightly.

Flowerheads

Bud

Short cylindrical buds which mature basally.

Bracts

Three to four layers of bracts subtend each flowerhead.

Flowerhead

Short cylindrical head similar to B.integrifolia, Colour pale to mid yellow.

Perianth

Fine and covered with dense appressed hairs 20mm long. Yellow.

Style

The straight style protrudes a further 5-8mm beyond the floral parts making it 25-28mm long. The stigma is tiny on the very fine tapered style. Pale yellow.

Fruit

Similar to B.integrifolia in size with the follicles opening on maturity and dropping ^{seed} from the bush shortly afterwards. This species does not appear to produce an abundant amount of seed cones.

Habitat

On edge of rain forest in sandy well drained soil.

Distribution

Northern coastal Queensland occurring on the western side of the Atherton Tablelands mixed with other heathland species.

Distinguishing Features

1. Long narrow leaves.
2. Absence of old seed cones on bush.

Cultivation

Generally unknown in cultivation due to the lack of seed. Should be a fairly hardy species but may not be tolerant to southern winters.

Propagation

Seed and cuttings

confesta var. *confesta*
Banksia sp. Mt. Tibrogargen ~~var. praecipitosa~~ George Qld. N.S.W.

April-Aug.

Habit

A large shrub to small tree 3-5m tall x 3-4m across, branches low to the ground. Flowers are well displayed in the junctions of older wood, similar to *B. integrifolia*. This species has been generally regarded as a form of *B. integrifolia* for many years.

Leaves

Arranged in whorls at regular intervals along the stems
Long lanceolate 120mm x 30mm wider, slightly towards the apex than the base. Margins are gently undulated and revolute with the upper surface glabrous and dark green. The under surface is almost white with wax and the lateral veins show out clearly. The midrib is covered with long, dense, rusty tomentum.

Flowerheads

Buds

Long conical and a grey green metallic colour.

Bracts

Narrow, linear with a slightly broadened base and covered with fine, dense, rusty brown hairs. Arranged generally in two layers around the flower.

Flowerhead

Large cylindrical cones of cream to light brown flowers 200-250 mm x 60-70mm in diameter. The florets are extremely closely packed.

Perianths

The fine floral parts are 23mm. long and covered sparsely with minute brown hairs.

Style

The glabrous style is gently curved at the apex and extends 5mm beyond the perianth parts. The stigma is straight. Pale brown.

Fruit

The long, narrow cones retain most of the spent flowers hiding the crowded, small, protruding follicles which remain closed.

Habitat

Found in exposed positions on cliffs.

Distribution

Restricted habitats on the summits of Mt. Tibrogargen and Mt. Beerwah in the Glasshouse Mountains and Mt. Barney south of Brisbane. Similar forms are reported from Mt. Darcy - near Kyber Pass 40km. east of Rylstone and Glen Davis in the Blue Mountains both in N.S.W.

Distinguishing Features

1. Long cylindrical flowerhead - brown.
2. Rusty woolly tomentum under the leaves which resemble *B. integrifolia*.
3. Seed cone with the follicles remaining closed.

Cultivation

Well-drained sandy or clayey soils that have some moisture. Frosts could be a problem. First noticed in 1962 with only a small number in cultivation.

Propagation

Seed - cuttings have not been attempted but should be successful.

Banksia ~~ilicifolia form~~ NS cuneata George W.A. Autumn/Spring

Habit

Dense bushy habit to ground level with many upright stems. Has been regarded as a shrub form of B. ilicifolia. It closely resembles a Dryandra but differs mainly by having an absence of large bracts which encircle the flowerheads.

Leaves

Distinctly small, cuneate leaves with several broad well spaced lobes with pungent points. 15-18mm long x 10mm broad. They taper to a small petiole and are arranged alternately along the stems and are often clustered on short lateral branchlets and below the inflorescences.

Flowerheads

Buds

Appear in a tight circle of leaves and look globular.

Bracts

Small fine bracts are hidden at the base of the inflorescence.

Flowerheads

The florets are arranged in an upright, domed, rosette, set in a cluster of glabrous leaves that are held terminally on lateral branchlets - they resemble Dryandra flowers. They are pink turning yellow as they age, the opposite to B. ilicifolia and are up to 45mm across.

Perianth

Pink changing to yellow with age. The segments divide as the tube opens. In other species they remain undivided for some time.

Style

Straight extending 5-8mm. beyond the stamen, glabrous.

Fruit

Two or three woody follicles grouped together in an upright position. Each elongated follicle would be no more than 20mm long.

Habitat

There are only a few plants in the natural habitat. Grows in undulating sandhills in full sun and is associated with B. prionotes.

Distribution

Extremely restricted and is regarded as a threatened species. Roadside near Quairading, East of Perth.

Distinguishing Features

1. Small cuneate prickly lobed foliage.
2. B. ilicifolia type flowers more like a Dryandra that are pink instead of yellow. B.
3. Shrubby habit whereas ilicifolia is a tree form.
4. Follicles grouped together in 2's or 3's pointing upwards.
5. Perianth segments separate as the tube opens.

Cultivation

Virtually unknown in cultivation but would probably require well drained sand soils that are not alkaline.

Propagation

Seed and possibly cuttings.

Chamaephyton
Banksia sp. ~~borealis~~ ms. George

W.A.

Spring

Habit

Prostrate by 1m wide with crowded, upright foliage. Tends to have a straggling habit.

Leaves

Stiff, upright, tangled, deeply divided with narrow gently curved segments that have finely undulating margins which taper to a point after remaining parallel. The thick segments which are divided to the midrib are up to 60mm long x 5-6mm wide. The leaves are on long petioles (1/3 of the leaf length) and are up to 40cm long. The leaves closely resemble *B. rubicunda* ms. George. New growth is densely woolly. Leaf surfaces have 3 faint veins and are covered with fine glands.

Flowerheads

Bud

Conical, well protected in woolly bracts in the early stages of development.

Bract

Tapering, densely woolly and scattered for 40mm behind the flower.

Flowerhead

Upright, terminal, well displayed at the ends of branches which appear to be growing out of the ground. The heads are cylindrical, light-brown and mature from the base.

Perianths

Densely woolly as they are covered by long fine light brown hairs which give the characteristic appearance and colour to the flower.

Style

Glabrous with a minute stigma which does not extend far beyond the floral parts.

Fruits

Similar to the flowers with the floral parts remaining. The felt covered follicles do not project far beyond the persistent perianths and shed this coating with age. Valves remain closed.

Habitat

Open sandheaths in full sun or partial shade in deep, well-drained, sandy soils or lateritic gravels.

Distribution

Northern sandplains. South of Eneabba and north of Badgingarra east towards Coorow and west towards Jurien Bay.

Distinguishing Features

1. Deeply divided leaves.
- 2.

Cultivation

Not known in cultivation, but should like well drained conditions in full sun or partial shade. It should be an excellent rockery plant.

Propagation

Seed.

gardneri var *brevidentata*

Banksia ~~sp.~~ no. orsophila

George

W.A.

Spring

Habit

Prostrate shrub which can spread to 1m with long upright foliage in dense clusters that resemble B.petiolaris.

Leaves

Long, upright leaves on petioles 50-60mm long. ^{that} extend 360-400 mm. The strong central vein is bordered by blades divided half way to the mid-rib. Each segment is mucronate and often irregular in size.

Flowerheads

Bud

Conical bud surrounded by dense hairy bracts in the early stages.

Bracts

Long tapered bracts to 220 mm. long covered with long, dense hairs which extend up to 40mm in. behind the flowerheads in an open scattered arrangement.

Flowerhead

Cylindrical 100+mm x 50mm wide, reddish-brown in colour. The flowers have a woolly, velvet appearance and are born terminally on the lateral branches and often have the appearance of growing out of the ground.

Perianths

Densely covered in long, rusty hairs which give a woolly appearance to the flowers. 20 mm long.

Style

Pale, gently curved and barely extending beyond the perianth parts. Stigma minute. Style 22-25mm long.

Fruit

Similar in size to the flowerhead. Retains the spent flowers and the few, large velvet covered follicles protrude beyond them.

Habitat

Slopes and sandplains in open or well drained sites in either sandy or rocky situations that receive full or filtered sunlight.

Distribution

Stirling Range area

Distinguishing Features

1. Prostrate habit.
2. Slightly irregular size of the leaf lobes, leaves tapered at the base.
3. Leaves are flat and not twisted.

Cultivation

Generally unknown in cultivation as it has been not recognized as being a separate species. It would appear to like a well-drained sunny position in either full or filtered sunlight and should be able to reach some moisture. Acid to neutral soils.

Propagation

Seed.

blanchifolia
Banksia ~~sp.~~ 'Lake King' ~~ms.~~ *rubicunda*

George W.A.

Spring

Habit

Dense prostrate plant spreading 3-4 m. under ideal conditions. Vigorous growth, flowering often in the second season.

Leaves

Upright, rigid and deeply divided with a prominent mid-rib to 520 mm. long. The petioles are long 100-120mm with the leaf often twisting. The new growth is characterized with tangled, long, rusty-brown hairs which form a dense velvet-like coating. With maturity this wears from the upper surfaces which become glabrous and deep green ~~wearing~~ later from the under parts. The segments are not arranged opposite each other but are similar in shape, tapering in size at either end of the leaf. These longitudinal veins are evident on the under surface of these lobes which also clearly display reticulate secondary venation.

Flowerheads

Bud

Characterized by long, hairy, rusty-brown bracts which completely enclose and protect the bud at a young stage.

Bract

With maturity the bracts occur for 40mm before the flower in a dense but scattered arrangement.

Flowerhead

Large, cylindrical head, dusty-red to salmon with the yellow stamens contrasting vividly. The heads are borne upright on long terminal shoots which are often buried giving the flower the appearance of growing from the ground. The flowers can reach 200mm x 90mm under cultivation.

Perianths

Long, narrow to 30mm, covered with moderately dense, twisted hairs along the red filaments, which terminate in tufts of long, paler leaves on the anthers.

Style

Gently curved to 40mm long extending 10mm beyond the anthers.

Fruit

Similar size to the flowers with the old floral parts remaining. The follicles are flattish and covered with a mat of hairs, but protrude from the cone enough to be obvious.

Habitat

Found as an undershrub in sandy heathlands, where it has good drainage, full sun or filtered sunlight.

Distribution

Found in south west W.A. in the Lake King area and also near Scadden north of Esperance.

Distinguishing Features

1. Deeply divided 'herring bone' leaves and prostrate habit.
2. Rich salmon - dusky red flower cones.
3. Prostrate habit.

Cultivation

A very hardy plant in cultivation tolerating a wide range of soil types from heavy clay to sands providing they are reasonably drained and acidic to neutral pH. This species will thrive in built up soils if it is able to get to some moisture, but will survive dry periods perhaps making slow growth.

Propagation

Seed.

Banksia ~~sp.~~ gardneri var gardneri

George

W.A.

Spring/Summer

Habit:

Low growing prostrate habit whose strong stems spread lm. The species is not as compact as some of the prostrate banksias.

Leaves

Very variable in size and overall appearance. Each rigid leaf is carried on a long petiole that can become twisted. The leaves are upright and divided up to 3/4 of the way to the midrib, with the segments being a little longer than broad, but all with a distinctive mucronate point. Many of the leaves have the segment margins quite sharply incurved giving a hollowed out appearance. The leaves vary considerably in length from 200 mm - 400mm with 7-17 segments, glabrous above with minute glands covering the under surface.

Flowerheads

Buds

Elongated maturing from the base upwards.

Bracts

Large 20-25mm long, tapered, brown, hair covered, extending 40-50mm behind the flower in a scattered arrangement.

Flowerhead

Oblong, cylindrical 60-160mm long x 45mm wide with a rusty-brown woolly appearance. The flowerheads mature at the base and are dramatically displayed terminally at the ends of the lateral stems which lie on the ground.

Perianths

The floral parts are covered with long, densely tangled, rusty-brown hairs 18 - 20mm. long.

Style

The glabrous, light brown style gently curves and barely exceeds the perianth parts. The stigma is minute.

Fruit

An elongated cylindrical cone, similar in size to the inflorescence. The follicles are covered with a velvet coating of fine hairs and do not protrude much beyond the persistent spent flowers.

Habitat

Deep sand areas and lateritic gravels in association with other heathland species, either in full sun or in the filtered sunlight of taller vegetation.

Distribution

This species occurs on the southern sandplains south of the Stirlings and eastward from Albany to Bremmer Bay.

Distinguishing Features

1. Prostrate habit.
2. Leaf margins can be strongly and regularly incurved giving a hollowed out appearance.

Cultivation

This species is more adaptable to cultivation in a variety of soil types including clays, provided it is given good drainage and neutral to slightly acid soils.

Propagation

Seed.

Banksia littoralis ~~V.~~ V. seminuda George W.A.

Habit

A medium, shapely tree that is most impressive with its deep green foliage and growth habit. From 10-15m tall x 5-6m wide. This tree makes a striking appearance.

Leaves

Narrow elliptical - oblong to broad linear leaves to 150mm long x 10-20 mm wide tapering to a short petiole. The apex of the leaf is truncate and terminates in three fine points. Generally finely serrated margins give way to several tiny serrations in the upper area or ^{they} are entire. The leaf is glabrous above and covered with densely-matted, minute hairs on the under side. Margins are slightly revolute and the midrib is pronounced. The leaves are arranged in whorls of 4 to 6 around the branches, which differs from the true species.

Flowerhead

Buds

Elongated cream to brownish coloured buds.

Bracts

Generally two layers of dark brown bracts subtend each flower.

Flowerheads

Large cylindrical cones 180-200mm long by 60-70 wide are well displayed behind the new growth. The flowers are yellow to yellowish - brown with an occasional red variation to be seen. The spikes mature from the base.

Perianths

Can vary from yellowish-brown to red due to the fine hairs which cover the floral parts. The length of the fine segments vary little from 15-18mm long. The florets are arranged in gently spiralling vertical rows with each pair facing opposite directions.

Style

This too is distinctly hooked with a avoid stigma and is glabrous, but can vary in colour from yellow to a rich red. The style protrudes well beyond the floral parts from 15-25mm.

Fruit

Long, narrow seed cones that are generally devoid of old floral parts. Not all florets are fertilized but those that are develop into narrow, sharp follicles which extend well out from the cone. Occasional follicles open on the tree, but generally they remain unopened and age smooth and dark, the fine felt covering of younger cones is shed.

Habitat

Generally found along river beds and swampy depressions in heavier moist, peaty soils than those associated with the genus.

Distribution

Between the Kalgan and Warren rivers on the south coast of W.A. The red form has been found at Manjimup.

Distinguishing Features

1. Tree habit
2. Whorled leaf arrangement.

Cultivation

It is important that this species be cultivated as the habitat is threatened by cinnamon fungus (*Phytophthora cinnamomi*). Not known in cultivation but should do well in moist, peaty soils that receive some drainage. Soils that are acid to neutral should suit the species.

Propagation

Seed and cuttings.

THE GRAMPIANS BANKSIA INTEGRIFOLIA

"Discovered" at Wilson's Promontory - by Alf Salkin

As many Banksia Study group members will know, the so called Banksia integrifolia which grows on many of the high peaks in the Grampians is a very different plant from the coastal form. In his revision of the genus Alex George will describe this banksia as a new species. The plant has many noticeable differences but the major ones are its flowering time which is towards the end of January early February and its cone. The cone retains seed for at least one year and the seed itself will not germinate unless it has a period of cold.

While looking at herbarium specimen in the National Herbarium of Victoria, I came across a collection from Wilson's Promontory collected by Brian Greer of the National Park Authority. The leaves were large like the Grampians form and the cone though collected in 1968 still had the follicles firmly closed. The location was given, so at an early opportunity after getting a licence to collect, I obtained some material.

Whilst the population is not exactly the same as the Grampians population it is distinctly different from the coastal form that in some places grows close to it. It is fairly wide spread and I have seen it along the Sealers Cove track from just below Ferny Glade right down to the Sealers Cove camping ground.

SWELLINGS IN BANKSIAS - by Alf Salkin

Banksias often have swollen areas and 3 forms of swellings can be found, these may be classified into three categories, axillary, tuberous and subterranean.

Subterranean

These swellings occur in the long thin surface roots which may be as far away from the parent plant as 10 metres. The swellings are nodes which contain dormant buds. These buds are held dormant so long as the parent plant is growing vigorously. Damage such as fire or drought will trigger these nodes and what appear to be seedlings around burnt or damaged plants are in fact root node growths. Species that are known to have drought-fire avoidance systems of this type are Banksia marginata B. integrifolia B. ornata.

Tuberous

Because they are usually covered by leaf litter these swellings known as lignotubers are not very obvious. They occur on some hakeas and grevilleas in the Proteaceae and of course are common on mallee eucalypts, the mallee root is the swollen base to the tree and contains dormant buds. A few West Australian Banksia species have prominent lignotubers and in the east B. spinulosa sm B. collina R.Br. B. asplenifolia, Salisb. B. paludosa, R.Br. B. robur, Cav. and B. dentata, L.f. all have prominent lignotubers. Experiments such as cutting all branches off the lignotuber has shown that this triggers the dormant buds and this occurs within a matter of weeks. Experiments with burning the plants give the same results as cutting off all growth. Once again the swelling has proved to be a storage of nutrients where there are numerous dormant buds.

Axillary

Many banksias also develop what can only be described as swollen joints. These occur where a number of branches come out of a stem. I have noticed these on a number of species B. ericifolia, B. canei, and B. marginata.

Swellings are not obvious on B. serrata because of the very thick bark but I have seen a colony of this species that had been burnt. On the trunk and branches there was fresh sucker growth and this new growth did come from swollen areas. So perhaps once again these swollen areas are collections of dormant buds.

Experimental Techniques Used in Banksia Grafting - by Colin J. Wilson

Following my failure to grow west Australian banksias in my garden and observing healthy local plants of Banksia ericifolia and Banksia spinulosa, I became eager to grow West Australian banksias on east Australian root stocks.

Methods that have been successfully used to graft west Australian banksias to east Australian banksia root stocks are described. Results of the trials carried out at different time of the year using different stock/scion species combinations are given. The behaviour of the different stocks and direction in which further work is proceeding is indicated.

Review of Literature

No published information appeared to be available on the grafting of banksias at the commencement of this project in 1972. In the early stages the approach graft technique as described by Pryor & Willing (1963) was used.

Materials and Methods

Gem razor blades are used for all cutting. 10mm P.V.C. budding tape is used to bind the grafts. It is split lengthwise to give a 5mm width for small diameter grafts. No wax is used. Where possible the graft union is made 4-8cm above the base of the stock plant with firm green stems 2-5mm in diameter. Grafts are held in a cold frame during their first winter or until new scion growth has commenced. No artificial heating is used. Four different grafting techniques have been tried:

1. Approach grafting is carried out using the whip tongue union. Plants are grown near the rim of individual pots to enable plants to be matched according to the diameter and firmness of the stem. Also, being separate, either plant can be raised to enable union at leaf nodes. Cuts 1, 2 and 3 (Fig.1) are made to produce matching tongues which are held together and bound firmly. Six to twelve weeks after joining, the top is cut off the stock plant (cut 4) and the bottom is cut off the scion plant (cut 5). If the scion still appears healthy after another week, the tape is removed.
2. Wedge grafting is carried out carefully so that the closest possible match of cambium tissue is achieved. A vee section is removed from the stock which is continued down into a vertical cut to a depth of about 2 cm. Shoulders are cut on the scion to match the top segment shaped sections of the stock (Fig. 2). These help to achieve a closer match of cambium around the entire stem.
3. Grafted cutting. The wedge grafting technique is used as explained above. The bound stock/scion combination, totalling 15-20 cm in length, is started as a cutting until roots have been found. The scion used may involve 1-3 leaf nodes.
4. Budding is carried out using the T-budding technique.

Discussion

Trials to date have been restricted to times of the year when open air growth conditions and therefore cambial activity, are optimal in Melbourne.

The overall results indicate clearly that West Australian banksias can be grafted to east Australian banksia root-stocks by the techniques.

The approach graft technique used has not proved completely reliable. Failures and successes occurred between the same species combinations, although most of the failures were possibly due to unfavourable weather (e.g. five consecutive days over 33°C in January 1974). No success has been achieved to date in grafting Banksia menziesii. The wedge grafting technique is much more productive and economical, and has proved most successful, particularly with species combinations that have already proved successful in approach grafting.

The results of B. brownii to B. spinulosa grafts may indicate the need for the establishment of compatible clones to achieve more reliable grafting. Wedge grafts were attempted partly below the cotyledon level on the stock in an endeavour to overcome the problem of shoot formation from the lignotuber. However, this resulted in death of the stock within two weeks. The success of the grafted cutting trials should, following development of suitable clones, prove to be adaptable to commercial use. Such clones are currently being established. The success of T-budding may also be of commercial interest.

Banksia ericifolia promises to be a suitable stock for B. nutans, B. laricina and the B. sphaerocarpa group. It may also be suitable for B. brownii, although producing a less vigorous product than other stocks. The tendency to form a large callus at the graft union is not as great as that in Banksia integrifolia and B. spinulosa.

B. integrifolia, marginata and spinulosa all promise to be useful stocks with little tendency to shoot below the union. B. brownii has grafted readily to all three, being more vigorous on marginata.

B. robur appeared suitable as a stock for B. brownii, B. hookerana and B. lemniiana. However, shoots were continually produced from the lignotuber, despite regular removal and the scions slowly dehydrated and died. This problem should not arise if cutting grown plants, of species that develop lignotubers, are used as stocks instead of seedlings. Further trials are being carried out using cutting grown plants as stocks.

GRAFTING BANKSIAS

by Doug McKenzie

Over the last few years I have had many attempts at grafting banksias, to date without much success. Although I have had a number of unions, all have failed after a number of months. Reading the reports of Colin Wilson recently, it seems that many of my attempts were bound to fail due to the poor choice of stock and scion.

My most disappointing failures have been two grafts last year - B. brownii on B. robur, and B. hookerana on B. spinulosa. Good scion growth occurred after grafting in early spring, but I foolishly exposed the grafts to harsh summer conditions which caused the grafted plants to fail due, I imagine, to the inefficiency of the graft in coping with the high transpiration of the soft new scion growth.

This year I have a number of successful grafts still in pots. I intend to have them in pots until autumn when I will then plant out when the plants are older, the grafts more efficient and when weather conditions will not place so much stress on the plant. The grafts which have succeeded to date this year are :

- B. hookerana on B. spinulosa (4 plants out of 3 attempted)
- B. sphaerocarpa on B. ericifolia (2 plants out of 2 attempted)
- B. nutans on B. ericifolia (1 plant out of 1 attempted)
- B. pilostylis on B. spinulosa (1 plant out of 1 attempted)
- B. lemniiana on B. marginata (1 plant out of 1 attempted)
- B. hookerana on B. integrifolia (1 plant out of 1 attempted)

Failures have been :-

B. benthamiana on B. marginata and B. spinulosa (4 attempted)

One approach graft on B. marginata appeared to 'take' with what seemed good callous growth, but wilting occurred a day or so after separation and the scion died.

B. menziesii on B. marginata lasted for several months after separation, but none of the dormant buds on the scion grew and gradually the scion died. B. dryandroides on B. collina. After untying the scion soon began to separate from the stock.

B. praemorsa on B. collina. Wilting occurred one day after separation.
The use of a glass or plastic house in growing difficult banksias.

For the last two years I have grown a number of the difficult banksias very successfully in large pots in a 12" x 9', home made plastic covered 'hot house'. Contrary to expectations I have found no trouble with the plants coping with the higher humidity of an enclosed growing area; indeed by comparison with similar species growing in a similar potting mix in outside conditions, growth is much more rapid and plants are extremely healthy and vigorous. My main aim has been to grow stock plants from which grafting material may be obtained. At present I have a number of plants in 25cm. pots that have grown for up to two years in my hot house. They include such species as B. hooksrami, B. burdetti, B. audax, B. benthamiana, B. menziesii, B. lindleyana, B. laevigata, ssp. fuscolutea, B. brownii, B. coccinea, B. sceptrum and B. attenuata.

No winter heating is used, and the temperature at night in winter is only marginally warmer than outside. Day temperatures in winter can rise to quite warm 20°C and above on sunny days. Watering can of course be controlled. In summer, the plastic is painted with a proprietary white wash. Because the house is set up for native only, my aim is to keep the humidity low. The floor is bricked, the house is not crowded and the vents and doors are kept permanently open in summer.

Quite often when banksias outside look sick I place them in the plastic house for a time and their revival is usually dramatic.

GRAFTING BANKSIAS - by Alf Salkin

Very little work has been done to graft banksias, but it may come as a surprise to banksia enthusiasts that there is one member of the Proteaceae family that has had a great deal of attention paid to it and very successful grafts by the thousand have been made. This is the nut producing Proteaceae Macadamia. Much of this work has been done in California and literature from as far back as 1959 is available mostly produced by the California Macadamia Society.

There is also an Australian Macadamia Society, Volume 2 numbers 1,2,3, of Jan, April and June 1975 contains some very useful information particularly on a process of cincturing : this is a method of keeping actively growing wood, by coating it in wax.

BANKSIAS AT CRANBOURNE. ROYAL BOTANIC GARDEN ANNEXE - by Alf Salkin

While working on my M.Sc. Thesis 'Variation in Banksia in Eastern Australia', I collected and had plants from over 200 different provinces. Practically all of these were planted out at Cranbourne with replicates of from 4 to 8 plants.

The area chosen was where sand had been mined; no watering or fertilizers were used on this bare sand areas. The results have been startling, practically all species have done well and after 3 years have produced considerable growth. Some are now over 2m. Many have flowered profusely and produced seed. The success with the eastern species has encouraged us to experimentally plant the western species and towards the end of April or early May, 1980 we intend to plant out an area with western banksias. If you are interested in this project contact Alf. 232 6213.

NEW BANKSIA NAMES

Kings Park Research Notes - Number 5 of June 1979 is entitled, 'Poorly collected and Presumably Rare Vascular Plants of W. Australia'.

A number of manuscript names are used in it. These are listed below with comments to keep members abreast of the state of the art Banksia borealis. A.S. George M.S. Mt. Peron - Mogumber area.

Banksia cuneata A.S. George M.S. Quairading.
This was originally included in B. ilicifolia but is a shrub rather than a tree and has a pink tinge to the flowers.

Banksia gardneri. A.S. George M.S. Mt. Barker-Borderin.
One of the prostrate banksias with a narrow evenly serrated leaf.

Banksia lanata A.S. George M.S. Eneabba - Winchester.

Banksia leptophylla A.S. George M.S. Walkaway Jurien Bay.

Banksia oreophila A.S. George M.S. Stirling Range.

Banksia rubicunda A.S. George, M.S. Lake King Ravensthorpe.
This has been sold for some time as sp. nova, L. King and has deeply divided leaves. It is one of the prostrate species.

Banksia scabrella A.S. George, M.S., Walkaway.
One of the sphaerocarpa group with large flowers and short narrow leaves.

Banksia telmatiaea Meisn.
Regans Ford - Serpentine. One of the B. sphaerocarpa group.

GROWING BANKSIAS IN CANBERRA

By Graeme O'Neill

I have a new definition of fear : Fear is having about 40 healthy young Western Banksias in one's garden with Canberra's sub-Antarctic winter approaching, bringing frosts which regularly dip below - 5°C and occasionally go as low as - 9°C.

My fascination with the genus began less than two years ago during a working visit to Perth for CSIRO. CSIRO at Floreat Park has natural stands of B.prionotes, B.menziesii, and B.grandis, with very large specimens of B.speciosa and B.media which were planted about 10 years ago.

Of these, only B.menziesii was in flower - a huge tree, gnarled and ugly, decked with extraordinary gold, burgundy and silver flowering heads. In a garden nearby was a small shrubby specimen which I took to be a young tree with the same flowers, but which I now realize was the dwarf Eneabba form of the species.

I obtained seed from the dwarf form and gave most of it away to sundry people who probably managed to kill any seedlings which occurred. I grew two myself, both of which are doing very well.

I then made inquiries about people growing Banksias in Canberra. Excellent specimens of B.baueri and B.prionotes grow and flower against the wall of the Canberra Girls Grammar School, just a stone's throw from the Lodge, so obviously a few of the Western species would survive under Canberra conditions.

I then stumbled across a CSIRO colleague, Henry Nix, who has successfully grown and flowered about 40 Western species, either in large tubs or in the ground. Since that day I have been a fanatic - and my obsession was doubled by a visit to Alf Salkin's garden and the discovery of a kindred spirit with an enormous knowledge of the genus.

By various means, and with help from Alf, I have managed to obtain seed for every species named in Holliday and Watton's field guide, plus a few more that aren't. I now know a little about growing Banksias. Probably very little of what I know is new, but in the certain knowledge that Banksia fanatics will read virtually anything about them, I venture my experiences.

Before talking about my own activities, it might be instructive to look at the success which the National Botanic Gardens has had with the Western species.

In all cases, the plants have gone straight into the soil of Black Mountain, which is of the same heavy clay loam as my own garden.

Phytophthora is an ever-present problem in the Gardens, and has taken many plants. B.grandis was successfully flowered several years ago, but died immediately afterwards. Phytophthora also took one of two adjacent plants of B.occidentalis - the survivor is grafted onto B.robur, which is certainly worthy of note. Perhaps just as interestingly, the plant which succumbed had not flowered on its own roots, while the grafted plant, slightly smaller, is now entering its second flowering.

B.media has flowered prolifically at the entrance to the Gardens, as well as inside. One plant at present has a dozen spikes on it, one of more than 25cm. Nearby, B.lemniana has also flowered successfully, but the plants are straggly and lack vigour.

Limping along elsewhere in the Gardens are B.caleyii, B.attenuata, B.baueri (many have been lost to root rot), and a lone B.coccinea which is now about 2m tall. A healthy specimen of B.speciosa on a B.serrata understock can be found elsewhere, but like all the others mentioned here, has not flowered.

I have taken great interest in a running debate between Jim Webb, head of the Calcium Nutrition Study Group, and researchers in the Gardens, on the merits of calcium nutrition of the Western Banksias.

Jim suggests that a slow-release calcium source such as limestone, crushed mortar, eggshells or seashells, promotes growth in many WA plant species which grow naturally in acid sandy soils overlying limestone. CSIRO studies have also shown that calcium inhibits Phytophthora, and Jim makes a further claim that calcium adds about 20°C to the frost tolerance of many WA Banksias (see the most recent edition of Australian Plants for his findings).

I don't know if Jim is right, but I suspect he is. All of my own WA Banksias have been grown with a calcium source, with the exception of B.caleyi, and also B.occidentalis, which Jim says should be treated as for Eastern species. B.caleyi was my first planting, and has not done very well.

I have used two very different techniques to grow the Western species. The first suggested by Henry Nix, involves growing them in large pots in a soilless mix comprising coarse sand, perlite and peat moss in a 2:2:1 ratio.

The advantage of the soilless mix is that seeds can be raised in it in small pots, then transferred to larger pots without ever being exposed to soil-borne fungi. I place limestone or crushed mortar in the pots, which enhances the already free drainage and provides a calcium source, and which also stops roots curling around and matting in the base of the pot. The mix has a pH of about 5, and proteoid roots are readily formed in it. The plants are fed once a month with half-strength Aquasol, and show no signs of either deficiency or toxicity.

My largest plants are B.baxteri and B.burdettii, both about 1.2m tall, and which I hope will flower in the near future.

All others are spring plantings, but have shown vigorous growth and have increased in size from about 10cm to about 25cm. All of the WA species in the 'Field Guide to Banksias' are thriving in pots, with the exception of B.elegans (unobtainable) and B.ilicifolia (ditto).

Even under these optimum conditions, I have lost two plants to Phytophthora - my only plant of B.ilicifolia, which stringly speaking died after being planted out in soil from a pre-existing condition, and B.pilostylis.

I attach great significance to the fact that these were the only two plants I did not raise myself - B.ilicifolia was given to me, and I bought B.pilostylis from a nursery.

I had previously pulled B.ilicifolia through an attack of Phytophthora, by removing it from the pot and soaking it in a solution of Mancozeb. It recovered, and was making strong growth when the effects of this fungistat finally wore off after planting out.

B.pilostylis first showed symptoms about two weeks before it died, with leaves at the base yellowing and going brown and dry. I thought it was merely nutrient deficiency, but it went under virtually in a single hot day after the disease took hold. Pruning it back and soaking it in fungicide made no difference.

This brings me to a piece of news which all native plant growers, but particularly Proteaceae enthusiasts, may be excited to hear.

The chemical company Ciba-Geigy Australia has recently produced a new compound which actually kills Phytophthora, both through a systemic and a soil-drench action. It should become available soon under the name 'Fongarid'.

I managed to obtain some, and had a chance to test its efficiency with the death of my lone B.ilicifolia. I pulled the dead plant out and immediately replaced it with a seedling B.solandri, then drenched the soil with Fongarid solution. There is no question in my mind that Phytophthora was present and active, due to the symptoms shown by the

plant which died, but two months later B.solandri is healthy and growing actively.

The makers claim Fongarid is fungicidal, unlike previous Phytophthora controls which were merely fungistats, like Dexon. They also claim it is systemic in its action, as well as being an effective soil drench. It is taken up through the leaves in an hour or less and translocated to the root zone, providing an internal source of protection for the plant.

One application in spring followed by another in autumn is all that is needed. I have not lost any susceptible species, in spite of the fact that I have been watering regularly in very hot, dry conditions - optimum conditions for the fungus.

Only time will give a fuller picture of the effectiveness of the new compound, but even if only one of its two modes of action is effective, a major obstacle to the growing of susceptible Proteaceae in eastern Australia will be hurdled. The makers also claim it is the most effective agent available for control of the Pythium fungi which cause seedlings to damp off.

I have already discussed a method of pot culture for Banksias, but I have an extensive range of young Banksias in soil in my garden as well. Some are growing with crushed mortar in the root zone and are flourishing growing as rapidly as their potted counterparts.

I am particularly proud of my B.victoriae, planted as a 15cm seedling in the depths of Canberra's Siberian winter against a north-west wall. With nightly protection from an upturned plastic bucket, it came unscathed through severe frosts and is now about 0.4m tall and growing strongly. It may be significant that it has outdistanced the far earlier planting of B.caleyi, a much hardier species, which has the same position against the north-west wall, the same well-drained soil, but no calcium in the root zone.

I neglected to mention that I have mixed equal volumes of sand with the heavy clay loam in my garden to improve drainage. Like others have found, good drainage is essential for most of the Western species.

Those species growing healthily with crushed mortar in their root zones are:

B.ashbyi, B.pulchella, B.benthamiana, B.laevigata var fuscolutea, B.repens, B.nutans, B.brownii (extremely vigorous), B.prostrata, B.burdettii, B.media, B.attenuata.

Two species which appear to be doing well without calcium (they don't appear to need it because of adaptation to heavier soils) are B.quercifolia var. quercifolia, and B.occidentalis.

More recently I have undertaken a more ambitious program of preparing special lime beds. My chiropractor has waxed fat on the back-breaking effort involved.

The technique is to remove the top 15-20cm of topsoil, break it up and mix it with an equal volume of coarse sand, and then place it aside. Then remove the next 25-30cm of heavy clay subsoil, mix it with an equal volume of sand, and put it aside as well. Then line the base of the cavity created with about 7.5-10cm of crushed limestone, shovel back the sandy subsoil, and finally replace the sandy topsoil. Mix peat moss with the top few centimetres of topsoil to improve water holding capacity and create extra acidity, plant your Banksias, and then mulch to a depth of up to 7.5cm with eucalypt chips to inhibit weeds.

NOTE: Recent experimental evidence suggests tan bark contains a number of compounds which inhibit seedling growth of vegetable species unless the bark is aged. Observations by SCAP people on species growing with and without tanbark mulch suggests the same may apply to natives, hence the suggested use of eucalypt chips as a preferable alternative.

All the seedlings I have placed in my lime beds are quite small, but have made good growth. One larger specimen of B.grandis is flourishing as well.

The following species are growing satisfactorily:

B.prionotes, B.candolleana, B.goodii, B.menziesii dwarf,
B.coccinea, B.lullfitzii, B.sphaerocarpa var sphaerocarpa, B.rubicunda,
(prostrate), B.repens, B.lemanniana, B.dryandroides, B.meisneri,
B.attenuata.

I am also growing all of the eastern species of Banksia, without the meticulous attention detailed above.

My oldest Banksia is the ubiquitous B.ericifolia. I have the usual orange form (ssp.ericifolia) which is flowering for the third year, plus a burgundy and white form and a burgundy and orange form (ssp.ericifolia and microphylla respectively) coming along well, but which have not produced flowers.

I am also growing seedlings of B.ericifolia x spinulosa from Tianjarra Falls near Nerriga, and a B.ericifolia x cunninghamii hybrid from the Blue Mountains (if one accepts the latter as a species).

These hybrids have a flower intermediate between the two parents, and although I have not flowered them, a healthy hybrid can be found at the National Botanic Gardens. The flowers are burgundy, orange and yellow, and quite striking.

From the B.spinulosa group I have several forms of B.spinulosa itself, including a selected form from near Nerriga which has fine leaves and flowers of pink and lemon, looking something like the pink form of B.occidentalis. None have flowered yet, but are growing well.

A form of B.collina with long, pendulous leaves free of serrations and pure yellow, very tall flowers is growing well. I believe this is one of the parents of the B.ericifolia x (spinulosa) cross cultivar 'Giant Candles', which I recently managed to obtain from Rockhampton. This cultivar is reputed to have flowers up to 40cm tall, which lean over at the top because of their size.

Alf Salkin provided me with seed of two forms of a B.species nova which grows at Glen Davis and Mt. Darcy in the Blue Mountains. Proteaceae expert Dr. Lawrie Johnson of the Sydney Herbarium describes it as B.sp.aff.paludosa, and I understand from Alf it may be given the species name B.precipitans in Alex George's forthcoming revision of the genus. It has beautiful pendulous leaves suggesting an ancestry of B.(integrifolia?) x B.robur, but has certainly stabilised as a species and found a niche of its own. I have not seen it in flower, but I am told it has very large golden flowers.

Another new species with very handsome leaves from the B.integrifolia stud which is doing well in the garden is B.integrifolia Grampians form, which will probably be renamed B.saxicola. Everybody who has seen it comments upon its unusual, very broad leaves, and this could be one of its major attractions.

Elsewhere in the garden are various forms of B.marginata which have been selected for flower colour - one is the usual lemon, another is a honey-brown colour, and another from Alf Salkin will have apricot flowers (the latter is from the Blue Mountains).

B.asplenifolia and B.paludosa are also making good growth, as are B.serrata and B.serratifolia - the latter is just getting its first flowers at the time of writing.

B.canei (Cooma form) recently had its stem broken by an errant newspaper deliverer, but was growing strongly, and I have just germinated the first seed of the beautiful mauve and lemon form, which comes from Gippsland.

From slides I have seen, this form ranks with the most beautiful *Banksias*.

Upon completing this article, I am conscious that I am a new *Banksia* grower and have a dreadful cheek telling people how well they are going even before many of them have gone through a Canberra winter. But whatever else happens, I seem by luck to have got most of the conditions right for excellent growth. In spring, I'll write again to tell how they survived (or didn't).

For the first-year plants, I will cover those that I know are likely to succumb, probably with hessian. In the winter of 1981, they're all on their own, and I should have very good information about frost tolerance. It may well be a long winter.

BANKSIA COCCINEA. - by Mr. Justice Peter Murphy

I have a *Banksia coccinea*. It is about 6 years old, 10ft. tall by 3 to 4 ft. wide. New growth this year is exceptionally good, almost worrying, because so many W.A. natives seem to die immediately after putting on spectacular new growth. However it is in great form - stiff, good colour, and upright. It is just finishing flowering. Ten inflorescences this year. Last year about 5 or 6, and the year before, 3. Most satisfying.

The site - The *Banksia* faces north west and on the east grows against a 3'6" high *Melaleuca ericifolia* fence. On the south it is crowded by a *Kunzea baxteri* (which flowers profusely) which protects it somewhat from the prevailing south west winds. The *Kunzea*, planted at the same time, is the same height - possibly higher, though I prune it each year.

The soil - We are on the commencement of the ridge of red soil running through the Peninsula to and beyond Arthur's Seat. We are right on a hilltop - winds sweep us from 360°, and we look out to the sea in Westernport.

The natural soil in which the *Banksia* is planted is red - but I've overlaid the area along the fence with tight white to greyish sand from another part of the property - to a depth of about 9" by 2' width.

It certainly seems to work for many WA species, e.g. *Hakea purpurea*, flowering profusely and seeding, *Hakea multilincata* (similar), *Alyogyne huegelii* (similar) *Dryandra nana*, *D. formosa*, *Hakea gibbosa*, *H. sulcata*, *Banksia sphaerocarpa major*, *Isopogon cuneatus* and *anemonifolia*, even *Banksia goodii*, *B. menziesii* etc.

A few weeks ago I watched a female Mistletoe bird on the *Banksia coccinea* inflorescences, stripping the down from them, oblivious it seemed, of my intrusion by watching. My wife and I had our glasses on it. It did precisely the same last year - it must be almost finished building its nest for this year. There are a lot of them, but more honeyeaters, *Novae Hollandiae*, Eastern Spinebill, Large and Little Wattlebirds, Noisy Miners, White Plumed, White-Eared etc. They love, above all, the *Grevilleas* and the *Callistemons*.

Reprint S.G.A.P. Maroondah Group Newsletter - April 1980.

BANKSIA PLANTINGS AT DEVON MEADOWS. VIC. - by Don Yates

So far on my property I have planted 51 species, and have 3 other species not planted as yet, the planted area covers about 2 acres all of which is undulating grey Cranbourne soil to a great depth, pH about 4.75. The drainage is excellent. As the area is still natural bush with at least so very tall manna gums, the plants get very little direct sun for any length of time, but grow in filtered light. This tends to make the plants grow upwards instead of bushy. When planting a hole is dug and bracken fern roots are removed for an area of a couple of feet to cut down competition for water. It would seem that Banksias can be planted in any month if looked after, but the majority of plantings in my case take place after the first good rains in autumn. Plants are mulched with a layer of coarse gravel and over this is placed a layer of 3/4" bluemetal, the idea of this being to reduce soil temperature in the root zone and allow better water penetration. Watering consists of overnight trickle by hose where possible, but because of the large number of plants to look after some had as little as one watering, and some none at all in the summer of 79. It was discovered from this program on 1 and 2 year old plants that summer watering is beneficial, especially in periods of growth. But that no losses took place in plants that did not receive water although some suffered burning of the lower leaves. Banksia quercifolia for instance was out of reach of a tap and could not receive trickle irrigation, and although attempts were made to water by hand most of this ran off and did not penetrate any depth, with the result that most of the lower leaves started to drop off, however the autumn rains came in time and the plant looked a lot greener, and sent out 3 flower buds at about 18 months. Perhaps this is closer to nature's way.

Most of the plantings so far have been purchased from various nurseries, but currently a scheme is under preparation to grow seeds after studying methods used by other members. Also it was noticed by accident that pot bound plants usually grow much better when planted out than very young plants particularly if they are watered once weekly for the first couple of months. (Depending on the planting time). This is possibly because they have a much better root system which quickly spreads to new ground. To test this theory I have about 20 WA Banksia's in large plastic pots. These were selected as root bound plants in plastic bags, potted up in March, and April and will be planted out possibly about November 1979. The soil mix for these containers consists of 25% ea. red mountain soil, local sand, coarse gravel, Azalea, Rhododendron prepared commercial mix, no fertilizer except any contained in the commercial mix. Watering is kept to minimum, and plants are still growing, although slowly at end of June, no losses have occurred.

The total losses of Banksia's so far have numbered about 6 out of approx. 120 planted out. These have been audax, sceptrum, ashbyi after wet winter, and a couple of Sphaerocarpa after humid weather in November. All of these were yearling plants, so far no 2nd year or later plants have died.

A list of the faster growing plants is included:

<u>Banksia</u>	<u>Age</u>	<u>Height</u>	<u>Comments</u>
<u>asplenifolia</u>	21mths	5'	½ Sun watering
<u>attenuata</u>	15mths	3'	Bushy, 2 flower heads possibly dwarf variety
<u>baueri</u>	20mths	4'6"	Healthy, no watering
<u>baxteri</u>	20mths	5'	Healthy, little watering
<u>burdetti</u>	20mths	4'6"	Bushy, growing beautifully no watering.
<u>canei</u>	18mths	4'6"	Grew 4' first year with watering, little growth, 2nd year with no watering, badly affected by dry summer
<u>coccinea</u>	14mths	4'	Occasional Watering, growing well.

<u>BANKSIA</u>	<u>AGE</u>	<u>HEIGHT</u>	<u>COMMENTS</u>
ericifolia	20mths	3'	Would do better with more watering 3/4 sun position.
goodii (2)	14mths 2mths		Leaves burnt by drying out Much better specimen planted April 79 settling in well
grandis	6yrs	10'	No flowers yet but growing well 3/4 sun, no watering
laricina	16mths	18"	Growing well, very bushy.
lullfitzii	2mths	15"	Obtained very bushy vigorous Plant settling in well.
occidentalis (2)	21mths 16mths	4' 3'	Both plants would do better if given more water.
ornata	16mths	15"	Planted April 78 in High dry position, but suffered burning of leaves in summer, recovering.
paludosa	20mths	2'	Growth moderate, needs watering.
praemorsa	18mths	3'	Vigorous growth, bushy, some lime added, no watering
prionotes	15mths	18"	Slow steady progress, no watering
serrata (5)	6 yrs	10-11'	Growing well, no flowers yet.
serratafolia	15mths	6'	Vigorous growth with watering
solandri	15mths	18"	Plant growing well
speciosa	20mths	4'	Growing well, little watering
spinulosa	6Yrs	7'	1 Flower 4th yr. 5 flowers 5th Yr. No flowers 6th Yr. Poss. too dry.

BANKSIA GROWING AT WARTOOK (GRAMPIANS) - by Royce Raleigh

We don't have many growing well as the soil here is shallow over clay but ones that have flowered are B.ericifolia, B.integrifolia, B.caleyi and speciosa with species L. King with 3 buds on this year. Others doing well are B.laricina, meisneri, pulchella, occidentalis, serrata, serratifolia, dryandroides, petio.laris, marginata, lemanniana, solandri, repens and robur.

We haven't tried many others but this spring have potted up many grandis, coccinea, benthamiana, elderana and a few others to plant on the sand areas.

We planted most of the banksias' seed this year - April, May and had excellent germination success. We also planted a number of B.grandis and others at this time and they have grown well so that we now have potted up and growing well a couple of hundred banksias of various species. All of these we will plant ourselves in the next month or so. Seed was planted in sandy soil - mostly sand and they were potted on into the local sandy soil.

SEED AND CUTTINGS - John Topp. Cranbourne Vic.

The soil mix used for growing banksia seed has been 2 parts sand, 1½ peat moss, 3 parts sandy loam and 2 parts mountain soil. We also add some Dexon fungicide and water in some Terrazole every 2-3 weeks. Although there has been very good germination it is felt that a lighter mix should be used in future.

The heath-leaved Banksia species strike readily from cuttings so that it is felt that all will be grown this way as soon as stock plants are well established.

The heath-leaved species are B.nutans, meisneri, laricina, sphaerocarpa, violacea, pulchella.

THE PRECIPICE BANKSIA - Phillip Manly, Brisbane

Location

Several peaks in South Eastern Queensland from the Glasshouse Mountains to the border and into N.S.W.

Appearance

Large shrub to a small tree. The leaves are entire like B.integrifolia. A theory existed that it was a B.robur x integrifolia hybrid, but B.robur does not grow in the vicinity.

Flowers

Occur April - August and are more orange in colour than the normal B.integrifolia (yellow/cream). Flowers are of considerable length 25cm x 7-8cm. diameter.

Fruit

The fruiting cones retain some spent flowers and the follicles do not open to release ripened seed as does B.integrifolia.

General

It is believed that this species was first noticed in 1962 but only few have found their way into cultivation, the species comes true from seed.

BANKSIAS IN TOOWOOMBA. Phillip Manly

Toowoomba in south east Qld. has several excellent specimens of W.A. banksias.

B.speciosa 3.5m high has flowered many times. B.lemanniana 3 x 3m in full flower, a beautiful specimen, this too has flowered many times.

Climatic conditions are a little different here as the altitude is 700 m. which lowers the summer humidity and temperature. Rainfall average is ... and the soils are generally deep moist.

THE BANKSIA REVISION

Six years ago we understood the revision would be published within a year but this has not occurred due to the need for further research and other projects that have taken precedence. It is now believed that this revision will take place concurrently with a superb series of 3 books the first of which is expected to be published in 1981 of the paintings of Mrs. Celia Rosser with the accompanying text by A. George. The paintings are of incredible quality, detail and of actual size and are sponsored by Monash University (Vic.) where Mrs. Rosser is the botanical artist. All paintings will be published in the chronological order of discovery together with historical notes and it is believed the new species will be described and treated accordingly. The volumes will be of limited edition and the first is expected to cost at least \$1000, with the subsequent volumes to follow as the paintings are completed. This project will take something like 10 years to complete.

1500

WILL YOU WATER YOUR BANKSIAS?

by Keith Alcock.

Obviously the best advice that you can get on growing western banksias is to buy a block of land where the soil is deep and well drained, preferably sandy with a climate that suits. As most Australians live in the eastern coastal fringe where the climate patently does not suit and most are not lucky enough to have a sandy soil you might well ask what's the next best advise. On our experiences it is, in fact, the most widely offered; don't water in summer. We have only had our garden four years and it has really only been established for the last two. The contrast between the summer just gone, which was one of Melbourne's driest ever, and of the previous summer which was quite wet has shown us the truth of the warning - water at your peril!

We live at Montrose on a sloping block with a northerly aspect on 20 cm. of heavy soil over another 20 cm. of grey clay thence into Mt. Dandenong granite. We grow eastern banksias well on this, a variety of B. spinulosa, B. ericifolia forms and B. marginata, which is a local species. Western species have not done well in the straight soil, B. caleyi, B. praemorsa have died and B. lemmaniana struggles on, though to be fair they are not in the best spots. Most of our efforts with the westerners have been with raised beds with imported sand and sandy loam. These have varied in depth from 20 cm. to two metres and of washed river sand and black Cranbourne loam. I would not recommend any in particular for they grew banksias equally well until the fateful 1978/79 summer. To illustrate; we had six flowers on a 2 metre B. victoriae which just had to be the best looking plant you would ever hope to see and that in 20 cm. of sandy loam over the local clay. B. quercifolia var. integrifolia was 3 x 3 metres and covered in flower heads and two B. hookerana, B. elderana, B. media, B. solandri, B. sceptrum and B. candolleana were smaller but just as beautiful. The reason for their thriving may have been that we were watering the sand beds about a fortnight over November and December telling ourselves they needed it. Well within a month over a hot January they were all dead as mutton, along with many other treasures of other genus; eighty five in all. Just about all of our banksias in sand that were over a year old died, the exceptions were B. laevigata ssp fuscolutea two metres away from the B. victoriae, B. sphaerocarpa and numerous B. repens form which seem much tougher than the rest. I believe the reason is more physiological than pathogenic. While there are numerous fungal species that will rot roots, under moist conditions Phytophthora cinnamomi for instance, is much more active in spring and autumn than in a hot summer or cold winter. The root systems of our dead plants were depleted and sometimes rotten, but I attribute this to either a physiological reaction by the plant or secondary rotting. It may even be simpler. If roots are mainly produced in winter then extensive top growth in summer will overbalance the plant which cannot compensate and dies when heat stressed. Whether this is true or not, I feel the main thing is that banksias should not be actively growing in summer so it is best if they start to dry off in late spring then go into summer growing very slowly if at all.

This year we haven't watered and although we have lost about twenty plants because of extreme dryness, there has been none of the trauma of a plant in its glory dying, but rather a plant petering out after a long struggle. Best of all only one banksia went, a B. meis neri in deep sand. In retrospect, last summer was probably ideal - a wet spring followed by dryness from November all through summer. We may not be lucky again, but at last we've learnt our lesson.

We now have B. benthamiana, B. violacea and B. dryandroides flowering well and the following growing freely; two more B. benthamiana, 2 B. rubicunda, B. caleyi, B. gardneri, 2 B. goodii the B. laevigata ssp fuscolutea, 2 B. lullfitzii, B. meis neri, B. nutans, B. petiolaris, 2 pulchella, 4 B. repens and B. sphaerocarpa. I would still not like to comment on the best depth or type of sand. We use no mulch on the sand beds and give no fertilizer or other special treatment. I am beginning to think that as long as the crown is well

drained and you are not stupid enough to water a mature plant in summer, it doesn't matter that much. The best plants are the B. laevigata, and B. sphaerocarpa, both of which unfortunately seem shy of flowering and B. dryandroides, which flowers well but you can't see them. Best of all is B. rubicunda which has gone from a seedling with about seven leaves to a plant two metres across with 20 flower beds in two and a half years. It is a top a metre high bank of hard, baked, imported, red mountain loam in full sun. In its position I can't see how it gets any moisture to speak of, but I guess that's the message - they don't need much.

ESTABLISHING TERMINAL FLOWERING BANKSIAS ON OLD DUNE SYSTEMS

For almost 2 decades a native plant enthusiast has been involved in establishing and watching the performance of the genus in south east S.A. In recent years he has been involved in planting 20 acres of terminal flowering species for the cut flower trade in a wide range of soil types.

Banksias seem happy with a drip irrigation system which is used to ensure the survival of plants in very loose dry sands during the first 2-3 years. It is proving beneficial as flowers have been able to be cut in the second season. Overhead watering in the area is not recommended.

Where calcium carbonate is present over 300 p.p.m. it leaves a film of white carbonate on the leaves. In areas where this is not present spraying can be successful particularly where the soil texture differs and the moisture holding ability of the soil is higher.

Further advantages of the drip system at this stage are that the blooms are well developed and there is a greater potential of flower production over the same period.

Banksias such as speciosa, prionotes, coccinea, baxteri, and hookerana have their terminal growth cut off at approximately 60cm. to promote lower level branching. (Who wants to pick flowers from a step ladder!). Of course once flower production commences this is a pruning process in itself.

Watering of the young plants takes place once a week during extreme heatwaves, preferably in the evenings when the ground cools down with 12-15 waterings per season. Watering is given only when it is thought the plants need it and losses would undoubtedly have occurred if neglected.

Banksias in the lower south east of SA do need natural to acid soil types with good drainage, although some varieties will tolerate mild amounts of lime. Naturally B. marginata will tolerate p.H. conditions between 5.0 - 9.5 with ease. It also tolerates dry and wet situations which must make it one of the hardiest of all Banksias.

Australian Native Plants are

Unfortunately Wrigley and Fagg in their misleading and fail to outline some vital facts on the growing of the genus in south east S.A. by failing to mention that the district has many old stranded sand dunes that were deposited as a result of fluctuating sea levels in the geological past. These inland dunes are ideal for Banksias; the soil being well-drained, acidic and are in some instances 2-5m. above the limestone which it is agreed underlies the whole district. The roots of these Banksia plants would be living most of their lives away from limestone. Any attempt to grow Banksias, particularly the spectacular W.A. varieties, where limestone is near the surface has proved fatal. The leaves become yellow and drop off!

Banksia prionotes is one of the few terminal flowering Banksias which will tolerate lime. Good specimens can be found in S.A. where pH is up to 8.0. Good drainage is essential otherwise the roots will rot and the plants die - this is a primary cause of death. It is considered misleading to attribute Banksia failures to a lack of lime fertilizers of any type should be avoided when growing them on poor south-eastern S.A. sands.

For those wishing to grow the spectacular W.A. banksias they should avoid soils where limestone is present close to the surface.

OBSERVATIONS ON THE CULTIVATION AND PROPAGATION
OF BANKSIAS IN GEELONG AND DISTRICT

by Tony Cavanagh and Doug McKenzie

The following Banksias have been grown to flowering stage in the Geelong area.

Banksia ashbyi, asplenifolia, baueri, baxteri, rubicunda, brownii, caleyi, canei, coccinea, collina, dryandroides, ericifolia, grandis integrifolia, lemmaniana, lindleyana, marginata, media, meis neni, nutans, occidentalis, ornata, paludosa, petiolaris, pilostylis, praemorsa, prionotes, prostrata, quercifolia and quericifolia var integrifolia, repens, robur, serrata, solandri, speciosa, sphaerocarpa, spinulosa, verticillata, victoriae, and violacea.

Of the remaining species, the only one not under cultivation is B.elegans. However, we have found that unless conditions are close to ideal, some species are nearly impossible to grow to flowering stage. These include many of the W.A. sandplain species - Rashbyi, B.benthamiana, B.burdetti, B.hookerana, B.sceptum, and B.victoriae, though specimens of all of these are being planted in the favourable soil conditions of Pt. Lonsdale.

We have grown Banksias with varying degrees of success for about eight years and some of our observations may be of interest to others. Unfortunately, in many cases too few specimens have been available to reach any scientifically valid conclusions and we are still puzzled about the general difficulties we continually meet with some species. We believe, however that soil type and fertility are probably the most important factors governing the successful growing of the "difficult" Western Australian species in eastern Australian and in southern Victoria in particular. Climatic conditions appear to be less important while in our experience, the much mooted "need" of many W.A. species for lime is by no means proved.

We will discuss our observations under the headings of Cultivation and Propagation.

Cultivation.

The soil and soil type appear to be critical for successful growing of the more difficult species. Our soils are very variable - some areas such as Pt. Lonsdale and Drysdale have "ideal" Banksia soil i.e. deep, infertile sand, while most other parts including our own area of Ocean Grove have clay and sandy loams of varying thicknesses over clay or limestone. The limestone belt is particularly noticeable in the suburbs of Belmont and Highton and also the farming area of Waurin Ponds. On three gardens in these areas Banksias have been grown for a number of years but under different conditions and with varying success. At Ted Erreys in Belmont, the soil is loam with small pieces of limestone throughout it - the solid limestone is from 0.5m to 2m down. Some of his plants are more than 10 years old, and only B.speciosa is showing signs of chlorosis. The others which flower well each year include B.baxteri, B.occidentalis, B.baueri and the eastern species B.marginata and B.ericifolia. B.nutans and B.lindleyana flowered for a number of years but died out in a very dry summer. Four hundred metres away at Peter McNeil's the limestone is much closer to the surface and the garden is more shaded. The only banksias doing well are B.praemorsa, B.spinulosa, and B.marginata - Peter has attempted 10 other species none of which lived more than 2 years. Keith Haggoods garden is roughly 1000 and 600m respectively distant from these two and is well drained, being established in what was an old sand quarry. Banksias are thriving under these conditions, B.praemorsa, B.pilostylis and B.prionotes flowering well in their 3rd year and looking remarkably healthy.

The importance of sand and its accompanying good texture and drainage and the lack of hostile pathogens such as *Phytophthora cinnamomi* are well typified by the almost complete success of any banksia planting at Pt. Lonsdale. The area is almost bottomless sand and generally well sheltered because of extensive tea-tree thickets - this may tend to produce a more favourable micro-climate. In any case, even in shade, both eastern and western banksias grow and flower well. The old garden of Gordon Clarke is now largely overgrown and shaded but every year the following banksias flower in spite of the shade: - *B. brownii*, *B. baxteri*, *B. lemmaniana*, *speciosa*, *caleyi*, *prionotes*, *occidentalis* and *victoriae* - most plants are 2-4 metres high and generally 5-10 years old. Several other gardens here also have magnificent individual specimens of banksias and chlorosis and other problems very rarely seem to be worry. On a nature strip is the largest *B. ericifolia* in captivity that I know of - at least 4m. high x 4m across and absolutely dense to the ground. It has many hundreds of flower spikes each year.

By contrast, in Ocean Grove which is only 10km away a lot of the soil is shallow and a moderately heavy clay/sandy loam over ironstone clay. It tends to water log in winter and dry out hard in summer. To grow the more difficult species, we have made use of slightly raised beds, using scoria or in some cases clay excavations or mounds of natural soil. Our observations of growing under these conditions are limited to plants less than 3 years old, but so far the success rate, at least for most eastern and the hardier WA species has been good. The acid test will come when the root systems of the plants begin to penetrate the clay sub soil, which in some cases is about 60cm below the surface. The combination of raised beds and consequent good rainage coupled with full sun has ensured rapid growth and relatively early flowering - *B. praemorsa* flowered in 2½ years at about 1m. height, *B. rubicunda* after less than 18 months in the garden. Two differences between our gardens are worth commenting on. Doug uses much deeper scoria layers, up to 30cms, and waters less frequently in summer. The lack of summer watering means his plants are somewhat smaller and are slower to flower. We have both plant a number of species in the normal soil, in full sun and semi-shade. Most eastern banksias are doing well though some are quite slow growing. The western species that have been tried - *B. caleyi*, *praemorsa*, *baueri*, *baxteri*, *speciosa*, *grandis* - have survived a wet and a dry winter so far and several are flowering. In Bill and Doris Gunn's garden, extensive shade from overhead eucalypts has restricted the number of successful species growing. *B. media* flowered well for several years but died in a dry summer - *B. lemmaniana* has not yet flowered after 6 years. *B. occidentalis* in a more sunny location flowers well.

General Observations on the Inter relationship between soil type Shade and climate

It is difficult to make more than a very general statement about the needs of banksias grown in the area. There is little doubt that raised beds assist the growth of many of the difficult species; however, most western sand plain species seemingly require deep sand to grow well in our area and have only been reasonably successful in Pt. Lonsdale. I do not know of any species that will not grow and flower well in sand; moreover, even in shade, the plants will flower whereas in the heavier soil of our area, plants grown in shade are very slow to flower or usually do not flower at all. Some species when grown in raised beds in full sun will flower at an early age and I believe that in the heavier soils, because of the bleakness of our winter, banksias will grow much better in an open position. The need of W.A. banksias for limestone or alkaline conditions is not established - in fact quite the opposite occurs in areas of solid limestone where a lot of species are difficult to establish. Our soil and beds are nearly neutral and with few exceptions we have encountered no problems in establishing plants.

Notes on Some Species

Hardy banksias - western. Undoubtedly *B. caleyi* and *B. praemorsa* are the hardiest species in our area, *B. praemorsa* being able to tolerate

wind and exposure without any protection at all and B. caleyi withstanding intermittent water-logging. Both B. baxteri and B. baueri are less reasonably hardy and have flowered well under a range of soil conditions. The prostrate species, B. petiolaris and B. rubicunda - are relatively rapid growers and early flowerers, while B. prostrata and B. repens tend to be relatively slow growing. Plants that require summer moisture but are otherwise hardy include B. occidentalis and B. grandis, B. verticillata also falls into this group. B. dryandroides and B. lemanna are less adaptable to our heavy soils but do well if drainage is good. B. quercifolia and B. speciosa are also relatively fussy about their requirements while B. media appears to be unhappy without good drainage in an open site.

Eastern Species.

In general, these prove much easier to grow and almost no troubles are experienced with B. collina/spinulosa, B. ericifolia, B. robur, B. integrifolia and B. marginata. B. canei is usually slow growing but in well drained soils causes few problems. Some Queensland forms of B. asp. lenifolia are adversely affected by our cold winters and make only slow progress especially in heavy soils. B. paludosa is very variable, with some forms again being very slow. However, there is one plant, now nearly 6 years old, in semi-shade and on sandy loam which is about 1m x 1m and has flowered and set seed for at least 3 years. B. ta does well in raised beds in a warm position, but cannot handle our heavy soils.

Problem Plants:

Except under special conditions, we have not been able to grow the following species: B. ashbyi, B. benthamiana, brownii, burdettii, hookerana menziesii, prionotes, solandri, victoriae; B. nutans has usually proved difficult. The problem time is usually winter, if the plants are small as most of them seem to have to struggle to survive and the changeable weather of spring for larger plants - hot and cold days alternating. The eastern and northern Australian species B. dentata always seems to suffer a severe check in winter but so far has survived two winters - I doubt whether it will flower, however.

Propagation:

Most of our propagation has been from seed, which is sown in early spring (August - September) or early autumn (March) though seed has been successfully germinated right through winter in a glasshouse. There appears to be no dormancy problem with banksia seed and while some such as B. canei and the Grampians marginata and integrifolia may require stratification, all others will germinate without pretreatment if the seed is viable - in fact, we believe, failure to germinate is a sure sign of lack of viability. The usual time required is 4-6 weeks and some species such as B. baxteri, praenorsa and solandri seem to be relatively slow and may require up to 8 weeks. Some species may have a natural low viability e.g. B. ilicifolia, pulchella, sometimes candolleana as we have frequently had poor strikes out of a number of batches of seed. We tend to avoid the warm months of December to February though some eastern species and northern sand plain species from W.A. will germinate satisfactorily then. We use a very sandy mix (90-95% sand balance peat moss) and damping off is rarely a problem as all plants are raised completely in the open.

Extracting seed is very difficult with some species and a method which has proved effective is as follows:

Heat the seed preferably over an open fire till the capsules begin to open and then plunge in cold water. Allow to soak for 24 hours or so then place in a warm spot say near a gas or oil heater or open fire. The seeds will often extract themselves. Much the same effect is achieved by leaving damped cones in the sun but the wind may blow seeds away.

We have had only moderate success with cuttings, B.ericifolia can be surprisingly difficult as can B.spinulosa - success has been had with cuttings taken in May. B.occidentalis is reasonably easy and B.meisneri but few others have been attempted.

NOTES ON BANKSIAS IN HEATHMONT. VIC. - from Paul Kennedy

My garden is in Heathmont a suburb 26 km. east of Melbourne, close to the Dandenong Ranges. The summers range from mild to warm with occasional thunderstorms. The winters are generally wet and cold with an approximate 1000mm. rainfall. The soil structure consists of 20cm. grey clay loam over a friable clay sub-soil that changes to heavy yellow clay and finally to mudstone at about 1m. deep. Every 1.3m down one 15mm thick sandy layers which contain moisture throughout the year. Drainage is excellent as the land has a 1 in 8 slope to the east. Frosts present little problem due to the air movement created by the hill.

After visiting W.A. in 1974 I became an enthusiastic native plant grower and prepared two special areas for W.A. banksias with eastern species being planted at random through the garden. A soil mix of 3 parts coarse river sand and 1 part mountain soil was added to the local clay loam and the bed was built up from 30cm to 1m. The slope was maintained with sleepers arranged in a bench formation at the lower end.

A northerly bed, under the eaves was prepared with local clay with an agricultural drain laid 50cm. deep to take excess water from neighbour's run-off.

I set out with the following aims in mind:-

- a) To provide porous, well-drained soils;
- b) To provide warm conditions and protection from cold southerlies;
- c) To allow the banksias to grow amongst other plants;
- d) To develop a ground cover of plants or screenings to ensure a cool root system during summer.
- e) To ensure the plants would be independent of watering after the initial planting regardless of heat and drought.
- f) To carry out plantings after autumn rains.

Groundcovers were grown over the first bed (Hibbertia empetrifolia, Grev. tridentifera, Kennedia macrophylla). Blue metal screenings replaced the rampant Kennedias, root system whilst K.rubicunda was trained to occur the basic area from some distance away. With the gaps closed the bed supports isopogons, banksias, rarer melaleucas, small eucalypts and hakeas.

Area 1

The following are healthy and growing well : - B.caleyi, B.dryandroides*, B.lemanniana, B.media*, B.praemorsa*, B.prostrata. Several other species have been planted but are less than a year old.

Area 2

B.prionotes* is one of the best specimens I have. B.sphaerocarpa, B.pilostylis, B.baueri are slower to establish.

* indicates the species has flowered.

A number of other species have grown and flowered well in local soil in other parts of the garden. They are:-

B.asplenifolia, ericifolia, robur, occidentalis, spinulosa. B.serrata is 5m. tall after 3 years with no flowers.

Ten years ago B.grandis was planted and it survived for 7 years to reach 2m. in semi shade with no groundcover.

Two interesting successes in my garden have been B.speciosa and B.hookerana. The latter is 11 years old, fence high and has flowered for the past 7 years with the roots shaded and covered by a creeper. B.speciosa is only 2 years old, 1.5m high and with 4 flowers. It is growing in a cavity filled with coarse river sand and mountain soil with clay on three sides and a drainage hole at the base. It remains to be seen whether this species will continue to be successful.

BANKSIAS - SOME BAFFLING RESULTS

Eric Anderson

Reprint from Mackay (Qld) Branch S.G.A.P. May, Newsletter.

Banksias were named after Sir Joseph Banks who accompanied Capt. Cook on his first voyage to Australia in 1770. They are unique natives, being found only in Australia (except for B. dentata which extends to New Guinea). They are all woody plants, varying in size from small shrubs to large trees, and having flowers and fruits unlike anything from other parts of the world.

The majority of banksias (46 of the 58 species) are found in Western Australia. It is in that State the most extraordinary examples can be seen with colours ranging from grey, green or orange, to pink, scarlet, red-brown and even purple. In Queensland species, the flowers are usually pale yellow, greenish-yellow or orange-yellow.

The survey of Mackay gardens in mid-1979 recorded 56 banksia plants belonging to 7 species. All these species come from Eastern Australia and except for B.ericifolia are commonly found in Queensland. The plants recorded in the survey were -

	<u>No. Recorded</u>	<u>% Dead</u>	<u>Oldest Plant (Yr)</u>
<u>B.asplenifolia</u>	1	0	3
<u>B.collina</u>	10	40	10
<u>B.ericifolia</u>	15	47	3
<u>B.integrifolia</u>	15	20	12
<u>B.qblongifolia</u>	7	43	14
<u>B.robur</u>	6	17	8
<u>B.spinulosa</u>	2	0	2

The average "deaths" for the whole group was 32%. This highlights two possibilities - either it is true that banksias are difficult to grow in cultivation, or they are unsuited to Mackay. It is likely that both possibilities occur although the first alternative is under most suspicion.

Three of the species (collina, integrifolia and robur) have plants which have reached a reasonable age (8-12 yrs).

Lack of aged plants in the other species is more a function of recent plantings than any other reason. The average age that the three most commonly planted species died was - B.collina and B.ericifolia 1 year, and B.integrifolia 1½ years. This indicates early establishment difficulties. In most cases the cause of death was "unknown", although wet conditions following heavy rainfall was at times implicated, particularly with B.ericifolia.

To assess the influence of soil type and drainage on the survival of the banksias, all the species were lumped together, as individually the numbers were too few.

Soil Type

As done previously (see Newsletter No.2) the soil types were placed into four groups. The following indicates the distribution of the soil groups and the percentage of plants which died in each group.

<u>Soil Type</u>	<u>Distribution (%)</u>	<u>Deaths (%)</u>
Sand	34	21
Sandy Loam	16	44
Sandy Clay Loam	39	27
Clay	11	67

An interpretation of the results is difficult. As might be expected the least deaths occurred on the light (sandy) soils and the most deaths on the heavy (clay) soils. However this trend is reversed on the two intermediate soil types. More recordings are definitely required to confidently isolate soil type influences.

Drainage

Shown below is the distribution of the three drainage categories and the percentage "deaths" that occurred at each of them.

<u>Drainage</u>	<u>Distribution (%)</u>	<u>Deaths (%)</u>
Good	63	31
Fair	32	33
Poor	5	33

The results indicate that drainage has had no effect on the survival (or deaths) of the banksias - or put another way, survival has not been very good regardless of drainage. This result is unexpected and slightly baffling. Some good authorities (*=see reference) indicate that for banksias, "good drainage is of prime importance and very often more important than soil type". Some of the difference could be due to using insufficient data (plant numbers), but other factors could be important such as (a) at least one of the species (B. robur) is known to come from relatively poorly drained areas, and (b) some species have some adaptation to a range of soil conditions (e.g., B.integrifolia and B.oblongifolia).

More importantly, we don't know how the plants were treated (e.g., mulched, fertilized, (over-) watered). This background information could be important and may well be what is baffling our simple analysis of seeing how they survive on different soils and different drainage conditions.

Growth

When assessed for growth the ratings were, Good - 30%, Fair - 36% and Poor - 34%. Not a very encouraging result when compared to Acacias which had a "good" rating of 65% (see Newsletter No. 2). For most of the individual species there were too few plants to take much notice of their growth ratings but for comparison it might be of interest to record that the "good" rating for B.integrifolia was 40% and for B.ericifolia it was 20%.

A reasonable consistent pattern of growth on the soil types emerged. The highest "good" growth rating (47%) occurred on the sands and the lowest (17%) occurred on the clays. However the results for growth in the drainage categories was again "baffling".

General

The survey indicated that banksias could not be reasonably recommended at this stage for general garden plantings. Their survival appears unreliable and their growth fairly poor. However once your garden is established with a range of reliable plants and you want to try something interesting and different, then put banksias very high on your list. Don't give them too much attention; such as applying artificial (particularly superphosphate) fertilizers, constant watering and digging around the base of the plants.

All species recorded in the survey could be tried. B.integrifolia occurs locally and is probably one of the most reliable to grow. Species not recorded in the survey that could also be tried include B.aémula (= B.serratifolia) and B.dentata.

One of the most recent of Banksia species to be described is Banksia canei this is despite the fact that it was collected as early as 1853. This collection was made by Ferdinand Mueller from the large colony near what is now Anglers Rest. It was not however until 1962 that Bill Cane drew the attention of Jim Willis to a banksia growing in the Wellington River at the foot of the Bennison Spur. The plant had deeply serrated leaves a thick squat core in which no perianth parts were retained and a velvety tomentum on the young follicles. Its most attractive feature however was a blue grey tomentum on the limb, the bulbous end to the closed petals. This gave the plant in bud a velvety blue grey appearance.

Once it was decided that this was a new species and not as had been previously thought a mountain variety of Banksia marginata, Jim Willis who was then the Assistant Government Botanist had to decide where the type specimen should be collected from. He chose the middle of the plants geographical range at a place near Wulgulmerang north of Buchan in East Gippsland.

In a study of all the eastern banksia species I had occasion to examine all the material of Banksia canei in the National Herbarium of Victoria. One of the most striking things was the variation between the Anglers Rest specimen and the Wulgulmerang specimen with the collection from the Wellington River. The adult leaves of the type material and the early collection of Mueller were identical being entire with a short mucro at the tip, but the Wellington River form always had serrated leaves.

One other collection was in the National Herbarium that did not agree with the type specimen and this was a form from Kyara Peak on the Kybean Range which is between Coma and Nimitabell in N.S.W. Seed collected from all these form indeed proved to be distinctly variable and a paper on the findings of this study was published in the Australian Journal of Botany. (1978:26 pp. 707-21). The variation is illustrated here on a dendrogram made of leaf prints with photographs of cone sizes. This shows the variation to stem from an original stock which presumably was common throughout the alpine areas.

Isolation of the colonies by the cutting down of the major river systems has led to what is known as genetic drift. This is a modification of Darwin's Theory where chance rather than the rigours of the environment favours are form over another. Four variations are shown in the dendrogram. The fourth being a collection from the Snowy Mountains. Information of this form came from Walter Folkman one of the members of the Banksia Study Group who gave me the location at the Greg Greg Track near Corryong. A further location came to hand in 1979 when I visited George Althofer. The form on Jounama creek near Talbingo N.S.W. proved to be similar in every way to the form from Corryong. Presumably there are other colonies within the Snowy Mts.

The Wellington River Form. The most noticeable characteristics of this form are the retention of serrated leaves and the blue grey limb on the flower. The plant is very common west of the Wonangatta Mitchell river system. The most noticeable location are :- Foot of the Bennison Spur 48 miles from Heyfield; Black soil Plains on the Wellington River, Maroka Gorge, Mt. McKinty, Crooked River, Barkly River. Mt. Margaret. Lazarini Spur.

The Wulgulmerang Form.

This form has an entire adult leaf the flower has a yellow brown limb and but for the cone could be mistaken for B. marginata. It is very common along the Omeo Highway from about 4 miles south of Anglers Rest to a few miles north of it. It occurs among granite rocks in a woodland of wandlebarks, Eucalyptus rubida. The other major colonies are in the vicinity of Wulgulmerang with the type area on the Mt. Seldom Seen Track and another area where the road goes down into the Snowy Gorge, other colonies occur on the Nuniyong Plateau at Brumby Point, near Benambra, and at Limestone Creek.

The Kybean Range Form.

The juvenile leaves of this form are much broader than any other form and may be mistaken for B. integrifolia. The adult leaves are very short. This form can have very large flowers and consequently very large seed cones. The form probably occurs all along the top of the Kybean Range from Kyara Peak to as far north as Tuross Falls. As far as is known the colony is contiguous unlike the others which are pockets with up to 50km between colonies.

The Snowy Mts. Form.

The most noticeable feature of this form is its very long juvenile leaves and its noticeably longer entire adult leaves. This form like the Wellington River form has the attractive blue limb but is not as compact a shrub being larger and more open in habit. The only two locations at present known are at Talbingo and Corryong which are 60km apart. Both occur at the fairly low altitude of 700m.

In the course of studying Banksia canei I have germinated literally thousands of seedlings. Most of these have come true to type, however four seedlings have germinated that have been widely different from any known Banksia sp. Great care is taken with recording seed and cone batches. The four seedlings came from two different cones and the cones came from different locations. One from the Wellington River the other from Wulgulmerang. That is the parent plants were two different forms. The leaf is shown in the dendrogram in comparison with the other forms. It is worth noting that there is the greatest similarity between the Wellington River form and the unusual seedling - both have deep sinuses and the juvenile and adult leaves are serrated.

The similarity however ends there. The unusual seedling, (I now have only one plant) has become a low decumbent shrub and the flower spikes are minute, about 20 x 20mm. Numerous cuttings have been taken of this form and distributed to various members of the Banksia Study group. It strikes much more readily than other banksias from semi ripened wood taken in the autumn. As it is of garden origin and so far as I know has never been seen or collected in the wild it has been registered as a cultivar. It has been named after Celia Rosser the famous illustrator of banksias; Banksia canei Celia Rosser.

This banksia is not a sport or a hybrid but a form that presumably was much more common when conditions were suitable for it. The decumbent habit suggests that it is from an alpine form rather than a subalpine altitude.

One can speculate that this form was common on all the high peaks before the Ice Age about 1 million years ago. As ice colonized the upper parts of mountains in the first glacial the plants would migrate by seed dispersal to the lower slopes. During interglacials they would migrate up again.

In Australia it has not yet been ascertained how many periods of glaciation occurred but movement of the colonies down ridges that were being increasingly separated by deepening valleys would cause effective isolation. There would also be a favouring of forms that could grow at lower altitudes.

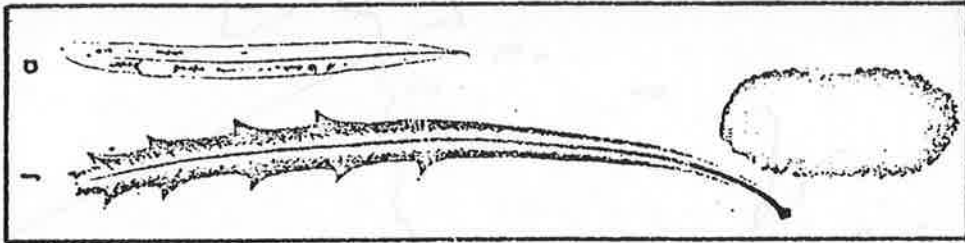
The primitive form occurs now at such low frequency that it is unlikely to recolonize alpine areas and is out competed for sites in sub alpine areas. If I ever have sufficient plants to grow this plant in an alpine area it would certainly make an interesting experiment and lend support to the hypothesis that B. canei was originally an alpine plant that has moved down the mountains and is in the process of speciating.

CONOS
4 8 12 16 cm

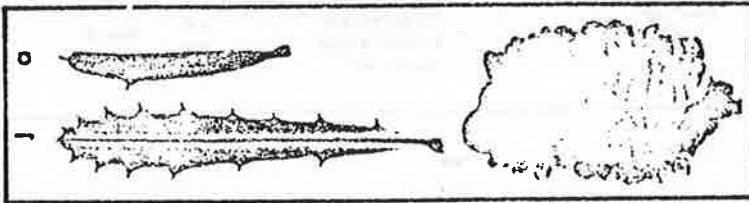
Kybean R.
80



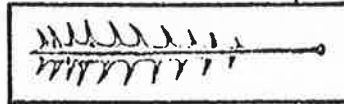
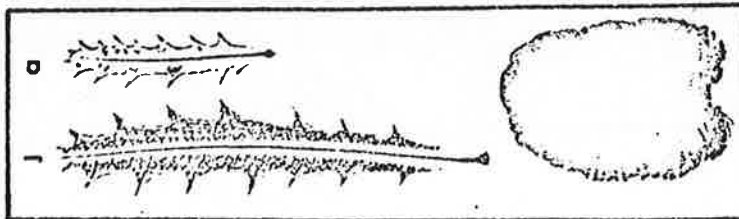
Snowy Mts.
101



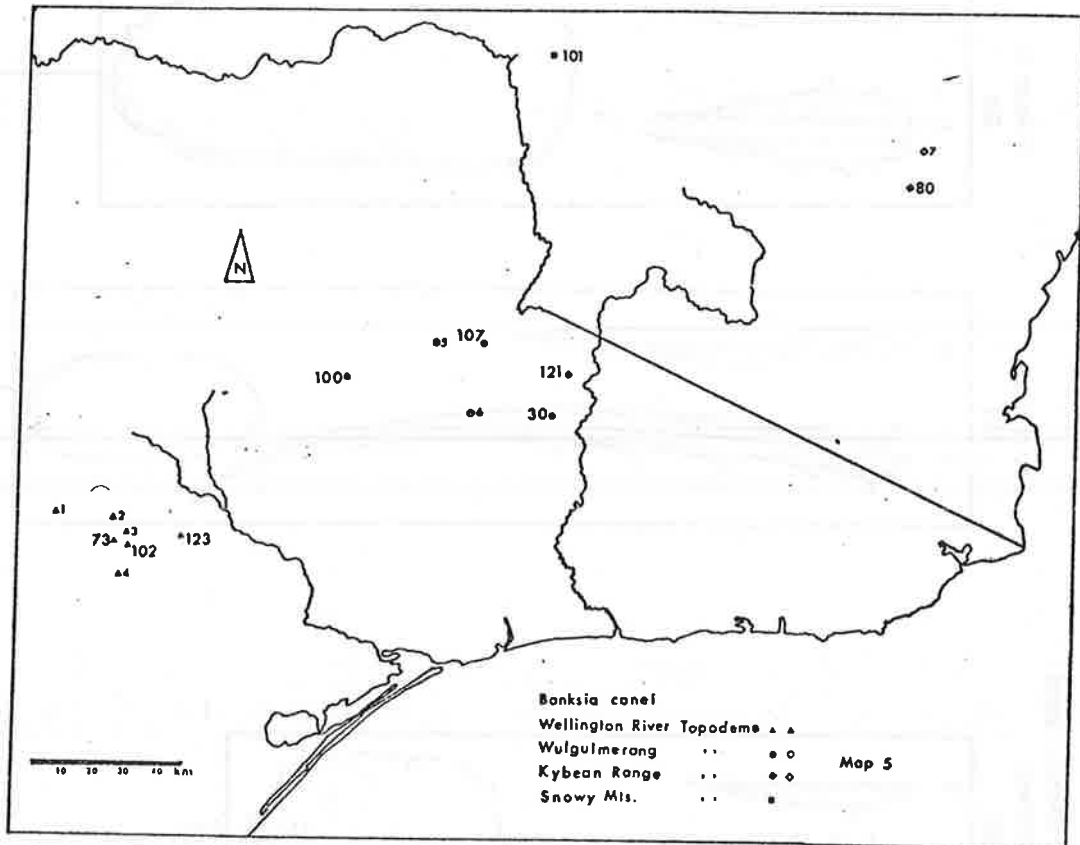
Banksia canel
Wulguimerang
30



Wellington River
73



1 2 3 4 cm



oo

W.A. WILDFLOWER TOURS

From August to October a series of 6 day wildflower tours will be available from Perth. All meals and accommodation are inclusive and a hostess and botanist accompany each tour. Interested persons contact GAANETGETAL PTY. LTD. 23 Fowler St. Camperdown 2050. (02) 519 5536.

BANKSIA COVER

Banksia sphaerocarpa form. *ms. leptophylla*.

SEED SOURCES

Bushland Flora, Post Office, Box 435 Subiaco, W.A. 6008
Kandelka Native Seeds, Ridgeway Crescent, Valley Heights, N.S.W. 2777
Nindethana Native Plant Seeds, Narrikup, W.A. 6326
K.G. Seeds, Box 182, Albany, W.A. 6330
H.G. Kershaw, Post Office, Box 88, Mona Vale, N.S.W. 2103
Goodwin & Sons, Bagdad, Tas. 7407
Tasmanian Forest Seeds (T. Walduck), Summerleas Farm, Kingston, Tas. 7150
J. Gotham and Partners, Post Office, Box 29, Kingston, A.C.T., 2604
Watkins Seeds, 21 Glover Street, Post Office Box 468, New Plymouth, New Zealand.
Grantville Native Nursery, Grantville, Vic. 3984
Harper Seed Co., P.O. Box 111, South Perth, W.A. 6151
Vaughans Wildflower Seeds, P.O. Box 66, Greenwood, W.A. 6024
Seeds for Preservation, T. Hall, Lot 6, Badgerup Rd. Wanneroo, W.A. 6065
Australian Tropical Plant Supplies, Pinnacle Road, Julattan Q. 4880
L.J. Langley, Australian Seed Co. Pty. Ltd., Robertson, N.S.W. 2577
W. McReaddie, Western Wildlife Supply, 'Terrara', Box 90, Gilgandra, 2827.
North Australian Native Seed Supplies, L.S. Brigden, Box 4003, Casuarina, N.T. 5792
Forestry Commission Nurseries (All states).

SGAP - REGIONAL SEED BANKS:

Mr. R. Worrall, C/- Post Office, Lisarow, N.S.W., 2251
Mrs. H. Venning, 14 Corbett Street, Scarborough, W.A. 6019
Mrs. R. Thompson, 23 Hill Street, West Hobart, Tas. 7000
Mr. F. Hall, P.O. Box 34, St. Agnes, S.A. 5097
Mr. J. Pike, 197 Chuculba Cres., Giralang, A.C.T. 2617
Dr. R.G. Cooke, 92 Belmore Road, Balwyn, Vic. 3103
Mr. B. Dawson, 37 Sorbiston Street, Wellers Hill. Q. 4121