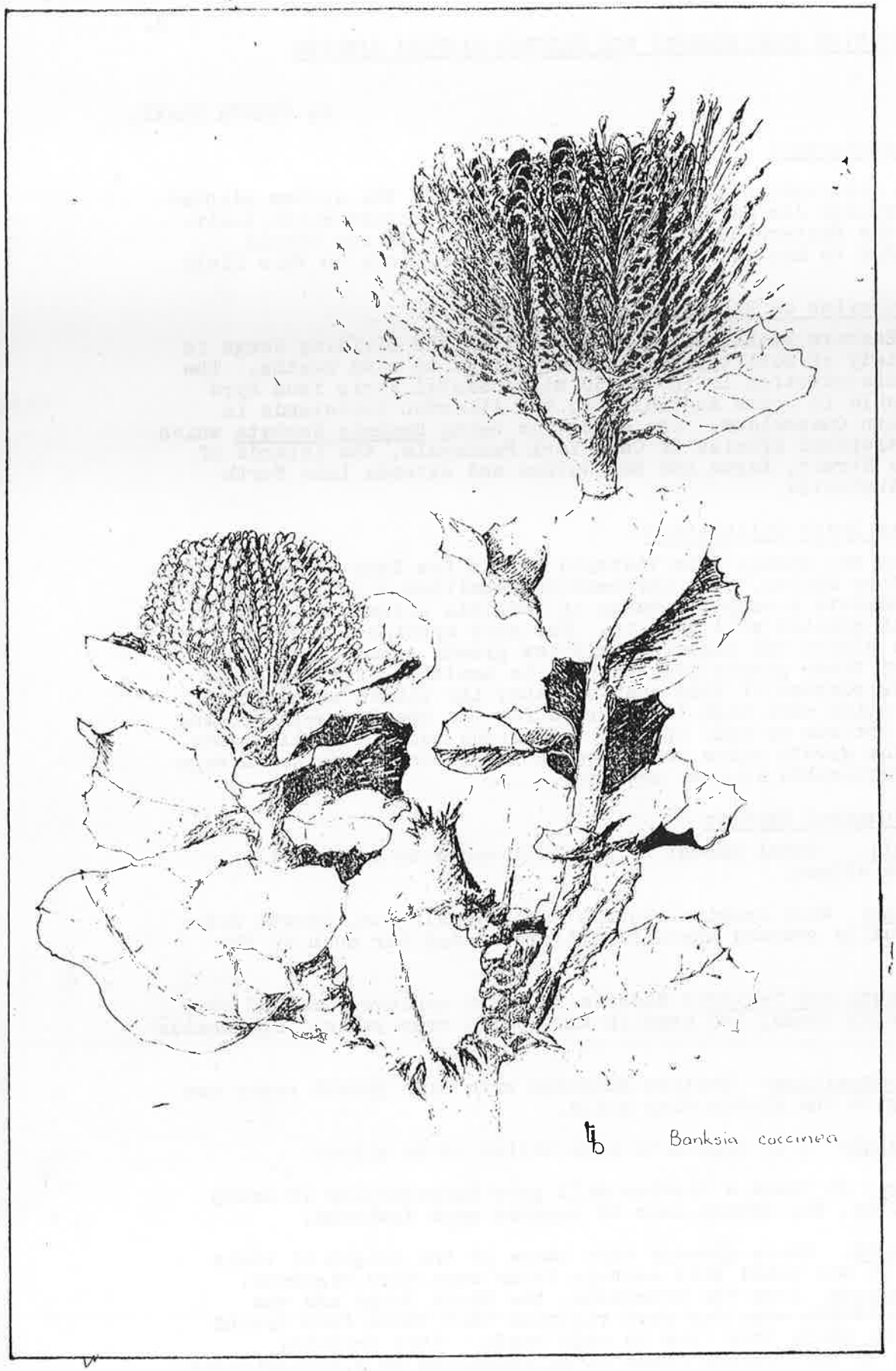
BANKSIA STUDY



REPORT 4

12 Little John Ave.
Vermont, 3133.
30-4-76.

Dear Members,

Report 4 will bring to a temporary close the work that the group has been carrying out over the last five years. As it has only just become available owing to typing and printing difficulties, apologies are extended to those who have been waiting for some time and it is hoped that the lack of notification is understood with current postal charges being so high.

From the response to the Study, it appears that many more people are in cultivation and that information is constantly becoming available as successes and failures are being experienced. It is woethwhile reporting our trials as it is only through the participation of many, that an idea of the range of tollerance of each species can be built up. In this Report it is obvious that there is a lack of data on the Eastern species. So many of those receiving this Report have information that should be collated and passed on to others. In this way our plants will become known and grown confidently in conditions that will ensure success.

We would now like to collect additional information on the cultivation of W.A. species. T hese are now much more widely grown than when the first survey was carried out and a follow - up would be highly desirable.

Quite a number of Eas tern species are virtually unknown in cultivation - B.asplenifolia, paludosa, serratifolia, canei and the tropical species B. dentata - all appear to be tollerant of a wide range of conditions. These should be in gardens and plantations. Availability of seed seems to be the main problem - its about time local groups rectified this situation. What of the future ?

Experiments under highly controlled situations are being carried out at a variety of institutions. From researches we will be able to pass on significant findings as they become available.

Monash University is currently undertaking a definitive research project on the genus, this includes the full scale, scientifically accurate painting of Mrs.Celia Rosser. As already mentioned the genus is currently being revised and should be published in about 12 months.

As a group we will now shift our arrention to the genus Dryandra however we will still welcome data on Banksia species. When sufficient information is available further reports will be prepaired - all notification of these will be through State Newsletters and "Australian Plants".

We have felt for some time that with the genus Dryandra closely related to Banksia that many of the conditions required are similar for both groups. As there is already a Study Group on this genus, led by Mr.Tony Cavanagh of 2 Wilkinson St., Ocean Grove, 3226, we have indicated that we will assist whenever possible. We are sure that many members have tried species and would like to assist, therefore we invite you to complete data forms and join in the work of this group.

Alf and I would like to sincerely thank all who have contributed and taken part in the Banksia Study since its formation.
We look forward future contacts. Yours sincerely, Trevor Blake.

CULTIVATION REQUIREMENTS FOR EASTERN BANKSIA SPECIES

by TREVOR BLAKE.

Acknowledgement

These cultivation requirements are based on the system adopted by the late Jim Carney in the first study report which dealt with the Western Banksias in cultivation. We are deeply indebted to his painstaking and pioneering work in this field.

Distribution of Banksia Species

Most Eastern Banksias are found East of the Dividing Range in a variety of soil types from heavy clays to sand heaths. The main distribution is in the 50 mile coastal strip from Eyre Peninsula in South Australia to the Atherton Tablelands in Northern Queensland. The exception being Banksia dentata which is a tropical species of Cape York Peninsula, the islands of Torres Strait, Papua and New Guinea and extends into North West Australia.

Results Under Cultivation

Reports are mainly from Victoria with a few from South Australia and other States. The information submitted will obviously not indicate a complete range of possible situations that the various species will grow in. For most species a majority of the plants had comparatively low growth rates. Although some of these plants are known to be healthy, it was assumed for the purpose of this analysis that the plants with growth rates which were high to moderate for the species were growing under optimum or near optimum conditions, and that all plants with low growth rates were growing under conditions which were less favourable in some respects.

Environmental Factors

Rainfall: Total amount of rainfall seems to have little obvious effect.

Sunshine: Most species require full to half sun. Growth rates are usually reduced where plants are shaded for much of the day.

Soil Depth and Texture: Success has been achieved in sand over clay, clay loams, and even in thin soils over yellow impermeable clay.

Soil Composition: Eastern Banksias with high growth rates are growing in the richer clay soils.

Soil Mulch: This appears to have little or no effect.

Drainage: At least 4 species will grow successfully in swamp conditions, the others seem to require good drainage.

Provenance: Where growers were aware of the origin of their plants it was noted that certain forms were more vigorous. B. marginata from the Grampians, the Black Range and the Blue Mountains were far more vigorous that those from around Melbourne where they grow in acid sands. This probably applies to the various forms of B. spinulosa or B.integrifolia.

Localities, Soils and Species

Mt. Gambier (S.A.) 15 cm. to 2+m of sandy loam over sand and limestone with occasional pockets of clay. P.H. 6-8 in both top and subsoils. B asplenifolia, B.dentata, B. ericifolia, B integrifolia, B.marginata, B.ornata, B.paludosa, B. serrata, B.spinulosa/collina.

St. Lucia (Brisbane) 0.5m sandy loam over pebbly orange grey silt. P.H. 5-6. B.asplenifolia, B.ericifolia, B.integrifolia, B.robur, B.serratifolia, B.spinulosa/collina.

Ringwood (Melb) 30cm. sandy clay loam over heavy yellow clay B. asplenifolia, B. ericifolia, B. spinulosa/collina, B.integrifolia. Annual rainfall 35"

Vermont (Melb) 25-40cm clay loam over heavy yellow clay. B.asplenifolia, B.canei, B.ericifolia, B.integrifolia, B.marginata, B.paludosa, B.robur, B.spinulosa/collina. Annual rainfall 35".

Mt. Waverley (Melb) 40cm. clay loam over heavy red clay. B.asplenifolia, B.canei, B.ericifolia, B.integrifolia, B.marginata, B.robur, B.spinulosa/collina. Annual rainfall 30"

Montrose (Melb) 30cm. sandy clay loam over sandy yellow clay. B.asplenifolia, B.ericifolia, B.marginata, B.serrata, B.spinulosa/collina. Annual rainfall

Sydney Deep Wianamatta shale over light loam. Acid Soil. B.collina occurs naturally. B.canei, B.ericifolia, B.integrifolia, B.serrata.

Croydon (Melb) 45cm. clay loam over clay B.ericifolia, B.marginata, B.robur, B.serrata, B.spinulosa/collina.

Garfield (Vic) 25cm sandy loam over heavy red clay and granite. Acid soil. B.ericifolia.

Pascoe Vale (Melb) Heavy clay soil, wet in winter. Deep clay subsoil over heavy basalt clay. P.H.7. B.ericifolia, B.serrata.

Coburg (Melb) 45cm heavy volcanic clay over basalt. B.ericifolia, B.serratifolia, B.spinulosa/collina.

Wangaratta (Vic) 40cm Red sandy loam over friable white clay. P.H.5.5 B.ericifolia, B.marginata, B.Spinulosa/collina.

Eltham (Melb) 30cm clay over rocky subsoil. B.ericifolia, B.marginata, B.robur.

Austins Ferry (Hobart) Clay loam over clay. B.serrata, B.marginata.

Bellerive (Hobart) 10-50 cm medium dolerite clay over dolerite rock. P.H. 5.5 - 6.5. B.serrata, B. ericifolia, B.marginata, B.collina.

Gympie (Q'ld) 30 cm sandy loam over phyllite rock. P.H. 5-6 B.ericifolia, B.collina, Rainfall 50" wet summers and dry winters

Caboolture (Q'ld) 40cm loam over clay loam. B.ericifolia Rainfall 55" - 60".

Kallista (Vic) 1.3 m red clay loam over clay. B.marginata, B.spinulosa.

SPECIES, LOCALITIES AND GROWING CONDITIONS

The majority of eastern Banksia species grow naturally in heathland communities in a cosatal environment. The most inland species being B.ornata from Mallee areas of Victoria and South Australia and is also represented on Kangaroo Island. B.marginata tends to extend further from the coast but hardly crosses the Great Dividing Range. Occurrences of B.integrifolia are found on the Divide, where it is common on the New England Tablelands with an unusual form being found on Mt. William. on the high peaks of the Victorian Grampians. B.canei favours altitudes in the ranges that are regularly covered in snow during winter. B.ericifolia and the B.spinulosa/collina complex are also represented in the ranges of N.S.W.

The conditions that these species enjoy is one where the soil has constant moisture below the surface. Generally drainage is good with few species being subjected to waterlogging for long periods. A number of Eastern species will receive filtered or half sunlight in forest areas with other species prefering longer periods of sunlight. The species below have been grown under these conditions unless otherwise stated.

B. asplenifolia. From coastal N.S.W. and S.E. Q'ld. it grows 1-2m x 1-2m on heaths. Grows well in Brisbane, Ringwood, Vermont, Montrose 4 x 2m in 6 years. Sandy loam to clay loam over clay silt or clay. Good to moderate drainage, full to ¼ sun, prefers constantly moist subsoil.

B. canei. From sub-alpine areas in N.E. Vic and S.E. N.S.W., 1-3m x 3m from alpine heaths and mountain forests, grows slowly in Vermont, Mt. Waverley, 70 x 60 cm in 3 years. Clay loam over heavy yellow clay. Moist conditions with good drainage, ¼ to ½ sun. More data required

B.collina. See B.spinulosa complex

B.dentata. Littoral N.T. and Cape York Peninsula. Reaches 5 x 3m. it is common along major rivers and freshwater streams. The only specimen recorded to date is from Mt. Gambier where it grows on sandy loam over light brown sand and has reached 2m x 60 cm in 3 years. Good drainage and moist conditions throughout the year. P.H. 6-8. More information is required. This species has been readily available from Australflora Nursery (Melbourne) for the last 2 years.

B.ericifolia. From central coastal N.S.W. amd Blue Mountains plateau tops 2.5 x 5 m. Grows well at Croydon, Mt. Gambier Vermont, Mt. Waverley, Montrose 6.5 x 5 m in 7 years. Clay loam over heavy yellow clay to heavy red loam over rubble and limestone. Well drained in full sun. Prefers moisture for most of the year. Hardy.

B. integrifolia. Generally a coastal heath inhabitant with a few isolated occurences in the Great Dividing Range on granite in N.S.W. and Victoria. 2-16m x 2-8m Mt. Gambier, Vermont, Mt Waverley, 4.5 x 3m in 5.5 years. Heavy to red loam on flintstone over limestone - to heavy clay over heavy yellow clay. Moisture throughout the year is preferable but not essential. Good drainage. ½ to full sun. Very hardy.

B. marginata. Wide distribution and soil types. Heaths, desert sands, mountain clays. o.3 to 20m. Tas., S.A., Vic., N.S.W. Mt. Gambier, Eltham, Warrandyte report strongest growths 2.6m x 2m in 7 years. P.H. 5.5-8. Good drainage with ½ to full sunlight. Moist winters and moist to dry summers suit this species. Sandy loam or clay soils over well drained subsoils indicate success.

As this species is variable, I consider the growth rate indicates little. Far more data on specific forms would be required before firm growth rates could be established. Very hardy.

B. ornata. From Mallee sandhills in Victoria and South Australia 1-2 x 1.5m with odd occurrences to 4m x 2.5 m. The only successful report on this species is from Mt. Gambier . 40cm sandy loam over limestone 1.2 x 1m in 4 years, P.H. 6-8. Moist soil in winter with moist to dry in summer. ½ to full sun. A note indicates profuse flowering in full sunlight. More data required. Reports of failure are common in clay loam over clay with very good drainage.

B. paludosa. Restricted to coastal heaths in southern central N.S.W. where it reaches 1 x 1m. Mt. Gambier Vermont 1 x o.5m in 2 years. Sandy loam over limestone and heavy grey clay over heavy yell yellow clay. Moist soils in winter and summer accentuate growth. Very good drainage with ½ to ¼ sun. This species is little known in cultivation as plants have been difficult to obtain commercially. More data required.

B.robur. From coastal swamps, plateausa and moist areas from central N.S.W. to S.E. Q'ld. with isolated occurences south of Cairns. 1.5m x 60cm. occasionally to 4 x 3 m. Croydon, Vermont, Mt. Waverley, 1.7 x 1 m. Clay loam over heavy yellow clay. Wet moist soils throughout the year. ½ to full sun. Good drainage. Will tolerate long periods of wetness and hot dry summer conditions. Very hardy.

B. serrata. Poor sandy coastal soils to rocky hill tops. Waratah Bay to Noosa Heads. Blue Mountains and isolated occurence in N.W. Tasmania 3-20m. Mt. Gambier Croydon. 3.3 x 2.8m. in 6 years. Sandy limestone to clay loam over heavy yellow clay. Well drained with moist winter and dry summer soil conditions in full sun.

B. serratifolia. Coastal sands in forest habitats and exposed dunes 6-7.5 x 5m, but 1.5 under exposure. Extends from northern N.S.W. to Proserpine, Q'ld. This species appears adaptable from deep sand to sandy loam over pebbly clay silt, to heavy clay over basalt. Brisbane and Coburg 2 x 0.7m in full sun. Moist throughout the year with good to fair drainage. Much more data is required on this species.

B.spinulosa/collina complex. Mountain forests to open plains on granite, clay or sandy soils. Seldom in exposed coastal situations 5 x 4 m in mountains. 1-2m x 2-3m in open country. Extends from Grampians along the Divide to S.E. Q'ld. with an odd occurence at Herberton on the Atherton Tablelands, Growth rates and maturity depends on the form cultivated. Mt. Gambier Brisbane, Vermont, Croydon 3.3 x 4m in 7 years. Sandy loam over limestone. Sandy loam over pebbly clay silt and clay loam over heavy yellow clay to sandy yellow clay. Moist winters with moist or dry summers suit this species. Good drainage with ½ to full sun P.H. 5-8 Very hardy.

THE STUDY OF SEEDLINGS AS AN INDICATION OF SPECIES IN BANKSIA

by ALF SALKIN

Many members are probably aware that a number of Banksia spp are difficult to tell apart mainly because of the variation in adult leaves, B.asplenifolia and B.paludosa are often difficult to tell apart and the various forms of leaves found even on one plant of B.spinulosa presents a major taxonomic problem.

In an effort to solve some of these problems I have been growing ecotypes - that is plants that show variation because of their isolation from other populations of all Eastern Banksias. I have collected seed from 130 localities, from the Jardine River in Cape York Peninsula to the western most limit of Eastern Banksias at Port Lincoln on Eyre Peninsula. From each cone collected I have raised more than 10 plants and kept these in a standard environment. The study of these seedlings has been very enlightening. It has tended to reveal very clearly the difference between what biologists refer to as phenotypic and genotypic variation. Genotypic variation is due to the chrosomes that a plant inherits from both its parents if it is grown from seed. Phenotypic variation on the other hand is the limit to which a plant may express the genes it has inherited. That is in a hostile environment such as the coast the height of B.integrifolia may be stunted by wind or nutrition. The plant may never reach its full potential, in fact there is a wide range of possible heights and shapes that plants with the same or similar genotypes may reach. This is not speciation but what is referred to as the plasticity of the phenotype.

There are however certain parts of the plant that are extremely conservative these are often indicators of evolutionary relationships. The most conservative parts of a plant are those related to reproduction - seed and flowers, but even more conservative are cotyledons, the first leaves that emerge on germination. In the Proteaceae I have observed that in Hakea, Banksia, Dryandra and Protea itself the cotyledons are difficult if not impossible to tell apart. The first set of true leaves however are most distinctive and with a little practice it is possible to distinguish species. It is notable that in these seedling leaves, the differences between B marginata, B.integrifolia and B.paludosa are very slight. One rather surprising thing to come from these studies is that in B.ericifolia there appear to be two forms. The first is a form from the coast which produces the typical entire short leaf with two spines at the tip. The second is a form from the Blue Mountains where seedling leaves up to the first year of growth are three times as long as the coastal form less revolute and with teeth from one third up to the top of the leaf. This form from the Blue Mountains has hybridised with B.spinulosa. Perhaps hybridised is not the correct word because when one collects seed from these plants that show the characteristics of both B.ericifolia and B.spinulosa the F1 generation show the characteristic of the plant where the co e was obtained. Seedling leaves show a characteristic which is in between the of B.spinulosa and B.ericifolia and second year growth leaves are of the very short spinulose type like the parent.

If fertile crosses are produced between B.ericifolia and B.spinulosa the so called B.spinulosa B.collina complex may have to be widened to include B.ericifolia. In fact what I believe we are dealing with is a very large gene pool where speciation has probably begun because of geographical isolation but that the barrier has broken down and the partially differentiated species are now able, in certain places such as the Blue Mountains to exchange genetic material.

As seedling plants grow and new leaves form, the leaves get longer and wider until they reach a fairly uniform size. Banksias have a spurt of growth in each season and seedlings one year old generally form a single stem at the tip of which buds develop which contain in mimature the next year's growth. Between October to December these buds start to open and elongate the young leaves are pubescent and the color of these hairs is an indication of species, most people who have seen either B.asplenifolia or B.robur at this stage of their development know them by the color of this new growth which is entirely due to the color of the haris. These hairs which cover a very large proportion of the upper surface and the vein areas of the lower surface are unlike the tomentum of the lower surface, not permanent features and fall off as the leaf elongates and hardens.

The Eastern Banksias fall into four main groups if one considers their young leaf hair colors. The most distinctive is the one mentioned above which occurs on B.robur and B.asplenifolia and can best be described as magenta, a reddish purple color. This color also occurs on two species that are related to each other but seem to have no obvious relationship to either of the two species above. This is B.canei and what will have to be described as a new species the form of B.integrifolia that grows in the Grampians. The form of B.integrifolia that grows on the New England Tablelands exhibits a certain purple color in its new growth foliage but not to the same degree as the other two. The second distinctive hair color is that of B.marginata this can best be described as brown or fawn, this color is shared with the coastal form of B.integrifolia and the crosses that form between them. As mentioned previously some of these are not hybrids, as they produce fertile offsprings, but some appear to be because although seed looks normal they fail to germinate. The B.spinulosa B.collina complex is the most difficult to assign a color to and the best that can be said is that they neither show the deep distinctive magenta of the first group or the heavy brownish pubescence of the second group.

The fourth and last group is that of B.ericifolia which have a very slight almost colorless pubescence which is characteristic because it is not obvious. It should be noted that crosses between it and B.spinulosa show an intermediate characteristic.

Of the 6 B.paludosas obtained from differing localities some show the B.marginata hair color while others show a tinge of magenta. From my experience in the field there would appear to be crosses between it and both B.integrifolia and B.asplenifolia wherever these species are growing in close proximity.

Perhaps the most useful information to come out of this study of seedling growth pertains to the "so called" B.spinulosa B.collina complex. Of plants grown from seed from 47 different localities 3 distinctive groups emerge. The first group is restricted to Victoria and has the longest seedling leaves of the group. Whilst some statistical work will need to be done I can without difficulty pick out the Victorian form from the other two. Its seedling leaf is usually over 140mm and may be as long as 170mm, its width including spines is 10mm.

The next group which is restricted to New South Wales mainly in the Blue Mountains and northern tablelands is very similar to the Victorian form, the leaf 10mm wide but often wider up to 15mm and the length much shorter 70mm -100mm. This was described as a separate species B.cunninghamii Sieb ex Spreng but was included in B.collina by Benthan as was the Victorian form. This is understandable because of the variability of the leaves at a later stage, the only common characteristic being that the leaves are generally flat whereas B.spinulosa is extremely revolute especially when dried.

The last group is one that has narrow leaves seldom wider than 6mm but with lengths from 60-120mm. It is this leaf which is very similar to the leaf of Brown's B.collina type specimen, being flat with the spines pointed away from the mod rib. Of this last group I have plants from 26 localities from the Victorian Border to Maryborough in Queensland, some collected from plants which were typical B.spinulosa forms others from typical B.collina forms. There would be in this group 200 plants raised from seed. Without exception they all have seedling leaves as I have described none of them yet exhibit the extreme-revoluteness of B.spinulosa.

Carolyn Beadle and Evans in their Flora of the Sydney Region note that there are intergrades in this group and that one of the things that distinguish B.spinulosa is that it is a divaricate shrub - that is forked or widely divergent 1-2m high and occurs south of the Hawkesbury.

Beryl Leber in that excellent publication, Advisory Leaflet No. 1157 Banksias of S.E. Queensland produced from articles in the Queensland Agricultural Journal on native plants, deals much more fully with this group in Queensland. She notes that B.collina is distinguished by its flat leaf with widely spaced teeth with dimensions of 40-100mm x 3-4mm and that it is a tall erect shrub 1-2.5 m. high with spreading branches in clusters. She also notes as do Carolyn, Beadle and Evans that B.spinulosa is a much smaller plant 0.6-1 m high and that it is a much more compact less spreading plant than B.collina. Now one of the interesting things that distinguishes the last group from the other two is the invariable presence of a lignotuber at a very early stage at the base of the stem; it seems to me that the low divaricate growth habit is likely to be due to the fact that the plants grow in a fire-environment. I have seen plants in the Blue Mountains and at Eden which had burnt blackened stems and very dense new growth from the lignotuber. The plants were in flower and by counting the number of bifurcations it was possible to determine that the fire had occured 2 years ago. B.serrata which was growing in association with B.spinulosa in the Eden colony had also been burnt but its recovery was different, new leaves from presumable epicormic meristems had pushed through the blackened bark. It is noteworthy that all the regrowth I saw on regenerating B.spinulosaa was of the extremely revolute form with the typical trifid tip.

These observations are by no means conclusive but it seems likely that the difference between B.spinulosa and B.collina may be triggered by fire. I have sufficient experimental plants and when these are well developed I intend to carry out experiments to verify this theory.

Seedlings of B. marginata are much more difficult to assess. Robert Brown (1773-1858) in his momumental work "Prodromus Novae Hollandiae" describes 6 species which can all be assigned to B.marginata. What he took to be species as Cavanilles the great Spanish botanist before him had done, was the difference between juvenile and adult leaves and the differences exhibited between different juvenile leaves. This is a much more complex problem than the B.collina B.spinulosa problem where at least first year seedling leaves are comparable.

Very little can be said at present about B.marginata seedlings except to say that it is a species with a great many ecotypes - that is plants taken from different localities when grown in a standard environment look different. The most obvious of these ecotypes is the one from the Little Desert. Apart from the fact that it is difficult to keep alive in cultivation, seedling leaves tend to droop and have a convex upper surface. The same problem of keeping plants alive is experienced with an ecotype from Mt. William in the Grampians. This plant in its natural habitat is a very low shrub with leaves

so short and narrow it could be mistaken for B.ericifolia. It is not often realised that B.marginata occupies a very wide range of habitats. It grows on coastal dunes at Aire River, it is a component of Snow Gum Woodlands on the Monaro Tablelands. A large form 5 to 10m tall grows in association with River Red Gums in many places in the Western District. Heath and Swamp forms occur as well as the desert and mountain forms previously noted. B.marginata has also the widest geographical range of any of the Eastern Banksias. Its westernmost extremity at Port Lincoln is also the western most limit of Eastern Banksias. It is I believe the only Banksia to cross the divide and can be found in very unusual company in the Warrumbungle Mountains. As far as I know it never gets into Queensland but has its most northern limit in the Gibraltar Range. It is, apart from a very isolated colony of B.serrata at The Sisters, the only Banksia in Tasmania and the islands of Bass Strait. It should not therefore be surprising to find ecotypes, perhaps the surprising thing is that seedlings from places as far apart as Port Lincoln and the Gibraltar Range should be almost identical while seedlings from places as close as Casterton and Goroke are completely different in the way they grow and the morphology of their leaves. The only thing that one can assume is that in a desert environment evolution proceeds at a greater pace.

One thing else needs to be said about the seedling growth habits of B.marginata and that is some forms are far more vigorous than others. Many of the forms from the Grampians and Black Range are extremely vigorous. These are the forms which in their habitat produce large flowers and have cones almost as large as B.ericifolia and invariably keep their capsules closed. Also in this category are forms from the Hawkesbury Sandstone which compare very well with the Grampians forms.

A species which bears a close relationship to B.marginata and was until the 1960's mistaken for it, mainly because the herbarium material did not include cones, is B.canei. Because of its limited distribution and relative isolation each colony bears different characteristics. The study of seedlings however has revealed something of importance.

The plant was first recognised as a distinct species by Jack Cane a beekeeper and native plant grower of Maffra. He brought to the notice of Jean Gailbraith and eventually to Jim Willis a plant which he had noticed in the Wellington River. This plant which grows in a small colony was distinctly different from any known banksia. It had deeply indented leaves and the flower had a blue limb. In this it differed from the type specimen which Jim Willis eventually collected at Wullgullmerang on the Mount Seldom Seen Track. I have collected seed from both these localities and practically all seedlings came up the same, they have the juvenile shallowly serrated leaf of the type specimen seedling. I assumed that perhaps the Wellington River form would revert to the deep serrations when adult, I am now doubtful of this because two of the seedlings from a batch of about 100 from Wallgullmerang have produced leaves that have deep indentations of the Wellington River form. This raises some very interesting questions - the first is why does the colony in the Wellington River have all deep indentations yet produce seedlings without them? If most forms of B.canei are crosses as I assume they must be, is the deeply indented form one of the parents? There are some fascinating problems here and I would certainly be pleased to hear if anyone has the Wellington River form with deep indentations in cultivation or for that matter anything pertaining to unusual forms of seedlings of any of the Eastern Banksias.

Post Script -

Of the latest batch of seedlings germinated of some 70 from one cone taken from the Wellington River, one looks as though it will have deep indentations

THE GERMINATION OF BANKSIA CANEI

By ALF SALKIN

Banksia canei is one of the few Banksias that can be described as subalpine and its mechanism of germination suggests that it is the only Banksia that is adapted to cope with the very low temperatures of the cold winters that are experienced in alpine areas. Whilst B.marginata is found above 4,000 feet on the Monaro Tablelands and a form of B.integrifolia grows at a similar height on the highest points in the Grampians it is only B.canei that is found consistently above 4,000 feet. It is as well to remember this point when trying to germinate this species.

In its natural habitat the folicles of B.canei remain closed even when the cones are taken from the plant. This would indicate that fire is required to liberate the seeds. The most likely time for fires to occur are in January and February. Seed released at this time would germinate after the rains of March or April and the seedlings would perish in the frosts of May. As with many of the plants of the Northern Hemisphere B.canei has evolved a mechanism to overcome this. The seed once released will remain dormant until a period of cold has been experienced.

Experiments with seed of B.canei taken from two locations reveal a very interesting climal adaption to altitude. Seed of the first ecotype from the Wellington River at the foot of the Benison Spur (height circa 1000") was stratified - placed in the crisper section of the refrigerator in damp sand at a temperature of about 2°c. Each week 2 viable seeds were removed and planted in a 2" pot. The first seeds to germinate were those that had had 7 and 8 weeks stratification. These germinated at the same time. The 7 week ones in 2 weeks and the 8 week in 1 week.

The same experiment was done consecutively with an ecotype of B.canei from Mt. Seldom Seen (height circa 3000') on the Wulgulmerang Plateau. Seed stratified for 7 and 8 weeks failed to germinate but seed stratified for 10 weeks germinated within 2 weeks. Controls of these ecotypes were planted when stratification began. These as well as the seeds that had not had sufficient stratification did not germinate until July. That is, they went through a natural period of cold before germinating.

It would seem then that when propogating B.canei it is best to hold the seed in stratification until the spring. Whilst seed seems to be capable of remaining in pots for long periods, the soil tends to get sour and favours organisms such as the damping off fungus Pytheum which can very quickly kill young seedlings. If seed is held in the crisper section of the fridge for at least 3 months germination should occur in warm weather in two weeks or less.

BANKSIA INTEGRIFOLIA "RELIC" IN MOUNT WAVERLEY

by ALF SALKIN

A number of my friends who know of my interest in Banksias had told me of Banksias growing in Syndal Cutting on the Glen Waverley line. Imagining these to be B.marginata, which are common in the Dandenong foothills, I was therefore surprised to find a stand of B.integrifolia this was growing in association with Leptosperinum laevigatum.

Acacia longifolia has long been known to grow in the Syndal cutting. It was known locally as the "Syndal Wattle" and was a recognised variety because of its profuse flowering habit. It suddenly struck me that here was a remnant of Coastal vegetation.

On close examination, the stand of B. integrifolia, appeared to be suckers. Cuttings taken from these in January struck 3 weeks which is marvellously short for Banksias. No seeds or flowers were present. Further enquiries among local residents who had been in the district for 40 years brought forth the information that a very large old tree had grown on that spot but it had been burnt. The colony of suckers from this one tree covered an area of 50 x 10 metres and raises some interesting questions about other Banksia colonies. I imagine there must be numerous colonies that are clonal , all connected to one root, derived from a single plant.

It raises the question of how this species has managed to survive a long way from the present habitat of the Coastal Banksia. The last high sea level was only 10,000 years ago and there are of course relics of this in the Springvale area 3 or 4 miles away but the "Coastal Banksia" in Mt. Waverley is still something of a rarity.

Failure

An experiment with Banksia integrifolia, B.serrata B.spinulosa, B.marginata, B.robur and B.paludosa to find which were less susceptible to the fungus Phytophthora cinnamomi proved to be inconclusive. This was partly due to the experimental set up, but also because of quarantine regulations.

All Banksia Spp were susceptible to the fungus and it was very evident that infected plants did not transpire to the same degree as the controls. Despite this few of the infected plants died, this we believe was due to the fact that the quarantine area was a controlled environment and no stress was placed on the plants.

It was hoped that by measuring the shoot root ratio an indication of which plants were most susceptible to the fungus might be obtained. The data from this was, to say the least, inconclusive. This may be partly due to the difficulty of obtaining all the roots or to the possibility that the fungus does not rot the roots but merely kills certain cells associated with water uptake. A further experiment using the experience obtained from this one will be carried out in the not too distant future and hopefully this may throw some light on which banksias are most susceptible to Phytophthora cinnamomi.

W.A. BANKSIAS - DO SURVIVE WITH DIFFERENT ROOTS!

by Col.Wilson (Melbourne)

Firstly,progress on those grafts that were mentioned in the last report.

SCION	STOCK	AGE (months)	SIZE (cm)	COMMENTS
ashbyi	spinulosa	21	70	Healthy
attenuata -	turned out to be occidentalis, thus a lesson in care with seed or seed supplier.			
burdettii	spinulosa	14	45	Died-dry conditions may have been too severe for rootstock
brownii	spinulosa	30	200	Healthy
brownii	robur	6	30	Scion died,new shoots at base of stock
hookerana	robur	6	25	Scion died, new shoots at base of stock
lehmanniana	spinulosa	27	100x75	Healthy, vigorous new growth
lehmanniana	robur	8	40	Scion died, new shoots at base of stock
nutans	ericifolia	18	25x30	Healthy
occidentalis	spinulosa	27	90	Healthy
sceptrum	serrata	16	40	Scion healthy, new shoot at base of stock
speciosa	integrifolia	18	110	Doing very well, flowered at 12 months

Such trends lead one to suggest that species which produce new shoots at the base (particularly those that form lignotubers) are best avoided as stocks. The B.spinulosa I have been using is the Blue Mountains form which does not form a ligno-tuber.

Further trials have produced promising results and enabled the following conclusions to be made.

1. Banksias can be grafted by inarching, wedge grafting, grafted cutting (see separate report) and budding techniques.

   All of these techniques have been used successfully in grafting B.brownii to B.spinulosa.

2. Compatibility appears to be best between closely related plants, i.e. stock and scion in the same sub species section.

   The following combinations should prove useful as a starting point for anyone who wishes to try grafting Banksias.

   B.brownii to B.spinulosa
   B.nutans to B.ericifolia
   B.verticillata to B.integrifolia

   Technique to use : Wedge graft.
   Time of year : March
   Remember : Use a sharp knife, clean materials and clean work area.

Would you recommend a doctor who used a blunt, rusty scalpel in a theatre littered with dead and decaying offcuts?

GRAFTED BANKSIA CUTTINGS

BY

IAN BRAND AND COL WILSON

Knowing my interest in propogation by cuttings, Col Wilson asked me what would happen if banksia grafts were done at the cutting stage, and the result treated as an ordinary cutting. I said I didn't have the faintest idea, but there was one certain way to find out, and that was to try it.

We started in October, 1974, and did some every 4 - 5 weeks until April, 1975.

Col did all the grafts (about which I know practically nothing) and then handed the result to me, which I then treated as if it was an ordinary banksia cutting. The grafts are simple peg grafts, the grafted region being 1 - 2 cms. long. At first he was horrified by the way I handled the cuttings, but has now got used to it.

The results are as follows:-

	Date	Result
Ashbyi/spinulosa	26.10	6
	26.2	6
	26.2	2
Brownii/robur	23.11	6
Brownii/spinulosa	26.10	2
	23.11	6
	23.11	2
	23.11	2
	23.12	2
	23.12	2
	23.12	2
	23.12	4
	26.2	6
	23.3	6
	23.3	6
	23.3	2
	23.3	1
	26.4	5
	26.4	6
	26.4	6
Brownii/robur	23.11	6
	26.4	2
Brownii/integrifolia	26.4	4
Caleyi/serrata	19.1	1
	19.1	1
Caleyi/integrifolia	19.1	1
Caleyi/spinulosa	26.10	2
Lehmaniana/spinulosa	26.10	4
	23.12	1
	23.12	4
Nutans/ericifolia	26.10	4
	23.11	4
Occidentalis/spinulosa	23.11	1
	23.11	2
	19.1	2
	19.1	2
	26.10	4
	26.2	2
	26.2	2
	26.4	1
Occidentalis/robur	23.12	2
Occidentalis/integrifolia	26.4	1
Quercifolia/integrifolia	26.4	4
Speciosa/serrata	19.1	1
Speciosa/integrifolia	26.10	2

...2

Grafted Banksia cuttings by Ian Brand and Col Wilson (contd.)

Legend for results:

1. Graft failed; scion died; stock rooted.
2. Graft apparently succeeded, but scion died, usually quite quickly; stock rooted.
3. Graft apparently succeeded, but the whole thing soon died.
4. Graft failed, and both scion and stock died.
5. Graft succeeded, but stock not rooted.
6. Success!!!

The successes have been Brownii/spinulosa done in October, March and April, Brownii/robur done in November, and Ashbyi/spinulosa done in October and February.

The crude success rate is 20%. The Brownii/spinulosa success rate is 37.5%. The crude rate for successful rooting of the stock is 84%, and for apparent success of the grafts 61%. On a number of occasions non-grafted cuttings of the stock were taken and treated in the same way as the grafts. In many cases the grafted stock cuttings rooted more quickly than those which were not grafted. We cannot offer any explanation for this.

According to Col Wilson failures are probably due to one or more of the following: poor matching of the cut tissues; non-compatibility of stock and scion; and some idiot taking the grafting tape off too soon!! I am the only one who takes the tape off!!

We have established that it is better not to leave leaves of either stock or scion in the region of the graft, and also that this method is perfectly feasible for producing grafted plants in at least two species of Western banksias.

Phytophthora cinnamomi in Australia

The soil borne fungus Phytopthora cinnamomi is widely distributed in Australia, in horticultural plantings and nurseries and home gardens in all states. It is the cause of very serious specific diseases in pineapples and avocados, in conifer shelter belts and has been implicated in dieback problems of a wide range of horticultural and ornamental crops. The fungus is unmatched in the variety of plants and the range of communities it affects, causing death in 45 families of plants. Phytophthora cinnamomi is a relatively common component of the soil microflora in forest, woodland and heath communities of coastal and near coastal Australia from Queensland to Western Australia, from latitude 17°S to 43°S. It is recorded as causing disease in native flora in all of these areas notably in Southern Australia where it has devastated more than 10,000 hectares of indigenous vegetation. The damage in the jarrah forest of Western Australia is causing the most concern but in Victoria parts of East Gippsland, the Brisbane Ranges and Wilson's Promontory are under threat. Disease outbreaks in native communities in NSW and Queensland have been less severe, mostly confined to particularly susceptible areas and under favourable rainfall conditions. This has led to the theory that Phytophthora cinnamomi is indigenous to this area and that there the disease is tolerated unless the balance is upset by high levels of infection in abnormally wet years, stress in the host during drought or disturbance of the environment by man. However, the extreme susceptibility of native communities in Victoria and Western Australia indicates that the disease is a new introduction and there is a very real threat to many native species.

1. Disease Symptoms

The symptoms of Phytophthora are those of extreme drought stress and most deaths occur under dry conditions in summer. The root systems have been previously critically depleted during moist warm conditions, favourable to infection. Symptoms vary as follows:

(a) Simultaneous chlorosis of all the foliage, followed by death of the whole plant with leaves still attached. In some cases single shoots may show these symptoms while the remainder of the plant appears healthy, only to follow as the disease develops.

(b) Progressive chlorosis, only a few leaves affected at a time followed by abscission of the affected leaves and dieback of branches, beginning from the tip. There is a gradual deterioration of the crown, new leaves are reduced in size and in susceptible eucalypts, epicormic shoots develop and in turn deteriorate.

The second symptom is characteristic of mature eucalypts. Most under story shrubs and eucalpyt seedlings show the more drastic symptoms. The roots show varying degrees of rotting.

/2....

In some species, notably eucalypts and exotic conifers the rotting is confined to small feeding rootlets. In more susceptible species invasion of the larger roots is common and the entire crown and root system can be blackened and rotted away.

2. Relative Susceptibility of Species

Amongst eucalypts there is considerable variation in susceptibility, tied in with established groupings within the genus. Members of the Monocalyptus subgenus show the greatest susceptibility. The following table taken from Pratt & Heather (Aust. J. Biol. Sci. 26, 559-73) illustrates the differences between Monocalyptus, Corymbia and Symphyomyrtus subgenera.

FIELD RESISTANCE OF EUCALYPTUS SPP TO THE DISEASE ASSOCIATED P. CINNAMOMI

Resistant: no disease evident; tolerant: disease rare, usually limited to scattered individuals, particularly young plants; susceptible: plants of all ages diseased, usually in small groups; highly susceptible: severe disease widespread in community

Category	Species and subgenus*
Resistant	E(S) alba, E(C) citriodora E(S) cypellocarpa, E(S) diversicolour E(S) grandis, E(C) maculata E(S) mannifera E(S) melliodora, E(S) ovata E(S) pellita, E(S) polyanthemos E(S) smithii, E(S) wandoo
Tolerant	E(C) calophylla, E(S) globulus, E(C)gummifera E(S) punctata, E(S) rubida E(S) saligna, E(S) sideroxylon E(S) viminalis
Susceptible	E(M) acmenoides, E(M) agglomerata E(M) delegatensis, E(M) eugenioides E(M) globoidea, E(M) muelleriana E(M) pilularis, E(M) piperita, E(M) radiata
Highly susceptible	E(M) amygdalina, E(M) baeteri, E(M) dives, E(M) macrorhyncha, E(M) marginata, E(M)obliqua E(M) regnans, E(M) rossii, E(M) sieberi

*C. Corymbia; M. Monocalyptus; S. Symphyomyrtus

Of other natives, species within the families Proteaceae, Epacridaceae, Dilleniaceae, Papilionaceae and Myrtaceae are generally highly susceptible. There are however susceptible species in most other groups and within the above families there is variation in the intensity of the disease. Members of the families Gramineae, Cyperaceae, Compositae, Liliaceae, Haloragaceae, Droseraceae and Restionaceae are generally resistant and increase in numbers in affected areas. These groups include many exotic weed species.

Podger (Phytopath 62, 972-981) found that in Western Australia the tree species of the Proteaceae were amongst the most highly susceptible. In areas studied he recorded, in plants over 6ft tall, 92% deaths in Banksia grandis and more than 65% amongst B. menziesii, B. ilicifolia, B. littoralis and B. attenuata. There was no association of susceptibility with habitat, Banksia littoralis, restricted to poorly drained swamp sites, was as susceptible as B. attenuata which is generally found on deep well drained sands. In the same study Myrtus floribunda and Melaleuca parviflora were unaffected while 46% of Casuarina humilis, 27% of Macrozamia reidlei and 25% of Xanthorrhoea preissii were killed.

There was evidence that the susceptibility of Banksia grandis decreased after the seedling stage but that a high level of susceptibility is reached when the plants are over 6 ft in height. Direct comparison of the levels of susceptibility in Eastern and Western Banksia species is not available. However, in contrast to Podger's rating of Banksia as the most highly susceptible genus, Weste Cooke & Taylor (Aust. J. Bot. 21, 13-29) in the Brisbane Ranges of Victoria recorded only 50% reduction in Banksia marginata numbers. This compared with complete removal of Dillwynia sericea and Hovea heterophylla, 95% reduction in Xanthorrhoea australis, 90% Isopogon ceratophyllus and 70% in Hibbertia stricta. In earlier work from the same area Weste and Taylor (Aust. J. Bot. 19, 281-94) rated Banksia marginata eighth most susceptible species after X. australis, I. ceratophyllus, H. stricta, three species of Pultenaea and Acrotriche serrulata. In a study in Wilson's Promontory, Weste and Law (Aust. J. Bot. 21, 31-51) rated B. marginata eigth most susceptible after X. australis, Sprengelia incarnata, I. ceratophyllus, Leucopogon virgatus, Bossaiea cinerea, Pultenaea hibbertioides and Leptospermum myrsinoides. Banksia serrata was not included in these ratings. It was however stated that B. serrata did not show symptoms until well after their appearance in the under-story. However deaths did occur. This may be contrasted to B. grandis in Podger's work which very rapidly succumbed to the disease. However B. serrata can be highly susceptible under the right conditions. Weste and Law recorded 60-80% deaths in 1971/72 in young regenerating B. serrata in a gully bottom in Wilson's Promontory.

3. Environmental Conditions Favouring Disease

The most important environmental requirement for infection and spread of Phytophthora cinnamomi is water in the root zone. In many areas major outbreaks of disease are correllated with above average rainfall and in individual areas the disease is most serious where standing water is present. Similarly, the spread of the disease is more rapid with water. Spread down drainage lines on poorly drained sites has been recorded at 40 metres per year, downhill on well drained sites at 40 metres in five years and along the contour of well drained soil at 3.6 metres per year.

To have an effect on virulence of P. cinnamomi the moisture must be present under favourable temperature conditions. The fungus has a minimum requirement of about 10°C and an optimum considerably higher. Marks, Kassaby and Fagg (Aust. J. Bot. 21, 53-65) carried out tests with Eucalyptus sieberi which showed no adverse effect at 9.5°C, slight effects at 12.5°C and 16.0°C, 10.5% death at 20.0°C and 100% dead at 22.0°C. Thus winter rainfall is probably not of any significance as temperatures are too low. However, above average rain falling in the warmer months favours disease establishment. Marks, Kassaby and Reynolds (Aust. J. Bot. 20, 141-54) showed that disease outbreaks in East Gippsland in 1952-53 and 1955-56, 1966 and 1970-71 were directly related to above average rainfall in the autumn and spring preceding the appearance of the disease.

The massive outbreak in the Brisbane Ranges studied by Weste and Taylor (Aust. J. Bot. 19, 281-94) in 1971 was preceded by a rainfall of 48" in 1970 instead of the average of 25", most of it falling in summer. Podger in discussing infection in the Western Australian forests states that the soils are frequently wetted in spring and autumn and by occasional summer storms. He points out that the light textured topsoils of the jarrah forest allow rapid wetting of the rooting zone, even light falls bringing large volumes of soil to field capacity. This exposes many roots to the chance of infection, which in the warmer months can take place in 24 hours.

Factors which favour retention of water in the root zone increase P.cinnamomi damage. Poor soil drainage is an important contributor. In the majority of cases, serious disease outbreaks are correllated with shallow soils overlying impermeable layers. In the jarrah forest of Western Australia the dominant soil pattern is shallow sand, silt or gravelly sands over indurated laterite or dense clay. In the Brisbane Ranges the soil is a shallow lateritic gravelly grey to yellow brown sand over a mottled claypan. Similar situations are found in east Gippsland and at Wilson's Promontory. However, it should be noted that the effect of soil type is not absolute as P.cinnamomi damage has been found over the entire range of soil types, including deep well drained gravels and aeolian sands.

The disease is more severe in flat or gently sloping terrain than steep hillsides. Podger found abundant disease in the jarrah forest on slopes up to 10° but 25° slopes were almost entirely disease free.

The climatic and soil requirements for disease are complicated by the fact that along with periods of high moisture there is a requirement for drought stress, for the devastation of the root system below to fully show above ground. Summer drought is a regular feature of the areas of Australia where P.cinnamomi is causing most concern.

In areas of high summer rainfall there has been little trouble with P.cinnamomi. The disease has been reported from many areas in Queensland but only in exceptional years have large scale losses occurred. In 1951 and 1971 exceptionally wet conditions resulted in losses in the coastal lowlands of south-eastern Queensland.

The reason why the normally high summer rainfall does not cause greater losses cannot be properly explained. It has been suggested that the flora is more resistant to P.cinnamomi due to its being endemic to the area. Another possible explanation is is that the plants are growing "in phase" with the climate having maximum growth under the favourable wet and hot conditions and are therefore able to rapidly regenerate feeding roots. The contrast is drawn with the "out of phase" summer growth of plants under drought stress in southern areas.

4. Methods of Control

Phytophthora cinnamomi is a soil inhabiting fungus which can survive and multiply on dead organic matter in the soil, in the absence of live host tissues. Survival in this way for at least six years has been demonstrated, although it has been shown that the disease potential of an infected area does decline as host plants are killed. Control of soil fungi is inherently difficult, even with high value crops, and the ability to survive away from the host makes conventional crop rotation and sanitation methods useless. When taken to the firest situation control is an impossibility. Current efforts are concentrated on limiting the spread of the disease within areas and more especially to avoiding introduction to new sites. It appears inevitable that vast tracts of native forest, woodland and heath will suffer damage to at least the wetter parts in years of above rainfall.

In cultivation it has been shown that P. cinnamomi can be effectively reduced by improved drainage and controlled by the use of fungicides. Improvement of drainage by laying pipes, raising beds and the incorporation of soil conditioners in the form of mulch, sand or gypsum have obvious benefits in reducing the build up of standing water. The fungicides "Dexon" and "Difolatan" are in regular use to control P.cinnamomi in horticultural crops and "Difolatan" has been successfully tried in the field to protect native species. Weste and Law (Aust. J. Bot. 21, 31-51)used "Difolatan" at the rate of 20 lb per 1000 square yards and watered in with 1000 gallons of water in Banksia serrata woodland at Wilson's Promontory. The treatment was applied in December and again six months later. To quote the paper; "Many of the symptoms, such as die-back and chlorosis, disappeared and plants grew vigorously and produced strong green shoots. With the passing of time the dead plants were no longer obvious and no additional plants became infected. No diseased grass trees (X. australis) recovered.

These observations were in marked contrast with those on the vegetation outside the sprayed area. During the same two months, chlorosis, die-back and death spread down the Vereker Spur below the road junction into a wide drainage area and extended for a half mile along the direction of water flow, in which grew a plant community of Sprengelia incarnata with scattered trees of Banksia serrata and scattered Xanthorrhoea australis and Leptospermum myrsinoides. P. cinnamomi was readily isolated from the affected and dying plants."

The effect of treatment was not to eradicate the fungus but to inhibit disease attack. Tests were still positive, at a lower level, to P. cinnamomi despite the obvious salutary effect on the vegetation. Re-treatment at roughly six monthly intervals would be necessary to continue control. Under cultivation, if drainage could be improved at the same time then the effect of treatment may well be greater and longer lasting.

Die-back Problems other than Phytophthora cinnamomi

It should not be considered that any plant showing the symptoms listed in Section 1 is automatically subject to attack by Phytophthora cinnamomi. As indicated the symptoms are those of root/shoot inbalance resulting in insufficient moisture being available to the plant. The symptoms could well be caused by drought alone or, by mechanical damage or by a wide variety of fungi or insects attacking the root or crown. These include other species of Phytophthora and species of the related genus Pythium.

There may also be physiological problems, totally unrelated to disease attack, that are peculiar to native plants under cultivation. The losses associated with summer watering of West Australian natives could well be in this category, tied in with in phase/out of phase growth under our drought prone climatic conditions.

FURTHER DETAILS ON CULTIVATION

By Dr. Trevor Broxton.

B.marginata and B.robur are planted in a lawn area so they effectively have mulch. B. marginata, ericifolia and serrata are planted on a natural slope and consequently have good drainage. B.robur is in a natural depression in the lawn and hence it is in a wetter position than the other species. N.B. in summer the lawn is watered so the B.robur is kept moist throughout the year. B.menziesii is in a slightly raised bed(about 6") adjacent to the lawn - it regularly receives water during the summer and does not seem to object. None of the banksias have ever been fertilised. B.ericifolia has flowered twice, B.marginata and B.robur are in flower now for the first time and B.menziesii is in bud for the first time. During winter B.menziesii has been protected from frost by a hessian cover. In its first winter (1973) B.robur suffered severe burns to its new foliage but last year it was O.K. (actually no new growth was observed in autumn '74, so maybe that is why it was frost hardy in winter '74).

Many other banksias have been tried without success. These include B.baueri, media, occidentalis, coccinea, speciosa and prionotes. It is my belief that banksias as well as requiring good drainage (most of the above species were planted in 3' of sand-mountain soil mix behind a retaining wall) also require some shade while young. With this idea in mind I have constructed a raised bed (2' of sand-mountain soil mix) in an area that receives about ½ sun. I have planted the following species in this bed in March '75, B.coccinea, baxteri, prostrata, pulchella and as well as Dryandra pteridifolia, nobilis and proteoides.

Most of my early plantings of banksias were of plants from nurseries but I have now established a program of growing my own plants from seed. All my recent plantings have been my own plants. Advantages of growing banksias from seed

i) plants can be planted while quite small
ii) plants are not force fed at any stage
iii) it is obviously much cheaper than buying plants at $1.40 each.

I feel that points i) and ii) must help when planting out banksias away from their normal environment.

NEW SOUTH WALES BANKSIAS

by HUGH STACEY

Firstly a comment re Banksia aplenifolia; while it is true that I have found it growing in swampy land alongside B.robur this is by no means generally the case. In fact B.robur is not a common plant, although it may be dominant in swampy areas. B.asplenifolia is quite widespread, and it is very common on shallow heathlands in the Royal National Park. While generally growing on sandstone, it seems to be at home on clay loam as at Menai (south of the George's River) I have seen it in heath at Blackheath, Blue Mountains. It is also the inhabitant of the swamp at Portal Waterhole in the Glenbrook National Park, lower Blue Mountains (Here it is identified as B.paludosa by Alan Fairley in his book "The Beaten Track").

I can also report now on B.paludosa which I have observed near Cordeaux Dam, south of Sydney, and also I believe, at Blackheath near a lookout known as Pulpit Rock, above the Grose Valley. (This latter population consists of several plants which have flowered without setting seed).

In some ways B.paludosa could easily be overlooked in mistake for the far commoner B.asplenifolia, particularly if attention is paid only to the leaves. In both species these are very variable in shape, size and degree of serration even on the same plant, and it can sometimes be difficult to pick specific samples apart There are, however, several general differences which can be used as a guide. B.paludosa is typically a shrub up to 5 ft high (much taller specimens have been noted by others, probably in areas less frequently subject to fire than the Woronora Plateau), fairly open in growth but with stems sufficiently upright to provide a pleasantly shaped bush. Leaves typically angled at 45° to the stem, with margins sometimes entire but usually fairly evenly serrated, edges recurved and tapering gradually to the base of the stalk such that there is virtually no petiole. The tapered portion is usually quite straight and free from serrations. Most leaves are less than 3" long, some up to 4" and up to 1¼" wide (say up to 1-cm x 3 cm) generally spathulate to obovate. The underside of mature leaves shows pale green with veins distinctly white, only the mid vein being prominent to the touch. Veins often angled at up to 60° to the mid vein. Leaves and stalks are quite glabrous at the end of the winter, but new leaves bear a very fine rusty tomentum over both mid and minor veins, the young stalks also being finely pubescent.

The contrasting features of B.asplenifolia so far are: new growth, both leaf veins and stalks thickly covered with a rusty velvet tomentum which persists on mature stalks and leaf petioles, gradually becoming black in colour. Leaves up to 5" x 1", elliptical to oblong or obovate, the edges rounded at the joint with the stalk, leaving a distinct petiole ¼" to ⅜" long. Veins prominent on the underside tending to be yellow rather than white; edges rounded but not recurved, irregularly toothed or entire.

The general impression is that B.asplenifolia is a much more thick set shrub, with stalks much bigger in diameter and leaves more inclined to spread. Flower heads are often terminal, whereas with B.paludosa they develop on mature stalks at least two seasons behaind the new leaf growth, and are therefore more enclosed within the foliage of the bush.

Plants are unmistakable by inspection of flower heads and seed cones. Spikes of B.paludosa do not exceed 4 cm in diameter, the styles being at right angles to the rhachis; spikes of B.asplenifolia are often up to 7 cm in diameter. Perianths and styles persist on seed cones of B.paludosa, at least as stubble, while seed cones of B.asplenifolia are invariably clean. Protruding valves of B.paludosa are black, thicker and blunt when open, while those of B.asplenifolia are grey, thinner and razor sharp.

I have not seen B.paludosa growing in swamp conditions as the name suggests, but rather on shallow sandstone pockets on a gentle slope in association with B. serrata, Hakea sericea, Petrophile sessilis, Isopogon anemonifolius and Persoonia species, together with several small eucalypts. As with so many of the Proteaceae it seems that young plants must be prevented from drying out, so that watering or planting where soakage ensures sub soil moisture is necessary in order to allow the plant to establish.

COMMENTS ON GROWING IN S.E. Q'LD.

Mr. J. Baker, Caboolture

The rainfall at Caboolture, Q'ld. is 140-150mm. per year and 125mm or so at Gympie. In both areas the summer is the "wet season" but the soil can become saturated at any time of the year for up to three weeks. We have found that Phytophthora cinnamomi destroys the root system of susceptable plants in autumn-winter-spring, during periods of continued wet weather.

The following are the results of some small trials carried out over the past 2-3 years

(i) Grafting: An approach graft technique was used, very similar to that described by Col.Wilson (1974 Report) with several minor differences. However one B.collina grafted on to B.asplenifolia succeeded. Five attempts were made - three onto B. robur. Matching of cambium layers was poor in two cases and two plants that had apparently taken died suddenly.

The differences were a) both stock and scion seedlings were both grown together in one pot and grafted when the stems were about 10mm in diameter.

B) Wax (Grafing Master) was used.
c) cuts 2 and 3 were not made
d) bark was removed from the scion plant about 12mm below the graft three weeks or so after the graft was made.

(ii) Nutrition: I have had good results with 'Osmocote', "Yate Plant Pills" and blood and bone. Seedings of B. robur were all killed by levels of fertilizer that B.collina seedlings thrived on, and B.asplenifolia showed leaf burn and death in some cases.

SPECIES NOTES

Banksia integrifolia (Mt. William).

Seed of this species was planted in February '75 with 3 germinating after 8 weeks, the pot remained outside and was subjected to all weathers. It was noted that after every subsequent shower 2 further seeds germinated with the result that 21 seedlings have grown up until mid July '75 - a 5 month period.

This raises a number of questions. Is this species dependent on su sudden releases of moisture for germination? Is it a combination of this moisture and a period of cold to stratify the seed prior to germination? This can be compared with artificial stratification treatment in a refrigerator to hasten the seed of B.canei. With sudden storms an extra quantity of nitrogen is released into soil, does this factor induce germination?

Remember this species is only found on high peaks in the Grampians (Vic) which are subjected to frosts, hail and occasional snowstorms. Maybe some members could try a series of tests on this species.

Another Victorian species that has germinated during winter time is B.ornata 95% Growing naturally in the Little and Big Deserts and adjoining areas in S.A., this desert dweller is subjected to cold wet winters and generally dry summers. It must take advantage of the favourable moist conditions of winter and germinate readily during this time. We believe this species to be hardy to frosts except prolonged severe exposures.

Banksia Caleyi

Reports have reached us from W.A. that there occurs in the Stirling Ranges a yellow form of this species. Has anyone seen it and photographed it, if so could we have a copy for our collection? Any details on habitat and distribution would be most welcome.

Another fascinating form of this species occurs again in these mountains at the western end. I have only seen the bush at the fruit stage and the seed cones were enormous 25 x 13 cm. Again we want information and photographs of the flower to complete records of this variation. If it is known in cultivation then let's have details.

Banksia attenuata (dwarf)

One of the most northerly occurences of this species is in the Kalbarri N.P. on the Loop 2 Bend track between the 2 vehicle tracks. Growing to only 1m with a 2m spread it flowers in late winter to early spring. An open shrub with bright yellow terminal flowers it grows in association with B.sceptrum in deep white sands.

Its southern distribution extends as far as Gin Gin, mainly on the coastal sand plains.

Banksia spp. nova (Lake King)

A form of B. repens (which may possibly be renamed in a revision of the genus by A. George, W.A. Herbarium) appears to be a superior horticultural specimen than B.repens. Growing in its natural habitat it extends 17 km south of Lake King eastwards in Mallee country to 2 km south of Scadden on the Norseman-Esperance Road.

Forming a dense groundcover 2m in diameter the deeply lobed leaves stand erect to 30cm. Well displayed in Spring on the perimeter of this excellent species are large dull red cylindrical flowers of 20 cm similar in colour to B.praemorsa.

This species is being sold by a Melbourne specialist nursery as B. sp.nova (Lake King). It is also the species illustrated in Holiday and Watton's Field Guide to Banksias. P 11b. The typical and widespread form has a leaf illustration on this page and is twisted and

Habitat is deep sand with mallee vegetation. This form is already in cultivation at Maranoa Gardens, Balwyn, Melbourne and is approx. 17 years old. It appears to tolerate Melbourne's clay soils of the Northern and Eastern suburbs.

Banksia Sphaerocarpa Variations

A form of B.sphaerocarpa occurs 5 km east of Walkaway in the Geraldton, Greenough vicinity. A small shrub 1.3 x 1.5 m with massed flowers in all stages of development. Mauve in bud opening to red at maturity. This form is growing along roudsides in lateritic gravel.

A prostrate form of this species exists further to the east again and thrives in heathlands in heavy laterite. The flowers are smaller than the normal species and sit upright on the horizontal stems. An open straggly bush with a spread of 1.5 m. with short, linear dark green leaves.

The type specimen of B.sphaerocarpa is a bush 1-1.5 x 1.5m. with blue grey linear leaves of about 5cm. The floral parts, unlike the varieties remain tightly packed and twisted around the globular fruits. Much of the mature seed of this form is destroyed by insects making collection difficult. Around Albany there exists a form closely related to B.violacea in habit and flower colour, in fact, it can be difficult to separate from this species.

Another form with extremely long leaves 10-16cm x 4mm and large fruits (12-15cm) with flower buds pink irridescent changing to golden yellow is found east of Jurien Bay to McDonald National Park, west of Coorow.

For the collection of seed from W.A. permission in the form of a permit must be obtained from the Department of Agriculture or the National Parks Board.

Over the last three years a small area containing B. goodii has been visited when plenty of unripened cones were evident - but no mature cones at all were found - the plants had been stripped. Again this year a similar result, and yet the plants of this restricted species had dozens of unripened cones in October 1974. If this continues and there is no seed to replace old plants, or those damaged by animals or fire, the species will be wiped out from its habitat.

I have also been disturbed to hear of a recent visitor to W.A. who "took all available seed" of B.lullfitzii and claimed that he has every cone of B.elegans. It is well known that the latter species produces seed rarely. If this sort of activity is to continue, and with the upsurge in popularity in native plant growing throughout the country, I'm sure it will, then rare or restricted species will be prime targets and face a new kind of threat. It also throws a responsibility onto the groups and individuals who know there whereabouts and wish to protect them to decide whether this sort of information should be generally available.

THE USE OF STOCKS FOR GRAFTING WEST AUSTRALIAN BANKSIA.

by Alf Salkin.

A number of points need to be made about using Eastern Banksias as stocks for grafting Western Banksias. The first is the problem of suckering, for this reason Banksia spinulosa var spinulosa from N.S.W. which has a ligno tuber at the base of the stem should not be used. The best forms appear to be one from the Blue Mountains with broad flat leaves or the form common in Victoria.

B.asplenifolia and some forms of B.robur also have ligno tubers and any damage to top growth usually triggers the ligno tuber into activity. It seems likely that if we want to use these very hardy root stocks we will have to produce them from cuttings. The second point relates to compatibility. As yet we know very little about this subject for banksias. We do however know that some groups of Eastern Banksias are more closely related to Western Banksias than are others.

The table below is based on flower structure and leaf morphology and may be useful as a guide. We would certainly welcome any feedback relating to this.

Banksias with Hooked Styles — Oncostylis

Eastern	Western
B.ericifolia	B.pulchella
B. spinulosa	B.meisneri
B. collina complex	B.violacea
	B.sphaerocarpa
	B.laricina
	B.nutans
	B.tricuspis
	B.occidentalis
	B.littoralis
	B.verticillata
	B.brownii
	B.dryandroides

Banksias with straight or slightly curved styles — Eubanksia

a. Banksias with deep pits on the undersurface of the leaves to which the hairs are confined leaving the surface more or less glabarous.

Eastern	Western	
B.serrata	B. baueri	B. caleyi
B.serratifolia	B.elegans	B.elderiana
B.ornata	B.hookerana	B.laevigata
	B.lullfizii	B.lindleyana
	B.quericifolia	

b. Banksias with reticulate venation on the underside of leaves the effect being due to a woolly tomentum with clear spaces where the veins are.

Eastern	Western	
B.asplenifolia	B.ashbyi	B.attenuata
B.canei	B.benthamiana	B.coccinea
B.dentata	B.grandis	B.media
B.integrifolia	B.pilostylis	B.praemorsa
B.marginata	B.solandri	B.victoriae
B.paludosa		
B.robur		

GERMINATION NOTES

Mrs.B.M.Rowley and Tony Cavanagh

Some time ago, we compared seed germination times we had recorded over a period of years for most of the currently named Banksia species. As these may be of interest to other members, they are presented in the attached table together with comments. The times stated are the shortest observed by us for each species; in some cases, longer times were noted for sowings in months other than the ones given. A second point which must be borne in mind is that in most cases, only a few seeds were involved (less than a dozen down to one or two) so the sample sizes are fairly meaningless from a statistical point of view. Thus the times below should be regarded as a rough guide only to expected behaviour though in some instances they indicate trends among seed from certain areas of Australia.

It is perhaps fortuitous that the main sowing times for each of us were resepctively autumn (B.M.R.) and spring (T.C.) The best time to plant Western Banksia seeds outside their home state is always a point of contention, with advocates for both periods of the year. However, the cold and generally wet winters experienced in southern Victoria allow relatively little growth and may well prevent germination altogether if seed is sown too late in autumn. Another problem is the possibility of seed rotting in water logged soil over a period of up to two months. The average temperature of South East South Australia is somewhat higher than that of Ocean Grove, particularly in the autumn months, and this probably accounts for the generally good germination achieved there for autumn sown seed. In both cases, plants are grown and hardened in the open; with a glasshouse, it may be possible to achieve satisfactory results even in winter if the temperature can be controlled, during the day at least, to somewhere near 25°C.

General Comments:
Perhaps the most interesting comparison is that between Eastern and Western Banksias. In very broad terms, it can be said that many of the Easternsspecies live under conditions opposite to those of their Western cousins - e.g. with dry, mild winters and wet humid summers compared with a colder wet winter and a moderate to hot dry summer. It might thus be expected that Eastern species would germinate better in spring rather than the autumn. This proved to be the case for all species apart from B. canei. Seed sown in September

or even December-January in Victoria required, on the average, 4 to 5 weeks, although both B.robur and B.dentata were much quicker at about 2 weeks, while B.ornata and B.integrifolia took a little longer. April-May plantings in South Australia in every case required longer times, in some cases more than double. The B.robur time of 106 days for South Australia (seed sown August) must be considered exceptional and not in any way an indication of normal times. Experience in Victoria shows that over period October to March, B.robur requires from as little as 13 days in January to 38 days in October, with shortest times between January and March.

As regards Western Banksias, there appears to be little significant difference between germination times recorded for the spring and autumn sowings in the two States, though, on average, th the Victorian spring figures are slightly shorter. For seed to be planted in the open in Victoria, early March is probably as late as is practical, otherwise the cold weather of April can cause germination to be slow and uncertain.

Further comments from Tony C vanagh:-

I have found the following species either difficult to germinate or difficult to grow on. In most cases, I suspect the seed to be at fault because others have reported relatively little difficulty. Several species planted in spring for each of several years have consistently been slow to germinate.

(1) Species not germinated:

B.ashbyi, sphaerocarpa, menziesii

(2) Species with poor germination and weak seedlings:

B. lindleyana, B.violacea

(3) Species slow to germinate, usually poor strike:

B.baxteri, B.praemorsa, Bquer[illegible] or integrifolia

(4) Species difficult to grow on after germination - possibly due to wet mixes:

B.burdettii, B.dryandroides, B.ornata, B.victoriae

GERMINATION NOTES

by Alf Salkin

Two important factors that affect the germination of banksia seeds are moisture and temperature and as these interact differences in germination times can often be put down to this. There are however other factors that control germination in plants and Banksias seem to be no exception. In Darwinian terms it is no advantage for all seeds to germinate at the same time and most Banksia seed will germinate in the same pot over a period of many weeks. The exception seems to be Banksia dentata where all seeds seem to come up as if by a signal. At the other extreme is B.marginata. Seeds of certain forms such as those from the mountain forests, and the form from Port Lincoln will continue to germinate for up to 3 months after the first ones have come up.

Some Banksia seeds may also also not germinate in the winter but come up in the spring after they were sown B.canei is one such and is discussed elsewhere. It is however not only Eastern Banksias that exhibit this curious adaption. Seed of a form of B.petiolaris from the Stirling Range was sown in 2" pots (1 seed per pot) all but a few came up in the summer, one that didn't went through the whole winter and germinated in October.

I use several methods of sowing seeds for germination trials I sow single fertile seeds in 2" pots. I fill these practically to the top with a mountain soil gravel peatmoss mixture, the seed is placed on this and the rest of the pot (about the same depth as the seed) topped up with coarse gravel. The pots are then watered with Dexon and placed in full sun. Another method which takes less space is to sow in a gravel peat moss mixture either in 2" pots or 4" square pots for transplanting and a number of seeds are placed in each pot and fertile and unfertile seeds are not sorted.

It is difficult to pick out fertile seeds but generally plump seeds that show no obvious damage usually come up. Species are very variable in the number of fertile seeds they produce. B.canei will often have 2 fertile seeds per folicle and as some cones have over 100 folicles this is 200 fertile seeds. On the other hand in B.marginata one may find cones with as few as 5 folicles on the cone and only one folicle will have one lower seed fertile.

Cones older than 3 years are often riddled with an Ascomycete fungus and no seed will be fertile. These are usually easy to pick as the fungus fruiting body is present and the cones may be snapped in half with comparative ease.

I use Dexon in my pots to inhibit the fungus Pythium the damping off fungus to which all the Proteacea seem very susceptible and there are the fringe benefits that it inhibits other fungi such as Phytophthera.

Occasionally I have problems with seedlings coming up very yellow but this appears to be an iron deficiency and can be corrected with iron chelate.

GERMINATION NOTES- Dr. T. Broxton.

Slow germination in November December. This could be due to inefficiency in keeping the containers moist in the warmer weather. The data from January-March (mostly this year) was a result of a concerted effort to keep containers moist especially during hot spells - they were religiously watered at least once a day.

Most of the seed has been purchased from Kings Park but I collected some species myself locally (e.g. marginata, integrifolia, serrata and spinulosa) and when I visited W.A. last August (coccinea, priorotes, dryandroides, prostrata, sphaerocarpa, baxteri and ilicifolia).

Germination details: medium:- 1 part Cranbourne loam, 3 parts propogating sand and some peat moss.

Containers:- plastic polybags $3\frac{1}{2}$ x $3\frac{1}{2}$ x 8 - easy to handle- easy to get seedlings out of, by cutting down the sides with scissors and gently watering the sandy mix away from the seedlings and reasonably well drained provided a sandy mix is used. Of course they encourage deep root growth.

Potting up:- I used to use a mix of 1 part of mountain soil and one part of Cranbourne loam in plastic poly bags but I found that these became too wet and waterlogged - I lost quite a few plants from this cause - even species like spinulosa or marginata.

Currently I use a mix of 1 part Cranbourne loam and 1 part propogating sand in hard plastic pots. The plants do not seem to get waterlogged using this system and as an added insurance I water occasionally with a 0.1% solution of mancojeb (1 gm/1 litre) to combat any fungi that may be in the soil.

To cover or not to cover: I have found out from experience that once the seed has germinated it is better to leave it in the open rather than have it covered by glass or polythene sheet etc. This is especially important in summer when susceptible species e.g. B.coccinea or B.sphaerocarpa will damp off very readily if covered, but appear quite handy if left in the open.

I think it may be useful to cover containers before germination occurs especially during April-November. Even this is not necessary during December - March.

No general fertilisers (N.P.K, types) have been used on my Banksia seedlings but in some cases of yellowing I have tried both an iron chelate solution (iron solubilized as an EDTA complex) and a trace element mixture with apparent success. (unfortunately no control experiments for a comparison).

GERMINATION NOTES Walter Folkman

The seeds planted in the period from 16/9/75 to 27/9/75, in plastic seed trays, 6" plastic pots and some in wooden boxes. Medium: 6 parts course river sand and one part peat moss. Seed embedded in medium, then covered with fine saw-dust and watered. Each container was covered with plastic (clear) to prevent drying out. These were removed after approx 20 days. Containers were all placed in a plastic covered garden house with ample ventilation. After seedlings appear, they are watered with weak solution of fungicide: "Captan". No damping off has been observed.

FURTHER NOTES ON STRATIFICATION Alf Salkin.

Recent experiments with the so called Banksia integrifolia form from Mt. William and several other summits in the Grampians show it to have closer affinities with B.canei than the coastal form of B.integrifolia. Not pnly is the cone similar to B.canei but unstratified seed has sat in the pot for the whole of the summer and up till the beginning of April had still not germinated - a period of over 5 months. On the other hand seed stratified for 46 days germinated in only 13 days after planting out seed which was stratified for only 32 days failed to germinate.

It appears too that some forms of B.marginata require stratification. These are the forms that do not open their follicles unless burnt. I suspect that the ones that do are B.marginata B.integrifolia crosses. Seed of B.marginata from the Billywing in the Grampians was stratified on 2/2/76 planted on 13/3/76 and germinated 18/3/76. That is they germinated in 5 days after 44 days stratification.

Seed from the same cone was planted 23/11/75 and germinated 6/4/76 that is after 137 days.

BANKSIA REVISION

A recent communication from Mr. Alex George of the West Australian Herbarium indicates that he should finish the revision of the genus Banksia within the next year. It is expected that the number of species will be increased to 80 with major changes in B.sphaerocarpa B.repens groups.

GERMINATION TIMES FOR BANKSIAS

	DR	TC	CW	AS	TB	WF	KN	Min	Max.
ashbyi	Mr 29			Mr 30	S 46		O 27	27	46
asplenifolia	Au 33			Mr 31	J 18		N 17	17	33
attenuata	My 64		Ap 21	D 21			N 33	21	64
attenuata dwarf	My 69								
audax	Mr 49	Oc 29	S 35			35	N 41	29	49
baueri	Mr 40	S 46			J 52	S32		32	52
baxteri	Mr 41	S 54	Ap54		S 46	S32	034	32	54
benthamiana	Mr 46		Ap21	D 38	J 47	28	N33	21	47
brownii		S 25	S 25		Ap24 N78		034	24	78
burdettii		N 26	S 26		Jan46	30	060	26	60
caleyi	D 51	S 37				36	N 5	5	51
canei	Mr 28	Jan70		* June22				22	70
candolleana	Ap 33	S 43		D 28		28	032	28	43
coccinea	Mr 45	S 29	Ap29	D 15	Ap24		N30	15	45
collina	My 64	S 36		S 35				35	64
dentata		Jan16	S 88	Jan20				16	88
dryandroides		S 30	S 70		Ap48 N78			30	78
eldereana	Mr 75			D 26	Jan53		N33	26	75
elegans	Au 28								
ericifolia	My 57	De 26	Ap27	N 16			N16 027	16	57
goodii	Ap 37	My 60	S 35					35	60
grandis	Mr 28				Ap24		N19	19	28
hookerana	Mr 42				S 34		025	25	42
ilicifolia	Ap 32		S 23	Jan32	Jan46			23	46
integrifolia	My 58	D 46	Ap 32	O 30	Ap 88	21	N44	21	88
laevigata									
laricina	Ap 37	S 26	S 37	D 30		22	033	22	37
lehmanniana		O 33		D 30			029 048	29	48
lindleyana	Mr 28	D 36	S 36			31	N26	26	36
littoralis	Mr 29		S 21					21	29
lullfitzii							040		
marginata	58	S 30	Ap 84	N 90	Ap 42	22	035 038	22	84
media	Mr 47	S 30		D21	28	28 33	033	21	47
meissneri									
menziesii				D 20					

* Stratified for 10 weeks

	D.	TC	CW	AS	TB	WF	KN	Min	Max
nutans	Ap 37	S 37	S 37	J 34			N33	33	37
occidentalis	Mr 27					S22 24	N22	22	27
ornata		S 41		O 30			036 N27	27	41
paludosa				O 41					1
petiolaris	Ap 37	S 39	S 47	D 17	J 28			17	47
pilostylis	My 57		S 21	D 25		24	N31	21	57
praemorsa	Au 77	S 45	S 74		S 63		N39	39	77
prionotes	Ap 24			D 28		S 26 32	N28	24	32
prostrata	Ap 53	S 52		D 40	S 41 N 77		N54	40	77
pulchella					Ap 24		N39	24	39
quericifolia	Mr 52	S 33	S 34	Mr27		31	N32	31	52
queric.var integ.		S 51							
repens		S 48	S 67	D 45		32	047	32	67
robur	Aul06	J 13	Ap 22	024	J 18	23	N31	13	31
sceptrum	Ap 32			J 14			N29	14	32
serrata	My 64	S 35	Ap 35	O 24	N 94 J 30		027	24	94
serratifolia	Ap 47	J 29		O 24			026	24	47
solandri	Aug46		S 56	O 30			061	30	61
speciosa		S 31	S 34	D 30		S 28 34		28	34
sphaerocarpa	Ap 37			D 18	S30 J24		044	18	44
" var major	Ap26								
" pinifolius	Mr 60			D 17				17	60
spinulosa		J 26	Ap 36	D 30		26 32	034	26	36
tricuspis		S 29	S 16	D 24		21	N15	16	29
verticillata	Mr 55		S 24	D 17				17	55
victoriae	Mr 30	S 34	S 40	D 24			N33	24	40
violacea	Ap 32	S 60					N26	26	60

DR	Dulcie Rowley	Mt. Gambier S.A.
TC	Tony Cavanagh	Ocean Grove Vic.
CW	Colin Wilson	Templestowe Vic.
AS	Alf Salkin	Mt. Waverley Vic.
TB	Trevor Broxton	Eltham Vic
WF	Walter Folkman	Pearcedale Vic
KN	K.Nossek	Edithvale Vic.