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Sustainability is a word very much misused. There is no such thing as sustainable agriculture, sustaining our way of life, sustaining this continent and this planet as long as we let the population explode and our present wasteful practices are continued. As a society concerned about the nature of our flora and its conservation efforts should be devoted to areas that we can contribute to. Sustainability needs an energy source, which comes from sources such as solar energy. Managed timber growing is sustainable.

This issue commences a series of articles encouraging the planting of trees, the right trees, for commercial purposes. It also delays the salinity crisis.

Salinity, our land is being destroyed. This is a matter of deep national concern. There has been much talk and many beautiful publications but an adequately funded national project is yet to eventuate, see page 71.

Each issue of Australian Plants is devoted to conservation of available resources, particularly biodiversity. All life depends on the flora and its dependent fauna. Growing native plants directly supports the healthy balance of biodiversity. We need colour in our living spaces. The cut flower industry based on native flora, not only earn millions of export dollars but also provides employment and discourages bush picking.

This issue, as with all issues, describes, in simple terms, how to grow readily cultivated wildflowers *Banksia*, native Citrus and productive timber. *Epacris* and related groups of plants are not so readily grown but are essential in our environment. We support research to learn the secrets of nature in nurturing these lovely plants.

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Front cover: *Archeria eriocarpa* is a slender shrub of the rainforests of Tasmania. The dainty bell shaped flowers may vary from a deep pink to near white. This plant is in the Epacridaceae group of plants of Tasmania as introduced opposite. It is described on page 50 with three other similar species of *Archeria*. Cover photograph - R.K. Crowden.

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Tasmanian Epacridaceae*

R.K. Crowden and Y. Menadue

The Epacridaceae is a significant family in the Tasmanian flora and is represented in all the major ecosystems of the state, heathlands (coastal to alpine), woodlands and forests (including rainforest).

In horticulture the epacrids have created interest as unique botanical specimens. As woody perennials they present a range of shapes and habits, ranging from a cushion plant (*Dracophyllum minimum*) with densely packed twigs and branches, through less densely packed mat-forming or semi-erect types, to erect or straggling shrubs and even small trees (*Trochocarpa gunnii*).

There are some interesting and contrasting types of foliage ranging from the minute, stem appressed leaves of *Epacris petrophila*, through the stiff, erect, hard and (very) prickly leaves of *Richea scoparia*, to the long and pendulous apical rosettes of the tree *Richea pandanifolia*. The rosettes may exceed 1 metre in length, which give this plant the superficial appearance of a *Pandanus* palm. Many species provide a bright splash of colour when in flower, while others may retain attractively coloured fruits (drupes) for many months *Richea dracophylla* and *Sprengelia incarnata* are wild harvested for the cut flower trade.



Gardener's Tip:
Many retain
coloured fruits
for months

Astroloma humifusum and *Styphelia adscendens* have large fruits that are edible and have been used to make a jam.

Species of *Epacris*, *Cyathodes*, *Prionotes* and *Richea* are relatively common in gardens. In *Epacris impressa*, a number of colour forms have been given cultivar names and 'double flower' forms of *E. impressa* and *E. gunnii* are known. Epacridaceae generally are not very suited to the average urban garden because they require very different husbandry techniques to most common garden exotics. They are surface-rooting plants mostly coming from well-drained sands and peats and they resent root-damaging hoeing and weeding, liming, pH correction and overwatering.

The presence of a friendly fungus living to mutual advantage with the root system, an ericoid mycorrhizal association, occurs in a number of species and this probably is a very widespread requirement. Most epacrids are very susceptible to infection by *Phytophthora cinnamomi* and are amongst the first plants to succumb to this disease.

***Tasmania Epacridaceae.** In this treatment we do not attempt any taxonomic revision and all presently named species are maintained. However, we do express some thoughts that may be relevant to any future reassessment of the family. Some recent revisions and name changes are commented on in the discussion relevant to the groups of species concerned. Forms which we consider need further investigation to decide their species status are noted as e.g. *Epacris* 'Union Bridge', the epithet referring to the location of the first record. Altogether there are described in this paper 92 named species and/or subspecies and a further 5 taxa whose status is yet to be determined. 68 taxa are endemic to Tasmania. This article is the first of a number of parts to be published on Epacridaceae.



Astroloma pinifolium

See page 50

B.A. Fuhrer



Brachyloma depressum

See page 50

B.A. Fuhrer



Brachyloma ciliatum

See page 50

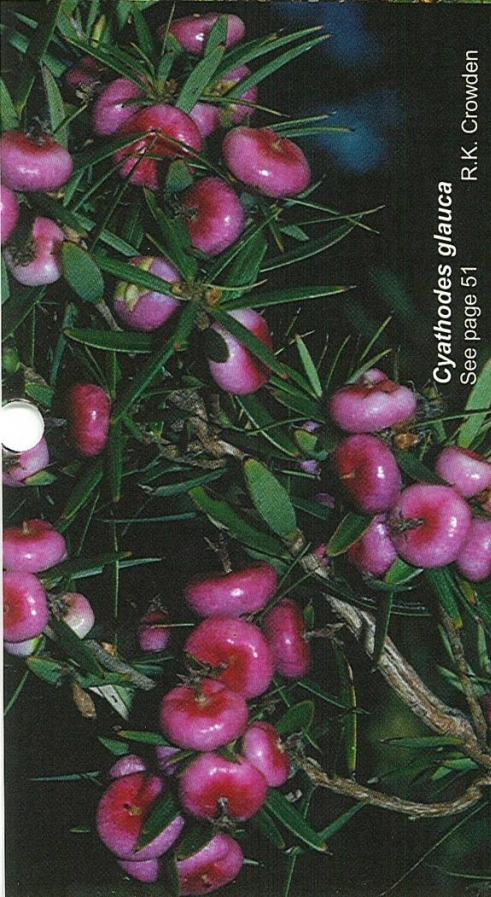
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Astroloma humifusum

See page 50

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Cyathodes glauca

See page 51

R.K. Crowden



Cyathodes dealbata

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Cyathodes platystoma

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Cyathodes straminea

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Propagation We have found that small, soft or semi-hard tip cuttings of *Epacris* strike readily, albeit slowly, but cuttings of other genera are more difficult and we have had few successes. Mark Fountain of the Royal Tasmanian Botanical Gardens has had success with cuttings of a number of genera. Other Tasmanian SGAP members have reported successes with *Priodontes* and some species of *Cyathodes*.

Propagation from seed is more probable, though not guaranteed. 'Green' seeds of *Epacris* from near mature capsules frequently give better germination than seed from fully ripened capsules. Smoke treatment (including watering with a smoke extract) is very effective with seeds of *Epacris*, *Sprengelia* and at least some *Richea*. *Richea pandanifolia* seed has germinated in a refrigerator when forgotten for over 12 months. Exposure of woody drupes to a light twig fire will promote some germination of *Astroloma humifusum*, *Leptecophylla juniperina* and *Styphelia adscendens*, and probably some heathland *Leucopogon*. Bird regurgitations (Black Jay or Currawong, *Stepera fuliginosa*, endemic) frequently give rise to seedlings of *Leptecophylla juniperina*.

The many species It is not possible to present so many species of plants without the use of botanical terms. Simple sketches are provided to illustrate the botanical descriptions. For convenience of treatment, the plants have first been grouped by using the botanical 'key' into 18 groups or genera. Such keys use diagnostic or shared sets of characters, which distinguish any one group from the others. The keys are intended for field use or for use with fresh specimens and some characters may become indistinct when dried.

Key to the Tasmanian Genera of Epacridaceae

1. Leaves with bases sheathing the stem. (Figure Xd) 2
 Leaves with petioles or sessile bases, sometimes stem clasping, non-sheathing. ... 4
2. Corolla lobes fused forming an operculum (Figure Xm) which cleaves near the base at anthesis. 15. *Richea*
 Corolla forming a tube, lobes free at anthesis (Figure Xn). 3
3. Corolla tube longer than the calyx, lobes rounded and shorter than the tube.
 Calyx herbaceous. 6. *Dracophyllum*
 Corolla tube shorter or equal to calyx, lobes narrow and pointed, spreading, longer than the tube. Calyx petaloid. 16. *Sprengelia*
4. Style inserted in depression in ovary. Ovary 5-locular with numerous ovules.
Fruit a capsule (hence for the genera in 5 & 6, *Priodontes*, *Epacris* & *Archeria*). 5
 Style terminal on ovary. Ovary 1 – 10 locular, each locule with 1 or a few ovules.
Fruit a drupe with a woody stone, number of locules often reduced by abortion. ... 7
5. Leaves with margins toothed and distinctly reticulate venation (Figure Xg).
 Filaments of anthers free to the base (as in 6a). 14. *Priodontes*
 Leaf margins not toothed or minutely so, venation (major veins) parallel, palmate (figure Xh), or obscure but not reticulate. Filaments of anthers fused to the corolla tube (as in 1a and 2a). 6
6. Flowers solitary. Numerous subtending bracts similar to and overlapping the sepals. 7. *Epacris*
 Inflorescence a short raceme (Figure Xj) often reduced to a single floret.
 Two bracts distant from the sepals and distinct, 2a. 2. *Archeria*
 Inflorescence a spherical cluster of flowers located on previous season's growth.
 Flowers usually projecting downwards and inconspicuous. 1. *Acrotriche*
 Flowers solitary, or in spikes or racemes, axillary or terminal on new season's growth. 8

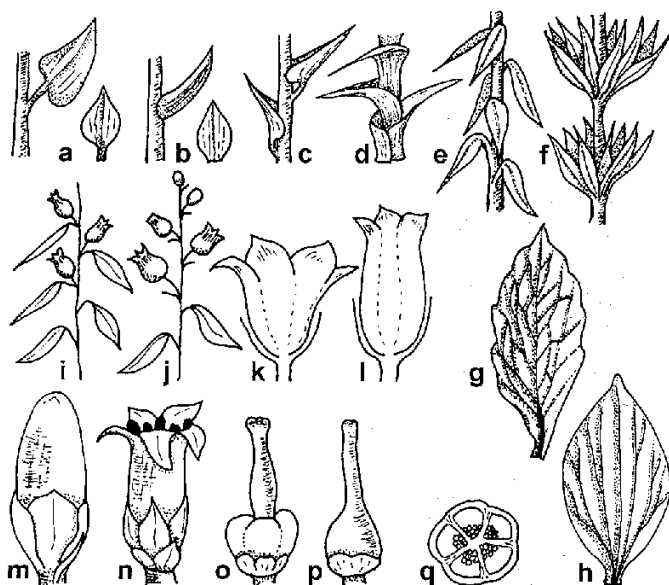


Figure X. Leaves: **a** petiolate (with stalk), **b** sessile (without a stalk), **c** stem clasping, **d** sheathing, **e** attached alternately or spirally, **f** false whorl, **g** reticulate venation, **h** palmate venation.

Flowers: **i** solitary, **j** raceme, **k** campanulate, **l** cylindrical, **m** operculum, **n** tube with lobes free, **o** style in a depression, **p** style terminal, **q** ovary then fruit with 5 locules.

The key to Tasmanian Epacridaceae continued

8. Corolla red, yellow or green, tube twice the length of the sepals or greater. 9
- Corolla white or pale pink, tube equal, less or slightly greater than the sepals. 10
9. Lobes nearly as long as the tube, strongly reflexed.
 - Anthers on long filaments. 17. *Stypheia*
 - Lobes flat, much shorter than the tube. Anthers sessile, enclosed. 3. *Astroloma*
10. Leaf venation pattern on abaxial surface highlighted by interveinal wax. 11
- Interveinal wax on abaxial surface lacking or indistinct,
 - venation pattern evident but not highlighted. 18
11. Flowers subtended by numerous imbricate bracts and bracteoles. 12
- Flowers subtended by 1 bract & 2 bracteoles, small sometimes caducous. 14
12. Plant prostrate, mat-forming. Fruit succulent. *Cyathodes dealbata*
- Plant erect. Fruit pithy. 13
13. Leaves clustered in false whorls (Fig. Xf). Corolla tube greater than 6mm long,
 - lobes revolute. 5. *Cyathodes*
 - Leaves alternate. Corolla tube less than (or rarely equal) 6 mm long,
 - lobes erect or spreading. 8. *Leptecophylla*
14. Corolla lobes with dense or sparse hairs or nearly glabrous.
 - Fruit flattened dorsiventrally, usually 5 mm or more in diameter. 13. *Planocarpa*
 - Corolla lobes glabrous or with sparse hairs or papillate to some degree.
 - Fruit spherical or ovoid less than 5 mm in diameter. 15
15. Corolla tube campanulate or shortly cylindrical, about 2 mm long,
 - inner surface of lobes glabrous. 11. *Monotoca*
 - Corolla tube cylindrical, 4 mm or more long,
 - inner surfaces of lobes papillate or with scattered hairs. 16



Bracophyllum minimum

See page 51

R.K. Crowden



Acrotriche cordata

R.K. Crowden



Acrotriche serrulata

R.K. Crowden



Archeria serpyllifolia

See page 50

R.K. Crowden

16. Leaves narrow – lanceolate, tapering to a pungent point.
 Inner surface of lobes with scattered hairs. 10. *Lissanthe strigosa*
 Leaves oblong, apex rounded, blunt or with a short callus. 17
17. Mature fruit over-winters on the plant. 10. *Lissanthe montana*
 Mature fruit falls soon after ripening, before winter. 9. *Leucopogon hookeri*
18. Flowers solitary. 19
 Flowers in short spikes or racemes. 20
19. Inner surface of corolla lobes densely bearded. 12. *Pentachondra*
 Inner surface of corolla lobes glabrous except for a ring of 5 tufts of
 stiff, reflexed hairs projecting backwards into tube. 4. *Brachyroma*
20. Drupes 5 mm or more in diameter, somewhat flattened
 usually purple. 18. *Trochocarpa*
 Drupes spherical, usually less than 5mm in diameter, red, white or yellowish. 21
21. Inner surface of corolla lobes densely bearded with fine,
 woolly hairs. 9. *Leucopogon*
 Inner surface of corolla lobes glabrous or papillate or with sparse hairs. 22
22. Mature fruit over-winters on the plant. 10. *Lissanthe montana*
 Fruit falls soon after ripening, before winter. 9. *Leucopogon hookeri*

1. *Acrotriche*

Flower of *Acrotriche* Fig. 1A



Acrotriche cordata is an erect shrub up to 1 m. Leaves are rounded, usually less than 1cm long, glabrous, with a blunt, obtuse apex. Flowers are pale green appearing in late winter. It is common along southern coastal regions of mainland Australia, Tasmania and Flinders Is. Photograph opposite

Acrotriche prostrata and *A. serrulata* can be difficult to resolve. Both form low bushy mounds, rarely more than 20 cm high. The leaves of both species are linear with an acute, though not prickly apex. However, the leaves of *A. prostrata* are longer (usually 1.0 – 2.0 cm) than *A. serrulata* (rarely more than 1.0 cm) and there is a more open appearance to the clump. Buried stems of *A. prostrata* will sometimes form adventitious roots, whereas we have not observed this in *A. serrulata*. Moreover there is a distinct habitat difference. *A. prostrata* is found in dampish patches on old vegetated dunes of the west coast e.g. just north of Arthur R. (cf. its occurrence on Wilsons Promontory, Vic.), and the flowering season is later (mid-spring) than *A. serrulata* (mid-late winter). *A. serrulata* is widespread and abundant in dry lowland woodlands and open forests, particularly in east and Southeast Tasmania on shallow clay loam soils on dolerite and also in sandy heaths.

2. *Archeria* All 4 species are endemic. Flower Fig. 2A



Archeria comberi is a bushy much branched shrub, up to 1.5 m diameter, of alpine heathland in the Southwest, often bordering tarns or lakes. The rounded leaves (3–4 mm) are blunt and often impart a reddish coloration to the bush. The conspicuous deep pink flowers (tube 5–7 mm long) are seen in late spring.

Archeria hirtella and *A. eriocarpa* (photo page 41), are slender woody shrubs to 2+ metres tall and are easily confused. The vestiture of the fruit is glabrous in *A. hirtella*, hirsute in *A. eriocarpa*.

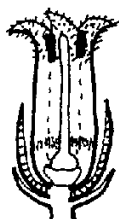
Both belong to rainforest communities, *A. hirtella* frequently along stream banks and in the scrub margins of the forest, particularly at lower altitudes. *A. eriocarpa* is more likely at higher altitudes, but there is considerable overlap. Flower colour may vary from deep pink to near white. The flowers appear in spring.

Archeria serpyllifolia grows amongst boulders and in cracks in rocks in the highest alpine heaths of the Southwest, including Mt. Field. It is an erect, sparsely branched shrub, rarely greater than 0.5 m high, with creamy white flowers in late summer. Photo on page 48.

3. *Astroloma*

Flower of *Astroloma* Fig. 3A

Astroloma humifusum forms low compact mats to 1 m diameter in most lowland habitats, in sandy heaths and open woodlands on shallow dolerite soils. The stiff, narrow 1 cm leaves have a serrated margin prickly to the touch. The autumn flowers are deep red, 2 cm long with tiny lobes and are half obscured by the leaves. The large (1 cm diam.) green drupe has a thin succulent mesocarp when mature. Photo on page 44.

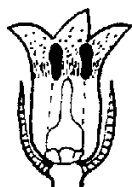


Astroloma pinifolium forms a semi-prostrate, spreading and more open clump than *A. humifusum*. The leaves are softer, longer and narrower and on the semi-erect stems, give the plant a 'pine seedling' appearance. The flowers (winter to early spring) are 2+ cm long and bi-coloured (yellow/green). The red/green form seen on the central coast of NSW does not occur in Tasmania. *A. pinifolium* is most common in the coastal heaths near the granite outcrops of the east coast (e.g. Freycinet Peninsula), but it is found also in isolated inland locations, e.g. a granite outcrop near Royal George, and on sands near Lake Crescent. Photo on page 48.

4. *Brachyloma*

Flower of *Brachyloma* Fig. 4A

Brachyloma ciliatum is a small, nearly prostrate plant of coastal heathlands and heathy woodlands on sandy soils of the north, east and Southeast of the state. The leaves are soft and rounded with a barely pungent point. The white flowers (tube 0.5 cm and longer than the sepals) appear in the spring. Photo on page 44.



Brachyloma depressum is an erect, sparsely branched shrub up to 0.5 m. The stiff, linear-oblong leaves (1.0–1.5 cm long) have a very pungent point. The white flowers appear in winter. The tube (0.5 cm) is barely as long as the sepals. This plant occurs amongst granite boulders near the sea on the Freycinet Peninsula and at Bicheno. Photo on page 44.

5. *Cyathodes* 3 species, all endemic. Flower Fig. 5A

The genus *Cyathodes* Labill. has been revised by Weiller, who has accorded the status of genus to the three natural intrageneric groupings, retaining as *Cyathodes*, 3 species *C. glauca*, *C. platystoma* and *C. straminea*. Three species of the *C. petiolaris* group are placed in the new genus *Planocarpa* C.M. Weiller, and five (formerly the *C. juniperina* group) in the new genus *Leptecophylla* C.M. Weiller.



Cyathodes dealbata is a prostrate mat-forming plant found near the summits of mountains of the central south and on the central plateau. The white flowers, which open in late spring, have a distinctly pink colouring in the bud stage. The plant is dioecious, the male flowers having a longer corolla tube than the female. In both the tube is longer than the lobes which are bearded inside. The small (0.5 mm diam.) orange, spherical fruits are succulent. Photo on page 45.

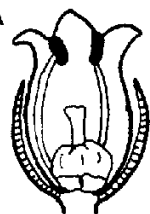
Cyathodes glauca is a bushy shrub often reaching 2 m. Leaves are in pseudo-whorls reflecting annual growths, variable in size, up to 5 cm long and 0.5 cm wide and are fairly stiff with a sharp point. The white flowers, with recurved corolla lobes, appear in late spring/early summer and have a noticeable honeydew 'scent'. Flowers are hermaphrodite. The large drupes, up to 1 cm dia. range in colour from deep purple to nearly white and may persist on the plant for many months. *C. glauca* is widespread in sclerophyll forests from low altitudes to sub-alpine in most regions of the state. Photo on page 45.

Cyathodes platystoma is a new species described by Weiller (1997). A tall shrub, up to 3 m, like an 'oversize' *C. glauca* in general appearance, with larger, broader leaves. The white flowers (hermaphrodite) which appear in spring differ from *C. glauca* in that they do not have the distinct constriction at the corolla throat. Localised in wet sclerophyll forests on the Tasman and Forestier Peninsulas of Southeast Tasmania. Photo on page 45.

Cyathodes straminea is a compact, commonly dense shrub often spreading over boulders at near alpine altitudes of the central and southern mountains. The shiny leaves are smaller and more rounded than those of *C. glauca* and although pointed are not so prickly. The white flowers (hermaphrodite) are slightly larger than *C. glauca* and appear a little later in the summer, though with sufficient temporal overlap to allow for natural hybridisation to occur, e.g. populations on the old ski run at Lake Fenton on Mt. Field. Photo on page 45.

6. *Dracophyllum* all endemic. Flower Fig. 6A

Dracophyllum milliganii is usually a sprawling, low shrub. The erect main stem, rarely more than 30 cm high, is crowned by a dense formation of long, narrow leaves (often coiled towards the apex), which range from 15 up to 50 cm in length. The floriferous, panicle terminal inflorescences of white flowers (tube 0.5–1.0 cm long) are erect, up to 40 cm high and appear mid-summer. It is a plant of alpine heaths of the southern and western mountains. Photo on page 88.



Dracophyllum 'Southwest' is an arborescent plant to 5 m or more in height, with leaves 80–90 cm long. It is restricted in occurrence to the most southerly mountains. It is included by Curtis in the broad description of *D. milliganii* (ht. 15 cm–4 m, leaves 15–90 cm long), but we have not seen plants of intermediate size. Further examination is required. Photo on page 88.

Drachyllum minimum is a cushion plant of the highest mountains of the Southwest and on Cradle Mt. It forms dense mounds of 1m or more in diameter. The solitary white flowers appear in mid-summer. Photo, page 48.

Tasmanian Epacridaceae, Part 2, will feature *Epacris* in our next issue.

Citrus reunited _____ Professor David J. Mabberley*

Any changes in botanical names, particularly of well known plants, should be justified to the general public, so that the work of botanists be seen as responsible. Far too often name changes seem arcane, to say the least. The story of citrus fruits, though, is a salutary one, which has a happy ending.

In preparing an account of the native citrus fruits for Flora of Australia, I had the pleasure to describe a species new to science. Any new citrus is interesting as possibly providing new germplasm or rootstocks for commercial citrus-growers. The tree was collected for the first time by J. McKean, about 8 km west of Humpty Doo in the Northern Territory in 1971. It was considered a new species of *Microcitrus*, a genus established by W.T. Swingle of the United States Dept. of Agriculture in 1915 for our native citrus, except the desert kumquat or limebush which he isolated in its own genus *Eremocitrus*.

Naming the new species was a problem. It had much of the habit of *Eremocitrus* with narrow leaves but with far more segments (8 or 9 as opposed to 3) in the fruit. *Eremocitrus* was thought distinctive in having only two seeds per segment but this is also a feature of the true kumquats in yet another genus *Fortunella*. However, within the known species of *Microcitrus* there is the complete range. All three genera have been split off from *Citrus* by Swingle. Left in *Citrus* were species like the well known 'lime-leaves' of cooking, *Citrus hystrix*, which has floral features allegedly characteristic of *Fortunella*.



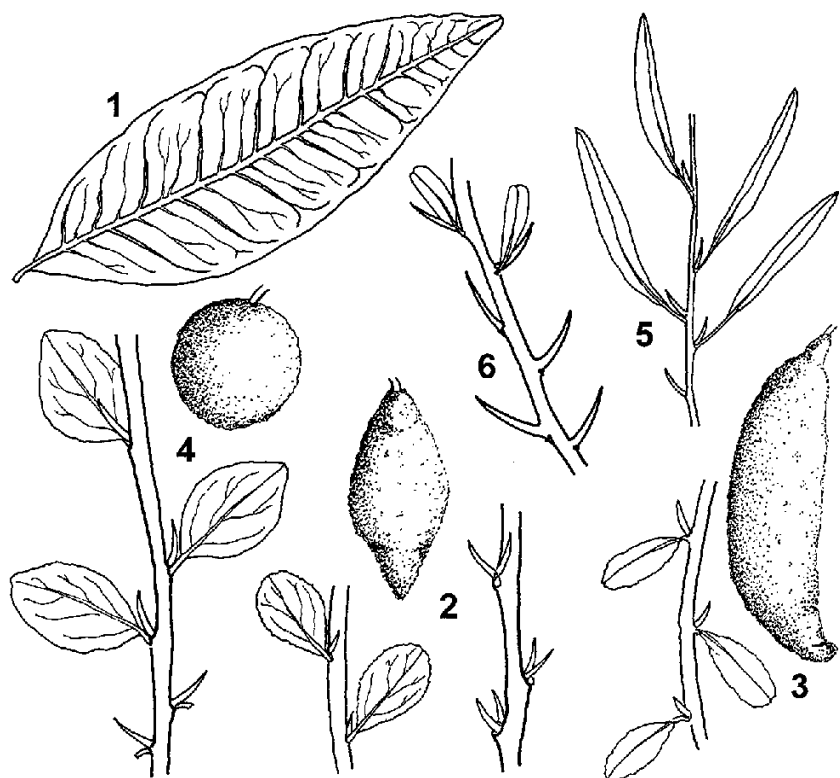
Gardener's Tip:
Australian citrus
are used to
produce edible
foods

Breeding experiments have long shown that *Fortunella* species can be crossed with *Citrus*, the so-called intergeneric hybrids called X *Citrofortunella*; among these is the familiar Calamondin. Similar work has shown that Australian and New Guinea species of *Microcitrus* can cross with a whole range of *Citrus* species as well as with *Eremocitrus*. Some hybrids synthesised had three or more Swingle 'genera' in their make-up, some given outlandish 'common' names.

From work on the chemical constituents of the peel, it has lately been realised that most of the edible citrus crops are also of hybrid origin and that they arose as crosses and back-crosses between a handful of species native in tropical Asia. Because these hybrids are capable of reproducing asexually by seed (apomixis), lines are 'fixed' and suitable ones were selected by the people of Asia long ago.

Further work on enzymes in the leaves and later on fusing cells from '*Microcitrus*' with those of *Citrus* showed not only that the two 'genera' are very intimately allied but that the lime, *Citrus x aurantiifolia*, could have a '*Microcitris*' in its ancestry and therefore be potentially referable to a new 'intergeneric' hybrid genus!

*David Mabberley, CEO of Greening Australia (NSW) Inc., explains how recent advances in taxonomic techniques have led to a new user-friendly classification of native and cultivated citrus fruit. This work has been published in the scientific journal of the Royal Botanic Gardens, Sydney, Telopea volume 6.



Sketches by B. Maloney

Fig. 1 *Citrus inodora* leaf

Fig. 2 *Citrus garrawayae* leaves & fruit

Fig. 3 *Citrus australasica* leaves & fruit

Fig. 4 *Citrus australis* leaves & fruit

Fig. 5 *Citrus gracilis* leaves

Fig. 6 *Citrus glauca* leaves

The solution to this ridiculous state of affairs was put forward in 1931, long before the recent experimental work, by Isaac Burkill working in Singapore on the species of the Malay region. He re-united all of the Swingle's splits referring to them as 'microgenera' with a narrowness which offends my conception of what a genus is. All subsequent genetic and biochemical work confirms his approach and already Japanese workers have knocked down the house of cards by returning the kumquats (*Fortunella*) to *Citrus*.

The modern classification

Including the new '*Microcitrus*' species from the Northern Territory, which I have named *Citrus gracilis* because of graceful foliage, there are six native species (five endemic) in Australia. The first to be collected was the desert kumquat, found by Robert Brown on Flinders' voyage, 1801-3, referred to *Citrus* as *C. glauca* by Burkill in 1932 (but not found in standard lists).

Next known was the dooja or Australian lime found by Allan Cunningham at Moreton Bay in the 1820s and first described in 1829 as *Limonia australis* by Robert Mudie in his *Picture of Australia*; it was soon moved to *Citrus* and the rest, save *C. gracilis*, were known before Swingle got to work and so were described in *Citrus* in the first place.

The genus *Citrus* comprises perhaps twenty or so species through south-east Asia to South Australia and now it becomes clear how important Australia is in terms of the genetic diversity of the genus; a diversity masked by faulty taxonomy. The new, actually old, classification of citrus fruits, uncluttered by fictitious 'intergeneric' hybrid names is therefore user-friendly for gardeners, farmers and botanists alike.

Key to native species:

1. Spines often in pairs; leaves up to 20 x 10 cm with many parallel lateral veins.
Citrus inodora F.M. Bailey [(*Microcitrus inodora*, *M. maideniana*;
 Queensland (Cook District)] **Russell River lime** (Fig. 1)
2. Spines solitary; leaves up to 6 (to 9) x 3 cm without many parallel lateral veins. 2
2. Leaves ovate to rhombic. 3
2. Leaves narrowly ovate to sublinear. 4
3. Fruits ovoid to ellipsoid. *Citrus garrawayae* F.M. Bailey [*Microcitrus garrawayae*;
 Queensland (Cape York) and Papua New Guinea (Goodenough Is.)]
 **Mount White lime** (Fig. 2)
3. Fruits cylindrical - fusiform.
Citrus australasica F. Mueller (*Microcitrus australasica*; southern Queensland,
 Northern New South Wales) **Finger lime** (Fig. 3)
3. Fruits globose.
Citrus australis (Mudie) Planchon (*Microcitrus australis*; southern Queensland)
 **dooja, Australian lime** (Fig. 4)
4. Leaves hairless; fruit with 8 or 9 segments.
Citrus gracilis Mabb. (Northern Territory) **Humpty Doo lime** (Fig. 5)
4. Leaves grey-hairy; fruit with three segments.
Citrus glauca (Lindley) Burkill (*Eriocitrus glauca*; Queensland, New South
 Wales & South Australia) **desert kumquat, limebush** (Fig. 6)

Citrus australis and *C. australasica* were hybridised in the Sydney Botanic Gardens some time before 1925 and the resultant 'Sydney Hybrid' has been used in breeding work. In the new classification it is *C. x virgata* Mabb. 'Sydney Hybrid'.

The correct Latin names for some commercial *Citrus*:

Citrus x aurantiifolia (Christm.) Swingle (*C. medica* x ?), e.g. 'Mexican' - **lime** ('Tahiti', the familiar seedless form introduced in 1824 may be a cross between this and the citron or lemon. It certainly has an extra set of chromosomes and, if the parentage does involve a further species, would be called *C. x latifolia* Tanaka to reflect this).

Citrus x aurantium L. (*C. maxima* x *C. reticulata*) - **oranges and grapefruits**.
 Sweet Orange group, e.g. 'Washington Navel' ('Baia'), 'Shamouti' ('Jaffa'),
 'Valencia' **sweet orange**; **ortaniques** are back-crosses with *C. reticulata*
 Tangelo group, e.g. 'Minneola' - **tangelo** (grapefruit crossed with *C. reticulata*)
 Sour Orange group, e.g. 'Bouquet' - **sour orange**
 Tangor group (back-crosses with *C. reticulata*), e.g. 'Wilking' - **tangor**
 Grapefruit group (back-crosses with pomelo first made in Barbados in the
 eighteenth century), e.g. 'Marsh Seedless', 'Star Ruby' - **grapefruit**.

Citrus x bergamia Risso (*C. medica* x *C. maxima* x *C. reticulata*) - **bergamot**.

Citrus x floridana (J. Ingram and H. Moore) Mabb. (*C. x aurantiifolia* x *C. japonica*),
 synthesized in Eustis, Florida, USA in 1909 - **limequat**.

Citrus hystrix DC - lime-leaves.

Citrus japonica Thunb. e.g. 'Marumi' - kumquat

Citrus x limon (L.) Osb. (*C. medica* x ?), e.g. 'Lisbon' - lemon

Citrus maxima (Burm.f.) Merr. - pomelo

Citrus medica L. e.g. 'Etrog' - citron

Citrus x microcarpa Bunge (*C. japonica* x *C. reticulata*) - calamondin

Citrus reticulata Blanco e.g. 'Clementine', 'Owari' - mandarin, tangerine, satsuma

There are a number of others whose parentage is still very unclear, one being the familiar 'Meyer' lemon, which is alleged to be a lemon x orange x mandarin hybrid. Until it is sorted out it is best to refer to it as a cultivar following the generic name, i.e. *Citrus* 'Meyer'.

Editor's note:

Commercial production of Australian *Citrus*

Superior varieties of our native *Citrus* have been developed and are now going into commercial production. The current farm-gate price of \$8-9/kg is expected to rise to meet the increasing demand. In two years time commercial experiences will be reported in Australian Plants. Readers interested in this product are urged to read *Australian Bushfoods* Magazine, Issue 16, Summer 2001, available from 38 Mountain View Rd., Maleny, Qld 4552, Ph 07 5494 3812 for \$5.50 plus postage. An exceptionally good periodical on all our bushfoods.

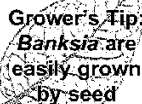
Banksia

Cultivation and propagation

by Russell McLean

There are about 75 species of *Banksia* in Australia, all woody evergreen plants, ranging in habit from prostrate shrubs to trees up to 30 metres tall. About 80% occur in Western Australia only. *Banksia dentata* extends from northern Australia into Papua New Guinea, Irian Jaya and the Aru Islands. Tree forms usually have a single trunk, while shrub forms have one or more stems at ground level. Banksias are renowned for the magnificent flowers they produce, and are popular as ornamental plants and for cut flowers.

The use of *Banksia* in horticulture and the home garden is widespread. With selection, there is a hardy showy *Banksia* for every well drained situation, particularly the eastern species - see photographs on pages 61 & 68. Banksias have many forms and are not only large shaggy trees or shrubs, but range down to small, even prostrate, plants and the foliage can be soft.



Grower's Tip:
Banksia are
easily grown
by seed

Banksia species native to south-western areas of Western Australia will not grow well, or at all, in those eastern parts of Australia with high summer humidity and heavy summer rain. As shown in the next article they are readily grown in the southern areas of Victoria and South Australia, this advantage is being taken up by many cut flower growers. Efforts have been made over many years to graft western *Banksia* on to eastern rootstock but this has not been commercially successful as yet.

Natural regeneration A number of species can regenerate from a woody stock (lignotuber) situated at the base of the stem at or just below ground level. Growth from this region is stimulated by destruction of the above-ground parts of the plant, usually by fire. Other species regenerate from seed released spontaneously after death through fire or other causes.

Many (e.g. *B. marginata*, *B. integrifolia* and *B. ornata*) have swollen nodes containing dormant buds as much as 10 metres from the parent plant. These occur on long, thin surface roots, and remain dormant as long as the parent plant is growing vigorously. Damage such as fire or drought will trigger these nodes to shoot. What appear to be seedlings around burnt or damaged plants are in fact root node growths. These are 'natural' methods by which banksias are propagated. There are other methods we can use.

Propagation of *Banksia* by seed

The most common method for both the professional nurseryman and home gardener is by seed. It is the simplest and cheapest way of producing new plants. Viable seed of most species is available if it has been stored properly. However it has the disadvantage of not always producing plants with identical characteristics of the parent plant.

Seed Collection Collect seeds only from healthy, vigorous specimens of desirable form. For those species that retain their seed indefinitely, it is essential cones are not collected too early after development of the follicles, otherwise the seed inside will be immature and not viable. It is recommended the cone be at least 12 months old. A good indication of maturity is to scratch the surface of the follicles. If they are brown and hard the cones are ready for collection; if they are soft and green the seeds inside are immature.



Grower's Tip:
Seed is
abundant
collect some
and grow
Banksia

Seed Extraction Several methods can be used:

- 1) Place the cones on a metal tray in an oven at 120 - 130°C for one hour or 200°C for 10 minutes, until the follicles begin to open. When the tray is cool the seed may be tapped out or extracted with tweezers (being careful not to mistake the separator, which is woody, for the seeds, which are usually black with a brown papery wing). Microwaving the cones is not a good idea, as this will 'cook' the seeds, rendering them useless.
- 2) Place the cones on an open fire and remove the seeds when the follicles open, taking care not to spill the seeds into the fire in the process.
- 3) Alternately soak the cones in water then heat in an oven until the follicles open, then extract with tweezers.

Seed Storage Dust seeds with an insecticide such as carbaryl*, and a fungicide such as captan* or thiram*, and then place in sealed, labelled, glass, plastic or metal containers. Store away from direct sunlight and vermin, at temperatures of 10-25°C and relative humidity of 40-60%.

Pre-germination treatment of seed Generally *Banksia* seeds require no special treatments prior to sowing in order to overcome any inhibitors to germination, such as a hard coat (testa) or chemicals occurring in the testa or endosperm that have to be leached out. However, several species e.g. *B. canei*, & *B. saxicola* occur in mountain areas. Place the seeds on damp sand in a container in a refrigerator at about 5°C for 60 to 120 days prior to sowing.

*The use of chemicals (and which ones) is under review. Your recommendations?



Banksia serrata

N. Marriot



Banksia ericifolia

Ilma Dunn

Some eastern Australia Banksia



Banksia paludosa

Ilma Dunn



Banksia integrifolia

Sowing the seed The propagating media needs to be slightly acid (pH about 6.0), open, free draining but also retaining moisture. A suggested mix is 2.5 parts of a blend of fine and medium grade pine bark, 2.5 parts of medium grade pine bark, 0.5 parts of coarse sand, 0.5 parts of sieved peat moss and 1110 grams of dolomite per 0.5 cubic metre of mix. It needs to be free of pathogens. Ideally the mix should be sterilised. (Professionals pump steam heated to 60°C through the mix for 30 minutes). Ideally the media should be maintained at between 20 and 25°C, which is the optimum range for germinating *Banksia* seed. The mix must be kept moist but not wet.

The containers need to be deep to drain the media. They can be narrow, deep tubes into which single seeds can be sown. Fill the container/s with the media and firm down, leaving room at the top for water catchment. Water the media to field capacity. Sow the seed, firm down and just cover with a layer of fine media or vermiculite. Thoroughly water them in with a fine spray and place in a cold frame and keep moist. The propagating area should be well ventilated, as an adequate oxygen supply is important to stimulate germination. Germination times vary with species and germinating conditions, but expect results in three to six weeks.

Grower's Tip
Using this
method you
can grow all
types of seed

Aftercare Damping-off of the seeds can be a major problem if not controlled. The fungi responsible are *Rhizoctonia* and *Pythium*, causing the stems to rot at the base. An application of furalaxyl* Fongarid*, Benlate* or Captan* fungicide sprays at germination time should give adequate control. Fungal spores are dispersed by splashed water, so an alternative method of control would be to water the seedlings from below. One method is to place the seed trays or pots on a bed of sand and apply water to the sand only. The water is taken up through the drain holes by capillary action.

The germinated seedlings rapidly develop a taproot and a fibrous root system. Plants germinated in community trays or pots should be transferred (i.e. 'pricked out') into individual tubes or pots no later than a few weeks after germination, otherwise the roots are prone to damage when pricked out. The pricking out medium can be of similar formulation to the germination mix.

If the seedlings have been grown in a sheltered position such as a propagation house or frame, they must be hardened off for 3 to 5 days before transplanting, otherwise they could suffer (fatal) damage through a too rapid change in growing conditions.

Following pricking out, place the seedlings in a mild, sheltered position or under shade cloth for up to 2 weeks to continue the hardening-off process to the stage where they will be able to withstand open conditions. During this time they should be kept moist and given half-strength fertiliser very low in phosphorus. *Banksia* are susceptible to phosphorus toxicity, as they are very efficient at extracting phosphorus from normally deficient soils through root structures called proteoid roots. They will take in too much phosphorus if more than a small amount (> 4.0) is applied to the growing media.

After this period they can be placed in a sunny position where they will grow into strong young plants provided an adequate watering and fertilising regime is maintained. A slow release native plant fertiliser such as nine month Osmocote applied in spring will provide all the plants' nutritional needs during the growing season.

*The use of chemicals (and which ones) is under review. Your recommendations?

Propagation of *Banksia* by semi-hardwood stem cuttings

Many of the fine-leaved banksias and some of the coarse-leaved species are propagated from cuttings. The eastern species are commonly grown this way. Cuttings are taken from leafy semi-hardwood stems. Glabrous species are generally considered to be more amenable than species with hairy stems and foliage. 'Semi-hardwood' is growth that is supple but not soft, around February/March when the spring/summer growth has not fully hardened.

Ideally the cutting material should be taken from managed plants in the juvenile stage of growth as these root more easily than those from the adult phase. Material taken from plants in bushland is not recommended. Collect material early in the morning before the sun has been on the plants as the sap flow to stems is at its peak, having been replenished during the night. Use clean, sharp good-quality secateurs as blunt ones tear and bruise tissue and provide point of entry for pathogens. They can be cleaned with a germicide or disinfectant such as methylated spirits or Dettol.

Take cuttings from between 8 cm and 16 cm long, just below a node (which is where the adventitious roots on the cutting will form). The cuttings must not be allowed to dry out, process as soon as possible. Clean plastic bags can be used to store material for short trips. For longer trips, cuttings can be wrapped in moist newspaper and placed in plastic bags then stored in a car fridge or similar.



Grower's Tip:
Using cuttings
in this way,
you can grow
a large range
of plants

A bath of 2% sodium hypochlorite, Dettol or Hibitane should be prepared into which cuttings can be immersed prior to preparation for insertion into the media. This is used as a general disinfectant.

Remove the leaves on the lower half to two thirds of the cutting, taking care not to damage the bark. If large leaved species are being propagated (e.g. *B. robur*), remove half of each of the remaining leaves to reduce water loss through transpiration.

Dip the lower 2cm of the cutting into a rooting hormone to promote the development of adventitious roots on the cutting. A suitable substance is IBA (indole butyric acid) at 3,000 parts per million. IBA is a synthetic auxin manufactured by several companies. (Note: Use of a rooting hormone on *Banksia* cuttings has caused some debate, and there is a school of thought which says they are unnecessary and could even be lethal to the cuttings. Use with caution, perhaps treat half without and observe the results.)

The mix itself should be open (about 25-30% air-filled porosity), slightly acid (6.0 pH), free draining yet also retains some moisture. An aerated mix is vital, as oxygen plays a major role in the process of cuttings forming callus and roots. A suitable mix is a blend of 100 litres of perlite, 40 litres of sieved peat moss*, 360 litres of medium grade pine bark and 375 grams of dolomite per half cubic metre. There are many other mixes that could be used.

Use a dibbler to make a hole in the propagating medium, and insert the cutting half to two thirds of the way into the medium and firm it down. A reasonable number of cuttings can be placed in the one container. Do not overcrowd, as it could increase the risk of infection by pathogens due to decreased aeration and increased humidity. Thoroughly water the cuttings.

*The use of peat moss is no longer recommended. Think environment - use coir.



Banksia caleyi

J. Benzie



Banksia media

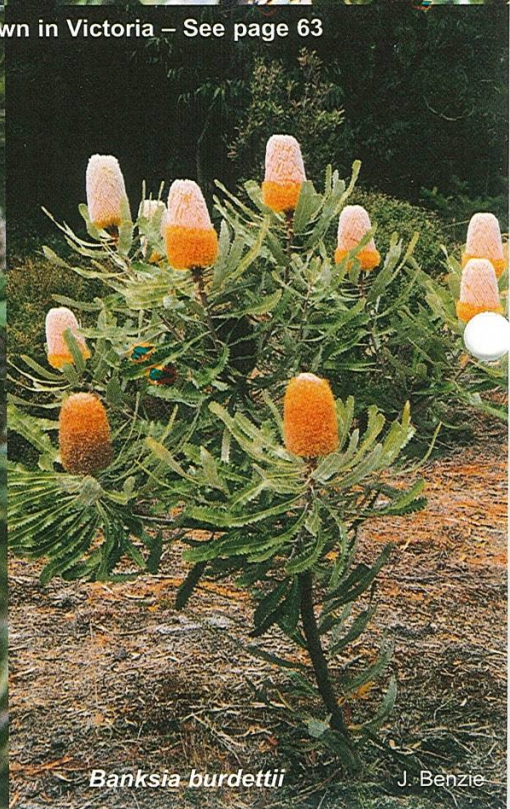
J. Benzie

Some western *Banksia* grown in Victoria – See page 63



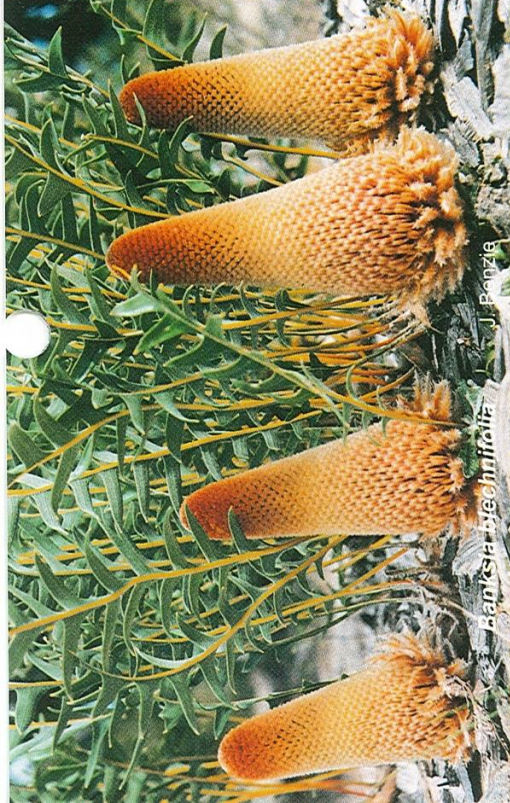
Banksia ornata

J. Benzie



Banksia burdettii

J. Benzie



Banksia pechinifolia J. Benzie



Banksia occidentalis J. Benzie



Banksia heterophylla J. Benzie



Banksia occidentalis plants with *B. heterophylla* in foreground J. Benzie

Maintain adequate watering, either through an automatic or manual watering system, or through the agency of an automatic misting system. Misting not only keeps the propagating mix moist, but places a film of water on the leaves of the cuttings, creating a humid atmosphere and reducing the temperature of the cuttings. This lowers transpiration and promotes root development, as ideally the tops of cuttings should be maintained 5-10°C cooler than the base.

For best results the correct temperature is in the range of 20 to 27°C during the day and 15°C at night. The base of the cuttings should be 5 to 10°C warmer than the top, so the application of bottom heat by heated cables/pipes through sand would be beneficial. This promotes root development before bud growth. The growth of buds before the development of roots can have a detrimental effect on the success of cuttings. Sufficient light must be available for photosynthesis to occur. However too much can lead to a rise in temperature and desiccation may occur.

Harden off for struck cuttings to be gradually exposed to the full range of outdoor conditions to prevent damage to the soft, tender new growth. If used turn off heating or mist a few days prior then move the cuttings to a sheltered location, such as under shade cloth. Seven to ten days prior to potting on it is recommended they be treated with a fungal drench such as Terrazole* and a root stimulant. There is a wide range of potting mixes that can be used; a suitable one consisting of fine pine bark, coarse sand and peat moss**.

Cuttings rooted in community pots or trays require a thorough watering, which will make the job of disentangling any roots easier, and ensure the roots and leaves are in good condition for the potting process. Prune the roots if they are too long for the new pots, and follow up with a good watering, which can include a fungal drench and root stimulant if desired. Place the pots in a sheltered area until the plants have recovered from the disturbance and new root growth has commenced, which may be within 4 to 7 days. Shadecloth can be used to provide some sun protection during this time.

The cuttings are now ready to be placed in the desired area for growing on to mature plants. Maintain a good watering and fertilising regime with a nine month pellatised fertiliser suitable for native plants at half recommended rates.

*The use of chemicals is under review. **We recommend the use of coir not peatmoss.

Editor's note:

***Banksia*, easily grown landscaping plants**

There are *Banksia* species ideal for any situation in any part of Australia. Selected species may become decorative shrubs with attractive contrasting form and leaf shape to complement any garden, with large showy flower heads to add beauty and grandeur. Previous issues had large colour photographs of the flower heads so in this issue I have presented a large number of smaller photographs of the flower heads to present the broad spectrum to new readers. The article describes propagation from seed. This is an exercise all can enjoy, let the youngsters harvest a *Banksia* cone, clean the seed, sow the seed and nurture the plants. Our last issue featured *Hakea* and described a novel, sure-fire way to germinate seed. It will work equally well with *Banksia* seed.

The next article seems to make the cultivation of western *Banksia* easy but note the garden is in southern Victoria where the annual rainfall pattern is similar to that of south western Australia. But is this the reason they grow so well there and we have so much trouble growing these beautiful western *Banksia* in eastern gardens? Under the ground conditions appear to be the trouble with western *Grevillea* and grafting western *Grevillea* onto eastern rootstock has solved the problem. If we could only find a way to graft western *Banksia* in the same way we may be successful.

Our Garden No 35

by John Benzie, Barongarook, Victoria.

My garden is 6 acres, near Colac just in the foothills of the Otway Ranges. There is humidity, but it's not bad. Rainfall is 1040 mm/year but has not been for the last three years. I'm expecting things to get back to normal this year.

The soil is mainly poor deep sand 20 m deep, grey in colour with a deeper orange layer lower down. The whole area supports large *Eucalyptus radiata* on the well drained areas, *E. obliqua* on the gentle slopes and *E. ovata* in the lower areas. I am told that my area was once the site of an ancient riverbed. I can dig several holes all over the block and they are all different, white sand, black fluffy sand, very gooey black sand, orange areas, deep black silt on the gully, and an area that looks like mountain soil to me. There are also patches of coffee rock about 60 cm down but the plants are able to find their way down through it. One particular area has grey sand with a large shelf of coffee rock, which is on a slope. On the 'down' side of this area is a stratum of dense chocolate soil that prevents the flow of water continuing through the sand. The water rises to the surface in winter and is perfect for *Banksia occidentalis*. I am very lucky to have several very distinct mini environments on the block and I plant accordingly.

Preparation for planting The trick is to match the plant to the relevant mini environment. I killed the bracken and then mulched. This was not done for the windbreak but all plants grew well. I have been planting since May 1992. Back then I did not have water so everything went in at autumn. The plants were dry planted into moist sand. Progress has been slow but now that I have a dam I can also plant through spring and summer.

I dig a hole with a mattock (much easier than a spade) as deep down as I can until I can lever up the dead bracken rhizome, this is about 30 cm down. The diameter of the hole is triple what most people would probably do but it is my gut feeling to really mix the sand up. In the winter a typical hole after digging is black and fluffy and in the summer you can put your hand into the hole and swirl the sand around like a fluid. *Acacia mucronata* grows everywhere and the book says its usually found on moist, well-drained sands. The plants are never watered past their original drink. The spring/summer plants get a bucket into the hole first and then about 2 litres to settle the plant. All plants get a spoon of Osmocote at spring for the first spring only.

My garden is shown in colour on the next pages. A number of photographs were coupled together to provide the broad picture.

- | | | |
|-------------------------------|---|--------------------------------|
| 1. <i>Acacia verniciflua</i> | 2. <i>Acacia terminalis</i> | 3. <i>Banksia brownii</i> |
| 4. <i>Acacia vestita</i> | 5. <i>Aotus ericoides</i> | 6. <i>Banksia coccinea</i> |
| 7. <i>Lept. myrsinoides</i> | 8. <i>Eucalyptus radiata</i> | 9. <i>Acacia retinodes</i> |
| 10. Grev. 'Copper Rocket' | 11. <i>Banksia media</i> | 12. <i>Banksia prionotes</i> |
| 13. <i>Acacia howittii</i> | 14. <i>Acacia iteaphylla</i> | 15. <i>Epacris impressa</i> |
| 16. <i>Acacia floribunda</i> | 17. Grev. <i>oleoides</i> x <i>shiresii</i> | 18. <i>Eucalyptus risdonii</i> |
| 19. <i>Kunzea baxteri</i> | 20. <i>Westringia brevifolia</i> x <i>raleighii</i> | |
| 21. <i>Banksia hookeriana</i> | | |

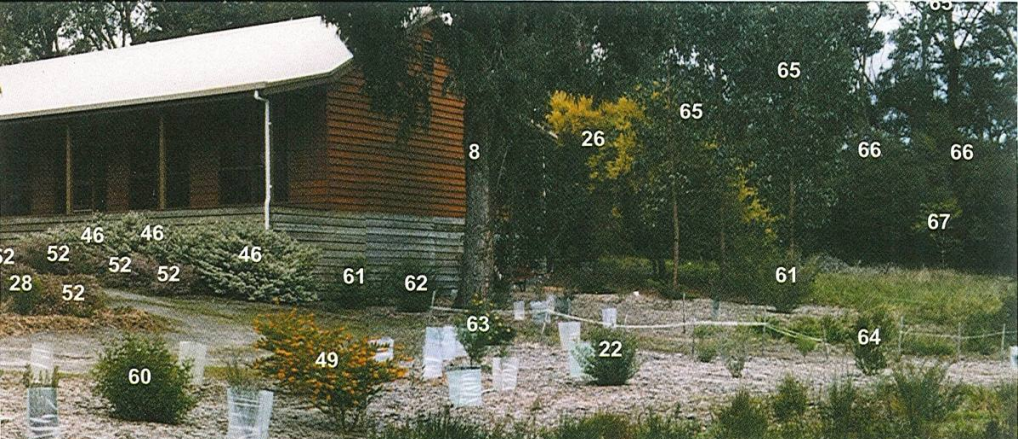


22. *Prost. scutellarioides*
 28. *Crocea exalata*
 34. *Eucalyptus crucis*
 40. *Correa* 'Dusky Bells'

23. Wallaby grass
 29. *Banksia quercifolia*
 35. *Dodonaea viscosa*
 41. *Correa baeuerlenii*

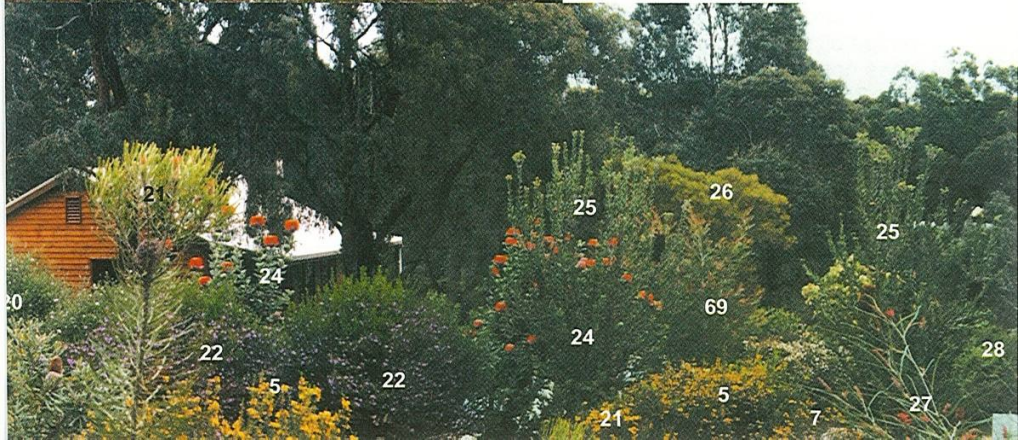
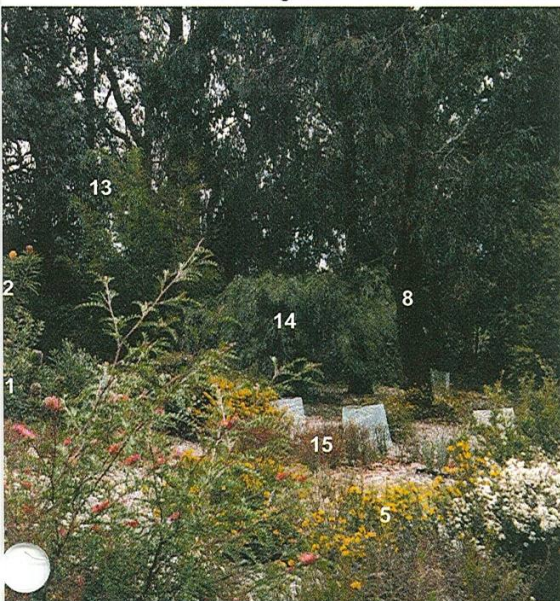
24. *Banksia coccinea*
 30. *Grevillea oleoides*
 36. *Grev.* 'Poorinda Queen'
 42. *Westringia fruticosa*





25. *Banksia praemorsa*
 31. *Euc. leucoxylon*
 37. *Grev. bipinnatifida*
 43. *West. fruticosa variegated*
 26. *Acacia mucronata*
 32. *Euc. mannifera*
 38. *Hard. 'Happy Wanderer'*
 44. *Prostanthera rotundifolia*

27. *Grevillea asplenifolia*
 33. *Euc. cinerea*
 39. *Grev. lavandulacea*
 45. *Acacia boormannii*
 46. *Philotheca myoporoides*
 47. *Dryandra drummondii*
 48. *Euc. leucoxylon*, dwarf
 49. *Eutaxia obovata*
 50. *Banksia solandri*
 51. *Westringia* 'Wynyabbie Gem'
 52. *Thryptomene saxicola*
 53. *Chamelaucium uncinatum*
 54. *Grev. 'Poorinda Rhondeau'*
 55. *Hakea* in rabbit guards
 56. *Astartea heteranthera*
 57. *Thryptomene calycina*
 58. *Grevillea 'Flora Mason'*
 59. *Dodonaea boroniifolia*
 60. *Westringia glabra*
 61. *Leptospermum 'Ballerina'*
 62. *Grevillea shiressii*
 63. *Isopogon anethifolius*
 64. *Leptospermum sericeum*
 65. *Eucalyptus obliqua*
 66. *Leptospermum juniperinum*
 67. *Eucalyptus crenulata*
 68. *Banksia marginata*
 69. *Grevillea hookeriana*



After Plant Care I soon learnt to put a rabbit guard on every plant. This has doubled my costs but must be done. I use an interlocking wire frame and a U.V. stabilised plastic sleeve. They can be used over and over and I have about 500 out there at any one point of time. They also protect my plants from unbelievable wind. My windbreaks are already working from the north, east and south, but the *Eucalyptus* cover in the area continues unbroken from the west all the way to my place. Consequently the wind swirls into my garden and can do damage. I never use bamboo stakes with the plastic sleeve. They are half the price of the wire frames but they only last long enough for one plant whereas I am still using the original frames from 8 years ago. The main reason, however, is that the wire frame will not move in the sand due to the design, but the bamboo stakes will move as the wind blows on the 3 surfaces of the sleeve. Eventually the bottom edge of the 3 sides will scoop sand (or mulch if I've been a good boy) into the crater and pile up as high as 50 mm around the plant. Once I start planting the likes of *Verticordia* the crater idea will have to go and I will plant into a mound with mulch up to the mound but stopping at the right point. This means autumn planting only.

Autumn plants are never watered but anything I put in at spring/summer gets 4 litres once a week in Jan/Feb. for their first summer only. This is done by slogging uphill from the dam carrying 2 buckets. Therefore, lately I have been preparing the next planting areas with mulch etc. and I will go back to autumn planting. I have settled down from the desire to constantly plant now that 3 of the 6 acres are reasonably established.



It is rare for me to lose a plant (except to wind) and as an example, I have 175 *Banksia coccinea* in the ground. They grow quite well, and I have only lost two. They were both 'Waite Crimson' and I do not consider them as summer hardy as the normal everyday *Banksia coccinea*, although I suppose two is not a test.

I've got an incredible mix of sand loving plants from western Australia besides *Banksia*, including *Isopogon*, *Petrophile*, *Mallophora*, *Lechenaultia*, *Dampiera*, and some test plants of *Verticordia* (which are doing well). However, I consider that I'm lucky to have my spot as I have also got all the species of snow gums (except *Eucalyptus stellulata* and *E. debeuzevillei*) and many clay and loam loving plants. I have found that it's easy to grow clay plants into sand and I suppose the ultimate height may not be as high but I get to eat my cake and keep it also.

Two more comments. - Pinching out is a real hassle as I have hundreds of plants and it must be done to avoid big pruning jobs later on. I now use a hedge clipper and give them a hair cut rather than the laborious pinch-out. It does not seem to hurt them and is great for plants like *Thryptomene saxicola* and *Baeckea astarteoides*.

My one big disappointment was *Eucalyptus leucoxylon* ssp. *megalocarpa* planted in the wind breaks. This small tree was a total disaster and they have been replanted with Grampian's gums and Victorian silver gums *E. crenulata*. In theory, they should have grown, but didn't.

*Our Garden series of articles gives details of practical experiences by other growers. Readers are invited to contribute some notes on their garden or just send in a few photographs. Editor.

Wildflower cultivars

Reports from the Australian Cultivar Registration Authority*

Edited by W.H. Payne

Banksia 'Superman' is a variety of *Banksia serrata* found growing in a wild area near Nambucca Heads, NSW. This form is much larger in both leaf size (twice as long, 32 cm) and flower size (twice normal). It was discovered during mapping for the *Banksia Atlas* in 1986 and mention is made of it in the subsequent publication (*Banksia Atlas*, 1988:225). It occurs in small stands between Nambucca Heads and Grassy Head, NSW. In all cases the plants were growing close to water along the edge of streams or in poorly drained sites. The form comes true to seed. The specimen received by ACRA was grown in a garden and was approximately 6 years old. It is a small tree growing to 6 metres in height with a spread of 5 metres. Leaves alternate, xeromorphic, oblanceolate, 32 cm long by 4 cm wide with evenly serrated margins, glabrous, dark green (137A) and shiny on upper surface, lighter green (138B), and penniveined on under-surface with a defined yellowish-green mid-rib. Flower inflorescences terminal spikes 26 cm long by 13 cm wide on short branches off the main trunk, the perianth greyed-green (198C), tubular in bud, splitting into segments with the style greyed yellow, (160B). Anthers sessile in the concave tips of the perianth segments. Ovary sessile, style long and wiry, 6 cm long, protruding from the slit in the perianth and curving out in a hook shape. Fruit a follicle, opening in two hard woody obtuse valves set transversely on the rachis. Seeds 2 with a terminal membranous wing, the seeds separated by a plate. Peak flowering is from January to March.

Planted in Armidale, *Banksia 'Superman'* is not drought tolerant and requires regular watering. It is frost tolerant down to a screen temperature of about -5°C but the tips of leaves and new growth are burnt in winter. The trial plantings are on a well drained basalt site which is watered daily with calcium rich bore water. At two years the specimens grew to 1.5 m. Propagation has been by seed. In its natural habitat the species is found beside saltwater creeks and on shorelines and is salt tolerant. This cultivar is fast-growing in cultivation with an annual growth rate of over a metre in the length of upright branches. The tips are affected by frosts but plants recover quickly. Splitting on the trunk appears to be a strategy for trunk widening. The trunk is short, brown and corky in appearance. The first flower spike appeared 5 years after planting. It has now set one pair of valves containing seeds. The following year the plant had 3 flower spikes including the specimen held by ACRA.

*The best forms of wildflowers are selected for horticulture, these selections being known as cultivars. The Society was involved in the formation of the ACRA (Australian Cultivar Registration Authority) an internationally accredited body to formally register cultivars based upon most of the Australian flora. Because of our involvement there is no charge for registration through the Study Groups. The only way we can identify special forms is to give them a cultivar name. This also conserves the name. While there is no legal or monetary protection as with Plant Breeders Rights, it prevents PBR registration. Members are urged to follow the example of members in Armidale & WA and bring to notice plants of special merit. One benefit is that it discourages bush picking.



Boronia 'Tyalge Ruby'
J. McAuliffe & ACRA



Leptospermum brevipes 'Blackwater Beauty'
M. Hitchcock & ACRA



Banksia serrata 'Superman'

M. Hitchcock & ACRA



Callistemon 'Hannahs Child'

N. Jupp & ACRA



Callistemon 'Hannahs Child'

P. Ellis & ACRA



Philotheca 'Kangaroo Gully Crimson'

P. Ellis & ACRA

Boronia 'Tyalge Ruby' originated as a seedling, thought to be a hybrid between *Boronia muelleri* and *Boronia citriodora*, from the garden of Mrs. Alvina Smith, Tynong North, Victoria. It is named after the property on which it originated and the applicant's mother. Registration applied for by Mrs. Alvina Smith of Tynong North, Victoria, in February 1995. It is a small shrub. Leaves strongly fragrant (citronella), 7-11 lobed, to 2.5 cm long. Leaflets 8 - 10 mm long, oil glands on upper surface, small hairs (sparse) on margins. Flowers usually 4 petals (75A) 4 stamens and 4 carpels but occasionally 5 petals, 9 stamens and 5 carpels. It differs from *B. muelleri* by having smaller but strongly fragrant leaves, like *B. citriodora*. It differs from *B. pilosa* in having fragrant leaves. It has smaller leaves than *B. citriodora* and *B. pinnata*. It has larger leaves than *B. citrata* and *B. 'Sunset Serenade'*.

Callistemon 'Crimson Cascade' arose in a batch of seedlings of *Callistemon phoeniceus* (possibly a hybrid with *C. viminalis* which grew close by) in the garden of Margaret Pieroni in Attadale, Western Australia in 1975. The name is derived from the colour of the flowers and the pendulous form of the branches. It is a medium shrub to 2.5 m high and 2 m wide and with a weeping habit. Foliage is medium density and bright green colour. Inflorescence 13 cm long by 7 cm diameter, filaments scarlet/crimson (46A ageing to 57B). Inflorescences are longer than the parent *C. phoeniceus*, with occasional multiple terminal spikes. The leaves are thinner, straighter and narrower and a brighter green than *C. phoeniceus* which is more bluish green, and the length of the fruiting portion of the stem is longer but more compacted. The flowering period is also slightly longer than *C. phoeniceus*. This is an excellent garden specimen, very drought hardy, tolerant of shade, moderately frost hardy and attractive to birds. Pruning will increase flowering, but the plant's natural weeping habit makes it a good screen.

Grower's Tip:
Bottlebrush
are hardy and
rewarding
plants for the
garden

Callistemon 'Hannahs Child' is believed to be a hybrid between *Callistemon 'Hannah Ray'* and *C. 'Kings Park Special'*. It was selected in 1987 from seedlings at Riverdene Nurseries, East Gresford, NSW, and produced commercially since. It is a shrub 1.5 x 4 m high producing scarlet (red 46A) flower heads (9 to 12 cm x 6 to 8 cm) from March to May and again in October/November. Young specimens are similar to *Callistemon 'Hannah Ray'*, but with denser flowers and only grow to two thirds its height. Mature specimens are more like *Callistemon 'Kings Park Special'*. New growth is pale yellow/green and covered with silky hairs. Mature leaves become glaucous. While it has medium frost hardiness and medium to low drought tolerance, it tolerates very heavy, wet soils. Propagated by cutting.

Leptospermum brevipes 'Backwater Beauty' is a prostrate variety of *Leptospermum brevipes* found growing naturally in the Backwater district in northern New South Wales. It grows as a dense groundcover to 0.3 m in height and 2 m in width. Leaves are ovate, acute tip; 8 mm x 4 mm wide; glabrous, green on upper surface, fine tomentum of silvery hairs on lower surface. Flowers are white, 1 cm across, with 5 petals each 3 x 3 mm the centres green surrounded by a ring of rusty red filaments, calyx green, 2 mm long and bearing 5 short teeth, pedicel 5 mm long, buds have a light pink tinge. The variety differs from the common form by its prostrate habit. *L. brevipes* is an upright, weeping shrub growing to 3 m, with longer, 14 mm, and narrower, 3 mm, leaves which are covered on both sides with a fine tomentum, and lacking the pale pink tinge present in this cultivar.

Trials in an Armidale garden have shown it to be drought and frost tolerant down to a screen temperature of -7°C . The plant flowers in spring lasting a month. Fruits are not persistent. Plants grown from cuttings will flower in pots, but as the flowering stems are long and untidy they are best grown as garden plants. Its natural substrate is granite soil, but specimens have grown well on basaltic soil. Plants will layer naturally covering large areas. Because of its proven hardiness, its low maintenance qualities and its ground cover feature, it has potential for land-care projects, park plantings and erosion control.

***Philotheca* 'Kangaroo Gully Crimson'** was first described as a colour variant in *Wildflowers of Bendigo* by the Bendigo Field Naturalists Club Inc. in 1988 and grown successfully at M. Sprague's 'Goldfields Revegetation Nursery' since 1993. The name derives from the geographical location it was found in, and the red/purple colour of its buds and flowers. It is a low shrub, 40-90 cm high by 25-60 cm wide. Young plants are compact with dense foliage, becoming more open as the plant ages, leaves green (137B). The flowers, 1.5 cm diameter, are profuse. It is distinguished from *P. verrucosa* by its much stronger flower colour, petals upper surface red-purple (58D/66D), and lower surface red/purple tips (60A/B). Flowering is in August/September. It grows naturally in Box/Ironbark forest on poor ridge-top clay soils. It is extremely hardy, having survived sustained drought and severe frost. In its natural habitat plant size is very variable due to heavy grazing by macropods, but it responds well in cultivation with strong growth.

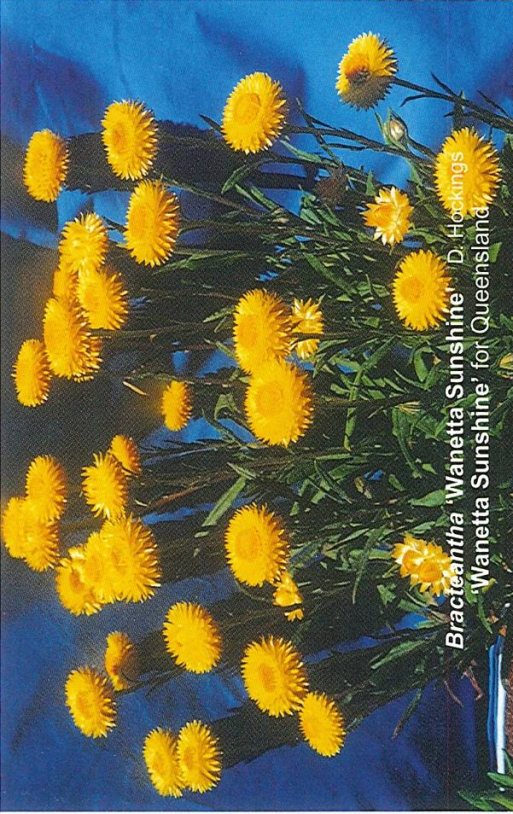
The Challenge of Salinity

W.H. Payne et al.

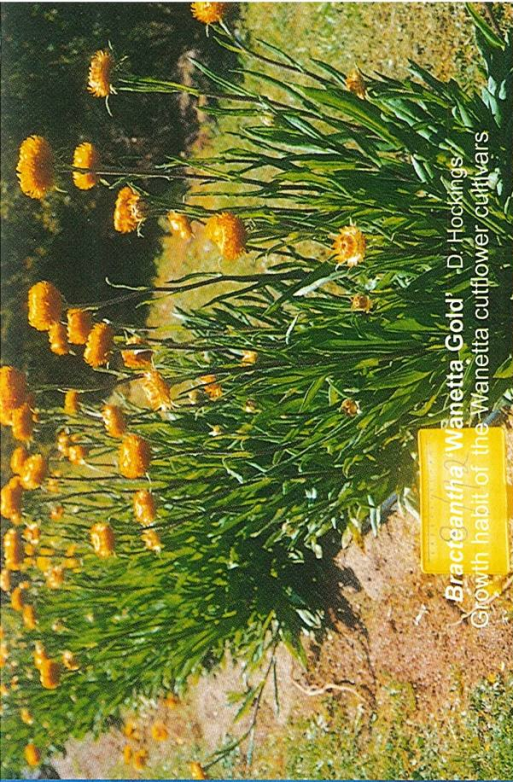
Following a Salinity Summit meeting in Dubbo in March 2000, NSW has produced a published report* that is exceptionally well done. The whole problem was carefully studied and detailed action plans defined to delay the creeping paralysis that is blighting our land. Items worthy of special note are:

1. Government, at least the NSW State Government, is aware of the major disaster confronting us and realise the urgency for positive action. Hopefully the Federal Government will respond with the level of funding the crisis demands.
2. An expensive conference has produced a positive action plan that encompasses the entire community and which they would appear to be committed to acting upon. Time will tell if the resources will indeed be allocated to aggressively implement the action plan as defined.
3. The report recognises the need for the physical extraction of salt. The NSW Government is working with the Murray-Darling Basin Commission to analyse the commercial feasibility of mining salt from saline water, in the hope that they can use the salt in useful products. The first step is to develop salt extraction systems. Solar power and electrostatic removal of the salt offers one solution. Another method would be to develop plants that take up salt in some form and then harvest the plants.
4. The report seeks to encourage private investment and is introducing a Salinity Business Development Program for opportunities to use saline lands productively.
5. NSW Government will work with land managers to incorporate salinity issues in applications for vegetation clearing.

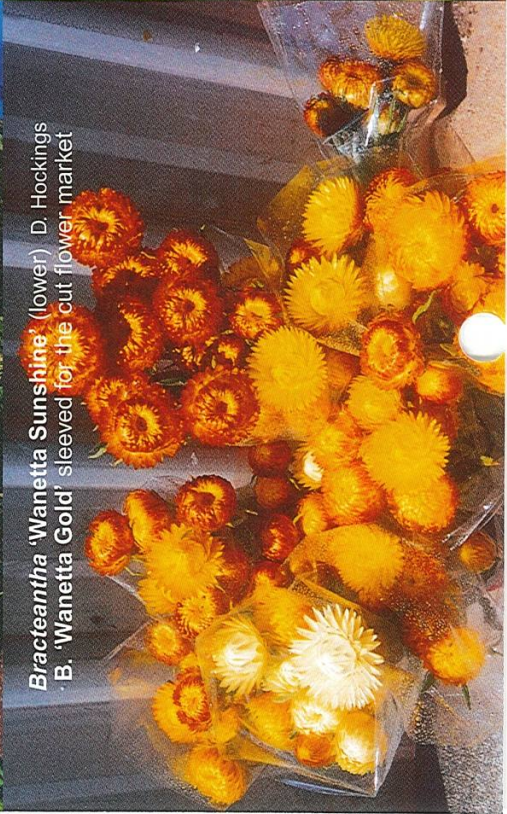
*NSW Department of Land and Water Conservation, *NSW Salinity Strategy*, August, 2000.



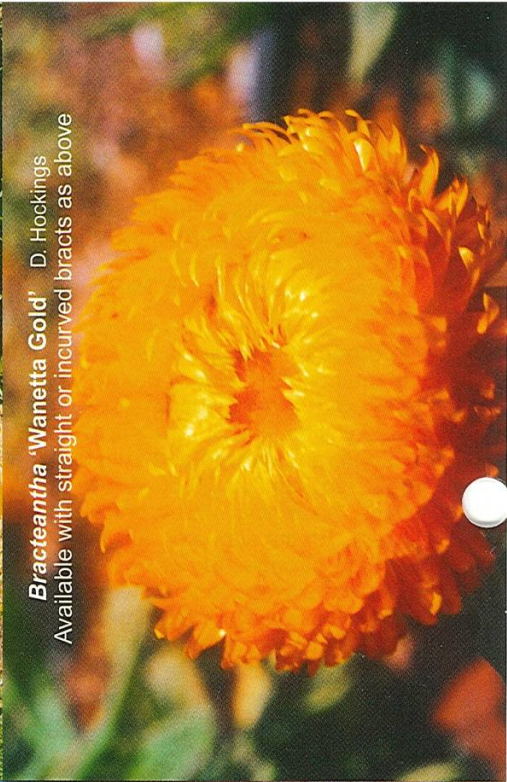
Bracteantha 'Wanetta Sunshine' D. Hockings
"Wanetta Sunshine" for Queensland



Bracteantha 'Wanetta Gold' D. Hockings
Growth habit of the "Wanetta" cutflower cultivars



Bracteantha 'Wanetta Sunshine' (lower) D. Hockings
"B. 'Wanetta Gold' sleeved for the cut flower market



Bracteantha 'Wanetta Gold' D. Hockings
Available with straight or incurved bracts as above

Federation gold

Federation flower for Queensland* _____ from notes by David Hockings

Two everlasting daisies have been selected by Queensland, 'Wanetta Sunshine', and 'Golden Nuggets'. The latter is a *Bracteantha bracteata* selection produced by Redlands Nursery. It is a low compact bush developed for landscaping and pot culture, further details yet to be received.

Bracteantha 'Wanetta Sunshine' is a complex hybrid developed by David Hockings from a tall annual form of *Bracteantha bracteata* and a perennial species with virtually no above ground branches (similar to a gerbera plant) producing tall, non-persistent single flowered stems 60—80 cm tall. Initially thought to be *Bracteantha subundulata*, the Queensland Herbarium now refer to it as *Bracteantha* sp. 'Blackfellows Gap'.

Careful development has produced stable plants that flower all year producing large clear yellow blooms, 60-70 cm diameter with prospects of a bloom to 90 cm across. On strong stems 55-75 cm long this makes a startling display in the garden without the large leaves that often detract from the larger growing *Bracteantha* hybrids. It will be a sensation in the cut flower trade. The plants will produce saleable flower heads quickly, a recurring bonus being blooms to order throughout the year.

Bracteantha 'Wanetta Gold' is a similar plant developed for the cut flower trade the flower heads are a vibrant gold (not yellow). The bracts (outer 'petals') may be incurved as shown or straight. It is planned to produce plants in yellows, oranges, creams and whites, with either straight or incurved bracts.

*The Federation Bouquet - an initiative by the Federation Authority

Each state was requested to select a wildflower to represent their state in a flower arrangement for national adulation. Most chose a flower that had commercial potential as a cut flower and a source of national wealth.

South Australia chose *Thryptomene ericaea* 'Centenary Starburst', a commercial crop they have developed for export and featured in *Australian Plants* 20:311.

Western Australia chose a kangaroo paw developed for export sales, *Anigozanthos rufus* 'Kings Park Federation Flame'.

Tasmania chose *Phebalium davisii*, St. Helens Wax Flower - a threatened species.

New South Wales chose the flannel flower *Actinotus helianthi* 'Federation Stars', a lucrative export earner and to be featured in an issue shortly.

Queensland chose two everlastings (*Bracteantha* hybrids) referred to as Federation Gold, as above.

Victoria chose a red flowered wattle *Acacia leprosa* 'Scarlet Flame' - discovered by two bush-walkers in 1995.

Northern Territory chose *Alpinia purpurata* 'Federation Lady' a pink ginger that is not a native but closely allied to an Australian ginger.

Australian Capital Territory, completely out of touch with the national mood, chose a rose - *Rosa* 'Canberra Rose'!

A plantation timber industry

by Jack Mitchell* & W.H. Payne

"We have the technology to create a viable plantation timber industry on sites as small as 2 acres. We have formulated a method of planting and management using proven fast growing and fast maturing species in mixed species plantings. These plantings are successful even in low rainfall areas and poorer soils providing the management of the planting is correctly maintained. Single species plantings is not successful but **growth rates using this method are up to three times faster than traditional methods.** A course at the Moreton Institute of TAFE, Brisbane, Queensland, trains property owners to grow and manage their own timber plantations. We now have over 50 plantations on properties south of Gympie".

This statement was made by Jack Mitchell during a field visit to one of his trial plantations during the federal conference of the society in Brisbane in 1999. The following is a brief summary of the advice given, the editor highlighting practices pioneered by Jack Mitchell, that could make a **significant contribution to the growing of plants generally.**

***The Jack Mitchell concept**

"The whole scheme rests on correct planting procedures, selection of the most suitable species, total weed control and careful pruning techniques that have been devised for each species.

We must understand how trees grow to be able to get the best result. Rainforest trees have their feeder roots close to the surface. There is also a deep root system but the primary purpose of this is for stability, not normally for plant food. Realising that the growth of our trees depends on available plant food close to the surface, we appreciate the importance of competition from other trees and especially weeds, and adequate mulching.

Rainforest can be successfully grown on a wide range of soils and it is not necessary to have rich soils to start with. As long as you have at least 15 cm of soil you can grow these trees. Rainforest is a natural builder of soil quality. Naturally good deep open soils are the easiest with which to start."

Editor's note: As Jack Mitchell is the originator of the details given he wishes it to be presented under joint authorship. It is a very brief summary of a carefully devised plan to assure maximum growth in a plantation of rainforest timbers specifically for commercial production. If it is proposed to proceed with a plantation first contact Jack Mitchell at PO Box 2614, Mansfield, Qld. 4122. He can supply the plants and detailed advice. If you are really serious purchase a copy of the videotape available for \$40 plus postage. The early plantings have appeared so successful that there are now 70 plantations on private land and Jack is having difficulty in meeting the demand. Thinning of his first plantation now 8 years old, will be during this year, 2001.

A major problem is now the availability of suitable young plants. **Availability of seed is a serious problem** and anyone who can assist should contact Jack. He will only accept seed from selected quality plants but if you have mature trees of any of the plants named, Jack will call and inspect your plant and if satisfactory, he will organise regular supplies each season. Who will do their bit for Australia and help with seed?

Preparation of the site before planting

a novel approach

Slash grass and weed and remove all unwanted re-growth trees etc. Trees must be cut low, never dozed out, and stumps painted with a tree killer to prevent suckering. No mechanical disturbance of the soil should be allowed. Make sure all stumps are left in place and leave all branches and logs on the ground. Trees should be felled across the slope to curb erosion. Any re-growth rainforest trees can be left. Never leave any wattles but leave stumps and roots to provide plant food as the roots rot away. If the site is open grassed land, probably grazed for many years, the soil may be compacted. Allow the grass to grow and slash it leaving all cut grass on the site, it will loosen the soil and provide mulch. Allow the grass to shoot then spray with roundup. It is essential to get a good kill. Do not burn any of the cut material, leave it on the ground to provide valuable plant protection.

Planting the site, preparing the holes

a new approach

First get quality plants to assure maximum return. Jack Mitchell can supply these or recommend the best place to obtain them. Allow 3-4 weeks after clearing and spraying before beginning planting. Carefully layout the area with a grid for planting at 2½ metres between rows and trees. **Plantings are mixed**, apparently at random but a carefully arranged plan has been devised to get the correct mix of fast growing plants to force the rest on, and to facilitate selective harvesting.

Make sure the ground moisture is sufficient to allow the plant to establish. Never water while field planting, wait until conditions are suitable, then you can be assured of a good strike. The best planting time is March to September as this gives the whole growing season of September to May. If in frost prone areas plant in early spring, a full growing season then ensures the trees are high enough to resist their first winter frost.

Trees must be planted in a hole about three times the size of the pot and a little deeper than the pot. The planted tree should be slightly lower than the surrounding area to allow for watering. **A planting mattock must be used.** Never use a spade, shovel or posthole digger because these methods are detrimental to early and sustained growth of the tree. (Jack Mitchell has developed a most effective planting mattock that comprises a normal mattock with the cross-blade reduced to 7 cm wide and extended a further 8 cm in length by welding on a spring-steel extension. You can make one of these or purchase one from Jack Mitchell.) The demand for new plantations has grown and Jack now uses a machine of his own design for new plantings. **An essential practice is to also fill the hole with water and allow it to drain away before putting the plant in the ground.**

Planting the site, plants into the ground

an important lesson

Planting from pots is the most successful as the trees will be larger than those in tubes, but tube plants are the most economical provided they are sun hardened. Always make sure the pots are well soaked before planting and they will slide out of the pots without root disturbance. Trees must be removed from the pots without disturbing the root mass. **Never spread out the roots**, even if the plant appears to have the roots compacted. Any interference before planting could be detrimental to natives.

Place some loose soil in the bottom of the hole. The plant should finish just slightly lower than the surrounds with a slight dip where the plant is. Fill in around the tree with loose soil and press in firmly with the hands. **Never** plant on mounds or **put fertiliser in the hole**.

Fertilising! After planting, dig a shallow hole about 40 cm from the tree uphill if on a slope. Place in this hole about 200 grams of slow release fertiliser and cover. Never place fertiliser in the same hole as the tree or scatter around the tree. These procedures can reduce the viability of the tree causing a slow root spread whereas this method encourages root growth and adds to the natural viability of plants. The growth of the trees depends on available plant food close to the surface. Moisture has a part to play but plant food is all important. Surface mulching as well as weed control is vital.

Watering and mulching Watering must be done soon after planting, about 2 litres per plant. The trees are mulched individually, about 1 metre in diameter is ideal. Care must be taken to avoid mulch contact with the tree.

Care and maintenance is important for maximum growth rates. Weed spraying is necessary in the early stages but a minimum of weed growth is found after the first year. You can expect 4 metres growth in most trees in the first year. It is essential to follow with a special pruning and care program unique for each species, each year for the desired maximum growth and straight trunks as described in detail in the video available. In the second year failures or plants not progressing well can be replaced. The following year you may like to plant understorey plants.

No insecticides are used In the early stages some pest damage may become evident but this is only because hardy pests remain in the absence of predators. Biological control of natural insect pests must be fostered as described for each species in the video. The growing of our native timber species can only be successful in companion planting. The bonus is the wealth of bird and insect life in balanced harmony.

The trees to plant For large plantings it is important to have a good mix of fast growing trees as this will produce an even canopy. It is not necessary to select species for shade cover of rainforest plants, a persistent fallacy. The faster growers, if planted close enough together, will soon provide a canopy in two years and force the others up in the quest for light. The mix recommended will allow for the culling of the fast growers in 10 to 15 years, providing some interim income and giving more room for the slower growing, often better quality timber trees. Faster maturing trees are Quandong, White Cedar, Silky Oak, and others to be advised.

The details given here were taken from various references. It is a brief summary of the plants recommended and their ultimate uses*. A mixed planting guide for these careful selection trees will facilitate harvesting. A critical factor is the pruning techniques to be employed, techniques that have been developed for maximum return for each of the recommended species. These pruning techniques are quite specific and beyond the scope of this report. You are advised to refer to details given in the video available.

***Trees for use in various areas** Future issues of *Australian Plants* will give details of trees suitable for various areas. Readers may wish to contribute. There are established plantations in many areas and the results will be available to all. Editor.

Trees Recommended for southern Queensland and northern NSW

Blue Quandong, *Elaeocarpus grandis*, is the most valuable tree in companion planting as it forces rapid trunk growth in other trees. In the forest it will mature to a giant of the jungle supported by high-flanged buttresses if left long enough. With this method thinnings will be millable in 10 to 15 years providing valuable timber. It is one of our most versatile trees, growing well in damp areas, tolerating extremes of dry or wet conditions. The bark is close-fitting, lichen-patched dun-grey, moderately thick and sappy when blazed revealing a gleaming white timber. The high quality timber is silver white with a greyish tinge, open-grained with long straight grain on longitudinal surfaces, light, tough and strong. It does not discolour with age, dresses with a fine finish and bends readily but keeps its shape well and does not split on the surface or ends.

White Cedar, Tulip Cedar, *Melia azedarach*, can be grown in a very wide range of conditions such as a shade tree in Alice Springs to 20 m high and wide. It is semi-deciduous and carries abundant lilac coloured blossoms and bead-like yellow fruit (drupes) which are both oily and inflammable. The soft, light, woolly-fibred ring-porous wood resembles Red Cedar but has bacon-streaky variegations of pink-browns upon a pale pink, or buff open-grained background. In panelling, a large tapestry flowered effect in browns and creams is revealed. It is non-durable in weather with a liability to split.

Celerywood, *Polyscias elegans* is a tree to 25 m tall. The wood is pale, soft and light with straight graining but of little durability; used for models & inlays.

Ribbonwood, Blush Cugerie, Pink Poplar, *Euroschinus falcata*, is a subdominant tree of coastal jungles seldom reaching 30 m in height. The bark is brownish-grey, fine-scaly or crumbly on the surface, the blaze brownish pink and exudes a gummy juice. The wood is silken-sheened and unevenly pale pink in colour, tinged with occasional splotches of faint greens, yellows and browns, soft light, open and straight-grained rather woolly-fibred and tough. It resembles Queensland Maple but lacks quality and highlights. It has the softness of Brown Bollywood, *Litsea reticulata* but is harder to work, bore into or chisel a hole. Being very woolly, it is difficult to finish.

Queensland Maple, Maple Silkwood, *Flindersia brayleana* is not a maple but a Silkwood with a much higher grade ranking as a prime cabinet wood ranking with Cedar, Mahogany and Walnut. It can become a massive-trunked noble tree of compact crown to 30 m high. The bark is brownish, sub-fibrous, and characterised by scattered 'bullet holes'. Its toughness and strength extend its usefulness to aeroplane construction, propellers and rifle stocks.

Silver Ash, *Flindersia schottiana*, is a slim-boled tree to a height of 30 m. The hard, smoothish surfaced, grey bark, has a raspberry odour when blazed. The timber is a silvery-white colour, straight and open grained, tough and flexible.

Crows Ash, *Flindersia australis* is a tree to 35 m with a scabby, scaly, grey-maroon bark, strong and durable in or out of the weather or ground. It does not rust iron and is not affected by borers or insects. It is used in coach building, decorative knobs, small trays, etc.

Yellowwood, *Rhodosphaera rhodanthema*, is also called Tulip Satinwood as the wood is variegated like the commercial Satinwood, a picturesque wood streakily variegated by growth ring coloration in mustards and bronze and occasional firm, dark, birds-eye knots. The surface finishes with a metallic lustre, the ray-grain a speckled silkiness, the other plane finely seamed with straight vessel lines. The sapwood is broad, white and definitely marked. It is a smaller tree to 20 m high, the bark resembling Red Cedar, tessellated scaly and leather-brown and with similar pinnate leaves.

Tulipwood, *Harpullia pendula*, is a slender boled, small tree, the timber used for decorative work. A very hard, heavy, close-textured and tough wood both in heartwood and sapwood, with strikingly, tortoise-shell variegations in cornelian browns and creamy whites. It is ideal for turning and polishing.

Burdekin Plum, or Tulip Plum, *Pleiogynium timorense*, may reach 30 m in height but is usually much smaller. The fleshy fruit is a deep purple, 2-4 cm in diameter, is edible, if acid. The timber is too hard for extensive cabinet-making and is used more as a fancy wood for turning, walking sticks, etc. Its flowered walnut variegations in pale and deep red-browns, its high polish, strength and durability make it very valuable.

Red Bean, Miva Mahogany, *Dysoxylum muelleri*, are not usually large trees but can grow to 30 m high. The timber is a mahogany red, a natural cabinet-wood midway between Red Cedar and Rose Mahogany in type. It is distinguished by a fine, satiny, zig zag tracery of soft tissue upon its tangential surfaces and by the glistening of minute gum particles along its fine vessel-lines. Straight grained, it is easy to work, dresses well, may be stained and gives a high polish. It is very durable in the ground and has been used as fence posts, such a waste of beautiful timber.

Rose Mahogany, *Dysoxylum fraserianum*, is a tree to 35 m high, buttressed by basal spurs, the crown of dark dense pinnate (5-10 leaflets) foliage. The deep rose-hue resembles an unfigured Honduras Mahogany in effect but Indian Teak in structure and character, the fine close-set zig zag satin tracery of soft tissue upon its longitudinal surfaces, the glistening minute gum-particles in its fine vessel lines and with a vague but permanent rose fragrance.

White Beech, Grey Teak, *Gmelina leichhardtii*, reaches 30 m in height, moderately buttressed. The wood is of the teak class, but pale grey in hue. Lacking decorative values, its special advantages of softness, lightness, toughness and mellow workability, combined with a high degree of durability in or out of the weather, and a refusal to swell or shrink or alter in shape when wetted make it a saleable timber.

Red Cedar, *Toona australis*, can become a giant tree and is the most prized of Australian cabinet woods after silkwood. In wood type it is a soft Mahogany, softer than silkwood, a very dark rich red, paling to pinkish in quick-grown small trees. Its deep rich red hue and beautiful finish assures its marketability. It is a fast growing tree but subject to tip moth attack. Planted in stage 2, one year later, the cover of other trees provides the habitat for predators of this pest. Development of a biological control could make this the most important timber tree to grow. There have been studies in the use of Grow Tubes in mass plantings of Red Cedar. The use of mixed plantings with fast growing species to shelter and force up growth appears to produce the same result.

Banksia propagation

In-vitro multiplication of *Banksia* species

by Kim M. Tynan¹, Eileen S. Scott¹ and Margaret Sedgley²

Banksia are increasing in importance as both floriculture and amenity plants. Material for commercial cultivation is propagated by seed and cuttings, although seed of many species is becoming difficult to obtain. Clonal propagation via rooted cuttings is difficult, particularly for the pre-eminent floriculture species, such as *Banksia coccinea*, the scarlet *Banksia*. The objective of this research was to investigate the in-vitro establishment and micropropagation of selected *Banksia* species. We compared the amenity species *B. ericifolia* and *B. spinulosa* var. *collina*, which are easily propagated via rooted cuttings, with the recalcitrant floriculture species *B. coccinea* and *B. menziesii*.

Establishment of explants

Seeds of *Banksia coccinea*, *B. ericifolia*, *B. menziesii* and *B. spinulosa* var. *collina* were obtained from Nindethana Seed Service, Albany, Western Australia, and seedlings were grown in the glasshouse for 6-12 months. Shoots were removed from 10 seedlings per species, defoliated, washed in tap water with a drop of detergent and rinsed in running tap water for 30-60 minutes. These shoots were soaked in domestic bleach solution (1% available chlorine) plus a drop of detergent for 10 minutes, followed by three rinses with sterile distilled water, then soaked overnight in 0.01% Benlate DF fungicide before cutting into nodal segments (5-10 mm long), 1 or 2 nodes.

Explants were placed upright in 10ml basal medium in polycarbonate tubes (80 mm X 25 mm) with loose fitting lids. The basal medium used was half-strength Murashige & Skoog tissue culture medium (abbreviated from here on as "1/2 MS") with 1.2 μ M thiamine-HC1, 2% sucrose, and 0.7% agar. The pH was adjusted to 5.7 before addition of agar and the medium was autoclaved at 121° for 20 min. The medium was supplemented at the initiation stage with the antibiotics rifampicin (0.005%) and cefotaxime (0.01%), and with 0.1% casein hydrolysate. Cultures were grown in a controlled environment room at 25°C, with a 16 hour day under cool white fluorescent lights unless stated.

Multiplication of *Banksia* species

Nodal segments of *B. coccinea*, *B. menziesii*, *B. ericifolia* and *B. spinulosa* var. *collina*, 160 explants per species, were initiated on 1/2 MS containing antibiotics. After 1 week, uncontaminated explants of each species were distributed in approximately equal numbers to 1/2 MS with eight different combinations of the plant growth regulators benzyladenine (BA, cytokinin) and indole-3-butyric acid (IBA, auxin) (Table 1). Every 4 weeks the explants were transferred to 1/2 MS supplemented with 2.9 μ M gibberellic acid for 1 week, then back to fresh medium with the growth regulator combination being tested. The number of nodal explants with bud swelling and/or development of axillary shoots was recorded at intervals over 6 months.

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The experiment was repeated once. In addition, some explants of *B. prionotes* and *B. hookeriana* were established, as described above.

Establishment rates 5 weeks after initiation of cultures in the first experiment were 78-92% for *B. coccinea*, *B. menziesii* and *B. spinulosa* var. *collina*, whereas only 22% of *B. ericifolia* explants remained uncontaminated. In the second experiment, rates for the first three species were somewhat lower, 62-78%, and for *B. ericifolia*, higher (52%).

Table 1. Percentage of nodal explants of four *Banksia* species with swollen or burst buds in response to various growth regulator combinations after 10 weeks. There were 16-22 explants per treatment.

Plant growth regulator (μM)		% explants responding			
BA	IBA	<i>B. coccinea</i>	<i>B. menziesii</i>	<i>B. spinulosa</i>	<i>B. ericifolia</i>
0	0	100	0	53	0
0	0.05	100	0	89	100
0.4	0	83	10	93	0
0.4	0.05	60	50	100	0
2.2	0	86	18	78	0
2.2	0.05	73	50	58	100
4.4	0	11	100	100	100
4.4	0.05	38	50	100	100

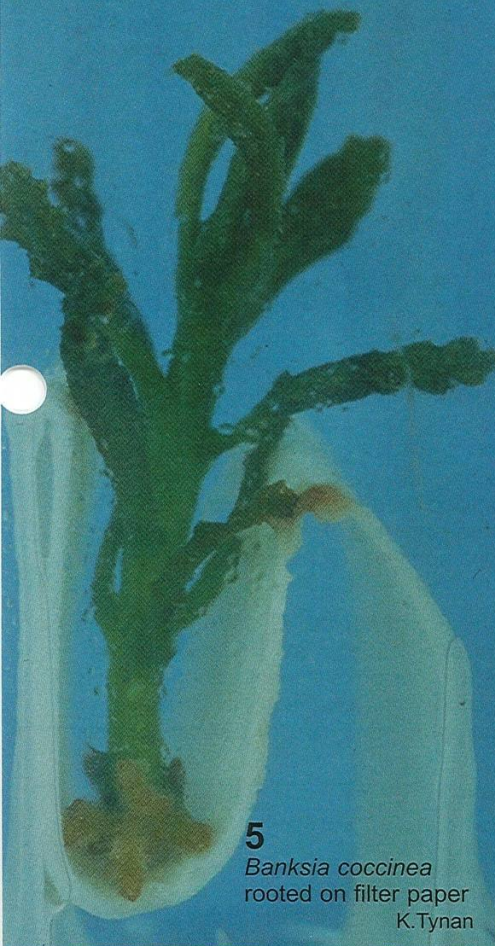
The response of the explants at 10 weeks is shown in Table 1. Results of the repeat experiment were generally similar. Buds which swelled on explants of *B. ericifolia* and *B. menziesii* failed to develop into shoots. Nodes of *B. spinulosa* var. *collina* responded to most growth regulator combinations but *B. coccinea* produced more shoots suitable for multiplication, Photos 1 & 2. Explants of *B. prionotes* and *B. hookeriana* produced some shoots also.

Over the 6 month period, 2-8 and 1-4 elongated shoots were produced per explant for *B. coccinea* and *B. spinulosa* var. *collina*, respectively. These shoots were excised and multiplied on 1/2 MS supplemented with 2.2 μM BA plus 0.05 μM IBA.

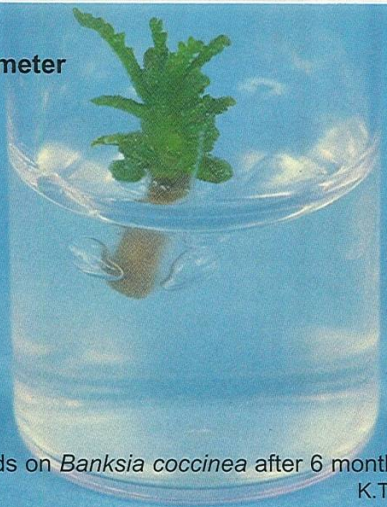
This plant growth regulator combination was chosen because explants of all species tested responded at greater than 50% within 10 weeks of culture. Each transfer on this medium yielded 5-10 new shoots per excised shoot.

Hyperhydricity (vitrification) was observed on some shoots, which were abnormal in morphology, with stems and leaves translucent and thickened. Such material fails to develop properly. Hyperhydric shoots of *B. prionotes* are shown in Photo 4. Hyperhydricity was reduced by solidifying with Phytigel (0.18%) in combination with agar (0.1%).

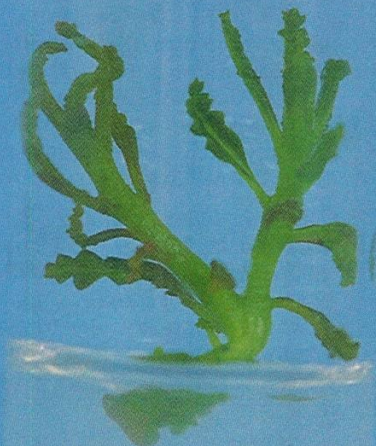
Explants & shoots are in tubes of 2.5 cm diameter



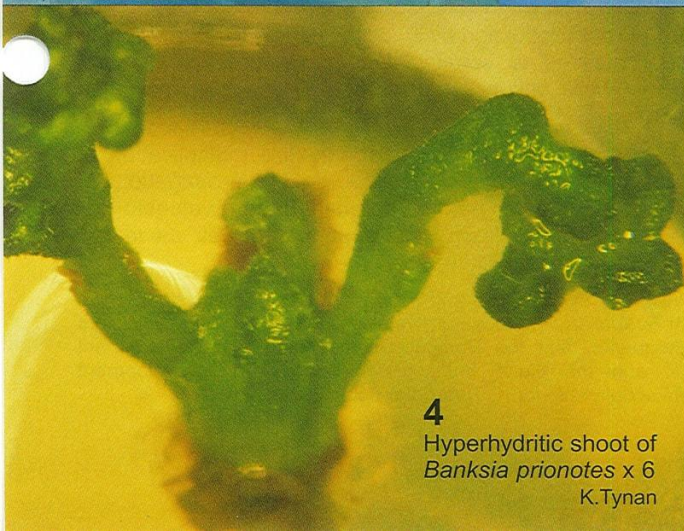
5
Banksia coccinea
rooted on filter paper
K.Tynan



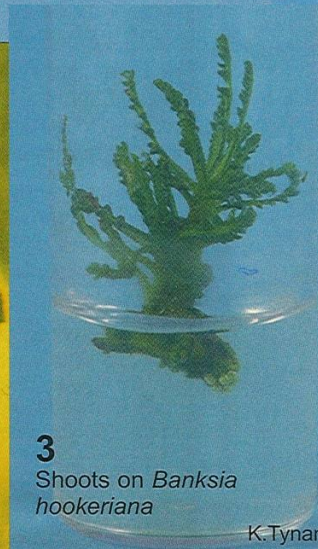
1
Buds on *Banksia coccinea* after 6 months
K.Tynan



2
Shoots on *Banksia coccinea* after 8 months
K.Tynan



4
Hyperhydritic shoot of
Banksia prionotes x 6
K.Tynan



3
Shoots on *Banksia*
hookeriana
K.Tynan

Rooting of *Banksia coccinea*

Shoots of *B. coccinea* 20 mm in length were subjected to root-inducing treatments, in vitro, 20 shoots per treatment, as follows: either a) shoot bases were dipped in IBA solution (4.9 μM) then the shoots were placed in 1/2 MS or b) shoots were placed directly into 1/2 MS supplemented with 4.9 μM IBA with or without 0.4 μM BA. Additional shoots were placed in 1/2 MS without growth regulators (controls).

Cultures were placed under lights, or in darkness for 2 weeks before being placed under lights. In a second experiment, shoots were cultured on filter paper bridges in tubes containing 1/2 MS solution alone or supplemented with 4.9 μM IBA or 5.4 μM naphthalene acetic acid (NAA). Shoots placed in tubes without IBA or NAA were dipped in a solution of IBA (4.9 μM) or NAA (5.4 μM) prior to being placed on the filter paper bridges.

Depending on the treatment applied, up to 75% of *B. coccinea* shoots developed roots within 4 weeks, and up to 90% had roots by 9 weeks (Table 2 and Photo 5). The incidence of rooting was greater in shoots treated with IBA alone than with IBA in combination with BA, or with NAA alone. Well-developed roots formed more readily on shoots cultured on filter paper bridges over liquid medium than in solidified medium, where the roots rarely penetrated the agar surface. A period of darkness did not enhance rooting and adversely affected plantlet health and survival. Control shoots placed on basal 1/2 MS failed to develop roots.

Table 2. Development of roots on micropropagated *B. coccinea* shoots exposed to various plant growth regulator treatments for 4 weeks in vitro. Shoots were placed in 1/2 MS agar (1/2 MS) or on filter paper bridges in 1/2 MS solution. Treatments marked "(dark)" involved incubation in darkness for 2 weeks before transfer to standard diurnal conditions. 20 replicate shoots per treatment.

Treatment	% Shoots with roots	Treatment	% Shoots with roots
1/2 MS	0	4.9 μM IBA in 1/2 MS (dark)	45
1/2 MS (dark)	0	4.9 μM IBA + 0.4 μM BA in 1/2 MS (dark)	15
4.9 μM IBA dip, 1/2 MS	60	4.9 μM IBA in 1/2 MS solution	35
4.9 μM IBA in 1/2 MS	75	4.9 μM IBA dip, 1/2 MS sol.	70
4.9 μM IBA + 0.4 μM BA in 1/2 MS	5	5.4 μM NAA dip, 1/2 MS sol.	20
4.9 μM IBA dip, 1/2 MS (dark)	65	5.4 μM NAA in 1/2 MS sol.	13

This is the first report of root production by *B. coccinea* in-vitro. Attempts to transfer plantlets of *B. coccinea* to vermiculite/sand mixture with mineral nutrients or to potting mix were unsuccessful, however, and acclimatisation requires further investigation.

Conclusions A protocol has been developed for in-vitro multiplication of *Banksia coccinea* and *B. spinulosa* var. *collina*. Micropropagation of *B. coccinea* and other *Banksia* species has the potential to be a valuable tool in breeding programs and in germplasm conservation, as well as in the propagation of elite genotypes for floriculture.

Acknowledgements We thank Lynne Giles and Rita Middelberg for assistance with statistical analysis; South Australian Proteacea growers who generously supplied plant material for use in experiments; and the Horticultural Research and Development Corporation (N/0001/R1) and the Rural Industries Research and Development Corporation (postgraduate scholarship for K. Tynan) for financial support.

Banksia propagation research — Report by W.H. Payne

The centre for research on *Banksia* has become part of the Adelaide University, under the supervision of Professor Margaret Sedgley. Earlier research produced the cultivars, 'Waite Flame' and 'Waite Crimson', forms of *Banksia coccinea*, and 'Waite Orange', a hybrid between *Banksia hookeriana* and *B. prionotes*, see *Australian Plants* volume 18:348.

Horticultural cultivars can only be replicated by vegetative propagation. Propagation by cuttings has failed for commercial production and there have been difficulties with micro propagation. The article above seeks solutions. In the quest for vegetative buds, Raelene Mibus and Margaret Sedgley have examined the lignotubers common with *Banksia* in a research paper published in *Annals of Botany* 86:575-587, 2000. The research is to locate buds that could be used to create new plants by micro culture and is summarised by the following sketches.

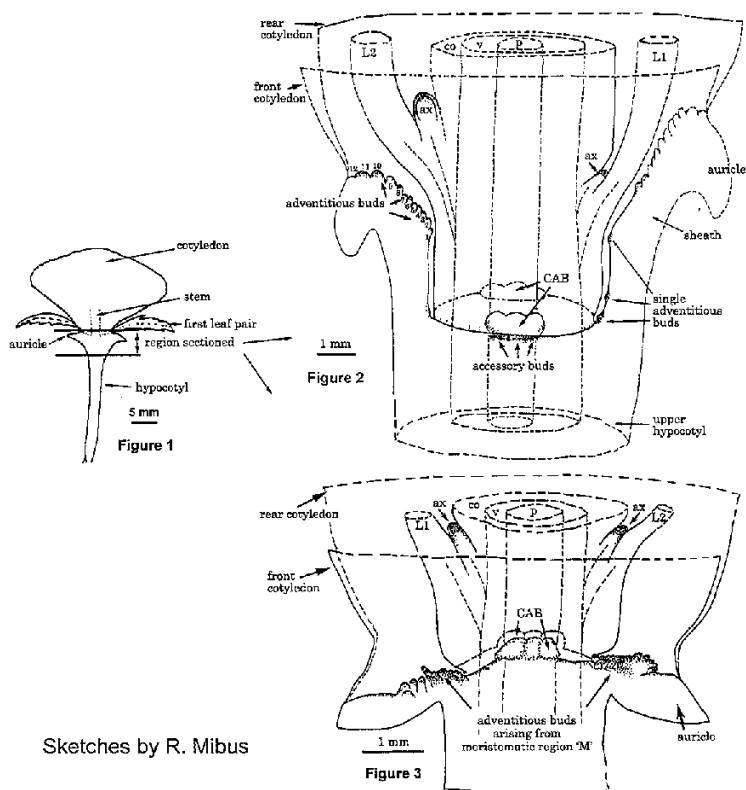


Figure 1 shows a typical *Banksia* seedling, in fact most seedlings
 Figure 2 is this region of a *Banksia menziesii* seedling
 Figure 3 is this region of a *Banksia serrata* seedling. L1 first leaf base; L2 second leaf base; CAB cotyledonary axillary buds; ax leaf axillary bud.

The Australian Flora Foundation has a membership mostly of scientists though anyone is welcome to join. The Society was instrumental in its creation to foster research into the biology and cultivation of the Australian flora. The research in the previous article was supported by the Foundation. As the Society contributes to the foundation then you, the reader have made a contribution to this scientific research.

Conservation of our flora is a major objective. Many members have bequeathed a sum of money to the foundation for vital research needed if we hope to conserve this magic flora of ours. Perhaps you could consider a bequest. Enquiries should be directed to The Australian Flora Foundation, Box 1566, University of Queensland, Gatton 4343.

Corrections, September 2000 issue

W.H. Payne

Haste led to some shortcomings in the reports in the September issue.

Olympic Bouquets The people from The Australian Flower Company headed by Jamie Creer and his staff deserve credit for their work in designing and assembling the medal winners' bouquets.

Paralympic Bouquets A serious error was not to acknowledge the photographic work of Peter Abell who provided many of the photographs including those on the card accompanying the bouquet. I introduced a major error. The card stated that a foliage used was Emu Bush. In the flower trade Emu Bush or Emu Grass is the foliage from *Podocarpus drouynianus*, a conifer from Western Australia, not *Eremophila* as stated.

Corrections to the article '**Ornamental Eucalypts**' - species for cut bud and flower production' by Kate L. Delaporte and Margaret Sedgley, pages 354-361, *Australian Plants* September 2000, Vol. 20, No.164.

The following photographs came from a file collection and were incorrectly attributed as follows:

- *Eucalyptus erythrocorys* (page 360) to the Laidlaw Plantation, Urrbrae, S.A.
- *Eucalyptus stoatei* (page 360) to the Laidlaw Plantation, Urrbrae, S.A.
- *Eucalyptus pachyphylla* (page 361) to the Waite Arboretum, Urrbrae, S.A.
- *Eucalyptus websteriana* ssp. *norsemanica* (page 364) to the Waite Arboretum, Urrbrae, S.A.
- *Eucalyptus tetraptera* (page 364) to Monarto, Callington, S.A.

None of the authors or organisations listed above were involved in the production of the photographs.

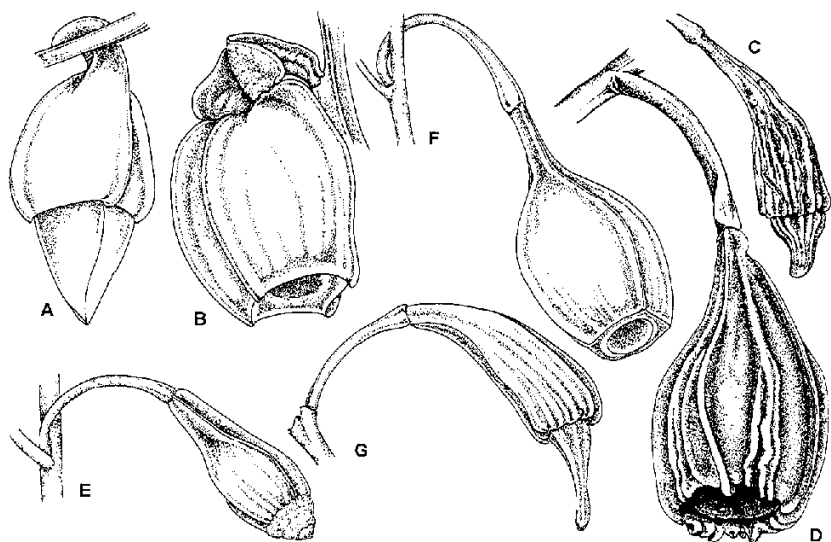
The following photograph had an incorrect name:

Caption, *Eucalyptus forrestiana* (page 357) should have been *Eucalyptus torquata*.

There was some concern over the name of the form of *Eucalyptus forrestiana* used in the bouquet and the floral arrangement on page 356. The author had the name previously in use *Eucalyptus forrestiana* ssp *dolichorhyncha*. What a name for a beautiful tree! It has been my policy to keep things simple and not to mention subspecies and varieties of species wherever possible. In this case, recent research has split off the spectacular plant used as a separate species as illustrated below, the current name being *Eucalyptus dolichorhyncha*.

I had spoken to Dr. Kate Delaporte at Flowers 2000 regarding the recent name change and we decided that it would be more correct to call the species in question *E. dolichorhyncha*. Unfortunately, in the table attached to the text, the species was referred to as *E. forrestiana*. I apologise to all for any confusion.

Thank you to Dr. Kate Delaporte, for bringing these errors to our attention.



Sketches by M. May

Reprinted with permission from *Flora of Australia*, volume 19 (1998)

Eucalyptus tetraptera, buds A; fruits B, photo, page 364, vol.20.

Eucalyptus stoatei, buds C; fruits D; photo, page 360, vol. 20.

Eucalyptus forrestiana, buds E; fruits F.

Eucalyptus dolichorhyncha, buds G; fruit is similar to F; photo, page 364, vol. 20.

Editor's note:

The commercial use of Eucalyptus

There is a growing market for the foliage of certain species, for the flowers and for the buds and fruits, as used in the Olympic bouquet. The timber is valuable and a future issue will define the species recommended. Farm forestry or plantation cultivation is a growing industry. It improves the efficient management of food producing properties (we all need to eat) and reduces the effect of salinity. The article 'A plantation timber industry' on page 74 refers to the cultivation of cabinet timbers in subtropical areas. The novel practices of planting and care to harvest described may be widely adopted.

Wildflowers of Victoria by M.G. Corrick & B.A. Fuhrer is a 246 page book providing an easily read reference to all the wildflowers you will find in Victoria. The descriptions of the hundreds of plants by Margaret Corrick are brief but accurate and readily understood.

The outstanding feature of the book is the 840 colour photographs by Bruce Fuhrer. A number of these slides have been generously supplied by Bruce to illustrate the article on Tasmanian *Epacridaceae*. Look for them in this magazine and observe the incredible skill exercised their production.

What needs special mention also is the very high standard of production of this book by Bloomings Books and their printer. Look for the book at your bookshop, superb value at \$59.95. If you live in Victoria or are planning to visit the area, this is the only book you will need to quickly identify the wildflowers there. Book review by Editor.

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Wildflower Society of Western Australia (Inc.) — PO Box 64, Nedlands 6009. A range of seeds available, labelled and packed, at \$1.50 (plus postage) per packet. Send for a 2000/01 Descriptive Seed List (\$2.50 posted) to: The Seed Sales Officer, Eastern Hills Branch, 65 Swan View Road, Swan View, W/A 6056. Also available a book *Hints on Growing Native Plants* \$4.00 posted.

The Grevillea Book, volumes 1, 2 and 3 by Peter Olde and Neil Marriott, is the complete reference to all species of *Grevillea*. The Australian Plants Society NSW ensured that they were published to a very high standard with at least one large colour photograph of each of the 340+ species, an easily read description of each species and details of its occurrence and cultivation. They are available from the Australian Plants Society NSW, PO Box 744, Blacktown, NSW, 2148, at \$44 per volume plus postage and handling of \$7.50 for 1 or 2 volumes and \$15.00 for 3 volumes within Australia.

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Dracophyllum milligani

A plant to 30 cm with a flower head. ▼ A form to 5 m high referred to on page 51 as *Dracophyllum 'Southwest'*

Photographs by R.K. Crowden

