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Editorial

Manfred Wagner, Convenor - Publishing Committee

This edition takes a quick look at two hemi-parasitic plants, *Atkinsonia ligustrina* (see the Tomah Treasure article on page 126) and *Nuytsia floribunda* (see page 133), which are a challenge to grow - why not have a go.

What's new? This question works both ways. This edition has stuff for you about *Platysace* tubers, which sound like an interesting gastronomic change, crinum and eucalypt dye. On the other side, it's been a bit quiet on the article source and feedback side. When you realise this magazine is entirely put together by volunteers, then I hope at least, we can be forgiven the magazine being occasionally late in production.

We want to hear what's new with Australian native plants, whether it be about new nursery releases, bushfoods, unusual species, newly discovered species (or rediscovered after being considered extinct), garden designs/successes, unique environments, research findings, uses for the plants/extracts, or the more usual things like book releases and significant taxonomic changes. Australia is a big place, with a huge number of plant species - there must be something new out there.

The magazine should cater for a variety of tastes from the beginner upwards to almost hardcore - I'm not sure that we are ready for articles discussing the minute of DNA sequences, just the implications. We would also like to have articles from places other than the eastern and western seaboard of Australia. If you have come across something of interest to others with a passion for Australian plants, why not write an article or provide photographs for this magazine? Or, maybe you can put us in touch with a source of these - the editorial contact details are at the bottom of the inside back cover.

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Front and back covers: *Atkinsonia ligustrina* - fruit, flowers and habit. All photographs by Jaime Plaza, reproduced courtesy of the Royal Botanic Gardens and Domain Trust - see page 126

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Platysace Tubers

From the bush to your shopping basket _____ Dr Geoff Woodall
Research Officer, Department of Agriculture, 444 Albany Highway, Albany WA 6330

In the past Australians have not embraced, to any great extent, the foods that were routinely consumed by indigenous people. In contrast, Americans today routinely consume many foods that were also consumed by the native Indian people (e.g. corn, pumpkin and turkey)⁽¹⁾. Australians are however becoming more willing to try native edible plants and the industry is now rapidly expanding⁽²⁾. The industry is commonly referred to as the 'Bushfoods Industry'. In 1997 its value was estimated to be \$12 million, which was based on 14 commercially significant crops (excluding Macadamia); *Acacia* spp. (wattle), *Acronychia acidula* (lemon aspen), *Backhousia citriodora* (lemon myrtle), *Eremocitrus glauca* (desert lime) and *Microcitrus* spp. (native lime), *Hibiscus heterophyllus* and *Hibiscus sabdariffa* (rosella), *Kunzea pomifera* (muntries), *Podocarpus elatus* (Illawarra plum), *Prostanthera* spp. (native mint), *Santalum acuminatum* (quandong), *Solanum centrale* (bush tomato), *Syzygium luehmannii* (riberry), *Tasmannia* spp. (native pepper), *Terminalia ferdinandiana* (kakadu plum) and *Tetragonia tetragonoides* (warrigal greens)⁽³⁾.

These species are grown for their edible fruits, leaves or seeds. None of these species are currently used by the bushfoods industry as staple foods and most are used as flavourings, spices or additives. Interestingly, there are no Australian native species widely grown for their below ground fleshy storage organs (tubers, corms etc). Australian native species with edible fleshy storage organs may have significant commercial potential because they could be used in large amounts as a bush food replacement for potatoes or carrots.

Numerous Australian native species are tuberous and within the Western Australian flora there are at least 172 species⁽⁴⁾. Several species of *Platysace* from southern Western Australia are tuberous and were important food for indigenous people prior to the introduction of western culture⁽⁵⁾. *Platysace* species (19 native to WA) are in the Apiaceae, an important horticultural family that includes many other important edible species such as carrots, parsley, parsnip, dill and coriander.

This current study assessed the following categories related to the horticultural potential of four *Platysace* species.

Horticultural potential of *Platysace* species

Root attributes were used to assess and rank the horticultural potential of four *Platysace* species from south-western Australia (see table 1). *Platysace deflexa* appeared to be the species with the best horticultural potential, principally because this species produces numerous large, visually attractive tubers that are pleasant to eat. Field observation suggest that mother plants of *P. deflexa* quickly recover after tuber harvest and rapidly produce new tubers in soil that was disturbed during harvest. This growth characteristic should allow adaptation to broad scale cultivation.



Opposite top: Healthy plants at the field site

Opposite centre: Planting *Platysace* at Ross Williams' farm

Opposite bottom: Field harvested tubers

Right: *Platysace deflexa* - tubers and root system

Below: Native environment

Bottom: *Platysace deflexa* - young plant prior to planting

See page 99 All photos G Woodall

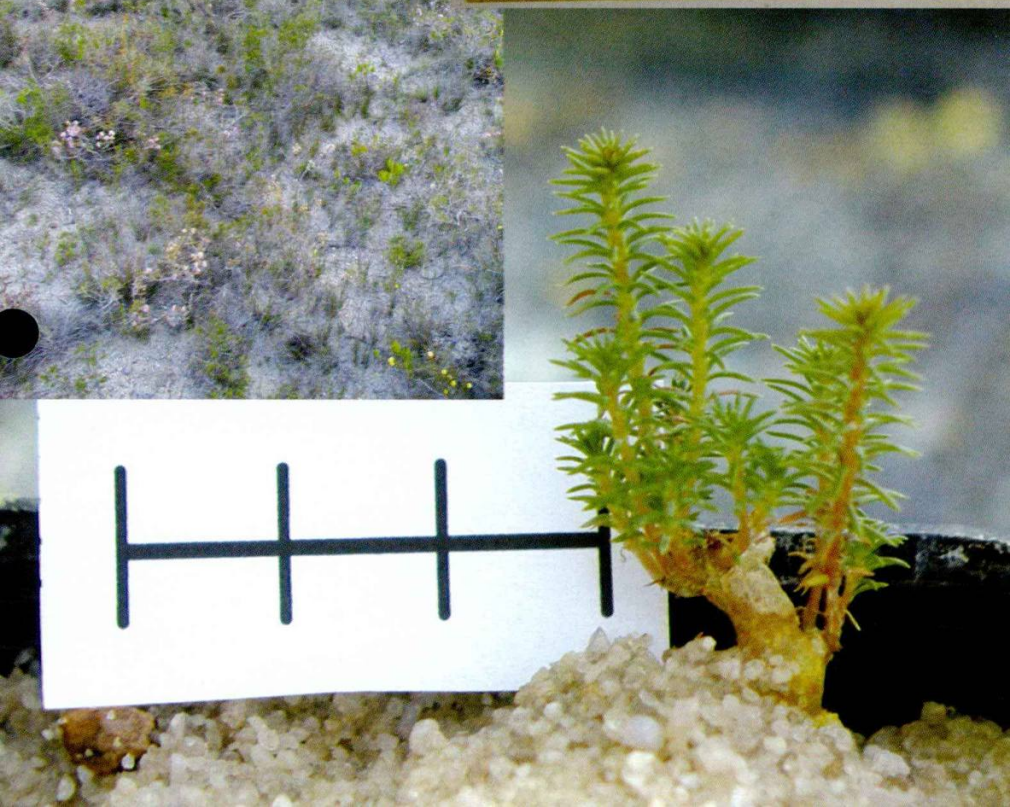


Table 1 Assessment of *Platysace* tuber attributes

Species	Tuber attribute					Total
	tuberous	size	yield	taste	appearance	
<i>P. deflexa</i>	yes	5	5	4	5	19
<i>P. cirrosa</i>	yes	5	1	4	5	15
<i>P. maxwellii</i>	yes	2	3	3	2	10
<i>P. sp</i> (Fitzgerald)	no	0	0	-	0	0

Size: 0 = no tuber – 5 = large defined tuber

Yield: 0 = nil – 5 = greater than 200g/plant

Taste: 0 = unpleasant – 5 = delightful

Appearance: 0 = unattractive form & colour – 5 = attractive form & colour

***Platysace deflexa*: Cultivation and production**

Platysace deflexa is a small perennial rhizomatous shrub, up to 50 cm tall, with aromatic leaves and white flowers. It grows naturally in the nutrient poor sandy soils of the Jerramungup–Ravensthorpe area of Western Australia. Field excavations have indicated that a mature plant can produce numerous tubers, 2–5 cm in diameter, 5–15 cm in length and 0.5–1 kg/plant. While *Platysace deflexa* appears to have considerable potential for human consumption we know little about its biology, propagation and cultivation requirements. *Platysace deflexa* has been propagated from harvested tubers that were replanted half-submerged⁽⁶⁾.

At the Department of Agriculture's nursery facility in Albany a small number of plants have been cultivated from tubers, however, the success rate has been low (10%). An improved strike rate was achieved with small suckers that were attached to sections of rhizome. Furthermore, plants cultivated from suckers were more robust and vigorous than those cultivated from tubers. Some small plants were propagated from seed collected from wild plants, however the seed appears to have low viability (<5%).

During the very dry winter of 2002 tubers, potted plants, seed and suckers were planted in a small experimental plot south east of Jerramungup, Western Australia. New plants were successfully established from 10% of planted tubers, while none of the sites sown with seed (0.1 g/planting spot) produced seedlings that were alive at the beginning of the following summer. Plants propagated from tubers were slow growing and were not particularly robust. Seventy five percent of the transplanted suckers (from the wild with minimal root disturbance) and sixty percent of the pot cultivated plants survived until the beginning of summer. Many of these plants grew vigorously, with some doubling or tripling in size between July and December.

The subsurface soil was dry when this trial was established and then drought conditions prevailed. Thus although *P. deflexa* is adapted to a very dry Mediterranean climate, all of the young plants that were established were unable to withstand very dry conditions that prevailed during 2002 and early 2003. Another trial plantation will be established in 2003. The use of transplanted suckers should ensure establishment and their survival will be dependant on the cessation of drought conditions.

Is there a market for *Platysace* tubers?

There does appear to be a market for the tubers of *Platysace deflexa*. Bush-picked tubers from Ravensthorpe were washed, packaged then distributed to bushfood suppliers and chefs. Members of the bushfoods industry, including cooks, overwhelmingly endorsed the product (raw and cooked tubers) after preliminary tastings. When eaten raw, tubers are crisp, crunchy, sweet and with a slight radish taste. When cooked they are crunchy with a taste similar to cooked squash. One chef suggested that the tubers could be used in much the same way as a radish. He suggested that they would complement a spicy salad, that is, a salad that contained rocket and or other hot/spicy ingredients. Other industry representatives commented that the colour (yellow outer skin) of the tubers was an attractive feature of the product and that they were impressed with its long shelf life (at least 8 weeks at 10°C).

One distributor was so positive about the tubers he wanted to know when a supply was going to be available. The distributor also said that he would only use the tubers if prices were competitive with other similar foodstuffs, that is, he would pay more for the tubers than red radish or squash but "don't expect truffle prices". Other feedback was that the tubers would be easy to promote and sell for two reasons, firstly they were pleasant to eat and secondly there were no other alternative vegetable products in the bush food industry.

Tuber composition

Platysace deflexa tubers are nutritionally similar to other common and widely eaten vegetables (see table 2). They have a starch content higher than that of red radishes and carrots but lower than potatoes. The bush picked *Platysace* tubers had a low nitrogen (and presumably protein) content and this may reflect the nutrient poor environment in which they were growing. When cultivated in a nitrogen-rich media the tuber protein content is expected to be significantly higher.

Table 2 Composition (on a dry weight basis) of *Platysace*, radish and carrot and potato tubers. Each sample was comprised of 5–10 tubers. Note: the *Platysace* tubers were bush-picked (from a low nutrient environment) where as, the others were all commercially cultivated (presumably in high nutrient conditions).

Nutritional Factor	Plant Sample			
	<i>Platysace</i>	Radish	Carrot	Potato
Nitrogen (%db)	0.2	2.7	0.8	1.8
Phosphorous (%db)	0.0	0.5	0.3	0.4
Potassium (%db)	2.0	5.5	1.6	2.6
Calcium (%db)	0.9	0.3	0.3	0.1
Magnesium (%db)	0.2	0.2	0.1	0.2
Sodium (%db)	0.4	0.3	0.7	0.1
Sulphur (%db)	0.1	0.4	0.1	0.2
Copper (mg/kg)	8.5	2.7	2.5	6.6
Iron (mg/kg)	51	58	34	69
Manganese (mg/kg)	64	12	14	10
Zinc (mg/kg)	12	39	19	27
Starch (%db)	9.4	2.4	5.9	55.7

Continued on page 123

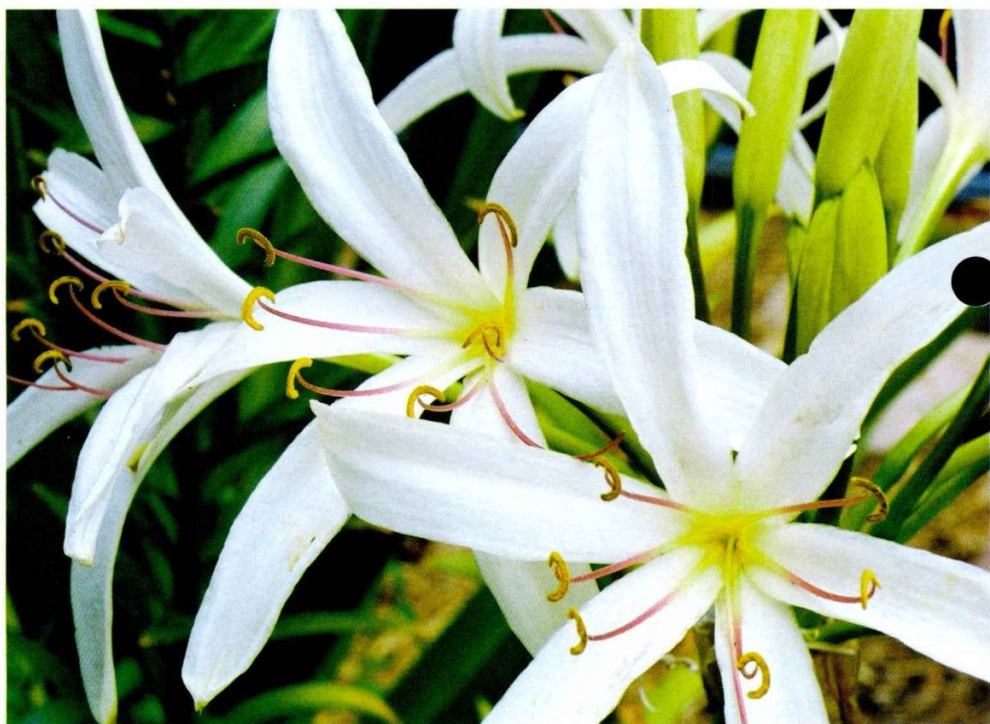


***Crinum flaccidum x*
*C. pedunculatum***

Both photos - R Gibson

Left: Note the red pigment developed in the ends of the filaments and style and the orange pollen.

Below: Note the weak clustering of the stamens on the lower side of the flower and the strongly curved anthers.



Artificially Crossed Crinums

Robert Gibson

In the early 1990s I crossed two native Crinums. The Darling Lily, *Crinum flaccidum*, with the large coastal species *C. pedunculatum*. The cross resulted in viable seeds, one of which has now flowered and is described.

Introduction

The genus *Crinum*, with over 100 species is the largest in the Amaryllidaceae family. This family of bulbous plants includes the familiar exotic garden plants of Daffodils and Belladonna Lilies. Hewson⁽¹⁾ recognised five native species, of which *C. flaccidum* was illustrated recently by Gibson⁽²⁾.

Crinum pedunculatum is a robust evergreen species from coastal wetlands of the north and east coasts between Wessel Island, in the Northern Territory, and Jervis Bay in New South Wales. It has also been collected in Lord Howe Island, New Guinea, Timor and the Cocos Islands⁽¹⁾. Vegetatively it resembles an *Agave* by the semi-erect arrangement of its long persistent leaves. The leaves are usually 1 m long by 10 cm wide with a smooth margin, and are borne at the top of a pseudo-stem to 45 cm tall. The persistent bases of older leaves form the stem. The flowers are borne in an umbel at the top of an erect and robust scape to 1.5 m long. The starry white flowers have six narrow tepals (the three sepals and three petals are identical in shape) that are up to 8 cm long by 1 cm wide. The six erect stamens are arranged in an erect circle around the throat of the flower, and each has a slightly curved anther. Each bloom has a strong, pleasantly sweet fragrance.

Crinum flaccidum was described earlier⁽²⁾ and the form used in this cross was the large white flowered form from near Menindee, in south western New South Wales. This plant had sprawling weak leaves and sickly sweet smelling blooms with broad tepals.

Description of the hybrid

The hybrid flowered in February 2003 and displays characters from both parents. The evergreen leaves are dark green, with an entire margin, and are up to 90 cm long by 6 cm wide. They are flaccid but borne at the top of a short pseudo-stem; the latter is 10 cm tall by 5 cm diameter.

The single scape was 70 cm tall with an umbel of 18 white tepalled flowers. The flowers lasted 3 days each and opened successively over a two week period. At its peak the flower cluster was an impressive 30 cm across. Each flower had its own stalk, to 4 cm long, above which sat the glabrous ovary. The base of the flower was a straight cylindrical tube, to 7 cm long and 5 to 8 mm diameter. At the top of it the six oblanceolate tepals diverged. The tepals were up to 8 cm long by 17 mm wide, and were reflexed so that their tips were commonly lower than the level of the top of the flower tube. Each flower was noted as having a pleasantly sweet fragrance.

The flower structure consisted of the six stamens weakly clustered on the lower side of the flower, i.e. in a position intermediate between both parents. The filaments were up to 4.7 cm long, with red pigmentation towards their apex. The anthers were strongly curved, and produced orange pollen. The single style was weakly up curved and the stigma was generally below the

level of the anthers.

The notable characters from *C. flaccidum* include the flaccid dark green leaves, and the strongly curved anthers. From *C. pedunculatum* this hybrid develops pseudo-stem formation, has leaves with smooth edges, and flowers with narrow tepals with a pleasantly sweet fragrance. The hybrid appears to be sterile, for despite hand pollination, using self-pollen and pollen from *C. flaccidum*, no fruit was set. The back cross also failed to set seed. To date this hybrid has not formed any offsets.

Discussion

Crinum hybrids have been made for more than a century⁽¹⁾ and it is likely this cross has been made several times before. Whilst the parental species are likely to be closely related, due to the relatively recent arrival and speciation of this genus within this country it is interesting to note that this hybrid is sterile. Perhaps a cross made using other forms of *C. flaccidum* with *C. pedunculatum* from further north would yield fertile results?

The hybrid is attractive and relatively hardy, but not vigorous. Given its likely sterility and reluctance to make offsets it may be more readily propagated by remaking the cross en masse.

Conclusion

It was a great reward to finally see the hybrid of two beautiful native *Crinums* finally bloom, and it was interesting to note the origin of its characters.

References

1. Hewson, HJ (1987) *Crinum*. In *Flora of Australia* **45**: 369–375
2. Gibson, R (1999) The Darling Lily: Its variation and cultivation. *Australian Plants* **20**: 200–202

How to Make Friends with Clay Soils

A sequel _____ Charles Loxley

In *Australian Plants* September 1966 Volume 3 Number 28 Page 344 there was an article on clay soils. I would like to bring it up to date. In it I said that gypsum was \$25 a tonne. It is now around \$450 a tonne. The best way to apply gypsum is in 25 kilogram lots. The best quality gypsum is marketed by Brunnings and Bunnings Warehouse stock it. This gypsum is finely ground and is a much better product than cheaper products that are gritty and lumpy.

Now to talk about calcium, magnesium, potassium and sodium clays. Sodium clays are the most intractable of all and calcium clays are the best. Ion exchange is what happens when gypsum is incorporated into a sodium clay. Sodium and calcium have antagonistic effects. Sodium clays disperse whereas calcium clays flocculate: that is have small lumpy masses. Gypsum does not have much of an effect on potassium clays. I do not know too much about magnesium clays. Clay soils consist of mainly colloids. Colloidal particles are defined in terms of size, which is responsible for their characteristic properties. Sandy soils are not colloidal. When gypsum is incorporated into a sodium clay ionic exchange takes effect and the sodium is replaced by calcium and sodium sulphate or washing soda, which is very soluble and is washed out of the soil profile by rain or irrigation.

Australia's Kangaroo Paws

John Scarveilis - Department of Land, Water and Biodiversity Conservation
Revegetation Centre Murray Bridge South Australia.

Kangaroo Paws are one of Australia's unique family of plants. Distinctively strange, interesting in form, biology, and really making a bold statement in the landscape. The unusual combination of bright colours and the distinctive shape of the flowers resembling a kangaroo's paw, so cunningly adapted for pollination by honey-eaters with their long beaks and long tongues. So why do we not see them in landscaping more often?

BOTANY

The Kangaroo Paws belong to the Family Haemodoraceae and are only found growing naturally in Western Australia. They belong in two genera *Anigozanthos* and *Macropidia*, with the latter containing only one species *Macropidia fuliginosa*, the Black Kangaroo Paw. *Anigozanthos* contains 11 species, all restricted to the South West Botanical Province of Western Australia one of the unique and diverse botanical areas of the world.

SPECIES

They are fantastic horticultural plants. Within the 11 species of *Anigozanthos* there is a wide range of natural variation and it's this variation that makes this group of plants even more exciting horticulturally.

Take for example the Tall Kangaroo Paw, *Anigozanthos flavidus* which is very vigorous, long lived, relatively disease resistant, and has a range of flower colours in individual progeny from burgundy, dark red, orange, yellow, green, and anything in between. So in this case you cannot guarantee flower colour in seedlings until the plant flowers. However these characteristics make this species a good parent plant for further breeding and some excellent hybrids have been produced.

The small red and green Kangaroo Paw, *Anigozanthos bicolour* has at least two distinct natural variants. Flower colour is usually light to dark green with a red base. Yellow and light pink variants also occur but are quite rare. The plants are usually between 20 and 70 cm tall.

A very closely related species *Anigozanthos gabrielae* grows in the wet areas north and south of the Stirling Ranges in WA. It's a pioneer species germinating prolifically the season after a bushfire. The flowering stems are only between 5 and 15 cm tall. Flower colour is again red and green with variants of all red flowers and a form with yellow and red flowers. This species makes an excellent annually flowering plant either in a container or *in situ*. The plant is frost tender. It's also very useful in mass planting small areas like courtyards so long as its cultural requirements are considered.

Another small, short-lived species is *Anigozanthos humilis*, the Cats Paw. Flower colour varies from predominantly orange with patches of yellow and visa versa, to introductions of red and even pink. The heights of the flowering stems can be 15 to 60 cm. The Cats Paw grows around the Perth suburbs, as far north as Kalbarri and east to the Fitzgerald River National Park.

Not as well known and only described in 1978 is *Anigozanthos kalbarriensis* found in Kalbarri National Park around the Murchison River. It flowers from August to October depending on the season. It is similar to *A. humilis* but differs in having perianth lobes that curl up and back along the floral tube. The flower is predominantly bright red with some yellow and red and yellow forms seen. The flower stems are between 5 and 20 cm high.

The Red and Green *Anigozanthos manglesii* is WA's floral emblem and is the best known of the Kangaroo Paws. It is one of the easiest species to germinate from seed and within eighteen months it is possible to produce a plant with 40 to 50 stems of flowers particularly when summer watered and fertilised. Natural colour variants include green with a yellow base, entirely orange, bright yellow with a red base, metallic blue with a red base and an all white form has been reported.

Anigozanthos onycis has also only relatively recently been named and comes from the Stirling Range and Bremer Bay areas of WA. The species name refers to the claw like appearance of the open flowers. It is one of the more endangered of the Kangaroo Paws being a short-lived pioneer species. Flowering stems are 15 to 30 cm long. Red and yellow are the predominant flower colours.

Albany Cat's Paw, *Anigozanthos preissii* has the largest flower of all the species Kangaroo Paws. The flowers are terminal with very little colour variation light orange/yellow with a red base.

Golden Kangaroo Paw *Anigozanthos pulcherrimus* is a late spring, early summer flowering species with flower stems one to two metres high and brilliant golden yellow flowers. It will tolerate moderate frosts and some dry periods.

The Red Kangaroo Paw *Anigozanthos rufus* is a good species for cultivation with flower stems up to 1.5 metres high. Flower colour is consistently an outstanding dark red which contrasts very well with the yellow *Anigozanthos pulcherrimus* and flowering at a similar time.

The last species Green Kangaroo Paw, *Anigozanthos viridis* has flower stems 0.5 to 0.75 metres tall with terminally displayed flowers in racemes of up to 15 flowers. The flower colour is an attractive iridescent green to yellow-green. It withstands periods of wet soils but good drainage is best. It will tolerate moderately alkaline soils in cultivation and does best when summer watered.

Macropidia Fuliginosa the Black Kangaroo Paw, is much rarer in the wild found in heathland north of Perth. The branched flower stems are up to 1 metre high with jet black and green coloured flowers making an unusual colour combination rarely seen in the plant world. It is more difficult to germinate from seed and commercially is multiplied from tissue culture.

BREEDING

Commercial breeding of Kangaroo Paws started in Australia in the late 1970's with Dr Merv Turner spawning a range of 'Bush Gems' at his nursery in Monbulk Victoria and forming some links with producers in USA. Other Australian breeders in NSW, at Kings Park Botanic Garden, and WA Wildlife

Research Centre in WA have since also produced a range of hybrids. More recently, some breeding has been done by Dr Yalon Shori from the Agricultural Research Organisation in Israel in co-operation with Sunglow Flowers in WA and Benzur Nurseries in Israel.

Once the breeding work has been done the mother stock plants resulting from the successful trials are bulked up for commercial distribution by tissue culture.

MARKETING

The commercial breeding work is market driven. The market requires plants suitable for landscaping, as flowering potted plants and as cut flowers. This is the starting point in addressing the original question posed, 'why don't we see them in landscaping more often'? Kings Park Botanic Garden has been doggedly demonstrating the virtues of the Kangaroo Paws for years in beautiful displays in spring but to date it has fallen on 'deaf ears'. Broad sweeping massed plantings to make bold landscape statements to rival similar traditional plantings of exotic species.

Commercially it becomes a matter of cost and marketing. Produce the plants in cell trays or in punnets to encourage landscapers to use large volumes of them as annuals or perennials and for landscapers to order them in that manner. With today's irrigation technology watering should not be a barrier. Think outside the square, trial and be innovative. Imagine the tourism and other benefits that such plantings can bring along with the further development of our unique floral resource.

Breeders can be compensated and encouraged in their work by receiving royalty payments. This requires further strengthening both within Australia and overseas. The market potential is enormous and good strategic planning and alliances need to be developed to ensure a fair distribution of the potential rewards.

For quite a long time Kangaroo Paws have been harvested from the wild in Western Australia for the cutflower trade. Fortunately this has been addressed and professional growers are producing plantation-grown flowers. Quality is an important commercial factor in this contributed to by better vase life, efficiency of harvest, increasing the number of flower stems per plant, and flowering time. Initial poorer quality of flowers collected from the wild has formulated a perception in the market not reflecting well on the flower as a feature plant. This perception has been difficult to change and has affected economic returns to the grower.

Unfortunately Kangaroo Paws have been marketed overseas as mainly a filler cutflower plant and not promoted in their own right as a feature. This suits the purposes of the flower agents overseas but has reflected poorly on the potential for use as a feature plant. Creative floral designers who are able to highlight the plant's real potential need to be promoted in domestic and overseas markets. This will require partnerships between growers, sellers and governments but if not done, nothing will change. The benefits of local knowledge in cultivation and selling conditions must also not be overlooked in the planning processes. For example in Japan many of the indoor flower arrangements are placed under fluorescent lighting. This light highlights

different colours than natural light and will influence the coloured flowers required. Transport and distribution networks require improvement and further development, right from the grower to the florist to allow better market access.

HYBRIDS

Since the late 1970's significant progress has been achieved in the selection and hybridisation of *Anigozanthos*. This has been done to address some of the problems that have occurred in cultivation of the species. Hybridisation often produces hybrid vigour. Success has also been achieved in breeding for disease resistance. Kangaroo Paw species have been known to develop a disease called 'Ink Spot' for which the causative agent is not well understood. Better free flowering varieties have also been achieved producing flowers with longer vase life. The variety in size and flower colour now allows greater freedom in growing Kangaroo Paws for landscaping, as flowering potted plants and as cut flowers.

Some examples include;

***Anigozanthos* 'Red Cross' (*A. flavidus* x *A. rufus*)**

A good example of the benefit of hybridisation, a vigorous cultivar with 1.5 to 2 metre long multi-branched flower stems of bright red/burgundy flowers. They will tolerate some humidity, hot dry conditions, and are frost tolerant. Excellent for landscaping and for cut flowers. Will tolerate moderately alkaline soil types.

***Anigozanthos* 'Regal Claw' (*A. flavidus* x *A. preissii*)**

A good cut flower variety for export. Flower spikes up to 1.5 metres long with multiple red green and orange flowers. The stems and flowers are covered with dense red hair. Will tolerate moderately alkaline soil types.

***Anigozanthos* 'Harmony' (*A. flavidus* X *A. pulcherrimus*)**

This is another vigorous *A. flavidus* derived hybrid but with the delightful flower colour of the yellow *A. pulcherrimus* borne on contrasting red stems. It grows into a showy rounded clump with attractive strap-like green foliage. The stems are about 1 metre long and the plant flowers in spring and early summer. A good cutflower variety for export.

***Anigozanthos* 'Dwarf Delight' (*A. flavidus* x *A. onycis*)**

A smaller cutflower variety but still with stems one metre in length. Multi-branched flower stem bearing bright red and apricot coloured flowers in profusion during late spring and early summer.

***Anigozanthos* 'Bush Dawn' (*A. pulcherrimus* x *A. flavidus* diploid)**

A good cutflower variety with a relatively long flowering season in late spring and early summer. Flower stems 1 to 2 metres long branched with flowers bright yellow with a lime tint.

***Anigozanthos* 'Bush Haze' (*A. pulcherrimus* x *A. flavidus* diploid)**

Flower stems 1 to 2 metres high, branched and differing in flower colour and flowering time to *A. 'Bush Dawn'*. Flower colour predominantly red suffused with some yellow and flowering in early summer. Good cutflower and specimen plant.

***Anigozanthos* 'Bush Ranger' (*A. humilis* x *A. flavidus*)**

This smaller hybrid has been bred for use as a container and landscape plant. The branched flower stems are 30 to 60 cm in length with bright red flowers in spring, summer and autumn. Will tolerate moderately alkaline soil types. Excellent in rockeries, small gardens and courtyards. The length of flowering time of some of these plants in situ and in pots is amazing.

***Anigozanthos* 'Bush Nugget' (*A. humilis* x *A. flavidus* x *A. humilis* x *A. bicolor* polyploid)**

Branched flower stems 50 to 80 cm in length with reddish stem and ovary and yellow flower. Has a long flowering period from early spring summer and autumn. A good flowering potted plant and for landscaping. Will tolerate moderately alkaline soil types.

***Anigozanthos* 'Bush Gold' (*A. humilis* x *A. bicolor* mutant)**

A compact branched plant with bright yellow flowers on stems 0.6 to 1 metre in length. Flowers in spring, summer and autumn. An excellent container plant and for landscaping. Will tolerate moderately alkaline soil types.

***Anigozanthos* 'Bush Opal' (*A. humilis* x *A. bicolor*)**

Short unbranched stems 25 to 40 cm in length. The stem and ovary are red and contrast with the yellow green flower. An excellent flowering potted plant and for landscaping.

CULTIVATION

Kangaroo paws can be grown in greenhouses or outdoors, in pots, in ground, or hydroponically, dependant on location and climatic conditions. Each has advantages and disadvantages and better suits some cultivars over others.

Kangaroo paws are specific in their response to day length⁽¹⁾ to induce early flowering. For example *Anigozanthos flavidus* has been found to be a long day plant, *A. manglesii* to be a short day plant whilst *A. rufus*, *A. Pulcherrimus* and the hybrid *A. flavidus* x *A. manglesii* proved to be day neutral. Autumn temperatures also play differing roles in flower initiation and subsequent growth.⁽²⁾

These two factors influence when the flowers can be presented in the market and the subsequent flower quality.

Good drainage is a prime prerequisite for being able to grow kangaroo paws. Sands and sandy loams are preferable with a pH of between 6 and 7.5. For field cropping or landscape increase the organic matter of the soil prior to planting. Frost during and subsequent to flower formation will affect flower quality. Commercial plantings are planted with the plants between 50 to 80 cm apart with a density of 6,000 to 8,000 plants per hectare dependant on eventual mature size of the plant, making sure to allow for access. Raised beds are a useful way to improved drainage if required.

Irrigation

Both commercial and landscape plantings are best watered with drip irrigation. Overhead watering causes increases in humidity, which may lead to ink spot, or rust although most of the new hybrids have good resistance to

these diseases. It is reported that total soluble salts levels in the water should be less than 800 parts per million (50 grains or 145 mS/m).⁽³⁾

Watering rates depend on soil types and the times of the year, and particularly evaporation rates. For loam or sandy loam soils water to a tensiometer reading of 30 centibars at a depth of about 30 cm. This will mean watering daily as a guide, 2–4 litres per plant in the warmer weather and 1–2 litres in the cooler months. A critical time for irrigation is during flowering. If the stem is allowed to wilt it will remain permanently damaged.

Fertiliser

Applying fertiliser in solution through the irrigation system is the most satisfactory method of supplying nutrients. At times foliar application can also be beneficial. Some of the Kangaroo paws are phosphorus sensitive so that a soil test prior to planting is recommended. Leaf tissue testing will provide information for ongoing fertigation. Since the plants will grow actively through the summer if irrigated, a spring application of low phosphorus slow release fertiliser should be added if a fertiliser solution is not being added to the irrigation water. Suggested fertiliser rates for kangaroo paws planted at 6,700 plants per hectare in kg/ha/year: Nitrogen 100, Phosphorus 15 (nil for some), Potassium 80, Calcium 20, Magnesium 10, with trace elements applied after tissue testing.

Weed Control

Strategies for weed control can be divided into pre-planting and post planting. 'Glyphosphate' is useful to control perennial grasses and other annual weeds before planting. 'Simazine' and 'Surflan' have also been used with success in Murray Bridge. Broadleaf weeds are difficult to control once they have become established and are the main problem. For weed control between rows 'Glyphosphate' can be used with a spray shield to protect the kangaroo paws. Pre-emergent herbicides such as 'Dacthal' have been used over the plants. They need to be applied evenly and watered in either by rain or overhead irrigation for effective weed control. Watering in has the effect of forming a layer or skin of herbicide through which the weed seedlings must pass on germination. Post-emergent control of grasses can be achieved with 'Fusilade' and 'Sertin'. Variation may occur in effect of herbicides on different soil types so trial a small area first.

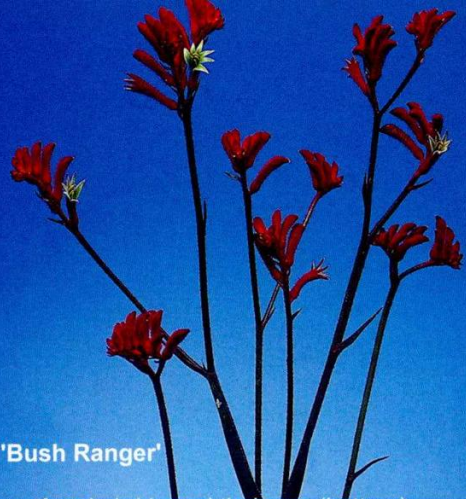
Pests and diseases

If ink spot develops the spray 'Mancozeb' may be useful along with reviewing the fertiliser program. Fungal diseases, whether root or foliar, should be identified by pathological test for positive identification so the specific treatment can be applied.

Susceptibility of species and clones to snails and slugs can vary. Control is by good hygiene (clean up dead leaves etc) and spray or pellet application of a molluscicide like 'Methiocarb'. During spring and autumn plants may become infested with thrips or aphids. Regular inspection and insecticide spraying must be maintained particularly if the flowers are being grown for export.

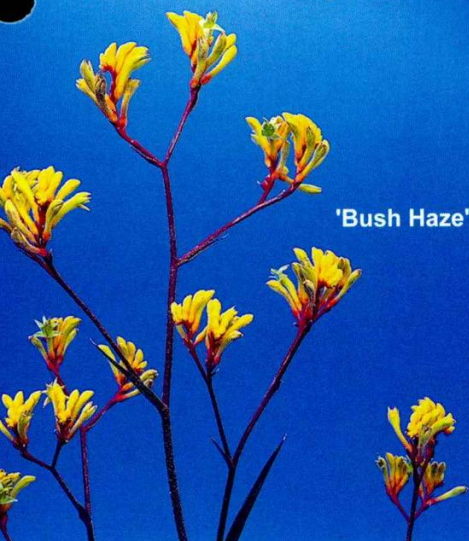


'Bush Nugget'



'Bush Ranger'

A selection of commercially available *Anigozanthos* hybrids and their use (bottom)
All photos courtesy of Ramm Botanicals Pty Ltd



'Bush Haze'



'Bush Gold'



Flower Harvesting and Treatment

When plants are planted in the spring by the following winter the taller varieties will yield ten or more stems per plant and by the second season they should be producing 30–40 stems per plant. The shorter varieties mature even quicker. Each fan of leaves produces one flower stem, yield is very dependant on the number of fans produced.

Harvesting should be done either early morning or late evening in the cooler part of the day. The flowers should be harvested when the first florets on the spike have opened. For the tall varieties the stem may have 10 to 15 branches with one third of these having one or two flower tubes open. Stems should be cut no less than 20 cm above ground level to leave enough base flower stem for possible secondary flower stems to develop. Pick the flowers directly into water and then pulse as soon as possible.

Pulsing solution contains between 2–20% sugar (depending on species or cultivar) plus 250 ppm 8-hydroxy-quinoline sulphate (8-HQS) for 12 hours in a lit area. Test the sugar concentration with each cultivar as pulsing with the higher rate (20%) may cause leaf blackening and dehydration of flowers in some cultivars.

The flowers are graded to the desired length, bunched into five stem bunches (or ten stem for the shorter stems) and disinfected by complete immersion in a 'Cislin', and 'Rovral' mix to kill insects and to control botrytis. The bunches are then sleeved, packed into cartons and cooled to 2–5 °C prior to dispatch.

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3. Grown Digby *Farmnote* 22/96 Cultivation of kangaroo paws Reviewed 1999 Agriculture Western Australia

About the Author

This article was prepared as a result of a presentation made to the Australian Plant Society Parakie Group in South Australia in 2002. SA is able to grow a range of plant material from both the West and from Eastern Australia. In my role with the SA Government I have been responsible for the propagation, and promotion of Australian native plants for ornamental, commercial and biodiversity uses. In the 1970's we promoted multiple use plantings for farmers so that they could better appreciate their economic as well as other benefits, in the 1980's the local species concept and direct seeding originated from our group. I have also been particularly interested in commercial cutflower production and promoted this in SA. In the 1990's my main focus was in the selection of intellectual property and its development. This led to development of pathways for overseas trade and agreements with international horticultural interests. I have been fortunate enough to be able to travel widely both overseas and within Australia to study species and cultivars in natural habitat and in plantations. Currently my interest is moving towards biodiversity conservation. I have been past President of APS SA Region and attended most of the conferences during the 1970's and 80's.

Note: The photos used were not supplied by the author and are courtesy of Ramm Botanicals Pty Ltd - contact them for details of their 22+ hybrids.

Eucalypts in the Goldfields

Margaret Moir

In late June, we enjoyed a too-brief trip to the Eastern Goldfields of WA, where I found myself falling in love with the woodlands of the region, all over again. Though I was born there and spent my 1950's and '60s childhood there, my last visit was 10 years ago.

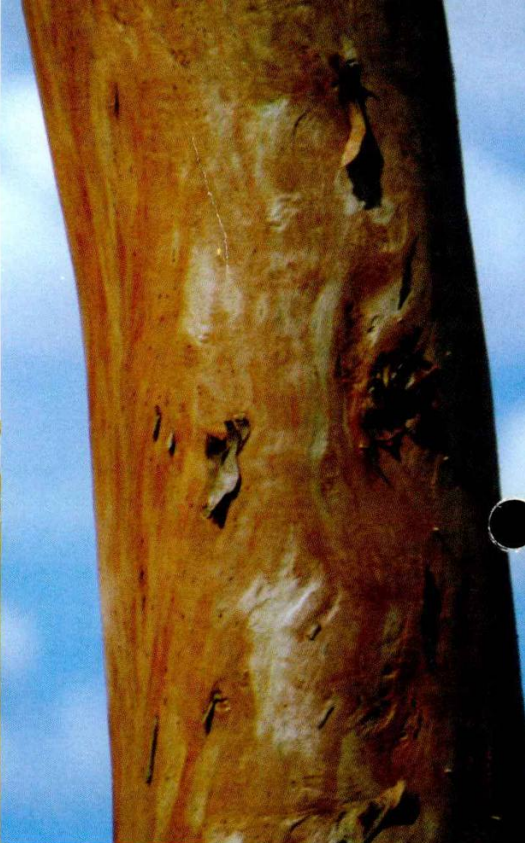
I don't think there can be many areas of the country of which we baby-boomers could say that is in even better environmental shape than when we were young, but this area is one of them. Regrowth and extensive replanting, combined with the astonishing resilience of these arid area plants, has worked wonders. Being lignotuberous or amenable to coppicing or with great seedling vigour, the eucalypts have come back from the huge amount of logging that took place up until the forties. Weed invasion is, for the most part, a less threatening issue than in many other parts of Australia because this is a semi-desert area.

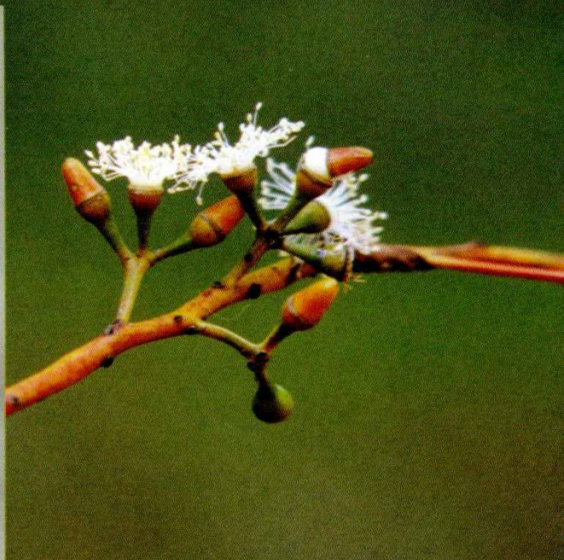
The Goldfields of Western Australia is heaven for eucalypt-lovers. When combined with the adjacent wheatbelt regions, into which the species overlap, the area is home to a staggering **25%** of Australian eucalypt species. This is in **less than 5%** of Australia's land-mass. There is an extraordinary degree of speciation, due to very idiosyncratic geology and landforms, and the very ancient, heavily weathered, frequently alkaline and leached soils. Plant associations occur according to the prevailing topography and soil types. Some of our best-known ornamental gums, e.g. *Eucalyptus torquata* and *E. woodwardii*, that have always been restricted in occurrence, only occur in small, isolated pockets.

Kalgoorlie itself has marvellous streetscapes, over 230,000 seedlings have been planted around the actual 'Golden Mile' and this, combined with a visionary street-tree planting scheme, makes the whole town an extraordinary arboretum. Mining money has been put to good use, and the success of the *Greening the Goldfields* programme has been inspirational.

There is also an official arboretum started in 1954 by local Forestry Department men, George Brockway, Bob Donovan, Phil Barrett, Bill Brennan, and further developed by Peter Richmond and Norm Caporn. In September 1952, the Forests Department Divisional Forest Officer, Phil Barrett, proposed an Arboretum and was instructed to select a site. The current site of 26 hectares was previously three reserves used as a horse paddock and sanitary reserve. The reserves were re-gazetted in 1953, 1958 and 1960 as an Arboretum vested in the Conservator of Forests, after discussions with the Boulder Shire and Kalgoorlie Town Council.

Planting commenced in 1954 with 25 trees each of six species raised locally at the Forests Department, Ward Street nursery. The Arboretum has 50 tree species in a mixture of planted areas and native woodland, with the plantings demonstrating suitable species, techniques and the effectiveness of planting for amenity in arid areas and currently receives in excess of 100,000 visitors annually.





Above and inset: *Eucalyptus salubris*

Opposite top left: *Eucalyptus salmonophloia* habit - sparse

Opposite top right: *Eucalyptus salmonophloia* trunk

Opposite bottom: *Eucalyptus salmonophloia* habit - stand of trees

Centre: *Eucalyptus campaspe*

Below: *Eucalyptus salmonophloia*

Bottom right: *Eucalyptus sheathiana*

All photos: Malcolm French



List of Eucalyptus species in the Kalgoorlie Arboretum:

<i>E. annulata</i> (Open Fruited Mallee)	<i>E. astringens</i> (Brown Mallee)
<i>E. brockwayi</i> (Dundas Mahogany)	<i>E. caesia</i>
<i>E. camaldulensis</i> (River Red Gum)	<i>E. campaspe</i> (Silver Gimlet)
<i>E. capillosa</i> (Inland Wandoo)	<i>E. celastroides</i> (Snap and Rattle)
<i>E. clelandii</i> (Cleland's Blackbutt)	<i>E. corrugata</i> (Rib-fruited Mallee)
<i>E. diptera</i> (Two-winged Gimlet)	<i>E. dundasii</i> (Dundas Blackbutt)
<i>E. ebbanoensis</i> (Sandplain Mallee)	<i>E. eremophila</i> (Sandplain Mallee)
<i>E. erythronema</i> (Red-flowered Mallee)	<i>E. erythrocorys</i> (Ilyarrie)
<i>E. ewartiana</i> (Ewart's Mallee)	<i>E. flocktoniae</i> (Merrit)
<i>E. foecunda</i> (Coastal Dune Mallee)	<i>E. gardneri</i> (Blue Mallet)
<i>E. kochii</i> var. <i>plenissima</i> (Oil Mallee)	<i>E. intertexta</i> (Gum-barked Coolibar)
<i>E. kondininensis</i> (Kondinin Blackbutt)	<i>E. kruseana</i> (Book-leaf Mallee)
<i>E. lesouefii</i> (Goldfield's Blackbutt)	<i>E. longicornis</i> (Red Morrel)
<i>E. loxophleba</i> (York Gum)	<i>E. occidentalis</i> (Swamp Yate)
<i>E. oldfieldii</i> (Oldfield's Mallee)	<i>E. oleosa</i> (Red Mallee)
<i>E. pterocarpa</i>	<i>E. redunca</i> (Black Marlock)
<i>E. salmonophloia</i> (Salmon Gum)	<i>E. salubris</i> (Gimlet)
<i>E. sargentii</i> (Salt River Gum)	<i>E. stricklandii</i> (Strickland's Gum)
<i>E. torquata</i> (Coral Gum)	<i>E. torquata</i> x <i>woodwardii</i> 'Torwood'
<i>E. transcontinentalis</i> (Red Wood)	<i>E. websteriana</i> (Webster's Mallee)
<i>E. woodwardii</i> (Lemon-flowered Mallee)	<i>E. youngiana</i> (Yarldarbra)

I would go so far as to say that without these quite visionary men of the 1950s, most country towns in Australia, not to mention gardeners, would be the poorer, as they really pioneered the use of endemic species as street trees. These street trees are now mature specimens, and worth the trip to the Goldfields for them alone!

They are unique for quite a number of reasons:

1. The number of species planted. There are 50 different species of which 43 are eucalypts with the majority being local species. The mix of eucalypts comprises:
 - 23 local Goldfield species,
 - 15 other Western Australian species, mainly from the adjacent wheatbelt, and
 - 5 Eastern States species.
2. The trees are all adapted to the drier climate and fit into the surrounding landscape.
3. The plantings are unique as very few towns, and even fewer with Kalgoorlie-Boulder's history have such well-planned, selected and managed amenity plantings. They also have a unique history and are a tribute to those who planned and organised their planting.

The history of the tree plantings is very interesting. Old records show that early in Kalgoorlie's history, efforts were made to plant trees. An article in the

Kalgoorlie Miner 23rd July 1898 stated that 900 trees had been planted that year mainly Kurrajong, Tamarisk, Pepper Trees, Moreton Bay Figs and Sugar Gums.

In the 1930's and 1940's Forests Department records show tree species available or suitable for local conditions were limited. It was a 'take what's available and make do approach'. Plantings were mainly Sugar Gum, Pepper Trees, Kurrajong, Jacaranda and some eucalypts. Local Foresters were frustrated in their efforts to obtain more suitable species.

In 1945 the Officer In Charge of the Forests Department in Kalgoorlie, Mr. George Brockway, proposed growing seeds of local eucalypts for dry area use. The Forests Department established an experimental nursery in Ward Street, which quickly grew to satisfy local and outside orders.

It was the Forests Department nursery started by George Brockway and subsequently managed by Phil Barrett, Bob Donovan and Bill Brennan that led to the production and planting of suitable local trees throughout the streets of Kalgoorlie and Boulder. The nursery started in 1945 and expanded quickly with production as follows.

- 1946 - Growing numerous plants in metal tube containers
- 1949 - 63 species grown including 38 local eucalypts and 2 Eastern States eucalypts
- 1951 - 14,500 plants produced, 43 eucalypt species and 11 others
- 1953 - 18,000 trees produced, 43 species

The nursery was closed in August 1954 and its functions transferred to Dryandra near Narrogin. The first nursery-raised trees were planted at Mt Charlotte in 1946 with the assistance of Mr. O'Brian from the Water Authority.

Here is a brief introduction to a handful of outstanding species, all used extensively as street trees, as well as being at home in the local woodland:

Eucalyptus woodwardii

As a small ornamental, the absolute standout in my opinion is the Lemon Flowered Gum (*Eucalyptus woodwardii*). This was in mass flower everywhere, and the huge yellow flowers combined with the frosty silver foliage, is stunning. It is restricted in its natural distribution, which is a tiny patch 145–225 km east of Kalgoorlie. It is found in sand or deep sandy loam, rainfall of 200–230 cm, temperature extremes of –2 to 46 °C and an average 8 frosts per annum.

Flowers from when about 1 m tall, and may bloom all year. Will tolerate heavy soils. It grows up to 12–15 m tall, broad crowned, with pendulous growth. The bark is smooth, grey or pinkish and flowers from July–November.

Eucalyptus campaspe

Another wonderfully glaucous-crowned tree is the gorgeous Silver Gimlet (*E. campaspe*). Widely used as a street tree in the Goldfields, as well as being very visible in the bush. It is distributed over a wide area, and is very striking, having a silver crown with fine weeping foliage, and stunning, smooth salmon to copper coloured bark, sometimes fluted.



Both photos:
Eucalyptus salubris
MalcolmFrench
Left: Trunk
Opposite: Habit



It grows to 11 m, sometimes branching low, flowers from October–January, with profuse, small creamy white flowers. The wood has been used extensively, as poles, firewood etc, and many of the trees to be seen are regrowth.

It grows over a wide area, in association with Gimlet and Salmon Gum, particularly to the south of Kalgoorlie, on red loamy flats and low hills.

Eucalyptus salubris

Often used as a street tree, the Gimlet Gum (*E. salubris*) has a sensuous, glowing copper coloured trunk, usually fluted and a rich green shiny canopy. The whole tree is a picture of shades of copper, bronze, plum, and green. Aesthetically, I think you would have to go a long way to find anything more stunning than the bark of this tree.

This is a widespread tree, growing throughout the wheat-belt and Goldfields, and grows in association with Mirret (*E. celastroides*), Salmon Gum (*E. salmonophloia*), Redwood (*E. transcontinentalis*) and the Ribbon Gum (*E. sheathiana*).

It grows up to 24 m tall (rarely), flowers from November–March, in flat or slightly undulating country, in sandy loam to clay. Rainfall may be up to 380 mm, temperature extremes -5 to 48 °C and up to 32 frosts per annum.

Eucalyptus sheathiana

The Ribbon barked gum is a small tree, occasionally a mallee, up to 8 m tall, shedding its bark in very long strips, which hang from the spindly branches like Christmas decorations (or plastic fly-strips, maybe?).

It has smooth, pale bark, which is prickly to touch, and flowers from January–June, pale yellow, profuse. It is an adaptable little tree, growing naturally in sandy soil, occasionally lateritic or alluvial.

Eucalyptus salmonophloia

The Salmon Gum is an iconic tree of the SW hinterlands of WA, growing once over a very extensive range. It has been one of the indicator species for agricultural land - so much of its former area is now cleared. An umbrella-crowned tree, up to 30 m, it is widely used for all manner of purposes, from fence posts to pit props. Bark deciduates in late summer, revealing the shining salmon trunks. The canopy is dark green and shiny.

Eucalyptus torquata

The Coolgardie or Coral Gum (*E. torquata*) is another species with a small natural distribution, and usually restricted to specific soil types - shallow rocky soil on hillsides. It is an indicator of ultra-basic rocks.

It grows up to 11 m tall and has dark grey, rough and fissured bark. Flowering occurs intermittently any time of year, and from a very young age. The flowers are profuse and decorative, colour may be cream to dark pink to red. In addition the anthers may be white or yellow, this affecting the 'colour' of the flowers. It is quite adaptable as to soils, but the foliage is prone to fungal spot in higher rainfall areas.

***Eucalyptus* 'Torwood'**

While many people know and admire the lovely hybrid, 'Torwood'

(*E. torquata* x *E. woodwardii*) few probably know of its origins and its link with one of Kalgoorlie's oldest primary schools. The seed was collected from planted parent trees at the North Kalgoorlie Primary School in the 1950s, and the first Torwood was raised in the Forests Department's Kalgoorlie nursery.

The North Kalgoorlie Primary School celebrated its centenary last year, and several years ago constructed a new library perilously close to the parent trees. At the prompting of CALM's Ian Kealley, whose wife Fiona teaches at the school, the parent trees were carefully protected, and the new library boasts the name of the 'Torwood Library'.

Acknowledgement

Sincere thanks to Ian Kealley, CALM, Kalgoorlie, a worthy successor to Brockman, Brennan *et al.*

References

1. *Eucalypts of the Western Australian Goldfields* (and adjacent wheatbelt), Chippendale *et al.*

Platysace Tubers

continued from page 103

Platysace deflexa: Toxicology

Compounds that are acutely or chronically poisonous are not expected to be found in *Platysace deflexa* tubers because it is known that indigenous people ate them raw and cooked^(4,5). The sweet taste of newly formed tubers (i.e. in late spring) could have been due to sweet tasting, but toxic, cyanogenic glycosides (i.e. cyanide attached to a sugar molecule). Fortunately, preliminary testing did not detect the presence of any cyanogenic compounds.

Summary

Platysace deflexa has traits that impart real horticultural potential. The five-year objective is to take this species from 'the bush to your shopping basket'. This cannot be accomplished without gaining an understanding of the biology, ecology and physiology of these unique Australian native plants.

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5. Bindon, P (1997) *Useful Bush Plants*. Western Australian Museum, Perth.
6. Personal communication, Greg Keighery, Western Australian Department of Conservation and Land Management, Perth.



Above: *Eucalyptus woodwardii*
Below: *Eucalyptus torquata*

Both photos Fred Johnston





Above: *Eucalyptus campaspe*
habit

Right: *Eucalyptus woodwardii*
habit

Below: *Eucalyptus sheathiana*
habit

All photos Malcolm French



Tomah Treasure

Jan Allen, Botanical Records Officer, Mt Tomah Botanic Garden

Introduction (Photos - see front and back covers)

Louisa's Mistletoe, *Atkinsonia ligustrina*, was named in honour of Caroline Louisa Waring Atkinson (1834–1872) a keen artist, novelist, naturalist and botanist who, through her writings, has left us with much insight into the natural world around her. Louisa lived for many years at Kurrajong Heights, in the Blue Mountains of New South Wales. The priceless botanical information Louisa has given us, often via fellow botanists of the time such as Dr William Woolls and Baron Ferdinand von Mueller, could have been more bountiful! She was constrained by return journeys achievable in one day, as camping out was not permissible for women at that time. Sadly, she died at age 38 soon after giving birth.

Could we propagate this mountain beauty and display it for the enjoyment of all? In doing so, we would be acquiring information, which may be of use in ensuring the long-term survival of this rare plant. Our Senior Horticulturist, Nursery, Karen Silvester, with encouragement from the Horticultural Research Co-ordinator for the Royal Botanic Gardens, is on the job! It's no easy task, as the intricacies of encouraging a partially parasitic plant to take up residence on a provided host are daunting, we've merely begun. There have been, already though, a few successes such as, the production of haustoria (the specialised, parasite-to-host connections, vital for the survival of the *Atkinsonia*).

Classification

Parasitic plants can be found in a large number of plant families. The plant family, Loranthaceae, to which our small treasure belongs, is comprised of hemiparasites ('hemi-' from the Greek, implying partially, and '-parasite', an organism growing and feeding upon another organism - the host). 'Semi-' implies exactly half, which is difficult to quantify, and for this reason, the term, 'semiparasite' has been abandoned. Plants from this family and others are commonly known as mistletoes. The mistletoe of Christmas lore, *Viscum album*, belongs to the plant family Viscaceae.

Most of us, however, are familiar with the weeping, hemiparasitic, mistletoes from the Loranthaceae family that often festoon the branches of eucalypt trees. These plants rely on their host for water and vital chemicals but, carry on their own photosynthetic activity. How do they do this? They attach themselves to branches, or roots in the case of the *Atkinsonia*, with specialised, clamp-like connections called haustoria [singular, haustorium] which tap into the supply lines (vascular bundles) of the host plant.

Brian Fineran, retired professor of plant & microbial sciences with a keen interest in Loranthaceae, adds that these haustoria appear to be a primitive feature and are similar to those found in Santalaceae (Quandongs). There are 3 terrestrial forms still extant, the other two being the WA Christmas Bush (*Nuytsia floribunda* - see page 133 in this issue) and *Gaiadendron punctatum*, a small yellow-flowered tree from Central America. These species are

believed to be relic ancestral forms and the aerial stem-parasitic ones more modern or 'derived'. They are not particularly closely related to each other within the family, however.

Most members of Loranthaceae went on to develop an arboreal rather than terrestrial habit. They are tropical and aerial stem-parasitic shrubs. There is some thought that the family has an ancient Gondwanan origin as there are genera with restricted distributions in south temperate regions such as Chile, New Zealand and Australia.

Description

Atkinsonia ligustrina is a seldom seen shrub, less than 2 metres tall and with opposite pairs of yellowish green leaves, (the sort of bush which might not command much attention when negotiating lumpy sandstone and prickly shrubs if it were not in flower). Flowering is in late October/early November and often only for one week. It is fragrant and colourful so I think it is worth a couple of trips to witness flowering, but I am definitely biased in its favour!

Distribution & Habitat

You may notice this poorly known shrub while bush-walking on the sandstone, in the mountains here in the Central Tablelands botanical subdivision or perhaps in the Central Coast hills east of Mount Yengo National Park. There is one at Mount Wilson close to the road. I have encountered it on ridge-tops, escarpment edges and valley floors between ridges. Peter Hind of the NSW Herbarium adds that the forest (western) side of Mt Hay Road is a good place to see it, plants can be seen alongside the road.

The known distribution of this plant is small and they are never abundant. These factors contribute to its current listing as a rare or threatened, Australian plant species (ROTAP) with the risk code, 2RCa, indicating:

2 - a very restricted distribution in Australia, with a maximum geographic range of less than 100 km.

R - a species which is rare in Australia but, overall, is not currently considered endangered or vulnerable. In this case represented by small populations spread over a wide range.

C - a species known to be represented within a national park or other proclaimed reserve.

a - considered adequately reserved, with a total population of 1,000 plants or more to occur within conservation reserves.

A search for information about parasitic plants in general, or of other members of the Loranthaceae plant family, may turn up a wealth of articles and entries in learned tomes. However, little is known or published about the life history and relationship with the environment, (autecology), of *Atkinsonia ligustrina*.

Response (and vulnerability) to fire

The Blue Mountains District of the National Parks and Wildlife Service included *Atkinsonia ligustrina* in its survey of the Grose Valley escarpments after the 1994 Bell Range Fire. This work looked at the effects of the fire on local ROTAP listed and uncommon plants at known locations, and, in the course of the survey documented some new locations.

The *Atkinsonia* was one of the first plants to resprout. However, the price to be paid for providing fresh leafage in the burnt vastness appears to have been high. Egg laying real estate for native cicadas with biological clocks ticking, is scarce after a fire and, the new stems of the *Atkinsonia ligustrina* plants, covered with ovipositing scars, were more noticeable because of the absence of leaves and general poor health resulting from this mechanical damage. A sudden, increased light regime, the result of significantly less shade when overtopping tree leaves and branches have been burnt, may well have been responsible for the 'sunburnt' leaves on many plants.



Melicope elleryana - flowering from branches
and size relative to house

Both photos Richard Logan



Melicope elleryana

Richard Logan

The Little Evodia (*Melicope elleryana* previously *Evodiella muelleri*) grows to about 6 m in the forest and from the height of my cultivated specimen, I do think this is achievable in the garden environment. The specimen I have is about 4–5 m after approximately 5 years. The plant in question has now flowered for its second year running as can be seen in the photographs.

The range of the plant is apparently from Iron Range in the north to the Atherton Tableland in the south, it also extends into Papua New Guinea. As the plant comes from both lowland and highland forest this would suggest that the plant can handle a fairly wide range of climates. It can be grown as far south as Wollongong, but the climate here is fairly mild due to the proximity to the ocean. This coupled with a warm micro-climate in the garden makes cultivation of the plant easy. In more exposed sites the plant does suffer greatly. The local soil is a black alluvial clay loam - this soil has been improved with the addition of organic material & gypsum. I think the protection from cold westerly and southerly winds in winter is the most important factor in my success.

Little Evodia is a lovely plant, which is endowed with beautiful clusters of bright pink flowers along the branches during summer. When the flowers fade, the green citrus like fruits follow which grow to about 30–40 mm in length and breadth.

From what I have heard birds such as lorikeets and honeyeaters adore this plant, but my locals have failed to find it as yet. In addition it is one of the food trees for the Ulysses butterfly, so a worthwhile addition to the garden if this lovely butterfly is a local.

Editor's note:

Ulysses Butterfly (*Papilio ulysses*)

For those living near coastal rainforests in Northern Queensland, the sight of the Ulysses Butterfly in your garden can be a real treat. It is also known as the Blue Mountain Swallowtail, the Blue Emperor and the Mountain Blue. It is a spectacular bright blue and black Australian swallowtail butterfly. The male is an iridescent blue-green with black edges. The female is more subdued in colour. The body is plump and dark with a blue-green sheen. The Ulysses Butterfly has a wingspan of about 14 cm (5.5 inches). Both have a long 'swallowtail'.

Males are attracted to most blue objects (mistaking them for females). There are 16 known subspecies of the Ulysses. It is a protected species in Queensland, despite its common status, to regulate the numbers of these butterflies being collected.

Females prefer to lay their eggs on small trees over 2 metres high, on soft re-growth foliage. The caterpillar is green with a white stripe across the front, a white underside, rows of large white spots along the top and a white spike on the rear. Its favourite food is *Melicope elleryana*. The pupa is light green and roughly crescent-shaped.

Melicope elleryana is a member of the Rutaceae family, though quite different from the Boronias and their allies. Richard is a horticulturist from the Wollongong area, south of Sydney.

Bungle Bungles

Val Williams

The Bungle Bungle Range in the East Kimberley region, is one of the most fascinating geological landmarks in Western Australia. A feature of the Range is the large beehive-shaped sandstone towers, which have prominent orange and grey banding. The banding is a result of alternating algal growth on permeable layers and mineral staining on non-permeable layers. The sandstone and conglomerate that make up the Range were deposited 360–370 million years ago during the late Devonian period. Contrary to its solid appearance, the sandstone is extremely fragile and although it is able to stand great vertical pressure, the wind, rain and sun continue to erode the sandstone into the beehive shapes that can be seen today.

The 500–700 mm average annual rainfall occurs mainly in the four month (December to March) wet season, and typical of the wet-dry tropics, there is great variability in rainfall between years with long drought periods occurring. The evaporation rate is very high and run-off is rapid, resulting in little permanent water in the area. Mean maximum temperatures are 30° to 40°C.

The Aboriginal people knew the surrounding area as Purnululu which refers to the sandstone construction of the range. It is an area rich in animal and plant food during the wet season. Much of their traditional activity was centred on the river systems and permanent pools, especially those of the Ord River. The area is rich in sites of enduring cultural significance.

The flora of the Bungle Bungles area has much in common with the East Kimberley – Victoria River region and relatively low similarity with the Top End regions with higher rainfall, such as Litchfield National Park, Katherine Gorge and the Alligator River region (Kakadu National Park).

Ferns and fern allies are a surprise in such an environment. The rich fern flora is due to the moist, sheltered areas in Osmand Valley and the gorges of the Bungles massif. Nine families each have one or two species, which include: *Blechnum orientale*, *Dicranopteris linearis*, *Taenitis pinnata*, *Lindsaea ensifolia*, *Marsilea mutica*, *Nephrolepis arida*, *Nephrolepis hirsutula*, *Ceratopteris thalictroides*, *Lygodium microphyllum* and, *Cyclosorus interruptus*, but the family Sinopteridaceae is represented by five species of the resurrection fern, *Cheilanthes*, the resurrection fern, which springs back to life after rain. The fern ally, *Lycopodiella cernua* is found in Bream Gorge and the very primitive fern ally, *Psilotum nudum* (fork fern) with no leaves, flowers or roots is found in Winnama Gorge. Both locations are in the Osmand Range.

Occurring in the sheltered habitats of the gorges of the Bungles massif are a number of rare species, undescribed species and significant occurrences. While arid area plants dominate the exposed plateau, relicts of a wetter climate such as the rare palm *Livistona victoriae* occur in the sheltered gorges. The precipitous gorge walls support a number of species not known from any other place such as *Grevillea psilantha*. New species of *Lindernia*

and *Stemodia* from the Scrophulariaceae family are restricted to these sandstone walls. There is a sparse tree layer of *Corymbia aspera* and *Corymbia brachycarpa*, one of the northern eucalypts which are deciduous in the dry season, occurs and the shrubs *Acacia eriopoda*, *Calytrix exstipulata* (photo page 141), *Sarcostemma viminalis* and *Santalum lanceolatum* and vines *Tylophora flexuosa*, *Tinospora smilacina* and *Stephania japonica*. Around permanent pools, a variety of plants can be found including forbs, grasses, sedges and carnivorous plants.

The plateau of the massif has sandy loam soils and sandy ephemeral watercourses and a low, sparse tree layer of *Corymbia cliftoniana* with occasional *C. collina*, *C. dichromophloia* and *Eucalyptus cupularis*. The understorey is made up of arid area plants - *Acacia gonocarpa*, *Acacia stipuligera*, *Acacia tumida*, *Jacksonia odontoclada* and *Grevillea* - *G. byrnesii*, *G. miniata* and *G. refracta* and the grasses, *Triodia spicata*, *Triodia microstachya* and *Eriachne ciliata*. (Altogether 12 species of *Grevillea* have been found in the Purnululu area.)

On the rugged sandstone breakaways around the Bungle massif *Eucalyptus brevifolia* is the dominant tree; *E. camaldulensis* (River Red Gum) and *Ventilago viminalis* occur occasionally in drainage lines. *Senna venusta*, *Gossypium australe* and *Acacia eriopoda* characterise the shrub layer. The forb, *Ptilotus fusiformis* (photo page 141), occurs frequently and grasses dominate the ground layer.

Broad sand plains surround the Bungles massif. *Corymbia collina* is the main tree, and common shrubs found in this area, which occupies much of the Bungle Bungles area, are *Acacia stipuligera*, *Grevillea refracta*, and *Jacksonia odontoclada*. The ground layer is made up of hummock and tussock grasses such as *Triodia spicata* (which occurs as large prickly hummocks in fire protected areas). At Piccaninny Gorge there is a tall 3-4 m shrubland of *Acacia eriopoda*, *A. tumida*, *Grevillea byrnesii*, with smaller shrubs *Acacia gonocarpa* and *Jacksonia odontoclada*. On sandy loam, an occasional *Eucalyptus* similar to the ghost gum, *Corymbia papuana*, may be seen and shrubs *Acacia tumida*, *Corchorus sidoides*, *Tephrosia phaeosperma*, *Senna venusta* and *Grevillea miniata* are common. Forbs which occur there after rain include *Indigofera linifolia*, *I. hirsuta*, *Ammannia auriculata*, *Bonamia linearis*, *Crotalaria incana*, and *Tribulopsis angustifolia*. Throughout the area *Eucalyptus camaldulensis* Australia's most widespread eucalypt, may be found along watercourses.

Sheltered sandstone gorges of the Osmand Valley, with permanent and semi-permanent watercourses, such as in Winnama Gorge support forests with a closed canopy and here occur *Livistona* palms, *Melicope elleryana* (see page 129), *Syzygium angophoroides*, *Carallia brachiata*, *Ficus platypoda* and *F. virens*. Common shrubs are *Acacia holosericea*, *Acacia tumida*, *Melastoma affine*, *Grevillea agrifolia*, *Leptospermum madidum* subsp. *sativum* and *Bossiaea bossiaeoides*.

In the flats and depressions around Osmand Creek, the main trees are *Corymbia ptychocarpa*, which with its large pink flowers has become well known in cultivation, *Melaleuca leucadendra*, with occasional *Timonius timon*, *Nauclea orientalis*, *Brachychiton diversifolius* and *Pandanus spiralis* with its

leaf bases spiralling the trunk. Here and on the sandstone hillsides of Osmand Plateau the only cycad in the area, *Cycas pruinosa*, occurs. Ephemeral watercourses are more open, with a woodland of a eucalypt similar to Ghost Gum, together with *Corymbia confertiflora* and *Bauhinia cunninghamii*, a sparse shrub layer (species of *Acacia*, *Sida*, *Crotalaria*, *Hibiscus*, *Waltheria*, *Euphorbia*, *Portulaca*, *Ipomoea* and the euphorb *Flueggea virosa*) and a grassy understorey. *Bauhinia cunninghamii*, usually a small tree, is very common in the area and is easily recognised by its leaves - two paired leaflets resembling a butterfly.

The Purnululu area has a rich grass flora with 91 species covering 44 genera, which dominate the ground storey. Both perennial and annual grasses and hummock and tussock habits are found. Spinifex grasses, the prickly hummock grasses (*Triodia* species), are plentiful.

The headwaters of the Ord River are in the region and the Ord River defines the south eastern boundary of the National Park and then flows North. In the riparian forest fringing the river, there are the only occurrences in the area of *Eucalyptus microtheca* (Coolibah) and *Syzygium eucalyptoides*.

River levee sands support *Melaleuca leucadendra*, *Eucalyptus camaldulensis* and scattered *Terminalia platyphylla*, *Lophostemon grandiflorus*, *Ficus racemosa* and *Bauhinia cunninghamii*. Shrubs are sparse but a rich array of annual grasses, forbs and exotic species colonise the alluvial sands after each flood. Common forbs are *Cleome viscosa* and *Indigofera linifolia*. On loamy sand and clay soils in the valley, there is a low woodland of *Bauhinia cunninghamii*, *Corymbia opaca* and *Eucalyptus pruinosa* (easily recognisable by its attractive blue grey leaves and rough flaky bark) with occasional *Grevillea striata* and *Hakea arborescens*. The Ord River valley is the most degraded part of the area. *Acacia farnesiana*, characteristic of disturbed areas and easily recognised by its thorns and pinnate leaves, forms dense thickets on heavier soils. The introduction in 1880s and overstocking of cattle, and feral animals, led to the degradation of soil and vegetation especially in lowland areas.

Limestone outcrops on the northern side of the Osmand Valley, western side of the massif and the southern section of the Conservation Reserve have a distinctive set of plants. Restricted to this area is a low woodland of *Hakea arborescens*, *Eucalyptus opaca*, *Bauhinia cunninghamii*, *Santalum lanceolatum* and *Atalaya hemiglauca* with occasional *Celtis philippinensis*, *Premna acuminata* and *Vitex glabrata*. Shrubs are common and include *Dodonaea polyzyga*, *Acacia acradenia* and *Carissa spinarum*. Large hummocks of *Triodia wiseana* occur on unburnt sites, often tangled with the semi-parasitic vine *Cassytha capillaris*.

To the west of the Bungle massif surrounding the access road and campsites, and to the north, are rugged plateaus, ridges and mesas. The rocky sandstone slopes of the Osmand Range support *Eucalyptus* open woodland over Spinifex, the main trees being *Corymbia cliftoniana*, *C. collina* and *Owenia vernicosa*, and a shrub layer of *Cajania* species, *Acacia gonocarpa*, *Corchorus sidioides*, *Grevillea refracta*, *Heliotropium epacrideum*, *Hibiscus leptocladus*, *Paratephrosia lanata* and the yellow flowered deciduous small tree *Cochlospermum fraseri* (photo page 140). **Continued on page 138**

Success with the WA Christmas Tree (*Nuytsia floribunda*)

Keith R Oliver

This is a follow-up article to the September 1995 Australian Plants article and summarises progress to date.

At last, in November and December 2002, I was rewarded with a dazzling display of brilliant orange flowers contrasting beautifully with a deep blue summer sky. The WA Christmas Tree must, indeed, be among the most spectacular of the world's flowering trees.

After producing just a little flower in 2001 the first of my three rooted cuttings of the hemi-parasite *Nuytsia floribunda*, potted up with a dwarf form of crepe myrtle (*Lagerstroemia*) host plant in 1993⁽¹⁾, flowered well this year. It is about 5 m tall. The other two cutting grown trees, one of which had been already planted and was dug up when 0.7 m tall and moved from a southern suburb (Wilson) to a northern suburb (Hamersley) of Perth, are growing well but are not yet of flowering size. All of the plants are being grown in sand with regular, but never more frequently than every second day, overhead summer watering. The transplanted tree, which was dug up together with its deciduous host plant in the winter of 1997, was by far the most advanced and may have flowered years ago if it had not been set back several years by being moved. A seedling tree that had also been provided with a crepe myrtle host two years after germination, and was also making good growth, was transplanted at the same time but unfortunately failed to survive.

I am well pleased by this success with cutting grown trees, with three out of three growing well, as none of the few seedling plants that I had planted previously, without crepe myrtle hosts, survived for more than two or three summers.

Although the hemi-parasitic *Nuytsia* is known to utilise multiple hosts over extensive areas it certainly appears not to have harmed, in any way, either the crepe myrtles or any other plants in my garden, which contains a rich mixture of both Australian and exotic plants. My brother also had a large wild tree in his garden for many years and also observed that it had no noticeable detrimental affect on any of his other plants.

It is worth noting here that although *Nuytsia* produces abundant fertile seed that germinates readily, the seedlings in the wild, very rarely survive beyond the first or second season. The trees reproduce almost solely by sucker shoots arising from underground rhizomes that radiate some 150 metres from the principal rootstock. *Nuytsia* is able to parasitise other plants by means of haustoria borne on roots arising from these rhizomes⁽²⁾.

My cuttings were purchased, in tubes, from David Green at the Jandakot Field Nursery (now relocated and renamed as the Oakford Green Nursery, 1071 Thomas Rd, Oakford, WA 6121 - Ph: (08) 9439 2555). David has been

growing *Nuytsia* from cuttings since the 1980's and was only selling about 40–50 a year when I purchased mine, but is now selling about 2,500 a year, most of which are grown on by George Lullfitz to about a metre tall at his nursery (Lullfitz Nursery, Caporn St., Wanneroo, WA 6065 - Phone (08) 9405 1607). David suggests carnations, roses, the perennial native grass *Cymbopogon oblectus*, or *Dichondra repens*, as suitable hosts. †

Armstrong⁽³⁾ showed that it was possible to get 90% strike rates from cuttings.

Pioneer Australian plants nurseryman George Lullfitz, finds that *Nuytsia* cuttings or seedlings do not require any host plants in a container, at least until they are a metre tall. There was however, healthy *Dichondra repens*, which came with the cuttings, growing in the containers that I saw but there was no other possible host. The good, sturdy, 1 m tall, 3 year old, cutting-grown plants that I saw have been one year in 70 mm tubes, one year in 200 mm pots and one year in 420 mm pots. These were being grown on, from cuttings supplied by David Green, for sale to Main Roads Western Australia and to landscape architects.

George recommends fertilising the plants well with low phosphate (18:2:10 'native plant') slow release fertiliser and watering them adequately during the dry summer as the keys to success. George estimates that seedling trees can flower in 12 to 14 years and that cutting grown trees can flower much younger. He is especially against using exotic plants as hosts.

George also says that now that there are good sized *Nuytsia* plants available in quantity, the same as with most other ornamental trees, there is a strong demand for them.

In his work, Calladine found that potted seedlings of *Nuytsia* can survive for four years without a host. There is further evidence from the finding of Calladine, Pate and Dixon⁽²⁾ that potted *Nuytsia* seedlings in pairs, without hosts, grew better than most, but not all, of the potted *Nuytsia* seedlings that were paired with 24 different species as hosts. Seedling trees, therefore, appear to not necessarily need a host. There also appears to be some doubt as to whether *Nuytsia* is an obligate parasite at the mature tree stage of its life cycle; Calladine and Pate⁽⁴⁾ write 'It remains to be seen whether benefits from parasitism apply to older trees in native habitats, especially where individuals are strongly tap rooted in addition to possessing massive lateral root systems'.

Adrian Bowden, however, has observed that mature trees, in the wild, deprived of hosts through land clearing appear to slowly decline over the years, but others disagree with this and cite cases of apparently thriving mature trees in paddocks that have been cleared for very many years, where there are no other living plants in the dry summer months; perhaps other factors, such as the depth of the water table, play a part. Adrian has found that excessive watering of remnant wild mature trees, as can occur in a plant nursery situation, can be fatal to them. I too have seen an advanced potted *Nuytsia* that had died in mid-summer through rotting, probably caused by excessive watering.

In trying to sort through the often conflicting evidence, it seems to me that it may be that although host plants can act as a source of nutrition and water, they can also act as competitors to the *Nuytsia* and that freeing the seedlings or cuttings from competition, while in pots, and watering and fertilising them adequately but not excessively, may make some sense as a way to grow them. It seems, however, that both providing them with a suitable host and fertilising and watering them appropriately, is the best way to go.

Nuytsia can photosynthesise normally and has a good root system and may be quite capable of growing for years without parasitism. Earlier guesswork statements by some authors to the effect that *Nuytsia* gets most of its nourishment from other plants, or that it is a destructive parasite, seem to be quite wrong.

Kingsley Dixon from Kings Park and Botanic Garden reports that *Nuytsia* grown by cuttings taken from mature trees, although they will flower in as little as three years, will only grow into shrubs that refuse to grow upright or to grow into trees. He further says that Western Australian species that occur with *Nuytsia* have co-evolved with it and are fairly resistant to it and are not suitable as host plants, but that *Nuytsia* will parasitise almost anything, so either almost any eastern Australian species or almost any exotic plants should be suitable hosts.

Gardener's Tip:
***Nuytsia* will**
parasitise
almost
anything

It appears to be very important that the cutting material is taken from suckers (photo page 140), or at least from young trees, if the cuttings are to successfully grow into trees.

Gwynneth Oxnam from another Perth suburb (Nedlands) planted many seeds of *Nuytsia* directly into her garden in 1965 and 1967. Both lots germinated well but only one tree from each planting, each of which had been provided with couch grass as a host survived. The surviving tree from 1965 took 22 years to flower, while the surviving tree from 1967 grew steadily each year, reaching a height of about 4.5 metres after 28 years, but failed to ever flower before the main tree died back when 33 years of age. This apparent death was followed by the growth of a lot of suckers from the underground rhizomes. When some of these suckers were removed to thin them out a bit, the whole lot died.

Both my cutting grown tree that has flowered and Gwynneth Oxnam's seedling tree that has been flowering for many years grew steadily with a single trunk and did not display the curious changes⁽¹⁾ that have been reported by others, although there may have been a little suckering when the plants were very small until one sucker became established as the sole or dominant trunk. However, the growth of a lot of suckers after the apparent death of the 33 year-old tree above does indicate that curious things may indeed happen.

A *Nuytsia* tree that was grown in cultivation in Kings Park and Botanic Garden, from seed, first flowered circa 1984 when it was 15 years old and is now very large and is suckering freely. Bob Dixon reports that there are several natural populations of *Nuytsia* growing in the Kings Park bushland; while some are typically suckering and producing clonal colonies of trees, others consist of just single trees.

As referred to earlier, some recent research, at the University of Western Australia and Kings Park and Botanic Garden⁽²⁾, has yielded a lot of new information as to the mechanisms by which *Nuytsia* is able to act as a root parasite on neighbouring plants and the probable benefits that it gains by this. There is also some information as to how Australian species, common to the native sand-plain habitats in which *Nuytsia* regularly occurs and which are known to be extensively parasitised by *Nuytsia*, compare as host plants. Other research⁽⁴⁾ has given information on haustorial structure and functioning in *Nuytsia* and its water relationships with its hosts. They found that haustorial size is highly variable, from less than 1.5 mm to 30 mm in diameter, depending on the size of the host roots being exploited.

With known successful methods for both striking cuttings and for growing them to maturity there now seems to be no reason why these magnificent trees, which are very hardy and long lived, cannot be grown at will wherever conditions are suitable for them. They can vary from a tree to 15 m high to, rarely, a shrub in coastal areas⁽³⁾. George Lullfitz reports that east of Esperance there are dwarf forms only 1 m tall. It has been said that *Nuytsia* trees can, on occasions, damage nearby plastic coated underground cables. Can anyone provide any detailed evidence regarding the possibility of this occurring?

I think that it is time that we saw many more of them in cultivation in landscaping and in gardens - avenues of them, perhaps in Kings Park and Botanic Garden and other suitable locales, would be really beautiful and would no doubt be a great tourist attraction in season. Also avenues or groves of *Nuytsia* alternated or interspersed with a selected grafted clone of the Australian Illawarra Flame Tree (*Brachychiton acerifolius*) or with Jacaranda trees (*Jacaranda mimosifolia*, from Brazil), or even all three together, could be a spectacular sight indeed.

The benefit of using rooted cuttings for such plantings is that these could be all from some chosen clone and would be rather uniform in size and form, and would also probably flower much sooner than seedling grown trees. However, it could be disadvantages in the event of the trees being attacked by some pest or disease if the trees were all the same clone, as they would lack genetic variability and would therefore possibly be extra vulnerable.

I would like to express my gratitude to Adrian Bowden for telling me of his observation that *Nuytsia* especially tended to parasitise crepe myrtles in preference to many other plants. This information apparently led me to this easy success, after my previous failures, in growing the WA Christmas Tree. I will now fertilise my two smaller trees well to see if good nutrition, together with adequate but not excessive summer watering, and being provided with suitable host plants, can speed up their growth to flowering size.

Acknowledgements

I am grateful to David Green, George Lullfitz, Adrian Bowden, Kingsley Dixon and Gwynneth Oxnam for providing some of the information used in this article (via personal communications).

Continued on page 138



Left: The cutting-grown *Nuytsia floribunda* in full flower in my garden, December 2002

Right: The same tree coming into flower, showing flowers below and flower buds above

All photos Keith R Oliver



Left: One metre tall, 3 year-old cutting-grown tree, growing at Lullfitz Nursery. The ground cover is *Dichondra repens*. (This also appears to be acting as a host to the tree)

Right: The root system of the same tree. The large roots are those of the tree, while the finer roots appear to belong to the *Dichondra*

Bungle Bungles

Continued from page 132

Drainage lines support woodlands of *Bauhinia cunninghamii*, *Lophostemon grandiflorus*, *Eucalyptus chlorophylla* and *Melaleuca viridiflora* and an understorey of *Carissa spinarum*, *Atalaya hemiglauc*a and *Acacia holosericea*, with a ground layer of tussock grasses. On the rocky undulating plains and lower slopes there occurs an understorey of *Spinifex* grasses and a low open woodland of *Corymbia opaca* and *Bauhinia cunninghamii* with scattered small trees and shrubs - *Grevillea pyramidalis*, *Acacia acradenia*, *Carissa spinarum* and *Dodonaea polyzyga*.

Acknowledgement

Much of the botanical information provided in this article is based on Research Bulletin No. 6 cited below⁽²⁾ - in particular chapter 3 written by Karina Menkhorst and Ian Cowie. The overall work represents the results of 10 weeks of biological survey of Purnululu National Park, Purnululu Conservation Reserve and adjacent areas during 1989. It lists 616 plant and 298 fauna species.

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Eucalypt Dye as a Potential Stain in Microscopy

Stewart Chew, Curtin University of Technology, Perth

Although natural dyes have been in use for thousands of years, its application as microscope stains is comparatively recent. Similarly, in Australia, the indigenous people have used eucalypt extracts as dyes for a long time.

The question one would ask is: 'Can eucalypt dyes also be used as stains in microscopy?' We do not have an answer to this question because our knowledge of eucalypt dyes in this area is largely unknown as virtually no research is being done on this likely application of eucalypt dyes.

It makes a lot of sense to explore this likelihood, as there is a universal shortage of natural dyes in microscopy. In particular, there is a dwindling stock of the world's supply of haematoxylin, the single most common dye used in biology and medicine.

Haematoxylin is obtained from the haematoxylin tree grown in Central America. More than a decade ago there was a severe world-wide shortage of the haematoxylin dye resulting in an escalation of its price and this has continued to the present day. With increasing cost and scarcity of imported haematoxylin, there is an urgency to find a comparable substitute.

Western Australia has a bounty of eucalypts and the dyes extracted from many of these WA eucalypts have already been used successfully for dying textiles. Previously, we have tested many of these eucalypts for their staining potential in microscopy with mixed results. We have used extracts from bark, wood, leaves and flowers.

One of these eucalypts, the Marri (*Eucalyptus calophylla**) was selected for investigation. It belongs to the eucalypt group called the bloodwoods, which is a common large gum found in the south of Western Australia. The dark red dye obtained from its bark was tested on tissue sections. Initial tests have shown that there was sufficient staining of tissue sections for them to be clearly identified under the microscope.

More tests will have to be conducted to improve the discriminative staining properties of the eucalypt dye to make it compatible with haematoxylin. The use of the dye derived from *Eucalyptus calophylla* in place of haematoxylin may have great scientific and commercial importance for Australia.

(**Eucalyptus calophylla* is now called *Corymbia calophylla* (Lindl.) K.D.Hill & L.A.S.Johnson, in the new classification per; Hill, KD & Johnson, LAS (1995) Systematic studies in the eucalypts. 7. A revision of the bloodwoods, genus *Corymbia* (Myrtaceae). Telopea 6(2-3): 240.)



Cochlospermum fraseri

See page 132

Photo Val Williams



Juvenile suckers from
a mature seed-grown
Nuytsia floribunda
tree in Kings Park
and Botanic Garden
See page 135

The mature *Nuytsia floribunda* tree
Both photos Keith R Oliver





Above: *Ptilotus fusiformis*
Below: *Calytrix exstipulata*
See page 131

Both photos Val Williams



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Dealbata (cold climate) Aust. Plant Nursery — off Bloomfield St, Dalgely 2630. Tel. (02) 6456 5043. Specialising in alpine and dry Monaro plants — Sorry no overseas orders. Phone to arrange a visit.

Newcastle Wildflower Nursery — 260 Lake Rd, Glendale 2285. Tel. (02) 4954 5584. Extensive range of native plants including rare and endangered species.

Stocks Native Nursery — Lot 3, Simmonds Rd, Harden, 2587. Tel. (02) 6386 2682. Plants for frost and dry weather suited to Canberra, Wagga Wagga, Orange type conditions.

Sydney Wildflower Nurseries — South at Heathcote (02) 9548 2818; West at Marsden Park (02) 9628 4448; North at Terrey Hills (02) 9450 1555. Excellent range of native plants. Open 7 days.

Wariapendi Nursery — Church Ave, Colo Vale (10 km north of Mittagong off the freeway towards Colo Vale). Tel. (02) 4889 4327. Extensive range of natives from tubestock to advanced for Southern Highlands and Tablelands, South Coast and Sydney Basin. www.wariapendi.com.au

Wildgums Native Plants — PO Box 89, Cobargo, NSW 2550. Ph/Fax (02) 6493 7398, Mob. 0427 937 398. Wholesale nursery open by appointment. Huge range including rare species.

Wirrimbirra Native Nursery — Hume Hwy, between Bargo and Tahmoor E. side 2574 (3 km from Freeway entry). Wide range including unusual plants. Tel. (02) 4684 1112.

Wirreanda Nursery — End of Wirreanda Rd, Ingleside 2101. Tel. (02) 9450 1400. Growers of advanced and semi-advanced native trees and shrubs. Open 7 days.

Wildflower Nurseries in South Australia

Brenton Tucker Native Plants and Carawatha Garden — Placid Estates Rd, Wellington East via Tailem Bend. Tel. (08) 8572 7104. Wide range of tubestock and advanced plants. Extensive display gardens and picnic areas. Open weekends and public holidays March to November and by appointment, 10 a.m. to 4 p.m.

Wildflower Nurseries in Tasmania

Plants of Tasmania Nursery — 65 Hall St, Ridgeway 7054. SAE catalogue. Tel. (03) 6239 1583. Open 7 days.

Wildflower Nurseries in Victoria

Kuranga Native Nursery — 393 Maroondah Highway, Ringwood 3134. Tel. (03) 9879 4076. www.kuranga.com.au For Australia's largest range of Australian flora including rare and unusual forms. Delivery to most states. Free stock list on request.

Australian Wildflower Seed Suppliers

R. Horner — 1 Grundy St, Alice Springs, NT 0870. Seed of trees and shrubs of Central Australia. Please send a 45c stamp for a list.

Nindethana Seed Service — Broad selection of Australian seed. Send \$3 in stamps for a list to: PO Box 2121, Albany WA. Ph: 08 9844 3533, Fax: 08 9844 3573. www.nindethana.iinet.net.au

Wildflower Society of Western Australia (Inc.) — PO Box 64, Nedlands 6909. A range of seeds available, labelled and packed, at \$1.50 (plus postage) per packet. Send for a **current** Descriptive Seed List (\$3.00 posted) to: The Seed Sales Officer, Eastern Hills Branch, PO Box 111 Glen Forrest, WA 6071. 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 a 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.

Australian Plants may be received by membership or subscription.

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<http://www.austplants-nsw.org.au> E-mail: office@austplants-nsw.org.au

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Office: Open Tuesday/Thursday — Tel. (08) 9383 7979 Fax. (08) 9383 9929

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Online: <http://farrer.riv.csu.edu.au/ASGAP> is the national internet page for all the above Societies, receiving thousands of 'hits' from all over the world. The wealth of information is augmented by a newsletter, Australian Plants Online, all free. Refer to it and enjoy.

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E-mail: edap@austplants-nsw.org.au Fax. (02) 9676 7603

PUBLISHING COMMITTEE: M Wagner (Convenor), J Caldwell, S Disney, C Liber, M Robinson, R Smyth-Kirk, K Sommerville, G Teague, V Williams

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