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Kangaroo Paw — A Horticultural Phenomena

The Kangaroo Paws of Western Australia are a unique treasure in the world's horticultural heritage. All of the naturally occurring species are described in the latter section of the issue. The thrust of this issue, however, is to present the horticultural forms that have been developed and have received a world wide demand of significant proportions. The staggering number of cultivars recorded here, most of which were developed to meet a growing overseas demand, will give some indication of this horticultural oddity.

I must admit a scepticism about the development of these horticultural hybrids, being familiar with the magnificence of good forms of the true species, especially the outstanding Green and Red Paw *Anigozanthos manglesii*. As yet none of the horticultural forms have equalled it in size and colour. I realised that, though beautiful they might be, I did not have any flourishing in the garden. A friend gave me two plants of *Anigozanthos* 'Regal Claw' and one of *Anigozanthos* 'Pink Joey' and six years later they are both covered with dozens of flower spikes still quite brilliant in January when flowers of other natives are not abundant. Last year I planted some of the Bush Gem range and the "Southern Aurora" range and have been rewarded with colour and character in the garden. A plant for the beginner!

Commercial producers of Kangaroo Paw hybrids were invited to take advantage of this offer of free promotion. Their response may be gauged from the information and photographs made available.

Easily Cultivated Wildflowers

This second issue in *Australian Plants* of the 90s, Series B, is again especially designed for non-experienced growers of wildflowers. A blend of Bottlebrush plants and Kangaroo Paw will provide a colourful garden with very little expertise in horticulture. The forthcoming issues extend this range of plants with special emphasis in two issues on tropical gardening. —Editor.

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COVER PLATE — *Anigozanthos* 'Western Star Ruby Blaze'. This spectacular hybrid Kangaroo Paw has a mature height of 0.7 metres. It was bred for pot culture or for a specimen garden plant.

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Kangaroo Paw

Plants for Horticulture — Forms and Interspecific and Intraspecific Hybrids

by Sue and Bob Dixon
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West Perth, WA 6005

Our interest in Kangaroo Paws started in the early 1970s when Bob was nurseryman at the Zoological Gardens (Perth Zoo), South Perth, and joined the Kangaroo Paw Study and Promotion Group. He was greatly enthused by the hybrids already produced by Keith Oliver. We also remember well our bush trips to collect as many species and variants as possible for breeding and in particular our first speeding fine miles from anywhere, or so we thought, on our way to Albany to collect *Anigozanthos onycis* and *A. preissii*. We are still producing a few plants and seed from those original collections.

Well, you have to admit Kangaroo Paws must be one of the easiest plants to hybridize. In general*, there are no hassles with insects interfering with cross pollination — you do not even have to emasculate the flowers (remove the anthers), transferring pollen can simply be done with your finger, if you are careful. However, you do need a bird-proof cage.

The Fi interspecific (cross between two species) hybrids are a piece of cake — all species can be crossed in any combination, without any special pre-treatment. However, using *Anigozanthos flavidus* as the female is not recommended as most plants usually end up as straight *A. flavidus*, not hybrids. If you require these hybrids for further breeding you may have to make them into tetraploids (four times as many chromosomes as haploid); however, some crosses are fertile. The usual method of treatment is to use colchicine, a derivative of *Colchicum autumnale*. This is extremely poisonous, therefore you require a poisons licence to store and use it, which costs \$40 in Western Australia. The cost of colchicine is also high — the second grade (non analytical) is about \$60 per gram.

Technique: The mature plant, preferably in a pot, should have the soil scraped away from the rhizome; place cotton wool around new shoots which are about 5 cm high; use .02% colchicine and moisten the cotton wool — it is best to use a syringe. Do this three times a day for three days. If successful, the shoot absorbs the colchicine. Shoots begin to swell at the base. This method is time consuming, does not always work and only affects the treated shoots.

More economical ways would be to treat the seed. Soak it first in water to imbibe then soak in colchicine. However, this could inhibit germination. You could also treat young seedlings or shoots in tissue culture.

*Research at Curtin University has shown some of the smaller flowered Kangaroo Paws, e.g., *Anigozanthos pulcherrimus*, can be pollinated by honey bees, probably other insects and maybe small mammals, e.g., Honey Possums.

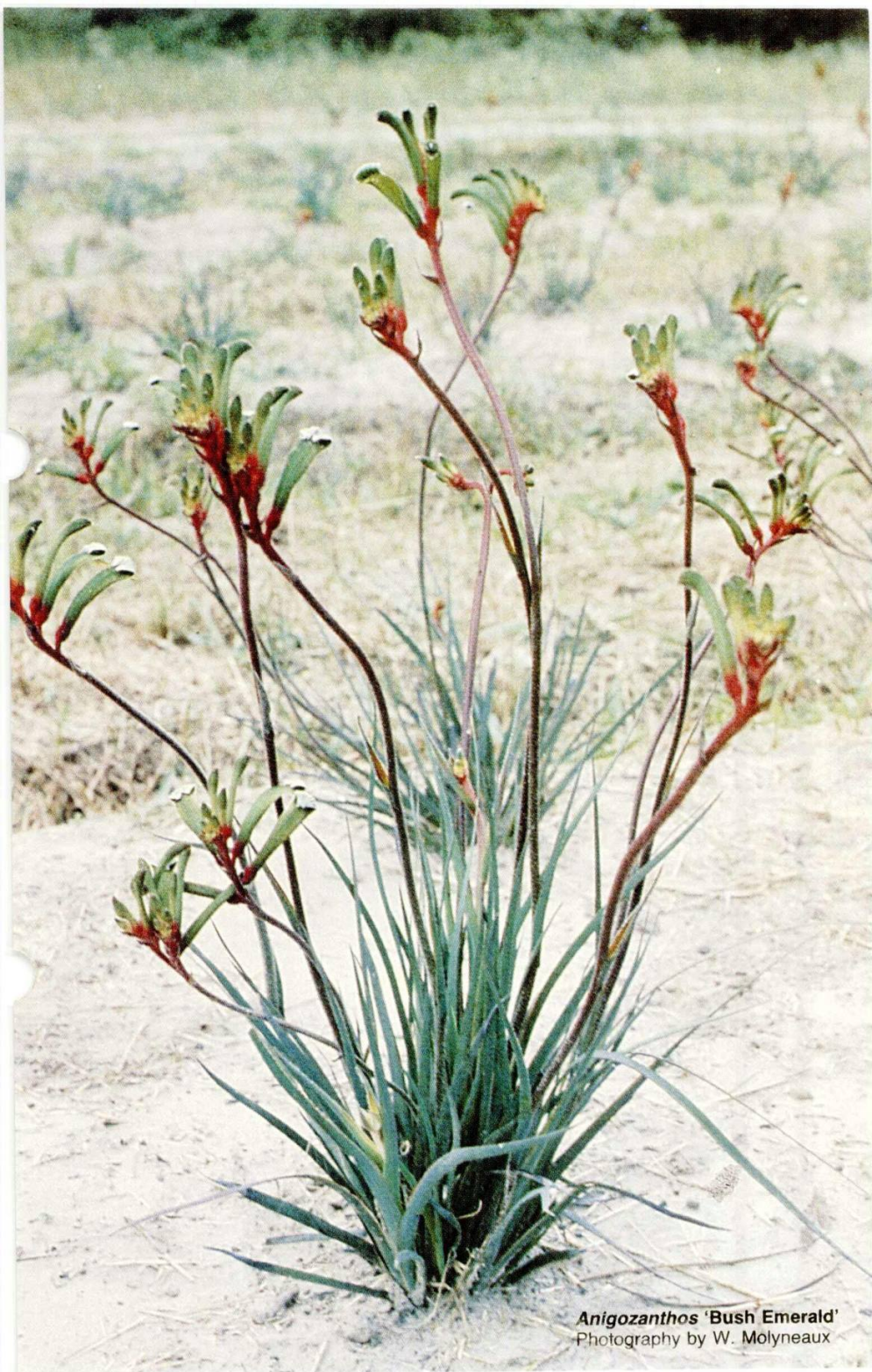


Anigozanthos 'Red Cross' △

▽ *Anigozanthos* 'Regal Claw'

Early hybrid Kangaroo Paw developed and photographed by Dr S. Hopper — see page 54.





Anigozanthos 'Bush Emerald'
Photography by W. Molyneux

Hybrid Kangaroo Paws

Back to the zoo. Many hardier hybrids were raised, that is, those more resistant to disease and our softer growing conditions, as well as shorter lived, but equally as beautiful crosses which included *Anigozanthos manglesii* (the all red form) $\times$ *A. humilis*, a short-stemmed, red-flowered floriferous plant; and *A. preissii* $\times$ *A. onycis* which was intermediate in height with many flower stems and large flowers similar in colour to *A. onycis*. Only two hybrids were eventually registered through the Australian Cultivar Registration Authority in Canberra — *Anigozanthos* 'Spence's Spectacular' (*A. preissii* $\times$ *A. flavidus*) and *Anigozanthos* 'Ruby Jools' (*A. humilis* $\times$ *A. flavidus*). Of course, intergeneric crosses (*Macropidia* $\times$ *Anigozanthos*) were also tried on many occasions without the aid of any modern techniques. They seem totally incompatible by simple transference of pollen. Unfortunately, most crosses undertaken at the zoo have been lost, mainly through lack of interest at that time. You can still see a good display of hybrids at the zoo, most of which were bred by Keith Oliver and are at least 15 years old.

After this period our interest waned for a few years until we became enthused again by the different colour forms of *Anigozanthos manglesii* and decided it was about time more people started growing them. We started breeding new colour forms. As you can guess, this is a long process and it may take a lifetime to produce some really outstanding new colours. We are now well on track with some new colours and much improved naturally occurring forms. New colour forms include a bright orange base and medium green perianth tube, a light pink base and perianth tube.

Naturally Occurring Kangaroo Paws — Outstanding Forms

Anigozanthos manglesii var. *flavescens*, usually found as individual plants. I have never seen a large population. It is a stronger grower than the more usual type form of *A. manglesii* with less yellowing of leaves; produces more seed and the flowers are a much deeper yellow at their base with a tinge of yellow on the perianth tube.

Anigozanthos manglesii — what we call the orange form. The flowers are orange at the base with a light green perianth tube. It is now a stronger growing plant producing better seed. The original plant was given to us by Keith Oliver over 15 years ago and, to my knowledge, no one has recorded this form again in natural populations.

Anigozanthos manglesii — the all-red form, that is, base and perianth tube of the flower is now available in many different shades of red. This is the most common colour form apart from the normal red and green flowered form. Individual plants or small colonies are found over a fairly wide area, but with clearing of bushland it is becoming more difficult to find.

Anigozanthos manglesii — metallic blue form. The flower has a red base and metallic blue perianth tube. To my knowledge this only occurs in one location. The shades of blue vary; one form is so dark it looks almost black.

Unfortunately, a pure white form, which we assume was taken from the bush, has proved elusive. The nearest we can get to this is a slide of one in Kings Park Slide Collection, taken in a garden in Northam many years ago.

Growing Kangaroo Paws

Although generally short-lived their life span can be extended by careful management. In general we tend to kill them with kindness by giving too much fertilizer, shade and overhead watering. Under these conditions plants often only survive for one or two flowering seasons. By using the following or similar methods plants will often survive up to seven or eight years in the home garden.

Plant in a full sun position. Water the plants regularly by trickle irrigation or hand watering, not over the top of the plant, for the first spring, summer and autumn until regular winter rainfall, to establish the plants. Watering, if you wish, can be commenced again in the spring until December, then gradually dry off the plants over a period of four weeks, or do not water at all. Also in early December cut off the old flower heads to about 50 cm above ground level. The old stems and leaves help to protect the plant and stop dehydration of the rhizomes during summer.

In early March cut down the plants to ground level. Leave the tops/rubbish to dry for about two weeks then give a quick burn or rake off the rubbish straight after cutting down. Immediately after burning, or two weeks after raking if you wish, you can recommence watering or you can leave them to fend for themselves. They do have enough stored moisture in the rhizomes to commence growing but should survive until the onset of the winter rains. ■

‘Bush Gem’

Hybrid Kangaroo Paws in Queensland

by Alex Hansa,
Fairhill Nursery, Qld

The following *Anigozanthos* Bush Gem hybrids are very suitable and will last several years in Queensland gardens: ‘Bush Dawn’ — ‘Bush Haze’ — ‘Bush Ruby’ — ‘Bush Noon’ — ‘Bush Sunset’ — ‘Bush Nugget’ — ‘Bush Gold’ — ‘Bush Glow’. Sometimes reliable are ‘Bush Ranger’ and ‘Bush Surprise’. They need to be planted in a sunny position with well drained but well watered soil. Cut back flowers and leaves to the ground after flowering. At the same time a little fertilizer may be added. ■

Growing Hybrid Kangaroo Paws

by Alison Moore,
Nunamara, Tasmania

I purchased two Bush Gem hybrids in January 1989: *Anigozanthos* ‘Bush Nugget’ — with 50–60 cm high flower stems of yellow gold flowers — and *Anigozanthos* ‘Bush Ranger’ — a plant with smaller stems, 30–40 cm long with red flowers. The plants sit in a northeasterly bed next to the house. The soil is introduced reddish loam and the plants are mulched with hardwood chips.

Purchased when flowering, the ‘Bush Nugget’ has longer stems — at least 60 cm — whereas the ‘Bush Ranger’ has 30–40 cm long stems. They survived a “Nunamara winter” where temperatures in 1989 fell to -5°C and can go as low as -7°C . They have been flowering since early summer with ‘Bush Ranger’ still producing flowers at all times of the year. ‘Bush Nugget’ is not so prolific but much leaf growth has occurred. Apart from the odd nibble by our wallabies they look healthy and have provided me with a continuous show of flowers since November. Early stages, I realize, but to survive here is often a battle for my plants. When planted I gave the recommended dose of Osmocote. Watering has been pretty regular following the initial planting but they now survive on infrequent (once a month) watering, relying heavily on mulch. ■



**Anigozanthos 'Western
Mini Mini Prolific'**



**Anigozanthos 'Western
Big Bicolour'**



**Anigozanthos 'Western
Ruby Radiance'**

Hybrid Kangaroo Paws

by Keith R. Oliver
President — Kangaroo Paw
Society* of Western Australia

Kangaroo Paws are now grown commercially in many countries (Israel, Colombia, Holland, Spain and Kenya), and are used in the cut flower trade, in amenity horticulture and as potted "throw away" plants. Kangaroo Paws are one of the three major promising Australian horticultural crops (the others are *Blandfordia* and *Chamelaucium*) and one which has been singled out for special attention by other nations (International Society of Horticultural Scientists Conference on New Horticultural Crops 1989). (John Considine, pers. comm.). Many of the plants grown commercially and in home gardens are hybrids, and indeed, there are good reasons why hybrid Kangaroo Paws will become much more prominent in the future.

Of course the present widespread use of hybrids and their perceived future prominence, in no way absolves us of our responsibility to conserve, in the wild, all of the species and subspecies of Kangaroo Paws. Every effort must be made to conserve all natural varieties of Kangaroo Paws, both in the wild, and in cultivation.

A Short History of Hybridization

So far as is known to me the following is the first public reference to Hybrid Kangaroo Paws. I have therefore reprinted it in full. The date of publication is uncertain but it is thought to have been published in the *West Australian* newspaper in about 1957.

"Hybrid Kangaroo Paw — "The first kangaroo-paw hybrid in history, so far as is recorded, has been produced at the Institute of Agriculture at the University of WA by Mr K. Finlay, the Edward Moss agricultural research scholar, whose experiments with hybrid tomatoes have created Australia-wide interest. The hybrid's parents are a King's Park dark red kangaroo paw and a green and yellow swamp kangaroo paw. The plant itself is tall, vigorous and upstanding with large green and cream blooms, pinkish stem and thick, springy foliage. It is between 3 ft and 4 ft high, and is an outstanding exhibit in the plant glass house at the institute."

Grieve and Marchant (1963) [1] recorded that Dr Keith Finlay obtained viable seed from such crosses as *Anigozanthos manglesii* × *A. humilis*, *A. viridis* and *A. flavidus* and state that "There is clearly considerable scope here for the horticulturist interested in plant breeding." So far as is known Dr Finlay abandoned the work, and as far as we know, none of his hybrids have survived. However, others were to carry on the work.

Sometime in the early 1960's the late Mr Ron Garrity crossed *Anigozanthos pulcherrimus* with *A. flavidus* in Perth. He was disappointed with the colours obtained (cream to yellow) and so far as is known he did nothing further and none of his hybrids survive.

*The Kangaroo Paw Society of Western Australia has been formed to foster the study, appreciation, cultivation and conservation of Kangaroo Paws. It is affiliated with the Western Australian Wildflower Society which is a member society of The Society for Growing Australian Plants. The annual subscription is \$6.00 and interstate members are welcome. (Secretary: Neil Arther, 23 Denmark Way, Warwick, WA 6024.)

In 1963 the author acquired, for the first time, his own house and garden and immediately planted some Kangaroo Paws, which were given to him by Mr Stan Haynes, his father-in-law and friend, who had been growing Kangaroo Paws for some years. The author was very impressed with the vigour and disease resistance of *Anigozanthos flavidus*, and although he had at that time no knowledge of genetics or plant breeding, he immediately set about crossing the other species with *A. flavidus*. This was the real beginning of the commercial hybrid Kangaroo Paws and some of the first of these hybrids (in tetraploid form) or their progeny are still in cultivation today.

The author found that his *A. flavidus* hybrids were sterile, and following reading books on plant breeding in 1964 produced fertile allotetraploids soon after this. These, so far as is known, were the first polyploid Kangaroo Paws, as none have been recorded in the wild and none had been produced in cultivation before this. The author continued breeding until 1973 and produced such plants as *Anigozanthos* 'Harmony', *A.* 'Big Red', *A.* 'Early Spring', *A.* 'Gold Fever', *A.* 'Charm' and *A.* 'Miniprolific' (now known as the "Bicentenary Kangaroo Paw"), which are still widely grown today. This work was published in 1971 [2] and 1972 [3]. In 1970 some of the author's *Flavidus* Hybrid Kangaroo Paws were planted at the Perth Zoological Gardens.

The author recommenced breeding in 1980 and now in association with Plantex Australia Pty Ltd markets the successful "Western Star" series of Hybrid Kangaroo Paws. More about these later.

Meanwhile in the mid 1960's the late Mr Stan Haynes also commenced breeding and although he produced no polyploids of his own he made many inter-specific crosses and also used many of the polyploids produced by the author in his work as they freely exchanged plants and seed between them. Among the most notable hybrids produced by the late Mr Haynes were *Anigozanthos* 'Yellow Gem' and *A.* 'Velvet Harmony', and these are still widely grown today.

Following the formation of the "Kangaroo Paw Study and Promotion Group" in 1971, Mr Bob Dixon, now of Kings Park and Botanic Garden, but then at the Perth Zoological Gardens, joined in the breeding programme. Many hybrids were grown at the Zoological Gardens, mainly from seed and plants supplied by the author. Mr Dixon has done much valuable work on growing Black Kangaroo Paws (*Macropidia fuliginosa*) from seed. He was also active in conserving colour forms of *A. manglesii*, which had been found in the wild, and in crossing these among themselves to produce yet more colour forms. The Kangaroo Paw Study and Promotion Group disbanded in 1972.

Also about 1971 Dr Les Bousfield, working at Kings Park and Botanic Garden, produced tetraploid forms of *Anigozanthos manglesii* and *A. flavidus* with a view to making this interspecific cross at the tetraploid level. So far as is known Dr Bousfield left Kings Park before achieving this cross. Some of the plants of *A. flavidus* that he worked with still grow at Kings Park but it is not now known for certain which of these are tetraploid.

From 1973 to 1976 Dr Stephen Hopper, then a student at the University of Western Australia, was studying Kangaroo Paws and made many interspecific crosses as a part of his studies [4] and in 1979 reported that only the *Flavidus* Hybrids survived for any length of time [5]. Three of these *Flavidus* Hybrids produced by him, *Anigozanthos* 'Regal Claw' (*A. preissii* $\times$ *A. flavidus*) *A.* 'Dwarf Delight' (*A. onycis* $\times$ *A. flavidus*) and *A.* 'Red Cross' (*A. rufus* $\times$ *A. flavidus*) have been widely grown.

Breeding Hybrid Kangaroo Paws

The tissue culture (micropropagation) of Kangaroo Paws was developed in about 1975 (Ellyard 1978 [6]) and these plants were among the first to be multiplied in this way.

About 1973 the late Mervyn Turner began breeding Kangaroo Paws and some of these were to be successfully marketed from about 1986 onwards as the well known Bush Gem series of Hybrid Kangaroo Paws. I had the pleasure of meeting Merv when he visited Western Australia in 1982 and he made many generous offers to supply me with seeds and plants but I was not able at that time to take on any more plants and so had to decline. Merv produced many *Flavidus* Hybrids, for example, *Anigozanthos* 'Bush Ranger', A. 'Bush Baby', A. 'Bush Glow', A. 'Bush Sunset' and A. 'Bush Flame'. He also produced plants whose parentage did not include A. *flavidus* such as A. 'Bush Emerald' and A. 'Bush Opal'. Merv reported his work in 1984 [7].

About 1980 the author recommenced breeding Kangaroo Paws and in partnership with Plantex Australia Pty Ltd began marketing the Western Star series of *Flavidus* Hybrids. These may not be that well known in Australia but have been widely sold overseas. Some of the best include A. 'Big Bicolour', A. 'Big Yellow', A. 'Citrus Glow', A. 'Copper Glow', A. 'Anne Marie', A. 'Peggie Thornton', A. 'Lady Stuart', A. 'Pastel Velvet', A. 'Ruby Velvet', A. 'Miniruby', A. 'Minipearl', A. 'Miniglory' and A. 'Minisplendour'.

In 1981, at the University of Sydney, G. Motum, I. A. Stewart and P. B. Goodwin commenced an extensive hybridization and breeding programme [8]. They were particularly impressed with the potential of *Anigozanthos humilis* × A. *flavidus* hybrids as potted plants and several of these have since been marketed as the Southern Aurora Kangaroo Paw Series, called A. 'Suffuce', A. 'Surouge', A. 'Sultan' and A. 'Solace'. These are marketed by Hortex Australia with the fitting words "*Discover the beauty of Kangaroo Paws — A gift to the world from Down Under.*"

In 1987, Dr Beng Tan and Ray Kan (pers. comm.) at Curtin University of Technology studied attempts to cross *Macropidia fuliginosa* (female) with *Anigozanthos manglesii*. It was found that although the pollen grew down the style and a hybrid embryo formed, the endosperm failed to develop and the embryo died.

The development of improved forms is well underway in other countries. A fertile tetraploid of the sterile diploid hybrid *Anigozanthos* 'Bush Ranger' has been produced in the USA. Netherlands authorities have now made arrangements for new varieties of *Anigozanthos* (for which Plant Variety Rights are applied for in their country) to be tested at the Australian National Botanic Gardens in Canberra.

Three more Hybrid Paws have been submitted for Plant Variety Rights registration in Australia, *Anigozanthos* 'Masquerade' and *Anigozanthos* 'Uluru Sunset' bred by Multiplant Pty Ltd of Coorow, Western Australia and *Anigozanthos* 'Milky Way' from Faceys Nursery Pty Ltd.

The author is well aware that there may be errors and omissions in this account and I would be very grateful to be put right by any readers.

Hybridization

Kangaroo Paws are classified into two genera, *Anigozanthos* (11 species) and *Macropidia* (one species). The genus *Anigozanthos* is divided into the subgenus *Anigozanthos* consisting of section *Anigozanthos* (*A. rufus*, *A. pulcherrimus*), section *Ceratandri* (*A. flavidus*), and section *Concatenati* (*A. preissii*, *A. onycis*) and the subgenus *Haplanthesis* (*A. humilis*, *A. kalbarriensis*, *A. gabrielae*, *A. bicolor*, *A. viridis* and *A. manglesii*).

It appears that all species of *Anigozanthos* can be easily crossed in any combination, but that the hybrids are highly sterile unless they are crosses between two species within the same subgenus. Thus crosses of *A. flavidus* with the other species in the subgenus *Anigozanthos* yield progeny that are slightly fertile, but crosses of *A. flavidus* with species in the subgenus *Haplanthesis* yield hybrids that are highly sterile. In both cases it is beneficial to produce fertile allotetraploids. Crossing these two types of allotetraploids seems to yield particularly pleasing progeny.

Most hybrids within the subgenus *Haplanthesis* are fairly fertile and hybrids within the same section in the subgenus *Anigozanthos* are often quite fertile. In the wild *Anigozanthos onycis* hybridizes freely with *A. humilis* and thus forms a link between the two subgenera.

Natural Hybrids

Kangaroo Paws hybridize freely in the wild, but the occurrence of hybridization is limited by the following factors:

1. The species involved must be growing in close proximity so that the birds (Honeyeater species), or perhaps, occasionally, insects can effect cross pollination.
2. The flowering seasons of the species must coincide, or overlap.
3. The feeding habits of the honeyeaters. These birds tend to move between inflorescences of the same height, rather than alternate between ground and perch feeding (Hopper and Burbidge 1978 [9]).
4. The shape and size of the flowers of the two species need to be similar for effective pollen transfer.
5. The quantity of seed set from interspecific cross pollinations.
6. The reduced fertility of the interspecific hybrids.

In all cases the F1 hybrids are usually quite vigorous and can compete quite well with the parent species and in some cases backcrosses between them and the parent species are common.

Listed below are the recorded natural hybrids.

A. rufus. Rare hybrids with *A. gabrielae* occur.

A. pulcherrimus. No hybrids have been recorded. (It would almost certainly hybridize freely with *A. rufus* and *A. flavidus* if it were not geographically isolated from them.)

A. flavidus. Rare hybrids with *A. preissii*, *A. bicolor*, *A. viridis* and *A. manglesii* have been recorded.

A. preissii. Rare hybrids with *A. flavidus* have been recorded.

- A. humilis*. Hybridizes freely with *A. kalbarriensis*, *A. onycis* and occasionally with *A. manglesii*, *A. bicolor*, *A. gabriellae* and *A. viridis*.
- A. kalbarriensis*. Hybridizes freely with *A. humilis*, and with *A. manglesii*.
- A. gabriellae*. Hybridizes with *A. humilis*, occasionally with *A. rufus*.
- A. bicolor*. Hybridizes freely with *A. manglesii* and *A. viridis*, occasionally with *A. humilis* and rarely with *A. flavidus*.
- A. viridis*. Hybridizes freely with *A. manglesii* and *A. bicolor*, occasionally with *A. humilis* and rarely with *A. flavidus*.
- A. manglesii* hybridizes freely with *A. viridis* and *A. bicolor*, less so with *A. humilis* and *A. kalbarriensis*. Hybrids backcross readily with parent species.

As can be seen above the valuable, vigorous, disease resistant hybrids of *Anigozanthos flavidus* rarely occur in the wild. In controlled breeding these are readily achieved and more complex crosses have been made, for example, the Bicentenary Kangaroo Paw (syn. *A. 'Miniprolific'*) was bred by crossing an *A. humilis* × *A. bicolor* hybrid with *A. flavidus*, and *A. 'Big Red'* was bred by crossing an *A. rufus* × *A. flavidus* allotetraploid with an *A. manglesii* × *A. flavidus* allotetraploid. As *A. 'Big Red'* is itself fairly fertile it can be seen that further hybridization is possible.

One objection raised against *Flavidus* Hybrid Kangaroo Paws is that their inflorescences (like those of *Anigozanthos flavidus*) have hollow stems and that the flowers, therefore, do not have the post-harvest wilt recovery of such species as *Anigozanthos pulcherrimus* when grown for cut flowers. This characteristic can be overcome by suitable pulsing immediately after harvesting (Adrian Bowden, pers. comm.). Pulsing consists of standing the stems in a solution of 2.5 grams 8-hydroxyquinoline sulphate and 200 grams sugar per 10 litres of water for a minimum of 12 hours, or of some such similar treatment. Selection of suitable hybrid varieties that have superior post-harvest wilt recovery and vase life would also be valuable in this regard and this could be a useful field of study for researchers. Feedback to the plant breeders from the growers, pickers and exporters about the qualities of the various hybrids in this regard would also be very helpful.

Another objection raised against *Flavidus* Hybrid Kangaroo Paws is that the hairy stems can induce dermatitis in some flower pickers. (*A. flavidus* itself has hairless stems). Clearly protective clothing is useful here but a better solution would be the breeding and selection of non-irritant varieties and here also feedback from growers and researchers would help plant breeders to achieve this.

The above characteristics are generally not a problem when Hybrid Kangaroo Paws are grown in parks and gardens. Here, vigour, reliability, adaptability and pest and disease resistance in addition to size and beauty of colour and form are more useful selection criteria. For potted "throw away" plants perhaps the most useful selection criteria are ease of multiplication in tissue culture, vigour, size and beauty.

At this point I will throw caution to the wind, stick my neck out and attempt to assess the merits of some of the better known Hybrid Kangaroo Paws.

Meritorious Hybrid Kangaroo Paws An attempted objective assessment

The full name of each of the cultivars is preceded by the word *Anigozanthos* which has been left off for simplicity.

'Harmony' — A good hardy plant with many yellow flowers on an inflorescence about 1.5 m tall. Evergreen, disease resistant and unpalatable to snails. A Flavidus Hybrid, bred in the mid 1960's and a well proven plant.

'Big Red' — A vigorous and hardy evergreen plant with large bright red flowers on an inflorescence about 1.5 to 2 m tall. Disease resistant and unpalatable to snails. A Flavidus Hybrid which was bred about 1970. One of the best.

'Early Spring' — An early flowering hardy evergreen plant with bright red flowers on an inflorescence about 1 to 1.5 m tall. Adaptable, disease resistant and unpalatable to snails. A Flavidus Hybrid which was bred about 1970. A good one.

'Gold Fever' — A hardy evergreen plant with numerous small, lovely, orange flowers on an inflorescence about 2 m tall. Disease resistant and unpalatable to snails. A Flavidus Hybrid which was bred about 1970. A good one.

'Charm' — This plant has very elegant flowers of a better colour (bright orange brown) than the similar but more well known 'Copper Charm' and 'Regal Claw'. Although the flowering season is short the individual flowers are large, shapely and beautiful. A Flavidus Hybrid which is perhaps not so vigorous but is quite hardy, disease resistant and unpalatable to snails. Bred about 1970. The inflorescence is about 1 m tall. (The reason that this plant is not well known is that it has never been in tissue culture and few plants of it exist.)

'Miniprolific' — (Also called Stan Haynes or The Bicentenary Kangaroo Paw.) An outstanding vigorous small plant with a very long flowering season (up to six months or more under favourable conditions). Hardy, disease resistant and unpalatable to snails. An abundance of pink to red flowers on an inflorescence about 0.5 m tall. A well proven Flavidus Hybrid.

'Yellow Gem' — A good hardy plant with many bright yellow flowers on a red-stemmed inflorescence about 1.5 to 2 m tall. Evergreen, disease resistant and unpalatable to snails. A Flavidus Hybrid bred about 1978. Colourful, widely grown.

'Velvet Harmony' — A good hardy plant with many lovely deep burgundy flowers on an inflorescence about 1.5 m tall. Evergreen, disease resistant and unpalatable to snails. A Flavidus Hybrid bred about 1970.

'Regal Claw' — Large orange brown flowers on tall, straight stems about 1.5 m tall. Evergreen, disease resistant and unpalatable to snails. A Flavidus Hybrid bred in the mid 1970's. Popular and widely grown.

'Dwarf Delight' — Masses of bright orange red flowers are borne on an inflorescence about 1 m tall. Evergreen and unpalatable to snails. A Flavidus Hybrid bred in the mid 1970's. A lovely sight when in flower.

'Red Cross' — A hardy evergreen plant with numerous small, lovely burgundy flowers on an inflorescence about 1.5 m tall. Disease resistant and unpalatable to snails. A Flavidus Hybrid bred in the mid 1970's. Flowers prolifically.

The Bush Gems Series — **'Bush Ranger'**, **'Bush Baby'** and **'Bush Glow'** — These have only been available in Perth since 1987 so the author is not very familiar with them. All are small Flavidus Hybrids and 'Bush Ranger' is a beautiful red while 'Bush Glow' seems to be prolific and hardy. They appear to be disease resistant but tend to go dormant (i.e., the leaves die off) in summer in Perth.

The Bush Gems Series — '**Bush Emerald**' and '**Bush Opal**' — These plants have beautiful flowers. The former appears to be an *A. manglesii* × *A. viridis* hybrid, while the latter appears to be an *A. humilis* × *A. bicolor* hybrid. As such they may not live for very many years and they may be troubled by inkspot disease and/or rust.

The Western Star Series — '**Big Bicolour**', '**Big Yellow**', '**Citrus Glow**', '**Copper Glow**', '**Peggie Thornton**', '**Anne Marie**' and '**Lady Stuart**' — These are large *Flavidus* Hybrids with large, brightly coloured flowers on stems 1 to 2.5 m tall. These were only bred in the mid to late 1980's but so far seem to be trouble free.

The Western Star Series — '**Pastel Velvet**', '**Ruby Velvet**', '**Miniruby**', '**Minipearl**', '**Miniglory**' and '**Minisplendour**' — These are small to medium *Flavidus* Hybrids, mainly of very recent origin. They are of good colour and appear to be trouble free.

The Southern Aurora Series — '**Suffuce**', '**Surouge**', '**Sultan**' and '**Solace**' — These are small *Flavidus* Hybrids that grow quite vigorously, but little else is known about them in Perth to the present.

***Anigozanthos* 'Pink Joey'**

Anigozanthos 'Pink Joey' appears to be a natural form of *A. flavidus* which was found in the wild along with red, orange, yellow-green and other miscellaneous colour forms of *A. flavidus* by the author in the Margaret River area in December 1965. It was named "Jefferene" after the author's younger son Jeffrey Mark Oliver who was born at that time.

Two of these magenta pink flowered plants were found, one short, one tall. The plants were left largely undisturbed, but two small pieces of rhizome were removed from each one and these were grown on. Later, plants of this were sold to the Wanneroo Wildflower Nursery where they were planted in the field. These plants flowered out of season, and as they are true breeding for colour when selfed or crossed with another of their kind, the seed collected from these plants produced a large crop of magenta pink flowered plants. It is presumed that seed from these plants found its way into the seed bank of the Western Australian Wildflower Society, as some *A. flavidus* seed sold by them to Mrs M. Fisch of East Doncaster, Victoria, yielded one or more plants of this kind in about 1973. Mrs Fisch registered a short form of it as *Anigozanthos* 'Pink Joey' with the Australian Cultivar Registration Authority. The recorded colour of *A. 'Pink Joey'* is "Pedicel and perianth tube: greyed purple, 186A".

Plants of *Anigozanthos* 'Pink Joey' are reported to have flowered well at the Australian National Botanic Gardens in Canberra in the summer of 1974-75.

The magenta pink flowered forms of *A. flavidus* are certainly very rare in the wild, and may even now be extinct as a search of the area of their origin failed to find any plants of this kind in 1988, but as the gene for this colour is recessive some plants may reappear and they may also occur in other areas.

Progeny of these two plants found in the wild are now fairly widely grown in Perth, and, having been raised from seed, are quite variable in some characters, but many are smaller plants with a shorter inflorescence than is typical for the species. One raised by Mr Bob Dixon has a perianth tube almost grey in colour, giving an interesting pink and grey variegation. It would be interesting to learn if this variant of *A. flavidus* is widely grown in other states and whether or not it has yielded yet more distinct forms of *A. flavidus*.

This seems to be a good case of a valuable form of a species of an Australian native plant being conserved by cultivation, which is one of the major aims of our Society for Growing Australian Plants.

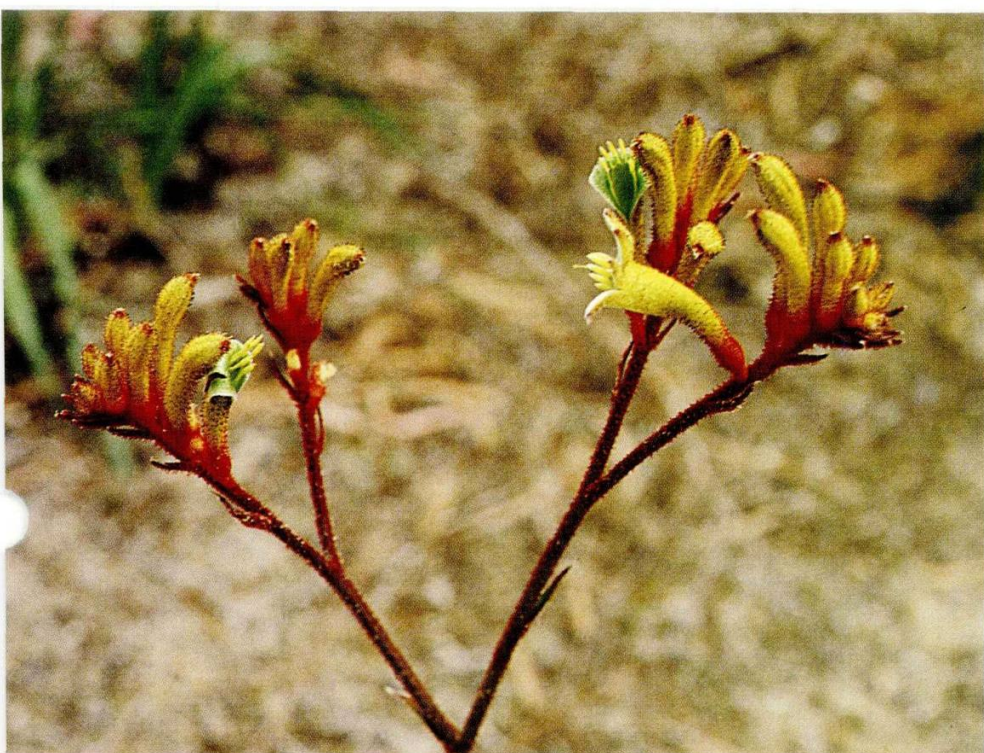
Growing the Hybrid Paws in the Sandy Soils of Perth

Hybrid Kangaroo Paws in pots can be planted at any time of the year but are best planted in the autumn. They grow best in an open sunny position but they will tolerate positions that receive sun for as little as one quarter of the day. They appreciate some improvement of the soil. Compost, cladium peat, old animal manures (in moderation), blood and bone and slow release fertilizers are all suitable. They grow mainly in the autumn, winter and spring and should be given moderate amounts of plant food at these times of the year. They must not be allowed to dry out when they are in flower or the flowers will be lost. Water well every second day from the finish of the winter rains until the finish of flowering (about Christmas). Watering can then be cut back to every third or fourth day on well established plants. If watering every second day is recommenced at the end of March, a good start to the growing season should be assured. (If it is more convenient then the plants may be watered every second day all through the summer, however, watering every day should be avoided as the plants may rot.)

Snails do not usually eat the Flavidus Hybrid Kangaroo Paws, but they may shelter in the clumps and may need to be controlled. Caterpillars are sometimes a problem when flowering commences, as they will eat the emerging flowering stems. They can usually be controlled satisfactorily by inspecting the plants every day or two and killing any that can be found. Fungal diseases should not be a problem if the plants are only given moderate amounts of a balanced plant food. Avoid excess nitrogen. Cutting off the spent flowering stems at the end of flowering and removing any dead leaves keep the plants looking green and tidy. Early April seems to be the best time to divide and multiply the plants if this is desired. A simple and safe way is to just cut the plant in two with a spade, leaving one half undisturbed and transplanting the other half in one piece with as much soil as possible left still attached to the plant. Alternatively, the whole plant may be dug up and the soil washed away, the rhizome may then be cut up with secateurs and the pieces replanted, preferably into pots which can be kept in a sheltered spot until the plants are fully recovered. When cutting the rhizome do not cut the pieces too small; larger pieces with three or more fans of leaves seem to do best. Trim the leaves back by one half to two-thirds of their length. Division must be done carefully, especially if the plants are in advanced active growth or are one of the less hardy cultivars.

Conclusion

There are now many hundreds of Hybrid Kangaroo Paws in cultivation, many of which have been named. It would be a formidable task to fully evaluate all of them. In the long term only the best will continue to be grown but many new Hybrid Kangaroo Paws are bred. The author read recently that there are about 12,500 named varieties of hybrid daffodils in cultivation in England. Kangaroo Paws certainly have the potential to be bred into a similar number of hybrid varieties. Hybrid Kangaroo Paws have the potential to become to Australia what the Tulip is to Holland, and like Eucalypts and Acacias can become a focus of a developing National Identity in Australia. ■



Anigozanthos 'Ecstasy' △

▽ *Anigozanthos* 'Copper Glow'

Western Star Kangaroo Paw Hybrids



The Western Star Kangaroo Paws

by Adrian G. Bowden

Plantex Australia Pty Ltd has a long-time involvement with the propagation of Kangaroo Paws, particularly hybrids with major production starting about 10 years ago and continuing to be developed further each year. Association with Keith Oliver has led to the development of the Western Star range of hybrid Kangaroo Paws, a selection of truly disease-free hybrids.

Each year in excess of 150 crosses are tested and maybe two to three new superior clones are retained for long-term testing before being introduced to our customers. Particular attention has been given to developing clones of size and colour that are in demand by the market. The plants range from 10 cm to 2 m for use as pot plants or as cut flowers.

Mother stock of straight species for breeding is retained in our tissue culture facility along with material to produce large numbers of identical plants. By the use of tissue culture exact replicas of the mother plants can be produced on a year round basis in large numbers. Techniques have been developed to make sure that initial crosses are not put at risk whilst the initial multiplication stage is being carried out. Plants are received on a monthly basis from the tissue culture laboratory, raised in sterilized media in greenhouses under fog and mist, then transferred to shaded areas and finally full sun for hardening off.

Plant material is supplied to cut flower plantations, other nurseries, government departments and councils as well as being exported to overseas buyers on a regular basis. Western Star *Anigozanthos* Hybrids have thus been made popular not only in Australia but also in other mass markets such as Europe and the USA. It is important that the market is supplied with quality material of correct size, colour and growth habit for each market preference.

Along with developing techniques for efficient multiplication of *Anigozanthos*, Plantex has also developed handling/pulsing systems to ensure hybrid Kangaroo Paw flowers reach overseas buyers in peak condition. Such research has been most beneficial in ensuring the continued popularity of hybrid Kangaroo Paws. The result of interaction between Plantex researchers, breeders and customers has meant refinement and development of the final product so as to make the market demand increase. Factors such as plant size, colour, growth habit, time of flowering, growth rate, cold tolerance, colour fastness when used as a house plant, resistance to disease such as inkspot and rust, resistance to slugs and snails, fertilizer requirements, customer approval, ease of production, ease of shipping are some of the criteria that need to be considered.

All Western Star Hybrid Kangaroo Paws have very good disease resistance. Some are slightly less resistant than the high standard we set but these have other attractive features that make them marketable, i.e., 'Near Miss', 'Copper Charm', 'Claret Glow' and 'Claret Queen'. All have an expected life of 10 years while the following have indicated that 15 years can be expected — 'Big Red', 'Big Bicolor', 'Big Yellow', 'Yellow Gem', 'Sunrise', 'Gold Fever', 'Autumn Harmony', 'Ragtime', 'Anne Marie' and 'Lady Stuart'.

All names prefixed with 'Western Star'	Flowering No.	Colour	Comment	Flowering period	Height	Uses
'Ruby Radiance'	P	Bright red	V. long flowering	Aug.–Nov.	1.5 m	1–3
'Ruby Velvet'	P	Deep red	Hardy/beautiful	Aug.–Oct.	1.0 m	1–3
'Mini Prolific'	P	Deep pink	Hardy/prolific	Apr.–Nov.	0.5 m	2–3
'Mini Ruby'	M	Bright red	Large flowers	May–Nov.	0.3 m	2–3
'Early Spring'	P	Dark red	Many fls. early	May–Oct.	1.0 m	1–3
'Mini Splendour'	M	Orange/yellow	Beautiful rare	Jul.–Oct.	0.3 m	2–3
'Mini Glory'	M	Orange/red	Large flowers	Jul.–Oct.	0.3 m	2–3
'Copper Kid'	P	Copper	Extra hardy	Jul.–Oct.	1.0 m	3
'Big Red'	M	Bright red	Outstanding	Sep.–Nov.	1.8 m	1–3
'Pastel Bicolour'	M	Orange/red	Beautiful colour	Jul.–Oct.	0.8 m	1–3
'Mini Marvel'	M	Bright orange	Good col. unusual	Sep.–Nov.	0.5 m	2–3
'Silver Dawn'	M	Ruby & yellow	Pastel colour	Jul.–Oct.	0.3 m	2–3
'Dusky Radiance'	M	Very deep red	Bright colour	Aug.–Oct.	0.5 m	2–3
'Big Bicolour'	A	Orange & yellow	Accent Plant	Sep.–Nov.	1.8 m	3–4
'Dusky Bicolour'	M	Red & green	Unusual colour	Sep.–Nov.	1.8 m	3–4
'Velvet Harmony'	P	Purple red	Hardy/deep colour	Sep.–Nov.	1.5 m	3–4
'Charm'	A	Orange	Very elegant	Oct.–Nov.	1.2 m	1–3
'Burke's Bicolour'	M	Red & green	Pastel colours	Sep.–Nov.	1.6 m	1–3
'Astron'	M	Bright red	Large flowers	Sep.–Nov.	1.3 m	1–3
'Golden Fawn'	P	Yellow fawn	Tall & vigorous	Sep.–Nov.	2.0 m	1–3
'Bland Bicolour'	M	Red & green	Tall stems	Sep.–Nov.	2.0 m	1–3
'Near Miss'	M	Red & green	Upright habit	Sep.–Nov.	1.0 m	3
'Peggy Thornton'	P	Bright yellow	Vigorous large	Oct.–Dec.	2.2 m	1–3
'Citrus Glow'	P	Yellow/orange	Outstanding	Oct.–Dec.	1.8 m	1–3
'Copper Glow'	P	Orange/yellow	Beautiful colour	Oct.–Dec.	1.8 m	1–3
'Big Yellow'	P	Bright yellow	Outstanding	Oct.–Dec.	1.8 m	1–3
'Yellow Gem'	P	Bright yellow	Ex. cut flower	Oct.–Jan.	1.8 m	1–3
'Sunrise'	P	Bright yellow	New release	Oct.–Jan.	2.0 m	1–3
'Harmony'	P	Red & yellow	Ex. cut flower	Oct.–Jan.	1.8 m	1–3
'Harmony Twin'	P	Red & yellow	Ex. cut flower	Sep.–Nov.	1.8 m	1–3
'Gold Fever'	P	Bright orange	Ex. cut flower	Oct.–Jan.	1.8 m	1–3
'Autumn Harmony'	P	Orange/yellow	Bright pastel col.	Oct.–Dec.	1.8 m	1–3
'Western Glow'	M	Bright red	Outstanding colour	Oct.–Nov.	1.0 m	1–2
'Mini Princess'	P	Bright pink	Ex. potted plant	Jul.–Nov.	0.3 m	2
'Mini Pearl'	P	Red & pink	Ex. potted plant	Jul.–Nov.	0.3 m	2
'Emerald Princess'	P	Turquoise/green	Contrasting anthers	Oct.–Dec.	0.7 m	2–3
'Mini Mini Prolific'	P	Bright pink	Miniature	Aug.–Nov.	0.3 m	2–3
'Sunglow'	M	Orange yellow	Straight stems	Oct.–Dec.	1.8 m	1–3
'Copper Charm'	A	Orange	Upright	Oct.–Nov.	1.2 m	1–3
'Velvet Star'	M	Good red	Att. flower shape	Jul.–Nov.	0.8 m	3
'Snowfleck'	M	Red/white flecks	Unusual and att.	Jul.–Nov.	0.8 m	1–3
'Space Age'	A	Red	Large flowers	Jul.–Nov.	1.0 m	3
'Claret Glow'	M	Red	A good red	Jul.–Nov.	1.0 m	1–3
'Claret Queen'	M	Red	Good red	Jul.–Nov.	1.0 m	1–3
'Near Miss Improved'	M	Pastel red & green	Bright colours	Jul.–Nov.	1.0 m	1–3
'Pastel Velvet'	M	Orange/red	Nice shape/col.	Jul.–Nov.	0.7 m	2–3
'Ragtime'	M	Good red	Large flowers	Oct.–Dec.	1.3 m	3
'Anne Marie'	P	Good yellow	Ex. large flowers	Oct.–Dec.	1.8 m	1–3
'Sunglow'	P	Yellow/fawn	Straight stems	Oct.–Dec.	1.8 m	1–3
'Ruby Blaze'	P	Bright red	Spectacular	Jul.–Nov.	0.7 m	2–3
'Ruby Cheer'	P	Bright red	Compact & prolific	Jul.–Nov.	0.7 m	2–3
'Lady Stuart'	P	Red stems/yellow	Large flowers	Oct.–Dec.	1.8 m	1–3
'Cocos Queen'	P	Orange/red	Big & beautiful	Oct.–Jan.	2.0 m	1–3
'Autumn Blaze'	P	Br. orange & yellow	Spectacular	Nov.–Jan.	1.8 m	1–3–4
'Autumn Glow'	M	Soft orange & yellow	Elegant	Oct.–Dec.	1.5 m	1–3–4
'Bicolour Blaze'	A	Br. red & yellow	Spectacular	Sept.–Nov.	1.0 m	1–3–4
'Copper Haze'	M	Orange/red	Soft colour	Aug.–Nov.	0.5 m	2–3
'Diana'	M	Orange & yellow	Good colour	Oct.–Dec.	1.5 m	3–4
'Ecstasy'	A	Br. red & yellow	Beautiful	Sept.–Nov.	1.0 m	1–3–4
'Georgina'	M	Orange & yellow	Bright colour	Oct.–Dec.	1.5 m	3–4
'Golden Girl'	P	Bright orange	Good cut flower	Oct.–Dec.	1.3 m	1–3–4
'Gold Mist'	M	Orange & yellow	Soft colours	Sept.–Nov.	1.2 m	1–3–4
'Velvet Pride'	M	Deep brown red	Unusual colour	Oct.–Dec.	1.7 m	3–4
'Carnival'	P	Nice red	Good cut flower	Oct.–Dec.	1.3 m	1–3

Code for number of flowers: P = Prolific; M = Medium; A = Average. 1 = Cut flower; 2 = Pot plant; 3 = Landscape; 4 = Feature
 Western Star Hybrids are all crossed with *A. flavidus*. The last 11 are recently developed forms.



Anigozanthos 'Bicolour Blaze' △

▽ **Anigozanthos 'Citrus Glow'**

Western Star Kangaroo Paw Hybrids





Anigozanthos 'Ruby Blaze' △

▽ *Anigozanthos* 'Georgina'

Western Star Kangaroo Paw Hybrids



The Bush Gem Kangaroo Paws

from Biotech**

A pioneer in the breeding of hybrid Kangaroo Paws, was the late Mervyn Turner. He was instrumental in the creation of the company now known as Biotech and the results from his work are shown below.

"BUSH GEMS" Hybrid Kangaroo Paws (*Anigozanthos*)

Name	Parentage	Typical Flower Stem Height	Flower Colour	Normal Season (Strongest flowering)
'Bush Emerald'	<i>A. manglesii</i> × <i>viridis</i> Diploid	0.7–1.2 m	Emerald green Red stem and ovary	Winter/Spring
'Bush Dawn'	<i>A. pulcherrimus</i> × <i>flavidus</i> Diploid	1.4–2.0 m branched	Bright yellow, with lime tint	Late Spring/Summer
'Bush Haze'	<i>A. pulcherrimus</i> × <i>flavidus</i> Diploid	1.4–2.0 m branched	Yellow suffused with red. Red stem and ovary	Summer
'Bush Ruby'	<i>A. rufus</i> × <i>flavidus</i> Diploid	1.4–2.0 m	Burgundy, a deep rich colour	Late Spring/Summer
'Bush Noon'	<i>A. pulcherrimus</i> × <i>flavidus</i> Diploid	1.4–2.0 m	Bronze stem Orange	Summer
'Bush Sunset'	<i>A. rufus</i> × <i>flavidus</i> Diploid	1.4–2.0 m	Bronze stem Bright red	Late Spring/Summer
'Bush Ranger'	<i>A. humilis</i> × <i>flavidus</i> Diploid	0.5–0.7 m branched	Bright red	Spring/Summer*
'Bush Nugget'	<i>A. humilis</i> × <i>flavidus</i> × <i>humilis</i> × <i>bicolor</i>	0.5–0.8 m branched	Yellow Reddish stem and ovary	Early Spring/ Summer*
'Bush Gold'	Direct mutation of 'Bush Glow'	0.7–1.0 m compact branched	Bright yellow	Spring/Summer*
'Bush Emerald'	<i>A. manglesii</i> × <i>viridis</i> Diploid	0.7–1.2 m	Emerald green Red stem and ovary	Winter/Spring
'Bush Glow'	<i>A. humilis</i> × <i>flavidus</i> Diploid	0.7–1.0 m compact branched	Orange Bronze/red stem Red ovaries	Spring/Summer*
'Bush Opal'	<i>A. humilis</i> × <i>bicolor</i> Diploid	0.4–0.6 m unbranched	Red stem and ovary Yellow green	Autumn/Winter* Spring
'Bush Baby'	<i>A. humilis</i> × <i>flavidus</i> Diploid	0.5–0.7 m branched	Pale orange with burgundy tips	Spring/Summer*
'Bush Surprise'	<i>A. onycis</i> × <i>preissii</i>	50 cm, once branched	Orange with lime tint Red stem/ovary	Late Winter/Spring*
'Bush Magic'	<i>A. onycis</i> × <i>viridis</i> Diploid	50 cm once branched	Pastel green suffused with red	Late Winter/Spring*
'Bush Emerald Gem'	<i>A. manglesii</i> × <i>bicolor</i> Polyploid	0.5–0.7 m unbranched	Bright red stem and ovary Green	Late Winter/Spring*
'Bush Flame'	<i>A. humilis</i> × <i>rufus</i> Diploid	0.4–0.7 m tightly branched	Red orange Bronze stem	Spring/early Summer*

*When propagated and potted on a year round basis these varieties will flower on maturity, giving programmable flowering for most of the year. Autumn and Winter flowers are therefore common.

**Despite repeated requests the best I could get from Biotech is the above schedule, no photographs, no descriptions, etc. Apart from the paws produced by Steven Hopper in the early 1970s, most eastern Australian gardeners have had experience only with the Bush Gem hybrids. They have given pleasure to so many for nearly 20 years. Naturally there have been problems but careful selection has resolved most of these. A comprehensive report will be given in an issue of *Australian Plants* shortly. What have you to report? —Editor.

The Southern Aurora Kangaroo Paws

Hybrid Kangaroo Paws have been widely used by the horticultural industry throughout the world, for a number of years now. A large market has developed because of the reliability and uniqueness of these plants and demand has crystallized in a number of specific areas.

The natural species that has proven extremely hardy is *Anigozanthos flavidus*, with certain horticultural selections having flower colour other than the usual yellow/green colour. One of the smallest and most attractive natural species is *Anigozanthos humilis* known as the Cat's Paw. There has developed a significant market demand for a Kangaroo Paw of low stature and colour somewhat similar to *Anigozanthos humilis* but with the robust hardiness of *Anigozanthos flavidus*. From many hybrid crosses the most superior attractive forms were selected and after five years of trials, the Southern Aurora range was selected. These are shown in the colour photographs opposite and are available as:

Anigozanthos 'Solace', with yellow flowers;

Anigozanthos 'Suffuse', a delicate pink flowered plant;

Anigozanthos 'Sultan', a plant with strong earth tones;

Anigozanthos 'Surouge', a rouge red flowered plant.

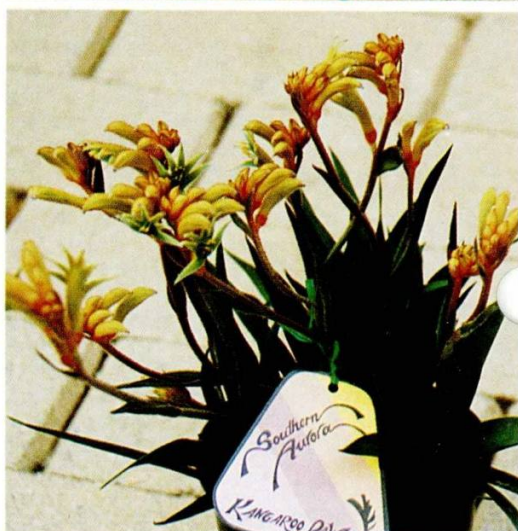
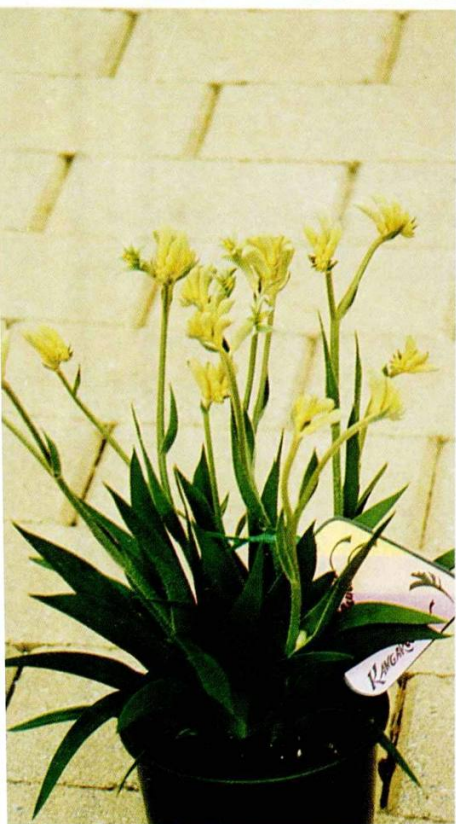
As with most Kangaroo Paws, the flower colour varies with age and the colours nominated are the colours at maturity. The range of four plants is uniform in foliage and form and when planted together the range of colours is attractive, blending one to the other on ageing.

The Southern Aurora range of Dwarf Kangaroo Paw were developed for:

1. As a pot plant of instant colour for use indoors and on patios. Keep them indoors in a well-lit position. When the flower colour fades after a few weeks they can become a character landscape plant in a sunny, well-drained position in the garden or rockery.
2. The four varieties are all sold in full flower so that landscapers can use them as a bedding plant, to add that instant splash of colour which lasts three to four months. Plants can be produced in flower at any time of the year so that a landscaper needing colour in spring, summer, autumn or winter can have it by planting the "Southern Aurora" range.

The vigorous foliage growth is a dark green colour and has a smooth shiny appearance. The flowers grow to about 350-450 mm height with foliage height of about half of this. The plant responds to heavy cutting back and, with fertilizing, will be back in full flower in approximately two months in most instances.

Like all Kangaroo Paws, these plants should be given good drainage but over a very wet humid summer in poorly drained garden bed, trials showed that the "Southern Aurora" range has incredible vigour and disease resistance. Only one plant out of 50 died (when first planted out) and no fungicides were applied during the six-month trial. ■



The Southern Aurora Hybrid Kangaroo Paws

***Anigozanthos* 'Suffuse'** (top L.H.)

***Anigozanthos* 'Solace'** (bottom L.H.)

***Anigozanthos* 'Surouge'** (top R.H.)

***Anigozanthos* 'Sultan'** (bottom R.H.)



Anigozanthos 'Bush Ranger' △

Photography by W. Molyneux

▽ *Anigozanthos* 'Pink Joey'

Photography by M. Fagg



Growth Retardants

Research Applied to Kangaroo Paw Cultivars

by Peter E. Albery*

The study was to evaluate the effect of some growth retardants to further enhance the "Southern Aurora" range of *Anigozanthos* marketed as a coloured flower pot plant for household decoration. They are: *Anigozanthos* 'Solace' (yellow flowers); *Anigozanthos* 'Sultan' (coppery orange flowers); *Anigozanthos* 'Surouge' (red flowers); and *Anigozanthos* 'Suffuse' (soft pink flowers).

Three growth retardants were used, "Atrinal" (200 g dikegulac-sodium per litre), "Cycocel" (100 g chlormequat per litre) and "Bonzi" (4 g paclobutrazol per litre). Ten of each cultivar were used in each trial, using three concentrations of each growth regulator per trial, plus ten of each cultivar for controls. 400 plants in total.

The Plants

All plants were the same age from tissue culture and all had an average of seven leaves. They were removed from the cell packs and potted into 125 mm pots on 12/5/89. The cultivars 'Solace' and 'Surouge' are more vigorous and had an average total green plant height of 20 cm, whereas 'Suffuse' and 'Sultan' had an average total green plant height at 17 cm.

Potting Media

The potting medium comprised 75% Canadian sphagnum peat, 25% commission sand (clean sharp), plus a small addition of horticultural grade perlite, (15 litres to each M³ of mix). The perlite aids as a guide to uniformity of mixing and adds a little more aeration. Soil additions per M³ were: 2,900 g Dolomite, 1,700 g Agricultural lime, 750 g Micromax, 1,000 g Osmocote 14-6.1-11.6 (three to four month release) and 2,360 g Osmocote 18-2.6-10 (eight to nine month release).

Single superphosphate was omitted from these trials, but the author has used single superphosphate at varying amounts in the media for previous trials with these plants with seemingly no ill effect. However, the reason for this omission is to minimize the possibility of tip burn that may occur as a result of fluoride excess. Though scientific evidence is available to support this theory the author thinks that *Anigozanthos* may be sensitive to fluoride. Therefore the omission of single superphosphate was to keep materials that may contain fluoride to a minimum.

All plants were placed in a poly tunnel house with very light shade to provide patches of clear light with lightly dappled shade. The plants had well developed root systems five weeks after potting and were developing flower stems. These stems were removed prior to treatments. No plant losses had occurred at this time and no plants were lost during the entire experiment. As ice had formed on the inside of the poly house during a cold spell, a small thermostatically controlled electric fan heater was installed to prevent plant injury. Just enough heat was provided to prevent frosting.

The plants were very uniform in size and development. 'Sultan' was least advanced and appears to be slower to establish than the other three varieties. However, all plants were healthy, green, free from tip burn and although total plant height was not great, the plants had developed many basal shoots. Approximately five breaks per plant, with the exception of 'Sultan' which had an average of three.

*This work was carried out at the University of Sydney, being funded jointly by Hortex Pty Limited and the Horticultural Stock and Nursery Act Grant.

Treatments 9/6/89 — 25 days after potting

Drench, 75 mls of solution per pot; the foliage spray to completely wet all foliage to run off.

Treatment No. 1: Bonzi at 1.5 ml per litre of water drench (6 ppm active constituent). Bonzi at 2.5 ml per litre of water drench (10 ppm active constituent). Bonzi at 3.5 ml per litre of water drench (14 ppm active constituent).

Treatment No. 2: Atrinal at 5 ml per litre of water spray (1,000 ppm active ingredient). Atrinal at 10 ml per litre of water spray (2,000 ppm active ingredient). Atrinal at 15 ml per litre of water spray (3,000 ppm active constituent).

Treatment No. 3: Cycocel at 15 ml per litre of water drench (1,500 ppm). Cycocel at 20 ml per litre of water drench (2,000 ppm). Cycocel at 30 ml per litre of water drench (3,000 ppm).

29/6/89 — 45 days after potting — Control plants, Cycocel treatments and Bonzi treated plants had similar basal shoot numbers and all looked very similar overall, except for a darker green colour in both the Bonzi and Cycocel treatments, irrespective of the concentrations used for each test.

The Bonzi treated plants showed no significant difference in plant shape compared with the controls, except that the treated plants were slightly darker green.

The Cycocel treated plants were not significantly different from the control.

The Atrinal treated plants were showing marked discolouration on the young expanding basal shoots. The plants' more mature leaves were of a paler green than the controls and other treatments. The 0.5% Atrinal spray treatment (5 mls per litre) were exhibiting a more advanced basal shoot growth than the other treatments, including the controls. The 1.5% Atrinal (15 ml per litre) had the poorest basal shoot development of any treatment, including controls.

26/7/89 (75 days after potting) — The control plants had an average flower stem height of 50 cm. All varieties were with flower stems. Fifty-eight per cent of plants had at least two open flowers.

Cycocel: These resembled the control plants without any significant difference, irrespective of differing concentrations used in the treatments, 57.5% having two open flowers with average height of flower stems of 49 cm. This was just slightly shorter than the controls.

Bonzi 1.5 ml per litre treatment as drench had an average flower stem height of 30 cm. Thirty-five per cent of plants having two or more open flowers.

Bonzi 2.5 ml per litre treatment drench. Average flower stem height of 30 cm. Fifty-seven and a half per cent of plants having two or more open flowers.

Bonzi 3.5 ml per litre treatment drench. Average flower stem height of 24 cm. Fifty-seven and a half per cent showing flower stems with well coloured buds, but no open flowers.

Atrinal: The cultivars 'Solace' and 'Suffuse' were the only plants showing flower stems at this stage, irrespective of concentration used. Only 2.5% of the plants with this treatment had well developed flower stems. Average stem height being 23 cm showing no open flowers.



Hybrid Kangaroo Paw in a Garden in Sydney △

Anigozanthos 'Red Velvet'

Both photographs by Fred Johnson





Western Star Kangaroo Hybrids in Sydney

The garden, opposite, is nurtured and admired by Fred Johnson of Sydney. The plant in the background is *Anigozanthos* 'Red Velvet' shown in the photograph below. When the photograph was taken this plant was well past its prime. In the front is a few plants of *Anigozanthos pulcherrimus* a species from the wild as described on page 84 and illustrated on page 85. The mass of yellow flowers between these two forms is *Anigozanthos* 'Gold Fever', a plant that flowers for a long period and gives great pleasure. There are numerous yellow flowered hybrid Kangaroo Paw, one of the most attractive being *Anigozanthos* 'Gold Mist' above.

All of these hybrid Kangaroo Paws have been developed by 'Western Star', a company based in Perth and specializing in trading overseas, especially Europe. A recent query was "but how do they perform in the climatic conditions of the Australian east coast?" The garden of Fred Johnson is a living example. The garden of Brian Walters, see Volume 15, page 30 also features *Anigozanthos* 'Early Spring' and 'Gold Fever'.

29/7/89 — 78 days after potting — All plants received a second treatment identical to the first treatment. One more treatment not included in the original trials was included at this time from plants that were potted at the same time as the plants in the original trials and were from the same batch of cultures. Advanced flower stems on these plants were removed and a drench of Bonzi at 10 mls per litre of water (40 ppm active ingredient) — again each plant received 75 mls of the solution. These plants had good basal shoots just at flower initiation stage. The overall growth about equal to the controls.

20/9/89 — 129 days after potting — All plants were in flower at this time from all treatments. The controls had an average height of 52 cm on the taller varieties 'Solace', 'Surouge' with 'Sultan' slightly shorter and 'Suffuse' 40 cm.

The Growth Retardant Agents — Results

Atrinal: Foliage green but showing some distortion and rather thin flower stems. Somewhat shorter than the controls but the plants looking thinner and with an open flowering stem arrangement. Concentration of treatments showing no significant difference except that the lengths of the flower stems were uniform irrespective of treatment concentration used. This could be a fault in spray coverage, even though care was taken regarding this point.

Cycocel: Average height of 'Solace' and 'Sultan' at 49 cm. Just a little shorter than controls, at the 30 ml per litre concentration. There was little difference between the other two lower Cycocel treatments and the control except for 'Suffuse' that appears to have responded at 15 ml per litre drench with the tallest flower stem being 39 cm.

Bonzi: All varieties responded at all concentrations with increasing shortening of the flower stems as the concentration of Bonzi increased. The exception again being 'Suffuse' which responds almost equally at 3.5 ml of Bonzi per litre drench as the 10 ml per litre single drench regarding flower stem height. However, the increase in flower stem initiation is dramatically increased by the increase in Bonzi concentration. The overall effect from the 10 ml per litre concentration is an improvement in plant foliage colour and a very compact appearance of the flower stems, with an increase in flower initiated shoots.

Summary

From observation it is thought that repeated applications at shorter intervals of Cycocel may improve the effect of this material on these *Anigozanthos* cultivars. However, since Bonzi is registered for ornamental plant use and is effective at one single application, it could be considered a useful tool to be used in enhancing these Southern Aurora *Anigozanthos* cultivars for the potted plant market.

Suggested cultural procedures would be to remove all flower stems when just large enough to twist out by hand, until the plant has the desired number of basal shoots. Approximately an average of seven breaks can be expected from the single bladed cultures in a 12.5 cm pot, with the exception of the cultivar 'Sultan' where only three to five can be expected. It appears desirable to use two plants per 12.5 cm pot for this variety, if a flower stem number equal to the other varieties is required. When these breaks have some flowers initiated, (this can be determined by feeling the shoots between the index finger and thumb and feeling the developing flower stem inside the shoot), then a single drench of Bonzi at 10 mls per litre will enhance plant flowering quality. The cultivars 'Solace' and 'Sultan' may need a further drench as good colour in the buds is visible but the concentration needed is subject to experiment. ■

Kangaroo Paw Cultivars

The Australian Cultivar
Registration Authority*

Anigozanthos 'Autumn Mystery' is thought to be a hybrid of *A. manglesii* and *A. flavidus*. The yellow-green (144A) flowering stems are up to 1 m tall with sparse stellate hairs towards the base, becoming woolly and plumose towards the flowers. The flowers are in simple terminal racemes, on pedicels to 5 mm long. The hairs are plumose and woolly, having red tips with yellow bases over the ovary changing to yellow tips with red bases toward the perianth lobes. The perianth tube is to around 50 mm long and the lobes 15 mm long. The anthers are linear and more or less the same length as the filaments, the connective tipped with a gland-like appendage. The ovules are numerous. The flowering season is the spring months.

Diagnosis — The flowers attain a similar shape and width to *A. manglesii* although shorter. *Anigozanthos* 'Space Age' is a cultivar resulting from the same hybrid cross and has somewhat taller stature and distinctly larger (wholly deep red) flowers than *Anigozanthos* 'Autumn Mystery' where the flowers appear yellow to brown with touches of red.

Anigozanthos 'Autumn Sunrise' is a hybrid of *A. pulcherrimus* and *A. flavidus*. The red (53A) flower stems are ± 1.7 m tall, panicle plumose, slightly villose. Flowers on pedicels to ca. 6 mm long; the wool plumose, dense with red tinge (33A) on the ovary, becoming more yellow-green (154A) and less dense towards the lobes. Perianth tube to 4 cm long, scabrous inside, hairs (194) more linear towards the base, some with stellate tips immediately above the ovary; lobes to 1 cm long, silvery plumose inside. Anthers oblong-linear, $\pm$ same length as filaments, the connective tipped with a gland-like appendage. Ovules 2–6 per locule. *Anigozanthos* 'Autumn Sunrise' differs from *Anigozanthos pulcherrimus* in having, generally, broader leaves which are lighter green (137A) and more upright, the corolla tubes are longer and broader, and there are less flowers per branch.

Anigozanthos 'Big Red' is the result of a manipulated hybrid between (*A. manglesii* $\times$ *A. flavidus tetraploid*) $\times$ (*A. rufus* $\times$ *A. flavidus tetraploid*). The flowers have the colouring of *Anigozanthos rufus* but are a darker, richer red. They have a prominent ovary and are similar in length to *A. flavidus* and shaped more like *A. rufus* although less branched. The stems are not as hairy as *A. rufus* but more hair and a closer habit to *A. flavidus*. The flowering stems are from 1.5 to 2 metres tall, glabrous or nearly so below the middle, with scattered plumose hairs becoming more dense under the inflorescence. Flowers on pedicels to 12 mm long. The wool is plumose and very dense, red (53A) on the outside of the perianth tube, tinged with black on the lobes. The perianth tube is ca. 4.5 cm long, glabrous and shining but minutely scabrous inside. Lobes are to .13 mm long with dense stellate hairs inside. Anthers are oblong-linear, more or less as long as the filaments.

More registered Kangaroo Paws will be described in our next issue together with reports by readers on cultivation of Hybrid Kangaroo Paws. —Editor.

*The Australian Cultivar Registration Authority is an independent body comprising representatives from the major Botanic Gardens in Australia, the commercial nursery industry and The Society for Growing Australian Plants. Plants of the Australian flora, developed for use in horticulture, are registered in accordance with the International Code of Nomenclature. Applications are invited for registration by submissions, in writing, to The Registrar, Australian Cultivar Registration Authority, National Botanic Gardens, Canberra, ACT 2600.



Anigozanthos manglesii

Various Colour Forms

No description of the wild forms of Kangaroo Paw is complete without a colour photograph of the most spectacular of them all. The usual colour is shown in the upper photograph by Ilma Dunn although this specimen does not have the usually vivid bright velvet green contrasting with the living velvet red. As reported on page 50, there are a number of naturally occurring colour variations one of which has been captured in the lower photograph by Fred Johnson. The yellow can vary to a deep orange.

Despite the record of achievement by the horticultural industry as recorded in this issue, they have as yet failed to produce reliable cultivars that match the unusual beauty and size of the best forms of *Anigozanthos manglesii*. I hope they never give up trying. —Editor.

Kangaroo Paw

by Bob Dixon, Horticultural Advisor
Kings Park and Botanic Garden, West Perth, WA

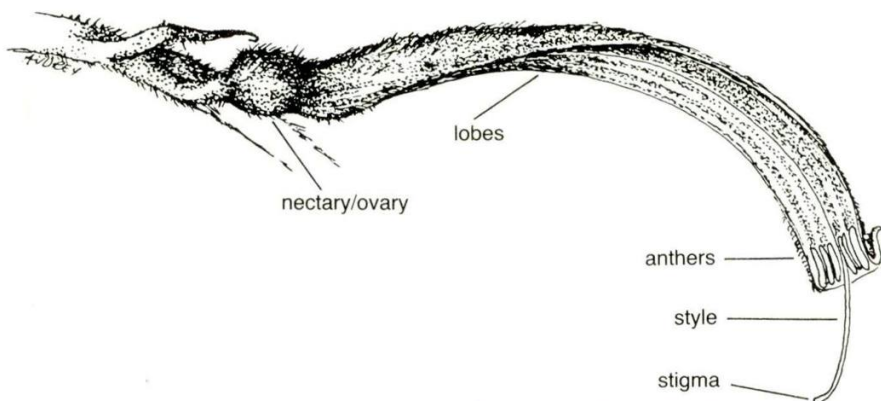
The Wild Species, Description, Propagation and Cultivation

The Kangaroo Paws are known botanically as the genus *Anigozanthos*, pronounced an-ig-o-ZANTH-os. The genus contains eleven species all of which are endemic to south Western Australia.

Below ground they all have horizontal rhizomes (short underground stems) which vary considerably in size, providing the ability to resprout after fire. Unfortunately, very little is known about their root system; some are large and fleshy growing vigorously early in the season, whilst others are fibrous. To my knowledge no publication has described their structure, or if they are mycorrhizal (living in symbiosis with a fungus). If they have a mycorrhizal association they are not dependent on it in cultivation as they grow very well in sterilized potting mixes. The root system in their natural habitat is dormant during summer, in dry conditions, with the plants relying on stored moisture in their rhizomes.

The leaves are generally flat sometimes subterete (rounded), hairy or hairless usually in a fan shape on each shoot. Only one species, *Anigozanthos flavidus*, is regarded as evergreen; leaves of other species die down during summer, although some will keep a tinge of green in them. Some may remain evergreen, especially in cooler climates, when watered during the summer.

All of the wild species are described below with details of propagation and cultivation for each. Flower colour is determined by the coloured hairs which cover the flower and usually at least the top part of the flowering stem. Seed varies considerably in size, shape, colour and may have a smooth surface, be pitted or furrowed; to the trained eye species can be identified by the seed alone. All species are bird pollinated, some may also be pollinated by small mammals and some of the smaller flowered species e.g., *A. pulcherrimus* can be pollinated by honey bees. Although we normally regard kangaroo paws as being short lived, perennial herbs, in part due to their short life span in cultivation, we have no satisfactory data on their life span.



*For a full botanical description on *Anigozanthos* and *Macropidia* see Hopper, S. D. (1985) *Anigozanthos, Macropidia, Flora of Aust.* Vol. 45

Propagation and cultivation of Kangaroo Paw

A few species are exploited as cut flowers, both fresh and dried, from bushland populations and some are also grown as row crops. Others are grown as container plants or as garden plants for borders, courtyards or bushland type gardens. Plants can be divided in autumn, although the success rate varies considerably between species. This simple technique involves dividing the rhizomes into two or three shoots with a sharp knife. For *Anigozanthos flavidus* these can be directly replanted in the garden, but for other species they are best potted up and grown on under light shade until they recover, to be replanted when ready.

Most species are easily raised from seed. However, some produce very few viable seed e.g. *A. pulcherrimus*. Others e.g. *A. onycis* germinate erratically. Therefore seed pots should be kept for several years. The usual procedure is to allow seed pots to dry off naturally, not watering at all during summer. In autumn recommence watering for further germination. Seed in warmer climates such as Western Australia is usually sown in autumn although it also germinates well in spring. Improved germination has been recorded with hot water treated seed. The seeds are placed in a hot water bath 55-60°C at a constant temperature for two hours (*Dixon and Hopper). Then sow as usual using a free draining preferably sandy mix. Seedlings are susceptible to damping off disease. A drench of fungicide such as Previcur or a spraying with a suitable fungicide will help to control this disease. Seedlings can be pricked out (transplanted) when one or two days old. This isolates them and damping off is less likely to be a problem. Seedlings can be planted out in the open ground when 5 cm high or grown on in containers for one year and planted out in autumn. Most species require full sun but not in an exposed position. *A. flavidus* grows well in light shade but may not produce as many flowers. Although a free draining sandy soil is most suitable a few species grow well in heavier free draining soils e.g. *A. bicolor*, *A. viridis* and *A. flavidus*.

Plants tolerate low applications of general fertilizer, preferably slow release. Too much fertilizer and water produces lush growth leading to the early decline of the plants. These lush plants appear to be more susceptible to disease. After flowering or seeding if you are saving seed, cut down the old flower stems. In March the plants should be cleaned up, that is, remove all dead and diseased leaves.

Pests and Diseases of Kangaroo Paw

In Western Australia there are only a few pests that are a major problem; slugs and snails which can be controlled by using pellets, laying baits or spraying; caterpillars, in particular the brown furry types, eat the leaves, stems and flowers and these can be hand picked or sprayed. Parrots nibble the flowers, and may be controlled by spraying fungicides/insecticides which have an unpleasant taste. We are also experimenting with a garlic and red pepper based dust "Sevana" and have found after the initial attack they have not touched them since. This year, parrot damage in Kings Park has been less severe than normal.

Ink spot disease is recognized by small black spots first seen on the older leaves. These increase in size often causing the death of the entire leaf, with secondary infection by other fungus diseases causing death of the plant. One

*Dixon, Bob, Hopper, S. D. (1979). Kangaroo Paws and Related Species. *Aust. Plants* Vol. 10:81, Pp. 199-211.

of the main causal agents is *Alternaria alternata* (*Verhoogt and Sivasithamparam), although other fungi are now also known to cause similar symptoms. These diseases are very variable, with some Kangaroo Paws being resistant to some strains and not others. Control of this disease, to a degree, has been achieved by using regular preventative sprays of Mancozeb. Biologically, some control is achieved by drying off the plants in summer, cutting them down in early March, then burning the dry tops two weeks later. This is regularly done on commercial plantations, using a quick burn. A slow hot burn can kill the plants.

Rust disease is as devastating as ink spot. Some species appear to be resistant e.g., *A. pulcherrimus*, *A. rufus*, and *A. flavidus*. This fungus disease starts as small black or brown spots often with a pale surround, on the leaves, which increase in size turning light brown, usually producing pustules and typical orange rust spores. Control has been claimed by using Thiram or Bacor.

Anigozanthos bicolor Little Kangaroo Paw or Two-coloured Kangaroo Paw

Anigozanthos bicolor grows predominantly in winter wet clay, loam or sandy loam and gravel between Moora and Albany with other populations as far east as Esperance. They are seen flowering, in profusion, after a bushfire, although they will flower in open situations without fire. The main flowering period is August–October. The flowers, carried on single stems, have 2 tone colours usually a shade of red on the ovary and green perianth above, the lobes at the end of the perianth being reflexed.

The only confusing species is *A. manglesii* which is usually much larger in stature. The perianth tube when opened out and laid flat has parallel sides, whereas that of *A. bicolor* is constricted above the middle of the tube. The filaments (stalk of the anthers) are much shorter than the anthers on *A. manglesii*, but equal to or longer in *A. bicolor*. To a degree *A. gabrielae* has also been confused with *A. bicolor* subsp. *minor*. *Anigozanthos bicolor* hybridizes freely with *A. manglesii* and *A. viridis*, rarely with *A. humilis*.

Anigozanthos bicolor subsp. *bicolor*. This subspecies has red flowers, rarely orange, on the ovary with a green or occasionally yellow perianth. The perianth is 45–65 mm long and slightly constricted above the middle. Flowering stems are few, robust and 20–60 cm tall. Leaves are medium green 10–35 cm long. Plants occur naturally from Gillingarra south to Mt Cooke.

Anigozanthos bicolor subsp. *decrescens*. This subspecies has red-purple flowers on the ovary with a green perianth which is strongly constricted above the middle and 45–65 mm long. Flowering stems are many, 10–45 cm tall. Leaves are medium green 10–25 cm long. Plants occur naturally from Albany and Nannup to Williams.

Anigozanthos bicolor subsp. *exstans*. The flowers of this subspecies are red on the ovary with a green perianth. The perianth is almost parallel sided or slightly constricted and 55–75 mm long. Flowering stems are many 10–25 cm tall. Leaves are medium green 5–15 cm long. Plants occur naturally in the Pingelly, Meckering area.

*Verhoogt, M. N., Sivasithamparam, K. (1986). Ink Spot Disease of Kangaroo Paws (*Anigozanthos* and *Macropidia*) in Western Australia. *Crop Res. (Hort. Res.)* Vol. 25 Pp. 49–55.

Anigozanthos bicolor subsp. *minor* often known as the Small Two Colour Kangaroo Paw has flowers with red on the ovary with a green perianth which is strongly constricted above the middle and 30–45 mm long. Flowering stems are many, 5–22 cm tall. Leaves are medium green 5–10 cm long. Plants occur naturally in isolated populations in the Esperance, Ravensthorpe area.

Propagation and cultivation. Both *A. bicolor* subsp. *bicolor* and the subsp. *decrescens* have been in cultivation for many years but are not widely grown. They prefer a loamy free draining soil and full sun but not exposed position. They are short lived in poor sandy soils where it requires regular summer watering. They adapt well to container growing.

Anigozanthos flavidus

Evergreen Tall or Tree Kangaroo Paw

This robust species grows predominantly in low lying moist soils, sandy loam or gravel, along drainage areas, edges of wetlands or along road verges where it receives extra moisture. It occurs naturally as far north as Waroona, south to Augusta and east to Two Peoples Bay. It usually grows under light shade amongst *Eucalyptus* species or occasionally in low heathland.

Plants are long lived, up to 30 years in cultivation, responding well to fire or mechanical disturbance. Flowering stems are up to 3 m tall, widely branching, and hollow when cut in cross section. Flowers are usually dull green to shades of red, occasionally yellow, orange or pink. Rare cultivated forms include greyish pink and blueish pink. The perianth is usually straight 30–45 mm long with straight lobes. Anthers are distinctive as they are always orange on the back. The main flowering period is from November to January. Leaves are evergreen, the only true evergreen species, 35–100 cm long and 5–20 mm wide, sometimes wider in cultivation. Naturally occurring hybrids have been recorded but are rare.

Propagation and cultivation — This is the toughest of the Kangaroo Paws, tolerating regular overhead watering and being fairly resistant to ink and rust disease as well as snail attack. Grow in a free draining soil in full sun or light broken shade. It is now a popular courtyard plant. Propagation is easy from seed or division in autumn and early winter.

Anigozanthos gabrielae

Dwarf Kangaroo Paw

It is found in winter wet areas along creek lines and in depressions, in sandy soils, only in the Stirling Range National Park and adjacent areas, usually in low open woodland or scrub. It is generally only seen in large numbers after a fire when all the competition is cleared away or on fire breaks or areas mechanically disturbed.

The flowers, carried on single stems, are two tone in colour red on the ovary with a green perianth 20–30 mm long, with reflexed lobes and 3.2 to 5.2 mm wide at the narrowest point which is well above the middle. Flowering stems are 5–20 cm tall, the main flowering period is September–October. Leaves are medium green, fairly rigid, 20–30 mm long and 1–3 mm wide.

This species is very similar to *A. bicolor* subsp. *minor*, but it is much smaller in all respects. The perianth when viewed side on is only slightly curved, whereas for *A. bicolor* it is sickle shaped. *A. gabrielae* frequently hybridizes with *A. humilis* and to add to the confusion you often get large numbers of back crosses which are more robust but similar to *A. gabrielae*.

Propagation and cultivation — This species has been in cultivation for a few years. It is now widely grown and marketed as a container plant, as such it prefers full sun but a sheltered position. It is very susceptible to ink and rust disease. It is difficult to keep in the open ground where it usually requires regular summer watering, especially in poor sandy soils. Tissue cultured plants can flower any month of the year and usually have a prolonged flowering period. They are usually short lived in cultivation. Propagation by seed is erratic. Plants can be divided in autumn with varying success. Commercially plants are raised in their thousands by tissue culture. Container grown plants raised by this method have also been used for cut flower production, with flowers sometimes being pressed and dried.

Anigozanthos humilis

Cats Paw

The Cats Paw grows in well drained sands, or sandy loam over limestone or laterite (crownstone) occasionally in moist areas close to streams or lakes. It is a wide spread species from Kalbarri to Dunsborough and south-east to Hopetoun, usually growing in heathland or low forest. It is very floriferous after fire and appears to be long lived in its natural habitat. Flowers are usually a shade of yellow and orange red, rarely pure yellow, pink or greenish white. They are usually carried on single stems, occasionally once branched or with multiple stems, each arising from the leaf joint (subsp. *chrysanthus*). The perianth is 25–50 mm long, 8–19 mm wide. When viewing the underside of the perianth the anthers are arranged in three distinctive descending pairs. The central perianth lobes are usually horizontal and the outer lobes recurved upwards to 90°. Flowering is from July to October. The leaves are variable in size flat sickle shape up to 20 mm wide and 20 cm long usually light to medium green.

Similar species include *A. kalbarriensis*, which again has three definite pairs of anthers but all the perianth lobes are fully recurved and *A. onycis* with straight perianth lobes and a flowering stem that is usually once forked. It hybridizes readily with *A. onycis* and *A. kalbarriensis*.

Anigozanthos humilis subsp. *humilis*. The flowering stems are 10–30 cm long, rarely up to 100 cm with flowers usually yellow, with varying degrees of orange or red hairs. The tall flowering form which grows in winter wet areas, usually around lakes, north of Perth is now fairly rare.

Anigozanthos humilis subsp. *chrysanthus*. The flowering stems are 20 to 40 cm high. It is distinguished from the other subspecies by multiple stems each arising from a leaf joint, and the perianth tube is uniformly yellow. This plant occurs in sandy loam in low lying areas and is declared rare flora in Western Australia. In its natural habitat it sometimes hybridizes with *A. bicolor*.

Propagation and cultivation — Dwarf Kangaroo Paw prefers a free draining sandy soil and full sun position. It is generally difficult to grow in cultivation and short lived both in the open ground and in containers. However, plants of subsp. *chrysanthus* have been grown for up to eight years in containers. All forms appear to be very susceptible to rust and ink disease. Although flowers are harvested from bushland populations and sold as fresh flowers, there seems little potential for cut flower production, with the exception of the tall stemmed forms. Germination of seed is erratic although the seed remains viable for at least six years. Both subspecies are easy to raise by tissue culture. Plants can be divided with varying success.

This is a fairly rare species, very difficult to find unless there has been a fire after which they flower prolifically. They can also be found after disturbance on firebreaks and road verges. It grows in sandy depressions and winter wet areas usually in low heathland, mainly in the Kalbarri National Park.

Flower stems are 10–20 cm high and unbranched. The flowers, which are produced in August and September, have red hairs on the top of the stem and ovary, changing to yellow red, greenish red or yellow on the perianth. The perianth is 25–45 mm long, 10–16 mm wide, with all the lobes being fully recurved. Anthers are arranged in three descending pairs. Leaves are bluish green, flat, sickle shaped, 3–10 mm wide and up to 12 cm long. The only similar species is *A. humilis*, see above, with which it freely hybridizes.

Propagation and cultivation — This is a very attractive species. It is rarely cultivated because seed is not readily available and it is difficult to germinate. It is best grown as a container plant as it appears to be short lived in cultivation and is very susceptible to ink and rust disease.

Anigozanthos manglesii

Red and Green Kangaroo Paw

Western Australia's state floral emblem. It is the most widespread of all the Kangaroo Paws occurring from Shark Bay to the Scott River and almost to Mt Barker. It occurs in low woodland, forest and heath, on poor sandy soils, sandy loam and gravel, on coastal limestone hills and sometimes in low lying areas e.g., fringe of swamps.

Flower stems, usually single, occasionally branched are 30–110 cm high. Flowers are usually bicolor with green hairs or occasionally red or yellow hairs on the perianth and red or rarely yellow on the ovary and top of the flower stem. The perianth is sickle shaped with straight sides and fully reflexed lobes. When viewed from the underside the anthers are in a straight row at the end of the perianth and their stalks (filaments) are much shorter than the anthers. The flowering season is from August to November. Leaves are green to greyish green, flat, fairly straight 10–40 cm long and 5–12 mm wide.

Anigozanthos manglesii subsp. *manglesii* is mainly found from Lancelin and Gingin to Mt Barker. The flower stem is rarely branched. The perianth is parallel sided near the anther stalks. Hairs red occur at the base of the tube and for no more than 10% of the perianth length.

The variety *flavescens* has yellow hairs on the top of the flower stem and ovary, grading to greenish yellow on the perianth. It is rare and occasionally seen in red and green populations.

Anigozanthos manglesii subsp. *quadrans* is mainly found from Jurien Bay to Kalbarri and Shark Bay. Flower stem often once or twice branched, hairs over most of the tube and 20–30% of the perianth is orange red.

Propagation and cultivation — This spectacular Kangaroo Paw is easy to grow in cultivation, in a full sun position with free draining preferably sandy soil; also a good container plant. Widely used as a fresh cut flower, most red and green forms are harvested from bushland populations. Other colour forms are being grown as row crops. It is usually short lived in cultivation being very susceptible to ink and rust disease, it is therefore best repropagated each season. It is easy to germinate from seed sown in autumn or spring.

Anigozanthos onycis

Branching Cats Paw

This is a fairly rare species only seen in abundance after mechanical disturbance or fire. It occurs in well drained sandy soils from the Stirling Range to near Bremer Bay. The flower stem is 15–30 cm high, at least once widely branched toward the top of the stem. The perianth is straight and 40–55 mm long; perianth lobes are widely spaced, not reflexed, giving a claw-like appearance. Floral hairs vary little in colour being dull red to cream. Flowers are mainly produced between September and October, usually two or three flowering stems per plant. Leaves are medium green, broadly keeled and folded together for most of their length, 5–15 cm long and up to 15 mm wide.

This species is similar to *A. humilis*. The leaves are different, not sickle shaped, the flowers are fewer, much broader and the flower stems are branched, although those of *A. humilis* are sometimes branched. The anthers are also arranged, when viewed from beneath, in a semi circle, whereas those of *A. humilis* are in pairs and the filaments are much longer. The main problem is one of hybrids and where the species occur together they frequently hybridize.

In cultivation they require full sun and a free draining soil. This is one of the most floriferous species, when in full flower it is difficult to see the foliage. It is short lived in cultivation and generally best grown as a container plant. Unfortunately it is very susceptible to ink and rust disease.

Propagation and cultivation — Propagation is by seed although the germination is erratic. The seed remains viable for at least 10 years after being in seed pots and receiving regular wet and dry cycles. Plants are easy to raise by tissue culture. Plants can also be divided in autumn although the rhizomes are very short.

Anigozanthos preissii

Albany Cats Paw

This is a fairly restricted species found growing in fine greyish sand in open woodland between Walpole, Two Peoples Bay and Mount Barker. Despite heavy clearing it can still be found in the township of Albany. It is generally only seen flowering after fire or in mechanically disturbed areas. It is a long lived plant. In cultivation it has been known to survive for 15 years.

The flower stems are straight 20–70 cm high and once forked at the top of the stem. This is the largest flowered *Anigozanthos*, with claw-like flowers, which are deeply lobed and broad. The perianth is straight 5–6 cm long. Floral hairs are red especially on the ovary and lower perianth changing to yellow towards the lobes. The filaments are 6–12 mm long, the middle four are in a straight row with the outer pair being about 2 mm longer and lower, closer to the ovary (usually the length of the filaments). Leaves are 10–25 cm long, 1–5 mm wide and medium to dark green. Not readily confused with any other species, but similar to the much smaller *A. onycis*.

Propagation and cultivation — It requires similar conditions to *A. onycis*. It will tolerate light broken shade in Western Australia although if too shady the plants will not flower. It is very susceptible to ink and rust disease. Although an ideal fresh cut flower, at present they appear to be uneconomic as a cut flower crop. New plants are usually raised by seed although germination is erratic. Seed remains viable for at least 12 years. Plants can also be divided in autumn and have also been raised by tissue culture.

Anigozanthos pulcherrimus

Golden Kangaroo Paw

Flowering stems are widely branched producing many flowers, usually on the top half of the stem. In cultivation, branching or new stems often arise out of the lower leaf axis. The height of the stems varies from 50 to 100 cm, often over 1.5 m in cultivation. Perianth is straight 2.5 to 3.5 cm long with fully reflexed lobes. Anthers are arranged in a semi circle. The stems are covered in yellow hairs with a mixture of red and yellow or rarely orange flowers. The flowering period is mainly early November to December.

Leaves are hairless or densely hairy 20–40 cm long, 5–15 mm wide. Plants occur naturally in winter wet sandy soils in low heath or open woodland between the Arrow Smith River and Gingin extending inland to no more than 100 km. This species is very similar to *A. rufus* except that the flower colour is different, the leaves are wider and *A. rufus* occurs in a different area.

Propagation and cultivation — It is easy to grow, preferring a sandy soil and full sun position. It responds well to regular summer watering but is susceptible to ink disease although apparently resistant to rust disease. Much sought after as a cut flower both fresh and dried and it is widely grown as a row crop, most of which is exported. Commercial growers dry off plants in summer, cut off the tops of the plants in early March then give a quick burn about two weeks later. This cleans up the plants and burns off diseased plant material. Propagation is usually by division in early autumn. Row crop plants are grown by tissue culture. Viable seed is difficult to obtain and germinate.

Anigozanthos rufus

Red Kangaroo Paw

This species is very similar to *A. pulcherrimus*, the principal differences being flower colour and the leaves. *A. rufus* is usually red to rich purple (yellow and apricot forms have been recorded), leaves are always hairless and narrower 2–6 mm wide. Distribution is from the Stirling Range east to Israelite Bay with an outlier population at Point Culver. Plants grow in winter wet sandy soils usually in low heath. Flowering period is from September to December.

Propagation and cultivation is the same as for *A. pulcherrimus*. *A. rufus* is not as widely used as a fresh or dried cut flower, although it grows well as a row crop. Unfortunately under very hot windy conditions the flower colour can quickly fade.

Anigozanthos viridis

Green Kangaroo Paw or Swamp Kangaroo Paw

Plants occur naturally in winter wet sandy clay soils around swamps or in depressions, in low heath, woodland or forest. The flower stems are unbranched and the flowers are always one colour, usually green, sickle shaped with a constriction above the middle of the perianth. Lobes are reflexed. The middle four stamens are in a straight row with the outer pair being lower. Leaves are medium to dark green and (subterete) roundish in cross section. It hybridizes frequently with *A. manglesii* and *A. bicolor* and occasionally with *A. humilis*.

Propagation and cultivation — Grow in a free draining soil in full sun. This plant, when grown in poor sandy soils, benefits from an occasional summer watering, although it is surprisingly drought tolerant. It is also a good container plant and the smaller forms have been marketed as pot plants. Although used as a cut flower it is rarely grown as a row crop. Propagation is by seed which is easy to germinate or by division in the autumn. Plants have also been raised by tissue culture.



Anigozanthos gabrielae △

▽ *Anigozanthos pulcherrimus*



Anigozanthos viridis subsp. *viridis*. This is the usual form of *A. viridis* throughout its range from Nambung National Park south to the Scott River with an outlier population at Walpole. It is extremely variable, from a horticulturist point of view. The flower stems are 10–85 cm high usually vertical with a slight curve below the flowers. The fresh flowers open in line with the axis or curve of the stem moving away from the axis as they age. The perianth is 55–75 mm long and 5–12 mm wide at the narrowest point. Flower colour is light to dark green occasionally yellow or rarely pink. The main flowering period is from August to November. Leaves are 10 to 50 cm long and 1 to 5 mm wide.

Anigozanthos viridis subsp. *terraspectans*. The Dwarf Green Kangaroo Paw is "declared rare flora" and is therefore difficult to find. It occurs naturally in winter wet depressions in heathland north-west of Dandaragan West. The flowering stem is straight, 10 to 15 cm high, arising at an angle of 45° to 80°. The fresh flowers open away from the stem axis, that is out of line with the unopened flower buds. Perianth is 45 to 60 mm long and 4 to 5 mm wide at the narrowest point. Flower colour is medium green. The main flowering period is August to September. Leaves are 5 to 10 cm long and 1 to 2 mm wide. This plant is often confused with a small form of subsp. *viridis* which grows in the same area and was once widely available in nurseries in Perth and known as *A. viridis* 'Nana'.

Macropidia fuliginosa

Black Kangaroo Paw

Macropidia has only one species and is endemic to south Western Australia, occurring between Muchea (north of Perth) and Walkaway (south of Geraldton). Plants grow naturally in sandy lateritic (ironstone) soils in low heath or mallee heath, however, outlier populations near Muchea and Gingin occur in the northern Jarrah forest. *Macropidia* are long lived plants with short rhizomes just below ground level. Large plants over 60 cm across have been observed usually with a dead central portion (older part of the plant). They respond well to fire, flowering the following spring. However, during the first winter after the fire, usually only a few seedlings can be found.

Flowering stems are up to 1.8 m high, usually shorter, branching terminally into one sided, many flowered branchlets. The individual flowers are up to 6 cm long, dividing into a tube to 18 mm long with the lobes curling backwards, the anthers which hold the pollen and stigma (female part) protruding further out of the tube, ensures cross pollination by the bird pollinators. The upper part of the flowering stem and the outside of the perianth tube is covered in black hairs, which look magnificent when magnified, forms with yellowish green hairs have been recorded whilst the inside of the tube is hairless and bright green, although the lobes are a yellowish green. The flowering period is usually late winter and spring, although plants in the bush, as well as in cultivation, can flower in the autumn. Leaves are flat glabrous (no hairs) up to 50 cm long and 15 mm wide, medium green to bluish green arranged in a flat fan shape on the shoot.

The main distinctive features dividing the genus from *Anigozanthos* are the long filaments holding the anthers, deeply divided perianth with the long lobes folded back, the large seed up to 5 mm dia. and small number of seed produced, that is only three seeds per flower, however, large plants in cultivation can produce over 1,000 seeds. The seeds are entire when falling and need to be collected every other day or bagged after being pollinated, to avoid the loss of seed.

Propagation and cultivation — Seed should be sown in the same manner as that outlined for *Anigozanthos*. However, seed usually germinates the second autumn after sowing, therefore leave it out in the elements, sun, wind and rain and do not water during summer. The following autumn recommence watering the seed which will then germinate in about three weeks. Seed remains viable for at least eight years. Prick out the seedlings when one or two days old, then plant out when 5 cm high or grow on in pots until the following autumn. Grow in full sun in a slightly acid sandy or sandy lateritic soil. In an exposed position on poor sandy soils, once established, plants will benefit from an occasional summer watering. Although individual plants are known to live in cultivation up to 15 years, when regularly watered and fertilized they are normally short lived.

This species is now widely grown from tissue cultured plants as a row crop for cut flower production. Although plants can be dried off during summer, slashing and burning can cause heavy losses in the plantation. ■

Kangaroo Paws in Adelaide

by Jeff Jones

In recent years a number of tissue-cultured *Anigozanthos* hybrids have become available. The most vigorous and reliable of these are the *A. flavidus* hybrids, but the others are worth growing for their rich display of flowers. For gardens and landscaping the *Anigozanthos humilis* × *A. flavidus* hybrids are to be highly recommended because of their much extended flowering period, mature plants in full sun sometimes having some flowers all year round.

If spent flowers are removed more blooms are encouraged to grow in their place. Thus a continuous pruning programme (including cutting flowers) will extend the flowering period. The size of the hybrids varies from 0.3 × 0.3 m (*A. gabriellae* × *A. humilis*) to 2 × 1 m (*A. rufus* × *A. flavidus* form).

All hybrids with *Anigozanthos humilis* as one parent are lime-tolerant, but experience has shown that most hybrids will grow in alkaline soil provided that the drainage is adequate. However, flower colour is best in acid, sandy soil. Frost tolerance varies, but *A. flavidus* hybrids are relatively hardy and while frost may cause some damage (particularly to young plants) they should recover in spring. Those tested in the National Botanic Gardens, Canberra, (e.g., *A. onycis* × *A. flavidus* 'Dwarf Delight', *A. rufus* × *A. flavidus* 'Red Cross', and *A. preissii* × *A. flavidus* 'Regal Claw') proved moderately hardy.

With *A. manglesii* × *A. viridis* we hope for the flower colour of *A. manglesii* without the poor tolerance to ink disease and consequential short life. *A. manglesii* × *A. bicolor* has lighter metallic green and shorter (0.5 m) flower spikes, but is very attractive in flower and foliage and is much more reliable. *A. onycis* × *A. flavidus* has a much brighter colour than *A. onycis* and is long lived with taller (0.5 m) flowers. *A. humilis* × *A. flavidus* (red form) has a slightly less brilliant colour than *A. humilis*, but is long lived (*A. humilis* 1–3 years).

Propagation is readily carried out by division, the *A. manglesii* and *A. humilis* hybrids being a little more difficult because of their short rhizomes and closely packed leaves. Application of a fungicide such as Benlate or Zineb and a root stimulant, Formula 20, two weeks before division will assist in obtaining vigorous, healthy plants. Viable seed may be set aside by some cultivars but they are not likely to be true to parent colour.

Some of the more desirable hybrids are: 'Bush Glow', 'Bush Nugget', 'Bicentennial', 'Early Spring', 'Velvet Harmony', 'Red Cross', 'Harmony', 'Bush Emerald', 'Emerald Glow', 'Emerald Gem', 'Dwarf Delight', 'Regal Claw'. ■



Anigozanthos
Photograph by [illegible]



Macropidia fuliginosa △
Photography by Ilma Dunn

▽ *Anigozanthos* 'Mini splendour'
A Western Star Kangaroo Paw Hybrid



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by Philippa Nikulinsky

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Anigozanthos rufa
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