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Editorial

Cas Liber and Joanne Caldwell, Publishing Committee

The flowers of *Woollsia pungens* are claimed to emit the sweetest smell in Sydney's bush. Yet this plant is one of the most difficult to propagate. Anne Ashford continues to take on this challenge. I'm sure that you will find the latest work by John Palmer (and Anne) very interesting and you'll find a use for those Chinese take-away containers that seem to accumulate.

Oh to be an editor. The Botanical Overview of the Eyre Peninsula (see page 278) being a case in point - nine photographers supplied a whopping 38 images. We must apologise to those whose material was not used and applaud the co-ordinators for their effort in marshalling the material. The area has a large number of orchids (see front and back cover). Given the diversity of the flora, it would seem appropriate that we all put a trip to the Eyre peninsula on our travel agenda to see it first hand (and sample the superb piscatorial cuisine while there)!

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Front cover: *Pterostylis erythroconcha* - Fishery Bay Both photos C Gill
Rear cover: *Pterostylis dolichochila* - Wanilla Con. Park (see pages 279-280)

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Woollsia pungens

Germination and Seedling Growth _____ John Palmer and Anne Ashford
School of Biological, Earth and Environmental Sciences,
University of New South Wales, Sydney, 2052

Introduction

Woollsia pungens (Cav.) F. Muell. is an erect, prickly, epacrid shrub, growing to a height of 0.5–2.0 m, with hard, sharply pointed (pungent), acuminate leaves attached to the stem by a short petiole (Fig. 1A, 1B). The shrub is commonly found in dry sclerophyll forest and heathland on nutrient poor sandstone and coastal dunes throughout eastern Australia (Powell, 1992). It favours damp partially shaded sites. Small, solitary, flowers appear in the axils of the leaves on the upper parts of the stem in early winter in coastal regions, with repeat flowering in spring (Fig. 2). In the Blue Mountains, flowering is in spring and summer (Powell, 1992). The highly perfumed flowers are normally white but pale pink forms have been reported and plants with deep crimson flowers occur on the Beecroft Peninsula at Jervis Bay in NSW (Fairley and Moore, 2000). Flowers have 5 petals, which show characteristic surface wrinkles (Fig 3). The plant may have horticultural potential for its slender flowering shoots and floral perfume.

W. pungens is botanically interesting for its hair roots (Fig. 4). The surface layer of these specialised roots hosts mycorrhizal endophytes, predominantly Ascomycetes. This mycorrhizal association is considered to aid nutrient uptake from soil (Kemp *et al.*, 2003; Midgley *et al.*, 2002).

Described here are procedures we have developed to grow *Woollsia* plants under glasshouse conditions, as part of a program to inoculate the hair roots of seedlings growing in non-soil sterile containers with mycorrhizal cultures. We have also examined germination and seedling growth since there does not appear to be any published information on these topics for *W. pungens*.

Seed Sources

In September 1999, seed was collected from a large *W. pungens* population growing on shale sandstone in a forested site in the Georges River National Park, a coastal location in New South Wales. Seed was bulked together to form one seed stock. Germination testing commenced early in 2001 and continued for 2 years. In 2001 a second seed collection was made in the same area, in which seed was collected from individual plants and separately stored.

Germination

Woollsia pungens seeds mature and are released during autumn and winter months. The seeds do not show dormancy and we found no specific light, photo-period, or temperature requirements for germination. Hence the seed can be successfully sown in any season of the year. However the majority of seeds showed a delay of three to five weeks before germination, as determined by primary root emergence.



Fig. 1. (A) Above Left: Adult shoot of *Woollsia pungens* to show the broad based leaf with its sharp terminal point.

Fig. 1. (B) Above Right: Side view of stem, leaves and compact leaf petioles - mm scale.

Fig. 2. Right: *Woollsia pungens* shoot with white flowers and buds.

Photos: J. Palmer

Fig. 3. Below: Flowering branched spike of *Woollsia pungens*. Flowers show characteristic petal crinkling.

Photos: A. Ashford





Fig. 4. Above Left: Cleared root of *W. pungens* to show 5 hair roots and their vascular connections. Tissue cleared with lactic acid and cell walls stained with Cotton Blue dye.

Fig. 5. Centre Left: 3 month old seedlings growing on moist paper in the glasshouse. Note the well developed pigmented stems and roots. The first juvenile leaves are emerging from the apical buds.

Fig. 6. Above: Three 15 month old seedlings in the juvenile stage, with numerous minute leaves 3–4 mm long. Tallest seedling $\approx$ 55 mm high.

Fig. 7. Bottom Left: Clump of juvenile seedlings, aged 15 months, with slender unbranched stems - cm and mm scale.

Soil-Free Germination Trials

To facilitate fungal inoculation of hair roots and to determine precisely the start of germination, we germinated seeds without soil. To gain experience with soil-free cultivation, we chose moist facial tissue as the growing medium and for germination containers we used thin-walled, 650 ml, food takeaway polypropylene boxes, with snap on lids (170 X 120 X 50 mm, Universal Wholesalers, Yennora, NSW). These were purchased in packets of 5 from Chinese grocery stores and proved to be ideal for germination, since they retain moisture around the seeds and the lids prevent evaporation, reducing maintenance. A feature of the rectangular thin-walled polypropylene food box is a shallow peripheral well 15 mm wide and 4 mm deep in the floor. For germination use, this serves as a water reservoir keeping the facial paper moist but not waterlogged. In later trials, still in progress, we used similar lidded plastic boxes to germinate seeds and rear *Woolfsia* plants under sterile conditions.

To eliminate mould growth during germination, seeds were surface sterilised with 2.5% calcium hypochlorite (Sigma-Aldrich, Castle Hill, NSW) solution for 2 hr, washed 3 times with sterile deionised water and then submerged in 15 ml sterile deionised water for 24 hr with occasional shaking.

After surface sterilisation, 150–200 seeds were placed on 4 layers of moist non-sterile facial cellulose tissue contained in the germination box and water added to the floor well. The seeds were not covered. Except when the effect of light was examined, the boxes were stored in darkness at 24°C. They were inspected at two week intervals and if required more water was added to the floor well to maintain the paper's moisture content. Root emergence served as a germination indicator and germination counts were made at weekly intervals.

The validity of germinating uncovered seeds on moist paper was tested in a single trial, by repeating the procedure but covering the seed with soil to a depth of about 5 mm. Natural soil was obtained from a *Woolfsia* growing site and sieved to remove coarse plant debris.

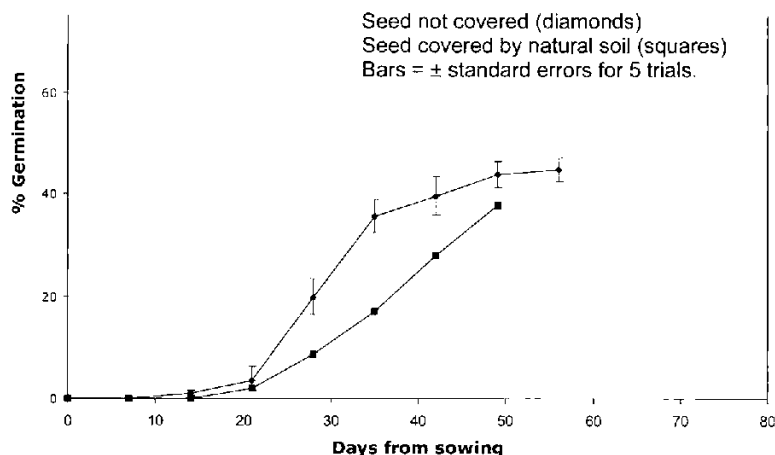
In early germination trials various chemical and other treatments known to increase percentage germination and/or overcome or reduce seed dormancy in other species, were tested. These included soaking in 0.04% aqueous solution of gibberellic acid (GA₃) (Sigma-Aldrich, Castle Hill, NSW) for 5 days, exposing the germinating seed to 50 PPM ethylene for 8 days, using smoked water in place of tap water for wetting the seeds, and exposing soaked seed to heat and smoke from burning eucalyptus leaves for 1 hr. The smoked water was obtained from Richgro, Canning Vale, WA.

Results

Summarising results for 5 trials with the bulked 1999 seed: germination commenced after a delay period, which for the bulk of the seed ranged from 3 to 5 weeks from sowing, and germination was largely completed after 7 weeks. The mean percentage germination was about 43% (Graph 1).

In the single soil-covered trial the percentage germination was about 10% less than the mean for the bulked seed trials and there was an apparent delay

in germination, which was attributed to the time taken for the shoots to grow to the soil surface (Graph 1).



Graph 1: Cumulative graph of % germination for 1999 seed germinating in darkness over 56 days.

In trials, not detailed here, we found that exposing seed to daylight (12–14 hr per day) during non-soil germination on moist paper, reduced the percentage germination to about 30%.

Chemical and Other Treatments

None of the treatments significantly shortened the delay period or increased the percentage germination.

Plant to Plant Variation in Fertility

Using the same procedures, we also did germination tests on the 2001 batch of seed gathered from individual plants at several sites. The results showed that seed from some sites was significantly more fertile than the 1999 bulk seed collection. For example, combined seed from 4 plants at one location (site 5) was highly fertile, with about 85% mean germination (Graph 2). This was not solely due to the seed being younger, since seed collected at the same time of year from 10 plants at another site in the same area, gave germination values which ranged from 13 to 74% (mean 38.5% $\pm$ 18.3%).

Seedling Growth

Seedling growth was dependent upon the maintenance of high humidity by keeping the boxes closed. Irons (2002) has commented on the sensitivity of epacrid seedlings to drying out. High seedling losses occurred when the germination boxes were situated in an un-shaded glasshouse, where the midday radiation level was about 75% full sunlight. The cause is not known, although the seedlings may have been adversely affected by elevated daytime temperatures. Placing the boxes in a shaded glasshouse (20% sunlight) in the temperature range 18–26°C, minimised seedling loss, although under these more favourable conditions, seedling growth was extremely slow.

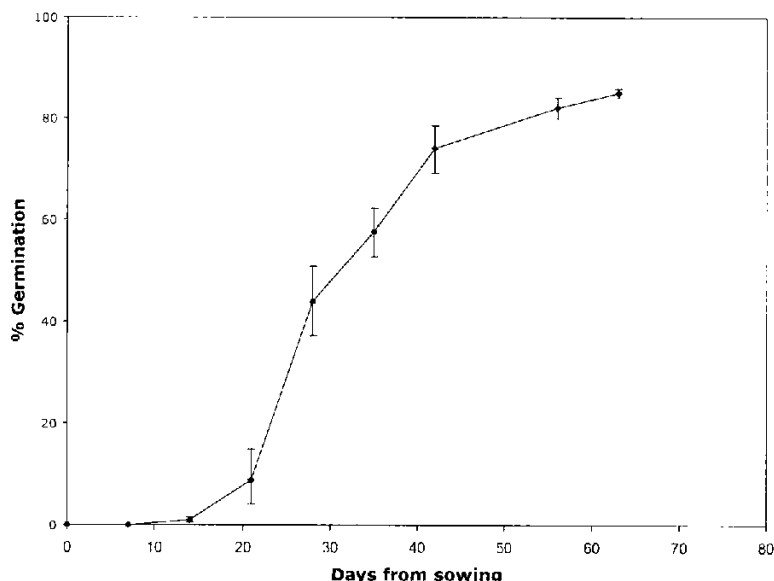


Fig. 8. Left: 20 month old plant showing the transition from the juvenile stage at the stem base (arrow) to the adult form at the tip of the stem and in the terminal bud. Shoot height 120 mm.

Fig. 9. Above: Two year old plant at the completion of the transition to the adult form, displaying upwardly curved adult leaves, with a characteristic triangular shape and sharp point in the terminal bud (inclination of the terminal bud is due to temporary wilting during photography). Photos: J. Palmer

Fig. 10. Below: Two year old plant, flowering in the winter of 2004, 4-6 months after the transition to the adult form. Photo: A. Ashford





Graph 2: Cumulative graph of % germination for 2001 seed collected from 4 plants at site 5. Bars = $\pm$ standard errors for 3 trials.

This may be a characteristic feature of epacrid seedling growth (Irons, 2002). Three months from sowing, seedlings were typically 20–30 mm tall with 4–6 minute leaves, 3–4 mm long (Fig.5). However seedlings of this size possessed a good root system and were suitable for inoculation with mycorrhizal fungi. Supplying seedling roots with nitrogen and potassium in the form of KNO_3 solution (0.1 g ml^{-1}) failed to stimulate seedling growth and promoted the proliferation of algal colonies on the supporting paper.

Response to Natural Soil and Mineral Nutrients

Active seedling growth beyond 3 months was achieved by covering the roots with soil obtained from a natural *Woolfsia* growing site at La Perouse in the Sydney region. The soil was sieved to remove coarse plant debris and then evenly distributed over the facial tissue surface to a depth of approximately 5 mm using a sieve. Seedlings with soil covered roots showed increased shoot vigour and responded to the addition of mineral nutrients by an acceleration in stem elongation and leaf production. Major minerals were provided at monthly intervals either by a liquid mineral fertiliser (KNO_3 6.6, MgSO_4 2.4, KH_2PO_4 1.15 g l^{-1} diluted 1:9 parts water) or with major and minor mineral elements provided by a commercial fertiliser made up with water at 5 g l^{-1} (Thrive, Yates and Co, Homebush, NSW).

Under these conditions, the seedlings entered a juvenile establishment phase, during which approximately 1–3 leaves per week were produced and stem elongation proceeded at a low rate of about 2–5 mm per month. The seedlings were generally free of disease. Few were lost to fungal infections such as damping-off diseases, so that even under high humidity and low light intensity conditions in winter, almost none succumbed to disease.

Sampling roots of actively growing seedlings, showed some possessed fungal coils inside the thick walled epidermal cells of their hair roots, indicating that typical colonisation by ericoid mycorrhizas had occurred.

Seedling Development

Seedling leaves differ from adult leaves in that the lamina is a narrow strip 1–3 mm wide and 4–5.5 mm long with a rounded tip and there is no petiole. While successive leaves emerging from the terminal bud showed a gradual increase in length, they retained their narrow strip-like shape (Fig. 6). Although adding soil and mineral nutrients stimulated stem elongation and leaf production, the seedling's general appearance was unaffected, there being no change in leaf shape or increase in stem diameter, no axillary branching and only a small increase in leaf length in successive leaves (Fig. 7). Thus during the juvenile phase, the seedling of *W. pungens* is a stable entity with recognisable shoot features.

Transition to Adult Form

After 12–18 months, the juvenile stage was phased out as newly produced leaves increased in area, developed a petiole and changed shape to a triangular form with a broad base and pointed sharp tip (Fig. 8), providing a visible indication of the start of the transition towards the adult form. This increase in leaf area and change in leaf shape was most rapid in seedlings attaining the transitional age in spring and summer but it also occurred in winter months, suggesting that it is age-dependent and not controlled by climate. After about 2 years adult leaves (Fig. 1) appeared in the terminal bud (Fig. 9) indicating the completion of the shoot's transition to the adult form.

Flowering

Adult plants first flowered in the autumn and winter of 2004, when they were approximately 2 years old. All the plants that flowered were small, less than 250 mm tall, and had single, unbranched stems (Fig. 10). Since the time of flowering coincided with flowering in natural populations in the Sydney area, it may be a short day response. However, at the time of writing, only a few plants in each batch had produced flowers.

Germination Program

Summary of our program that can be used to obtain vigorous *Woolfsia* plants.

1. Surface sterilise seed with calcium hypochlorite and rinse well with sterile water.
2. Sow washed seed on moist facial tissue in food take-away plastic boxes.
3. Keep boxes dark for 4–5 weeks in the temperature range 18–24°C.
4. Transfer boxes to a shaded location for 2 months.
5. Using soil from a *Woolfsia* growing site, sieve soil over seedling roots to a depth of about 10 mm. Use a fine water spray to remove dust from seedlings.
6. At monthly intervals, supply 3–5 ml fertiliser in dilute liquid form.
7. At 4 months perforate box lids to reduce humidity and harden seedlings.
8. Increase the soil cover at 6 month intervals.
9. Pot on seedlings 1 year from sowing.

Mycorrhizal Trials

We have used the above routine for inoculating seedlings with specific mycorrhizal inoculates, but with the following procedural changes:

- Food boxes replaced by plastic lab culture boxes with sealed lids (Sigma-Aldrich, Castle Hill, NSW);
- Moist paper replaced by a solid aqueous gel (phytoGel Sigma-Aldrich, Castle Hill, NSW);
- Fungal isolates added to the gel surface at 2 months, followed by addition of sterile natural soil to a depth of about 10 mm.

These trials are still in progress. If successful, they should be of assistance in deciding what growth benefits *W. pungens* derives from the mycorrhizal association.

Conclusions

Our trials show that *W. pungens* seed is comparatively fertile and there are no special requirements for germination. A feature of germination is a 3–4 week delay before root emergence. Since the embryo in the mature seed is well developed and occupies the full length of the seed, this delay is not due to the time taken by the root apex to reach the seed's surface. Possibly it's the result of a growth inhibitor within the seed taking time to break down and allow embryo growth to commence. If this is the case, then the inhibitor appears to be unaffected by chemicals such as GA₃, or ethylene. Of particular interest is the lack of response to heat and smoke, or smoked water, since other epacrids require exposure to heat and/or smoke for germination (Gilmour *et al.*, 2000). Seed from individual plants, collected in 2001, showed that plants at some localities produced more fertile seed than others. The reason for this variability is not yet known.

Although the germination trials indicated that soil assists the successful establishment of *Woolfsia* seedlings, the technique of germinating surface sterilised seed on paper that we used, gave good germination rates and may be useful for other species as a means to improve germination and accurately record percentage germination.

Maintenance of high humidity was found to be essential for successful seedling establishment and subsequent growth under glasshouse conditions. It is possible that a deficiency exists in the seedling's water transport system (Allaway and Ashford 1996), or that adaptation of stomata to a reduction in atmospheric humidity, occurs only slowly. We are attempting to acclimatise seedlings to fluctuating humidity by partially opening the box lids to allow a reduction in humidity in daylight hours. Early results indicate that this hardening process is most successful when carried out at low temperature in winter and with young seedlings less than 6 months old.

This investigation has revealed that post-germination, *W. pungens* enters a juvenile state which is unaffected by day length, season and light intensity and which lasts for 18 months to 2 years in our trials. The occurrence of this condition has not previously been reported for *Woolfsia*. Possibly it occurs in other epacrids.

A remarkable feature is its uniformity, with seedlings produced in different seasons of the year all producing large numbers of similar leaves on slender unbranched stems.

Acknowledgements

This project is supported by a research grant from the Australian Flora Foundation. We are indebted to Mr Robert Miller for collecting the seed used in this project.

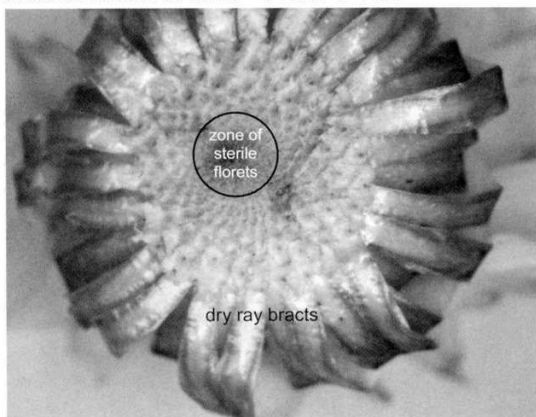
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Errata: Pink Everlasting Daisy

The March 2004 issue of Australian Plants, Volume 22, Edition 178 contained an incorrect caption on page 224 for Figure 2. The caption should have read:

Fig. 2. Goose-pimple texture of dry involucrel platform after fruit dispersal: scars of achene attachment are spaced, compared with dense, pointed ridges left by sterile florets at centre of disc. Photo B Tan



Our Garden No 42: Deviation Road

Dick Burns*, Penguin, Tasmania

Things have never been rushed at Deviation Rd. After 28 years of deliberation (or obfuscation), I had the driveway concreted in February 2004. The delay has been to a great extent due to the desire to do everything myself. But the idea of sealing a small section each year never eventuated.

Some details about the Penguin climate and my site are in my article in *Australian Plants* vol 19, no 156 p 366. In summary, Penguin has a milder climate than either Hobart or Launceston, with occasional frosts. My home is built on a west-facing slope with poor soil that dries out rapidly. The site probably originally carried *Eucalyptus obliqua*, *E. viminalis* tall forest with a shrub understorey. Most had been cleared for farming prior to subdivision. Australian plants on site when I moved here included those two eucalypts and *Acacia mucronata*, *Leptospermum scoparium*, *Pultenaea juniperina*, *Goodenia ovata*, *Lomandra longifolia* and *Dianella tasmanica*.

I have been able to grow plants from all across the continent, from Western Australia to New South Wales and up to Queensland. However, there have been some notable Tasmanian failures.

Planning

I have never formed a proper master plan. At the start, I bought all the books and prepared a scaled 'map' of the block. I did notice the similarity between the art of bonsai and Tasmanian highland trees, and between Japanese garden design and places like Twisted Lakes at Cradle Mountain and the Walls of Jerusalem. But while I was thinking about how to create something that represented Tasmania, the garden was spreading.

One strong principle I have maintained is that the garden should be for all seasons, and for all the senses. Mass plantings of the same plant is good for TV shows and in large spaces, but not in a backyard. Few plants flower throughout the year, so I have tried to mix leaves of different sizes, colours, textures and smells in each area.

Establishing a lawn is a form of self-torture only slightly more acceptable than pulling out your toenails. So the only grassed area that remains is around the fruit trees.

Getting around the garden

The previous owners left behind a pile of bricks, so I laid out a brick pathway along the back of the house. Other pathways fanning out from here were matted in. Some were paved with basalt or dolerite rock that I collected from old quarries etc. I have also used decomposed granite or sawdust. Those further from the house were left to return to grass or, in later years, covered in accumulating leaf-fall. Path edges steps and small retaining walls are of scrounged rock, railway sleepers or large pruned branches.

* Dick is a life member of Australian Plants Society Tasmania and is currently secretary for ASGAP. In 1970, he moved from Sydney to Tasmania and became involved with bushwalking, teaching, gardening and Australian plants.

At one stage, when I thought I had determined my final layout, I made concrete mowing strips curving through the garden. But as the plants accumulated and grass retreated, the strips were overtaken. They now are more likely to run through the centre of a bed.

One small area, the only flat part of the garden, was going to stay as grass. But trees over-shaded it, so I paved it. I made the pavers by pouring coloured concrete into the bottom of ice-cream buckets. That part of the garden won the Tasmanian section of the photography competition run by the Garden Design Study Group. But the photo never made it into their book.

Development stages

When I bought the house in 1976, there were a few virgillias, beds of daffodils, some cotoneasters, and one privet. I left the virgillias to go through their life cycle, the daffodils still come up every spring, but the last two were promptly dispatched.

The house is an uninteresting grey cement-brick rectangle, so the initial aim was to disguise it. Virginia creeper, climbing fig, wisteria and ivy went in soon after I moved in. The rampant ivy came out soon after.

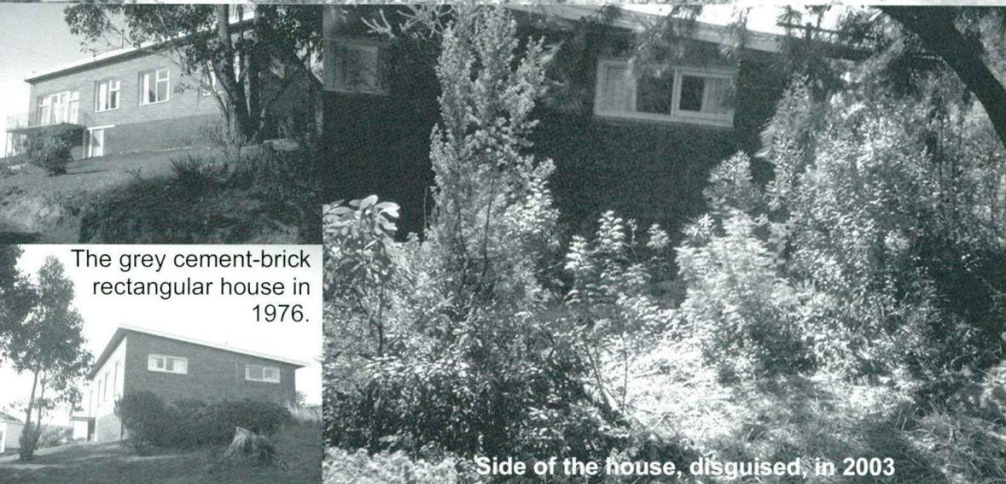
Having grown up with Sydney sandstone flora, my first real collection was of plants that reminded me of home. I still have a wonderful *Angophora costata*. Crown growth is denser than in Sydney and the trunk does not twist as I remember or wanted it. But the new growth is wonderfully burgundy, and new bark when wet is an incredible colour. My *Ceratopetalum gummiiferum* wants to grow tall and columnar. In Tasmania, it's not NSW Christmas bush, rather Penguin autumn bush. *Doryanthes excelsa* of course was compulsory. The tall bright green leaves of my two plants are a feature of the garden, but I have only ever had one flower: it towered over the house. Mountain devil fruit from *Lambertia formosa* fascinated me as a child. The flowers on my plant are normal size but fruits are miniature, probably unfertilised.

As other Sydney plants died, a fascination with Banksias was developing. There were many more deaths during that period. Surviving Banksias that are growing well include *Banksia serrata*, *B. baueri*, *B. caleyi*, *B. grandis* and of course *B. marginata*. My *Banksia integrifolia* was sold to me as *B. menziesii*, and I bought the *B. coccinea* that survives for \$2.50 at Mitre 10, labelled '*Banksia integrifolia*'.

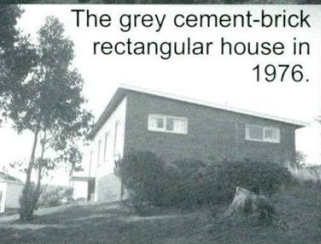
A couple of years after my buying at Deviation Rd, the local SGAP group started up. Several early members collected Grevilleas. Their collections were all large spreading shrubs with only subtle differences in the flowers. So I decided to ignore such a boring genus. It would be 10 years before Grevilleas started to accumulate, with a preference for species rather than hybrids. My treasures are *Grevillea buxifolia*, *G. ilicifolia* and a pink *G. linearifolia*. But Proteaceae is a fascinating family. I have had over 40 Hakeas growing, but in recent years some have died. The Western Australian *Hakea amplexicaulis* and *H. victoria* have grown spectacularly. The latter plant's leaves are only about half-size, but often produce the yellows and brown that you see in books. I have had to prop up the plant: it is many branched, and the profuse flowering has resulted in it being top-heavy with fruit.

Driveway and letterbox featuring
Acacia genistifolia Mt Rumney
(Tas) form.

All photos: D. Burns



The grey cement-brick
rectangular house in
1976.



Side of the house, disguised, in 2003

There are about 20 *Persoonias*. *Persoonia levis* is spectacular when the low afternoon sun makes the leaves glow. My pride and joy is a *P. linearis* that I grew from seed. It is erect to about 4m with pendent branches and greyish foliage contrasting with the papery brown and red bark. *P. pinifolia* flowers densely for long periods and I have dense carpets of *P. mollis* subsp. *revoluta*, *P. chamaepitys* and *P. prostrata*. I have 7 species of *Lomatia*. My seed-grown *Lomatia silaifolia* has never flowered. One part of the garden consists of a corridor of the remarkable leaf variation in the Tasmanian *L. tinctoria*. My trials with the Waratah group have not been the greatest success. ***Telpoea alloxylon*** and ***Telopea embothrium*** failed, as have most *Telopea* species. Around Penguin there are several healthy *T. speciosissima* plants, but mine are too shaded or crowded to do well. Plants of the Tasmanian *T. truncata* have all died. My only real success is *T. mongaensis*.

A family that gives Tasmania its distinctive appearance is Epacridaceae. I have had no long-term success with *Richea* species. A few *Trochocarpa* species are growing slowly. *Pentachondra involucrata* and *P. ericifolia* do well. I have seen *Prionotes cerinthoides* growing spectacularly in terracotta pots or hanging baskets but I still have to find the best spot here. Several *Epacris* species are long-lived. These include *Epacris myrtifolia*, *E. franklinii*, *E. longiflora* and *E. reclinata*.

No family provides contrasting foliage better than Rhamnaceae. Many gardeners go directly to Acacias when looking for yellow flowers. *Pomaderris ferruginea* or *P. elliptica* forms produce vivid yellow flowers as well as contrasting foliage and stems. The previously mentioned article has more on this family.

Present directions

My aim nowadays is to replace losses with Tasmanian plants. Plants from this island have been accumulating through the years. I once could boast having all the Tasmanian conifers. But my glorious *Lagarostrobos franklinii* died after reaching about 4 metres. *Athrotaxis selaginoides* and *A. x laxifolia* both succumbed to dry summers. *Callitris rhomboidea* and *C. oblonga* dominate their parts of the garden, both with columnar growth, the first dark green, the latter blue-green. *C. oblonga* has been growing in my dry garden 27 years and is still less than 4 m with foliage missing only from where adjacent plants have blocked light. I have two plants of *Diselma archeri*. Both are attractive low rounded shrubs with dense growth and pendent tips.

Photographs Opposite:

Top Left: The tree is *Angophora costata*, *Boronia heterophylla*, *Calothamnus quadrifida* (grey leaf form) in the middle and *Brachyscome segmentosa* (white flowers), *Brachyscome multifida* and *Eucalyptus vernicosa* in the front.

Centre Left: Front Garden with *Leptospermum petersonii*, *Eucalyptus pulchella*, *Melaleuca squarrosa*, *Allocasuarina torulosa*, *Isopogon anemonifolius* in the background and *Spyridium ulcinum*, *E. forrestiana*, *Phebalium squamulosum* and *Isopogon formosus* in the middle.

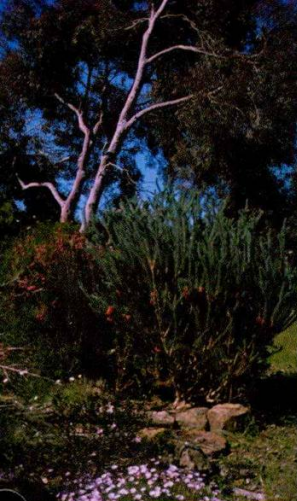
Top Right: The Shady Rest showing *Cyphanthera tasmanica* and *Olearia tomentosa*.

Centre Right: The Shady Rest showing from left to right, *Baloskion tetraphyllum*, *Spyridium obovatum*, *Eucalyptus sideroxylon*, *Banksia collinus* and *Callitris rhomboidea*.

Bottom Left: *Callistemon pallidus*.

Bottom Right: Front of the Penguin House in 2003. See the 'Before' photo on page 255.

All photos: D. Burns



Most of my trees are Tasmanian. The approach to my block down Deviation Rd is dominated by *Eucalyptus pulchella* with its cream bark and fine delicate foliage. Coming from the other side, you see *Eucalyptus risdonii*. This grey-leaved spinning gum is a much more attractive plant than *E. perriana*. At another corner is *Eucalyptus pauciflora*. I planted it, thinking it would be like those I remembered from around Mt Kosciuszko. But I soon found out that the Tasmanian form is much larger. It is a lovely graceful tree and the mass flowering belies the specific name. At the other extreme is *Eucalyptus vernicosa*. After 6 years, my most recent plant had reached about 60 cm. Damaged during the concreting of the driveway, it is even lower right now. *Eucalyptus coccifera* seems happy, but sometimes bursts out in masses of juvenile foliage. Anyone who has camped on river flats in the Blue Mountains will remember the whispering of the wind in the She-oaks. So a grove of *Allocasuarina verticillata* was planted to replicate that experience. Plants of *A. littoralis*, seed-grown from plants 1.5 m tall on Tasman Peninsula, are now about 6 m high.

I have several wild-collected Tasmanian forms of *Leptospermum scoparium*, upright and low to prostrate. One of interest has red centres to the flowers. I would generally recommend the Tasmanian variety *eximia* over var. *scoparium*. Leaves are closer set on stems and flowers, white or pink and white, are better formed. *Euryomyrtus ramosissima* (previously *Baeckea*) varies quite markedly across Tasmania. My best form grows as a dense weed-suppressing mat that trails and layers, turning white in spring. My *Callistemon pallidus* is dense rounded and about 5 m tall. In season, the cream bottlebrushes hide the foliage, followed by red-bronze new growth.

At the Launceston seminar in January 2004, Maria Hitchcock showed slides that gave mainlanders an idea of the variety within Tasmanian *Correas*. Several of these, and others, grow at Deviation Rd. My best finds from the bush are a trailing *Correa backhouseana* var. *backhouseana*, and a *C. reflexa* with vivid pink and green flowers.

I could go on.

The current garden

Deviation Rd has never been a display garden. How would you describe it? A jungle? A collector's garden? Neglected, overgrown and overshadowed? All of these really. But I like it.

And so do the superb fairy-wrens that have re-colonised the garden. Both neighbours now have dogs that keep away the cats that ate my previous families of wrens. Ringtail possums nest in my trees, chirp to each other and thump across my roof at night. One neighbour regularly sees a Rufous Wallaby bound out of my shrubbery at dawn. Cicadas buzz on hot summer days. For these creatures and many others, it is a home and haven.

For me too.

Shrinking Violets

Kevin Thiele & Suzanne Prober

Introduction

The common native violet of Australia is the Ivy-leaved Violet (*Viola hederacea*). Most gardeners will know this, as it's sold in many nurseries and is one of the easiest native plants to grow, provided it has a bit of shade and moisture.

The only problem is, the plant that's been sold for years isn't *Viola hederacea* at all. It's been recently renamed, and thereon hang several tales.

Viola hederacea in the broad sense was first collected by Joseph Banks and Daniel Solander, and drawn by Sydney Parkinson, while the *Endeavour* was moored at what is now Kurnell in Botany Bay. Banks' intention when he returned was to describe the plants collected on the Australian voyage in a grand and stylish publication complete with copperplate engravings and descriptions worked up by Solander (who was employed by Banks until his death in 1782).

But, sadly, Banks the grand and colourful visionary was not a great finisher of projects! After his return he was lionised by European society, became President of the Royal Society, ate too much and developed the gout and never finished his great work. The engravings and Solander's notes gathered dust until they were finally published nearly a century after Banks' death by James Britten (and again nearly a century after that as Banks' *Florilegium*).

But while the Banks specimens languished in London, another famous and well-travelled botanist, the Frenchman J.J.H. Labillardiere, collected specimens of a violet from southern Tasmania while on the 1791–4 D'Entrecasteaux expedition searching for the lost La Perouse.

Unlike Banks, Labillardiere set to work when he returned to Paris and by 1805 had described his violet, as *Viola hederacea*, in his perhaps unglamorous but immensely important work *Novae Hollandiae Plantae Specimen* (*Plants Specimens of New Holland*), the most comprehensive work on Australian plants published at that time.

So it was that by the time the Banks plant was finally described and illustrated, it was called *Viola hederacea*, as the botanist who checked Banks' specimens regarded that it was identical to Labillardiere's species.

But was it? Many botanists since that time have marvelled (or despaired) at the variability of *Viola hederacea*. Great progress was made in the *Flora of Australia* treatment by Laurie Adams in 1981, but still *Viola hederacea* was regarded as disturbingly variable. It was obvious from herbarium specimens that leaf shape, for instance, varied greatly in different populations, but the forms seemed to intergrade in a confusing manner.





Opposite:

Viola banksii found at
Kurnell
See page 262

Left:

Viola eminens found at
Zumsteins
See page 263

Photos: K. Thiele

Opposite:

Viola x zophodes
See page 263

Right:

Viola hederacea found at
Martins Creek.
See page 262

Photos: K. Thiele



In the early 1990s Suzanne Prober and I were hunting plants in the subalpine swamps of the upper Delegate River. *Viola hederacea* grows throughout these swamps, but we were surprised to find two distinctly different forms, with very differently coloured flowers, growing side by side. Careful study showed that the forms were always distinct - there were no intermediates.

What's more, we soon found that the two swamp forms differed markedly from the plants growing in the drier forests around the swamps. Then we found that all three of these differed markedly from the plants we were growing back home, purchased from our local nursery as *Viola hederacea*! It began to emerge that '*Viola hederacea*' comprised several distinct species, was a tractable challenge rather than a confusing mess and that field observations would help to sort things out.

Since then we have chased native violets from South Australia to Queensland and have studied specimens in all the major herbaria. We now believe that there may be up to half a dozen distinct species hidden within the old '*Viola hederacea*'.

Setting aside the species already segregated from the original *Viola hederacea* (such as the tiny-flowered *Viola fuscoviolacea* and *Viola cleistogamoides*) and the much-misunderstood *Viola sieberiana*, we have recently published names for the two swamp violets from Delegate River and the cultivated species, and defined the differences between these and the true *Viola hederacea* as collected by Labillardiere. For more information, see our paper 'New species and a new hybrid in the *Viola hederacea* species complex, with notes on *Viola hederacea* Labill.', *Muelleria* 18: 7-25 (2003).

The true *Viola hederacea* (Ivy-leaved Violet)

True *Viola hederacea* is common and widespread in Victoria and Tasmania, along the Great Dividing Range in New South Wales north at least to the Barrington Tops area, in the far south-east of South Australia, and in a small area of the Adelaide Hills between Belair and Mount Lofty.

The best distinguishing features of true *Viola hederacea* are that the flowers are usually rather pale and washed-out looking, the anterior petal (the one at the bottom of the flower when looking face on) is widest towards its apex, and the mature seeds are brown. Well-developed leaves of *Viola hederacea* are also distinctive; semicircular in outline, about as broad as long, and usually rather dark green above and paler beneath. There are also distinctive features of a small gland that occurs on the lowermost two anthers.

True *Viola hederacea* is rarely grown in gardens. It is a less spectacular plant than the cultivated species (*Viola banksii* - see below), with a more open, less robust habit and less striking flowers. Nevertheless, it's easy to cultivate. Photo page 261.

***Viola banksii* (Banks' Violet)**

The plants collected by Banks and Solander at Botany Bay belong to a species that is characteristic of near-coastal areas from around Bateman's Bay in New South Wales to near Brisbane. Photo page 260.

Viola banksii is a much more robust plant than *Viola hederacea* and often forms large, vigorous patches both in the wild and in cultivation. It has strikingly discolourous (bright violet and white) flowers. The anterior petal is very rounded (broadest around the middle), and the seeds when mature are glossy purplish-black. It has very large and distinctive glands on the lowermost two anthers (easily visible with a hand lens). The leaves when fully developed are almost circular in outline with a deep, narrow, V-shaped sinus at the base, and are usually rather bright, fresh green.

We collected the Type specimen of *Viola banksii* from Kurnell. Cook's journal mentions a small freshwater stream a few hundred metres from the anchorage, where the sailors filled their water barrels. The stream, now called Cook's Rivulet, is still there and when searched was found to have large patches of Banks' Violet. Most of the Kurnell Peninsula has unsuitable habitat, and we suspect that Banks' original specimen came from the Rivulet, over 200 years before.

***Viola eminens* (Stately Violet)**

Viola eminens is a common and widespread species at higher elevations throughout eastern Victoria, from near Melbourne to the New South Wales border. It is not common in New South Wales and we know it from only a few localities in the far south-east. It is also found in the Otway and Grampian Ranges, and is the most common violet on the Fleurieu Peninsula in South Australia, from Cape Jervis to the Barossa Valley. Photo page 261.

Viola eminens typically grows in moist places, either in swamps or (in the high country) in moist areas of woodland and forest. It is distinguished from *Viola hederacea* by its brightly discolourous flowers, neatly ovate anterior petal (broadest in the lower third), long and narrow anther glands, and purple-black seeds, and from *Viola banksii* by its narrower anther glands, ovate anterior petal, (usually) sub-alpine habitat, and its leaves which, when fully developed, are distinctly broader than long.

We named *Viola eminens* using the epithet *eminens* (tall, stately) for its habit. *Viola eminens* sometimes grows in mixed stands with *Viola hederacea*, and when it does the flowers of the former are always on longer scapes, often standing a good 10 cm higher, than the latter.

In the Grampians and in South Australia *Viola eminens* is sometimes a scrambler with elongate stems, climbing up to 30 cm amongst swamp vegetation. *Viola hederacea* never scrambles like this.

Viola eminens is rarely grown in gardens. It would be well worth growing, and should do well in a summer-moist, shaded spot.

***Viola x zophodes* (Dark Violet)**

Viola x zophodes is one of the two forms we originally found along the Delegate River. Since then we have also seen it at scattered localities in the Victorian Alps. It always grows with *Viola eminens* and the tiny-flowered *Viola fuscoviolacea*, never sets seed, has empty, sterile pollen and is, we believe, a hybrid between those two species. Its features are intermediate, being smaller than *Viola eminens* in all its parts and with much darker flowers, but with flowers on scapes longer than the leaves, unlike *V. fuscoviolacea*. It forms clonal patches, and could be grown in a garden in a suitable moist site. Photo page 260.





Infernal splitters

Taxonomists sometimes have a poor reputation amongst gardeners for changing names of well-known plants, and perpetually splitting species. We feel that we should justify our recent splitting of these new species from *Viola hederacea*.

Firstly, most gardeners are happy with historical splits once they become familiar with the new species, but are unhappy with new splits until they also become known. But taxonomy is an evolving discipline, and gardeners have been well-served by taxonomists for generations. Imagine how poor our gardening would be if we did not know about the many new species of *Banksia*, for example, split by Alex George in the 1980s.

Secondly, we have abundant evidence that the new species we have described in *Viola* behave as distinct species in the wild. There are many sites where two or more of the new species grow together, and intermediates are almost always non-existent. As mentioned above, true *Viola hederacea* grows intermingled with *Viola eminens* in many places in Victoria, and with *Viola banksii* in New South Wales, without any sign of hybrids. If the species can keep themselves separate in the wild, then they should clearly be recognised as distinct entities in our taxonomy. And once the characters that separate them have been noticed, it's always a thrill to find mixed populations and to notice their differences in morphology and ecology.

Thirdly, by recognising the species as distinct we can better conserve them. For example, the fact that *Viola banksii* is so widely cultivated may create problems in the future as it escapes from gardens. We have seen an escaped population near Mount Donna Buang near Melbourne, well outside its natural range, invading a fern gully and perhaps displacing the truly native *Viola hederacea* growing there. Until the new species are recognised this situation would not be noticed.

Where to from here

With the publication of *Viola eminens*, *V. banksii* and *V. x zophodes* we have a better understanding of the true *Viola hederacea*. It is clear that there are more undescribed species, particularly in New South Wales and perhaps on Kangaroo Island, that will need more work. Similarly, there are several 'forms' in cultivation currently called *Viola hederacea*. Some of these may be mere selections but others are probably distinct species. Once the taxonomy of the *Viola hederacea* complex has been sorted out, we will know much more about the potential of these native violets for horticulture.

Australian Solanums

Adam Marchant, Royal Botanic Gardens, Sydney

Solanum is a genus of plants thought of primarily in terms of food (containing as it does the potato (*Solanum tuberosum*), and, as it should, the tomato plant (*Lycopersicon esculentum* or *Solanum lycopersicoides*), and then as an American, not Australian, genus.

Many *Solanum* species in fact have very attractive flowers, comparable to those of their better-known relatives in ornamental gardens, the *Petunias*, *Brugmansias*, and *Cestrums*. The genus, which has around 1500 species, is indeed largely Central and South American, but there are more than a hundred endemic Australian species, reflecting this group's ancient Gondwanan origins (which it shares with such iconically Australian plant groups as the Proteaceae and the Myrtaceae).

Five of the seven sub-genera into which *Solanum* is divided (Hunziker 2001) are found in America, of which two are confined to the Western Hemisphere. One other sub-genus is confined to Africa, and another is found only in Australasia (Symons 1991). *The Flora of Australia* (Haegi *et al* 1982) lists 117 species of *Solanum*, of which 94 are native, and 87 endemic.

Australian Solanums

Solanum species are found in almost all habitats in Australia. Most of the species are ecological opportunists. They come up after fire or other disturbance, from seed or perennial root systems, grow quickly into a small shrub, and live a short number of years (Symon 1981).

Many Australian *Solanums* are notable for their extreme spininess. *Solanum pungetium* and *S. prinophyllum* are annual or short-lived perennial herbs, from the forests of eastern Australia. They are very similar, both having very attractive flowers, deep green shiny foliage, with interestingly sculptured leaves, and extremely sharp spines everywhere. *S. hoplopetalum* (south-west Western Australia) and *S. hystrix* (southern South Australia) even have prickly petals! (Symon 1981). *S. cinereum*, the 'Narrawa Bur', is pictured here, showing the fruit enclosed in its extremely spiny calyx.

Almost all *Solanum* flowers are symmetrical, with five fused petals. Most species world-wide, and all the native Australian species, have purplish or bluish petals, although here are occasional white forms. The shade and intensity of petal colour can sometimes vary with growing conditions, or with the season (Symon 1981). The contrast of the golden colour of the prominent anthers, against the purple of the corolla, makes the flowers very attractive.

Some American species have yellow flowers, and one of these, *S. rostratum*, occurs here as a weed.



Left:
Solanum lasiopetalum
 North of Kalgoorlie WA.
 Photo: Dr M. Henwood



Right: ***Solanum cinnereum***
 Central Coast NSW Photo: Dr A. Perkins
 Below: ***Solanum hoplopetalum***
 North of Kalgoorlie WA.
 Photo: Dr M. Henwood





Above Left:
Solanum aviculare.

Above:
Solanum pungentium.

Left and Below:
Solanum curvicauspe.

All photos taken on the Central Coast
of NSW

Photos: Dr A. Perkins



Subgenus *Archaesolanum*

This section has seven species listed in the Flora of Australia. Four members of *Archaesolanum* (*S. vescum*, *S. simile*, and *S. symonii* and *S. capsiciforme*) are found in south-western Western Australia and southern South Australia. The other three species occur in eastern Australia, and the name 'Kangaroo Apple' is applied to them. *S. linearifolium* is endemic to the south-east corner of the mainland, while *S. aviculare* and *S. laciniatum* are also native to New Guinea, New Caledonia, Lord Howe Island, and New Zealand.

The name '*Archaesolanum*' would seem to suggest that these plants represent the ancestral forms of the genus. Were this so, their distribution would indicate that *Solanum* was of Australasian origin. Alas, this does not appear to be the case (Symon 1979), as cytological studies indicate that they all have the common characteristic of being polyploid (having more than the usual two sets of chromosomes in each cell). Since this is generally unusual both in other sub-genera of *Solanum*, and in other genera of the family Solanaceae, it is evidence against *Archaesolanum* being the primitive form of *Solanum*.

The kangaroo apples have oval berries, about two or centimetres long, green, cream, orange, or bright red. The flowers are purple, up to five centimetres diameter. These species are listed in several books about the horticulture of Australian plants: Dunn (1989) describes *S. laciniatum* as "a very pretty shrub" with "lovely" flowers, while Bindon (1996) writes that *S. aviculare* "has been introduced into gardens... but is of dubious decorative value". These two species are generally very similar and easily confused - the defining difference is their chromosome number, with *S. laciniatum* having twice the number of *S. aviculare* (92 vs 46, whereas most other *Solanum* species have 23). Differences between the plants themselves are quantitative rather than absolute (see Baylis 1966; Macek 1989; Conn 1992), with *S. laciniatum* generally being somewhat bigger and better all round. It seems not impossible that *S. laciniatum* may have originated multiple times from *S. aviculare*, by a simple chromosome doubling.

Kangaroo apples have a tendency to look very straggly, and the floral display is not dense. However, the flowers are attractive, and the plants could presumably be improved by judicious pruning.

The young leaves of *S. aviculare* and *S. laciniatum* are a source of the chemical solasodine, which is used as the basis for the manufacture of steroid pharmaceuticals, such as anti-inflammatory medications and contraceptives (Baylis 1966; Symon 1979; Macek 1989). Plantations and commercial production of solasodine are in New Zealand, Russia and Bulgaria.

The ripe fruits of kangaroo apples are described as edible, in most of the books and papers that mention them. An acquaintance of mine, however, was sick for a week after just biting one. **Explore with caution...**

Continued on page 274

Melaleuca psammophila

Ivan Holliday

Melaleuca psammophila Diels, in Diels & Pritzel

DESCRIPTION: Small, bushy shrub, 0.5–1 m or more high.

LEAVES: 2–8 mm long by 0.5–1.5 mm wide, crowded and spirally arranged; blade features long, sparse, pubescent hairs, contrasting with dense, woollier hairs on branchlets; oil glands prominent; apex obtuse or rounded; 2 shallow channels on under-surface.

FLOWERS: in small, reddish pink heads; yellow anthers conspicuous and style long; heads to 14–25 mm wide, in triads (1–4); hypanthia hairy with very pointed acuminate lobes so that buds often appear rostrate; stamens 7–15 per bundle. Flowering season: September–December.

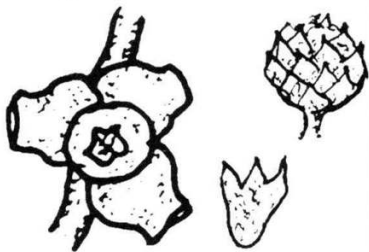
FRUITS: distinctly urn-shaped, in non-globose or peg-like clusters.

DISTRIBUTION: Kalbarri–Geraldton districts of WA, in sand.

DISTINGUISHING FEATURES: Beaked (rostrate) buds; small, sparsely hairy, obtuse, channelled leaves and distinctly urn-shaped fruits.

SIMILAR SPECIES: *Melaleuca bisulcata* F. Muell., also from Kalbarri district of WA, is very close in most features (flower colour, leaf shape and size, etc.) but differs in not having long, acuminate or beaked calyx lobes.

Cultivation: *M. psammophila* has been successfully cultivated in temperate areas (Adelaide, Perth, Melbourne), in soils which are light and well drained, acidic to neutral, in warm sunny locations. Profuse flowering with dense groundcover. The author has no knowledge of *M. bisulcata* in cultivation, but both species would form attractive, small foreground or rock garden shrubs.



Above: Fruits distinctly urn shaped, Buds, enlarged.



Reproduced from *Melaleucas, a field and garden guide*, Ivan Holliday, 2nd edition, New Holland Press. ISBN 1 876334 98 3



Above: *Balaustion microphyllum*

Below: *Balaustion pulcherrimum*

Photos: F. Johnston



Balaustion (Native Pomegranates)

Greg Keighery, CALM WA

Introduction

Balaustion is a genus of two species of colourful shrubs confined to southern Western Australia. Both species are pollinated by nectar feeding birds and have large, prominently displayed, brightly coloured flowers with copious nectar, but with little or no scent. The genus is closely related to, and perhaps not distinct from, members of *Hypocalymma*, such as *H. puniceum*, the major difference being all members of *Hypocalymma* are insect pollinated.

Propagation & Cultivation

Both species strike readily from firm new growth. They require well drained soils in full sun. At Kings Park fresh seed germinates in 45–55 days after sowing, but the seedlings are very susceptible to damping off. *Balaustion microphyllum* has grown well in large containers at Kings Park. Both species are potentially very attractive garden plants.

Descriptions

Balaustion microphyllum (C.A. Gard.) is a low densely branched shrub to 50 cm tall by 50 cm wide, occasionally in cultivation spreading to 1 metre across. Leaves are small ovate, with densely hairy margins. Flowers are clustered at the ends of the branchlets, about 1 cm long in total and often pendulous. The calyx is yellow-green and densely hairy, with the petals bright orange to red.

The species grows on deep red, yellow, lateritic or loamy sandy soils between Yuna, south to the Morawa area and inland to Mellenbye Station in the 200–300 mm rainfall zone. This area has a extra dry to semi-desert Mediterranean climate. Flowering occurs from late winter (July) to early summer (December).

Balaustion pulcherrimum (Hook.) is a prostrate shrub with numerous long branches to a metre long from a woody rootstock. The branches bear short side branchlets which carry clusters of the small linear leaves. The large flowers are borne singly in the new growth at the ends of the branchlets and are up to 2.5 cm long. Both the calyx tube and petals are scarlet in colour.

The species normally grows on deep yellow sandy soils between Latham, south-west to the Bruce Rock/Narembeen area, inland to Boorabbin and the Bungalbin Hills and south to Forrestiana in the 200–350 mm rainfall zone. This area also has a extra dry to semi-desert Mediterranean climate. Flowering occurs from late winter (July) to early summer (December), but peaks from August to October.

Egg-plant relatives

The egg-plant (*S. melongena*) is one of the relatively few economically important species of Solanaceae which does not originate in the Americas. This is the type species of the section *Melongena*, which has members native to north-east Africa, the Indian sub-continent and south-east Asia. The exact wild origin of the cultivated *S. melongena* is uncertain, but possibly in India. Another cultivated species is the African *S. aethiopicum*. World-wide, egg-plant has the position of third most important vegetable crop (even though it is a fruit!) in terms of tonnage of production.

Twenty-one species in section *Melongena* are listed in the *Flora of Australia*. Of these, two are naturalised exotics, a third is endemic to Eastern Australia, and 'not closely related to other Australian species'. The other eighteen species are all endemic to an area of northern Australia from the Gulf of Carpentaria across to islands off the north-west coast of Western Australia.

This pattern of distribution suggests a *relatively* recent dispersal of this group into Australia from south-east Asia. This account of present distribution differs from that which probably applies to most other native Australian Solanaceae, that they are here because of the ancient inclusion of Australia in the 'Gondwanaland' super-continent, along with South America (and India, which might have carried the ancestral *Melongena*).

As well as the geographical history of the group, the north-west Australian members of section *Melongena* have an interesting story in the form of their sexual reproduction.

Most species of flowering plants, and most species in the genus *Solanum*, are bisexual – they have 'perfect' flowers which have both male and parts. A number of *Solanums* are **andromonoecious**: they have an inflorescence in which some of the flowers are perfect, while some have only male functions. This phenomenon would appear to have arisen several times independently in the genus.

Nine of the north-west Australian *Melongena* species are andromonoecious. Most of the other andromonoecious species of *Solanum* have varying numbers both of male and female flowers, which changes with the developmental stage of the plant; the Australian species are peculiar in having only a single bisexual flower at the base of the inflorescence.

The other nine species of *Melongena* in the area are fully **dioecious** - that is, their male and female functions are separated to different plants. There are no other fully dioecious species known in *Solanum*.

Australian *Solanum* species in cultivation

Solanum stelligerum, 'The Devil's Needles' grows in the wet forests of Eastern Australia. Despite its common name, it is not nearly so fearsome as many other species. Symon (1981) relates that this species was brought into cultivation as an ornamental in 1792.

The kangaroo apples, as ornamentals, and as sources of pharmaceuticals, have been mentioned already. There are several varieties known, which may be 'cultivars' (Symon 1981).

The 'Bush Tomato' (*Solanum centrale* - and possibly several closely related species) has long been an important food for indigenous people in Central Australia. The berries desiccate on the plant, and are thus preserved indefinitely. There are two traditional methods of storing and transporting bush tomatoes that are notable. One is to skewer fruits on a stick, like a kebab, before they become dry. Another is to grind the dried fruit, and press the material into cakes. These cakes can be later reconstituted with water to form a kind of tomato paste. Recently, bush tomatoes have been cultivated commercially, and sold by specialist 'bush tucker' providers.

One common problem with the cultivation of native Solanums is very low germination rates. This was noted by Symon (1981), who cultivated many native species at the Waite Agricultural Research Institute; techniques for encouraging germination are also currently under investigation at the Royal Botanic Gardens, Mt Annan. It may be that, as is the case for many Australian natives, seed dormancy is an adaptation to the ecological opportunist niche, especially in relation to post-bushfire germination; it may also be the case, as has been found for many American Solanaceous species, that there is a requirement for partial digestion by animal (particularly bird or reptile) seed dispersers.

The cultivation, and 'improvement', of the attractive *Solanum brownii* (Violet Niteshade) is the subject of the accompanying article.

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Solanum brownii in Horticulture?

Exploring the Horticultural Potential of Native Australian Flowering Shrubs in the *Solanum brownii* Group

Adam Marchant, Andrew Perkins, Gillian Towler and George Orel

Solanum brownii (Violet Niteshade) and its relatives are native to eastern NSW, extending into the south-east corner of Queensland, and the eastern tip of Victoria. They are perennial shrubs, and have very attractive and unusual blue or purple flowers up to four centimetres diameter. They have been used to a limited extent as a garden ornamental (Wrigley and Fagg 1996).

Their exploitation by the nursery industry is limited by their having prickles, which makes them less desirable for most customers, and awkward to handle for nursery workers.

However, compared with other native *Solanums* also with attractive flowers, *S. brownii* (broad sense - see below) has generally fewer spines, and there is a wide range of variation in prickliness in the wild. There is also variation in flower colour and size.

The '*Solanum brownii* group' has recently been revised taxonomically by Bean (2001). This author recognises ten species, in a group that has been covered by earlier authors with the species names *S. brownii* and *S. cinereum*.

Bean recognises eight species that may have been subsumed under a broader definition of *S. brownii*, and two species (*S. cinereum* and *S. nobile*) that may have been classified as *S. cinereum*.

Bean's use of the term '*Solanum brownii* group' implies that these ten species are more closely related amongst themselves than it is to others. However, the treatments of *S. brownii* and *S. cinereum* in Symon's 1981 monograph, and in the (1982) *Flora of Australia*, put these two species in different (and non-adjacent) sections, *Oliganthes* and *Melongena*.

A connection between *S. brownii* and *S. cinereum* has however been noted before: 'In northern areas the leaves [of *S. brownii*] become more deeply lobed, and plants approach *S. cinereum*' (*Flora of Australia* vol 29, p 159); and '[*S. cinereum*] does not appear to be related to other Australian species of *Solanum* except perhaps *S. brownii*' (Symon 1981, p 260).

S. cinereum is widespread on the western slopes of the Great Dividing Range in NSW. It is an extremely prickly plant, and so probably not of interest to us for horticultural purposes, although it is possible that it may have valuable properties to contribute to hybrids.

This is a new project which aims to develop the horticultural potential of native Australian flowering shrubs in the *Solanum brownii* group. It is being funded by the Australian Flora Foundation.

Solanum nobile occurs on the Northern Tablelands of NSW. It is described as less prickly than *S. cinereum*, and having an 'impressive floral display' (Bean 2001, p 646). This species is of 'vulnerable' conservation status, due to competition from the weed *Lantana*.

The eight other species, *S. curvicaule* (whose flower is illustrated on the first page of this application), *S. brownii*, *S. amblymerium*, *S. limitare*, *S. silvestre*, *S. armourense*, *S. celatum*, and *S. neoanglicum* occur in different regions on the eastern coast or tablelands of the Great Dividing Range. It is these eight species which we intend to concentrate on in this project. Five of these eight species have a 'vulnerable' or 'endangered' conservation status. Threatening processes noted by Bean (2001) are changes in land use patterns, competition from *Lantana*, and 'deliberate destruction by ignorant people who think that any prickly plant is a weed' (Bean 2001, p 642). This illustrates a point about native Solanaceae - their Australian-ness is not popularly recognised.

We are looking for natural variation, especially in important characters, such as flower size, colour, and reduced prickliness. Propagating material - both cuttings and seeds - are being collected from wild plants, and grown and assessed in the nursery of the Royal Botanic Gardens in Sydney, and the University of Western Sydney at Richmond.

Our collecting expeditions will incidentally yield valuable information about the natural distribution, abundance, and health of populations of the various species.

We intend to set up a cross-breeding program, and hopefully will develop cultivars which enhance the natural beauty of these flowers, and which are suitable for growing in Australian gardens.

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Eyre Peninsula

In this article we wish to give you an overview of the native vegetation of Eyre Peninsula, South Australia. Here one may see the northern side of an established sand dune ablaze with flowering *Templetonia retusa*, or unexpectedly come upon a large patch of a metre high *Thryptomene micrantha*, or drive into an open area and behold a carpet of yellow everlastings, and more.

C. Twidale, in the Natural History of Eyre Peninsula, states:

To understand the vegetation of Eyre Peninsula it helps to remember that the west coast of Eyre Peninsula was once seafloor. Extensive aeolian dune sands, alluvial sands, silts and conglomerates, and often very tough calcareous layers form a thin veneer rarely more than a few metres thick covering almost the entire Eyre Peninsula.

The Eyre Peninsula stretches from approximately latitude 31°S to 36°S and is bordered on the east by the relatively calm waters of Spencer Gulf, while the west coast is pounded by the full force of the Southern Ocean. The northern boundary is roughly the Gawler Ranges. The waters of Eyre Peninsula are harvested for tuna, prawns, oysters and whiting, with crops of wheat, oats, barley, lupins and canola thriving (in a good year) inland, on soils once considered impoverished due to mineral deficiencies. Sheep and cattle are also economically important. Like so many areas in Australia weeds, salinity, lack of good water and housing developments are causing problems.

However, compared with other areas in SA there are large sections of native vegetation found in National and Conservation Parks, Reserves, Heritage and private properties; also some roadsides both sealed and unsealed. The vegetation of Eyre Peninsula makes a transition between Western Australia and the eastern States, sharing many species in common. It looks its best in August/September with a succession of flowers from July through to October. Soil types have a great bearing on the plant diversity, while rainfall which varies from a 'drought-proof' 50 mm on high ground in the south to less reliable and lower falls towards the east, north and north west hence less dense vegetation. The profusion of flowers in spring is very dependent on local rainfall.

Southern Section

When considering native vegetation, Eyre Peninsula may be roughly divided into three sections - west, centre-east and south - with mallee as the dominant plant community. Within this vast community are many mallee species common in all sections - *Eucalyptus oleosa*, *E. porosa*, *E. socialis*, *E. odorata* and *E. gracilis* - all very difficult for amateurs to distinguish, while others grow in specific areas.

The Eyre Peninsula has been described as one of the best places to see wildflowers in South Australia. We asked the local branches of the 'Society to produce an article.

For example, *E. albobpurpurea* showing its pretty purple flowers in the south competes with the Cummins Maliee (*E. peninsularis*) with its yellow flowers.

There are taller eucalypts mainly on the higher ground in the south, namely, cultivar *E. cladocalyx* 'Nana' and the endemic *E. petiolaris*, which grows along creek lines and in gullies. The cream through to deep red flowers of the latter are much favoured by lorikeets and honeyeaters, which discard them in profusion beneath the trees. There is also a small patch of *E. viminalis* subsp. *cygnetensis* south of Port Lincoln, browsed on by introduced koalas. Like elsewhere in Australia, *E. camaldulensis* var. *camaldulensis* is found along water-courses and that is the western side on Eyre Peninsula.

Growing amongst the eucalypts are approximately forty *Acacia* species throughout Eyre Peninsula. In the south the endemic *Acacia gillii* grows in undulating open mallee scrub and on roadsides. *A. imbricata*, also endemic, is restricted to a small area north of Port Lincoln in the Koppio and Tumby Bay Hills and competes with the graceful branchlets of the more widespread *A. triquetra*. The low growing *A. continua* often seen on roadsides may be surrounded by the blues of *Dampiera rosmarinifolia*, *Halgania cyanea*, *Scaevola linearis*, the stunning *Cheiranthra alternifolia*, taller native *Alyogyne huegelii* and purple *Melaleuca decussata*.

In Coffin Bay National Park, 40 km north-west of Port Lincoln, there is a slight shift from mallee dominance to she-oak woodland, *Allocasuarina verticillata*, which has been considerably reduced by grazing in an earlier era, and by excess kangaroos, feral horses and rabbits. Within fenced enclosures, however, attempts to re-vegetate sheoaks at Yangie Bay by the Friends of the Park Group, and the 4WD Club project at the western end of the park have been spectacularly successful, with under-storey plants such as *Stipa*, *Danthonia* and *Myoporum* reappearing. Regeneration along the western coast from Mt Hope towards Streaky Bay has not been a success as all stock, kangaroos and rabbits like young sheoaks. Despite the lack of sheoaks there are many areas of healthy and varied under-storey hidden from sight of the Flinders Hwy amongst the mallees and Melaleucas that have been retained on private properties.

The southern coastal heath ecosystem is an exciting area to explore. Travel south from Port Lincoln along the Fishery Bay Road, (the front cover shows a specimen of *Pterostylis erythroconcha* found at Fishery bay) which has dense patches of *Xanthorrhoea*, *Leucopogon parviflorus*, *Hibbertia* species and *Daviesia brevifolia* to the cliff top. There you will find a great diversity of species often wind pruned into rounded shapes. Within such growth there may be up to ten or so species intermingled. There are also fantastically elongated, twisted and tortured old stems or trunks of mallee or *Leucopogon* with just a little flourishing growth on the lee side, interspersed with *Correa*, *Pomaderris* and *Leucophyta brownii*. This coastal heath ecosystem and superb coastal scenery continues westward along the privately owned Whaiers Way, to the east in the Lincoln National Park and at intervals up the west coast.

Much dense vegetation grows along some other roadsides out of Port Lincoln, for example Warunda, Strawberry Hill, Duck Lake and Settlers roads, and also in conservation parks and reserves. Understorey plants of Acacias, Hakeas, *Grevillea ilicifolia*, *Leptospermum coriaceum* and South Australia's only Banksias, *Banksia ornata* and *B. marginata* thrive. Continue on from this area to Wanilla Reserve, where amongst the pea-flowered Pultenaeas, Dillwynias, Eutaxias and Daviesias you may find native orchids, such as *Arachnorchis stricta*, *Caladenia latifolia*, *Pheladenia deformis*, *Pterostylis dolichochila* (see back cover) and *Pyrorchis nigricans*. Other places to visit for keen orchid spotters are Murray's Point and the Parnkalla Trail near Port Lincoln.

Unfortunately southern Eyre Peninsula is beset with some plants not wanted at all. The rampant infestation and rapid spread of Bridal creeper (*Asparagus asparagoides*, prev. *Myrsiphyllum asparagoides*) smothering native plants is a big problem. Glyphosate spray can control it in gardens, but this is not feasible in bushland; and birds spread the seed. Several years ago leaf hoppers and a rust fungus were introduced to attack the leaves, but despite some localised success the plant's spread has not been curtailed. A similar plant, Bridal Veil (*Asparagus declinatus*) has emerged in Port Lincoln and may be even more difficult to eradicate because of its larger rhizomes and finer leaves, making spraying more difficult. Aleppo pines, (*Pinus halepensis*), declared a pest plant in southern Eyre Peninsula, thrive in the higher rainfall. Though mature trees are removed, the regeneration of the myriad of seeds dropped makes their control an ongoing job. Garden escapees - Freesias, Gazanias, *Acacia cyclops*, *Polygala myrtifolia* and others spreading into parks and reserves also pose an increasing problem.

Centre - Eastern Section

The sheltered eastern side of Eyre Peninsula has some extensive mangrove areas and associated samphire flats (comprises *Halosarcia*, *Sclerostegia*, *Sarcocornia* spp. etc. -ed.) , notably at Cowell, Arno Bay and Tumby Bay. There are fewer weeds in these areas.

Recently an excellent board walk has been constructed at Arno Bay, which takes one through the mangroves, out across the samphire Flats and then out onto the sand dune ridges dominated by *Callitris*. The return board walk crosses another channel and back to the carpark. There is another board walk at Tumby Bay and this one ends at a bird hide amongst the mangroves.

Now travel inland towards the hills surrounding Cleve where among mallees and Melaleucas are thriving species of acacias including *Acacia praemorsa*, *Grevillea aspera*, *Dodonaea* spp., *Hakea* spp. and orchid surprises.

From the town of Kimba in the central northeast of Eyre Peninsula, roads radiate out in all directions to and through areas of botanical interest and the local Australian Plants Society group can always find a new area to visit and enjoy on their monthly outings.



Eremophila alternifolia
Chandala - Pt Kenny area
Photo: E Carey



Hakea francisiana
Chandala - Pt Kenny
area Photo: E Carey



Templetonia retusa
Poochera Photo: E Carey



Lasiopetalum baueri
Kimba Photo: M Leiblich

There are five Conservation Parks and fourteen Conservation Reserves within a 65 km radius, as well as the new Gawler Ranges National Park to the north west. The range of vegetation is therefore very diverse with the mallee heath in the agricultural areas, the semi arid mallee landscape in the transitional zones of Lake Gilles and the Gawler Ranges as well as the granite hills of Carapsee and Caralue Bluff to the south west.

Most roadsides retain good amounts of vegetation, although unfortunately some have been widened to accommodate farm implements. This has resulted in the loss of some vegetation. There is one three chain road which the local council, having been petitioned by the local APS group, has retained as a roadside with significant value of flora. This is Whitwells Road 21 km from Kimba off the Cleve road. It is considered to have a very wide range of plants representing the sandy mallee heath country.

Southwest of Kimba, Caralue Bluff and Carapsee rise from the surrounding farmlands. Carapsee is the highest and most extensive granite hill on Eyre Peninsula. Here the vegetation varies from lichens on rock faces and aquatics in temporary pools to dense patches of mallee and tea tree. It contains elements of the southern heathland such as *Astroloma*, *Baeckea*, and *Boronia* as well as some of the drier mallee and northern flora like *Senna* and Bullock Bush (*Alectryon oleifolium* subsp. *canescens*). Of particular interest are the Darke Peak mallee (*Eucalyptus cretata*) growing at the base and on the roadside near Darke Peak, *Anthocercis anisantha*, which is confined to Eyre Peninsula and two forms of *Indigofera australis*.

Kimba is the eastern gateway to the Gawler Ranges, part of which, taking in Paney and part of Scrubby Peak Stations, has now become a National Park. On a recent campout there it was good to see the recovery of many plants and trees now that sheep and fewer goats are no longer inhibiting their growth. Even the old bullock bushes were sprouting along their aged trunks. It was exciting to see the rare Crimson Mallee (*Eucalyptus lansdowneana* subsp. *lansdowneana*) flowering and there were so many *Acacia iteaphylla* flowering we wondered why they are called Flinders Ranges wattles. Over 400 species have been recorded in the park with 20 considered rare or threatened.

Just 20 km north east is the Lake Gilles Conservation Park through which the highway passes. From early spring both sides of the highway are usually very colourful with *Senna*, then various acacias and later *Melaleucas* in full creamy-white flower. All this is interspersed with the dark green of the native pines in places and the many small plants in flower. The park is a popular area for bird-watching and those seen may include the rare mallee fowl, Rufous Treecreeper, Gilbert Whistler and Turquoise Wren.

Samphires fringe the salt lakes and these are bounded by mallees, pines and Western Myall (*Acacia papyrocarpa*), with Bullock Bush and native grasses on the gypsum dunes. Here also are areas of mallee and bluebush, mallee and Tea Tree, Myall and Blue bush. Mallee scrub communities exist on the southern side where many small plants flower in spring. *Hakea francisiana* is well represented on the sandy ridges.

On the rocky rises, (O'Connor Hill for example) on the south of the highway native pine, black oak and False Sandalwood grow amongst *Dodonaea*, *Geijera* and *Eremophila* species.

Pinkawillinie Conservation Park, the largest on Eyre Peninsula lies 65 km west of Kimba where white sand hills are the dominant landform with a cover of various mallees, *Callitris*, *Triodia*, a wide range of *Hakea*, *Grevillea* and *Melaleuca*. In the northern section *Myoporum*, *Santalum*, *Casuarina* and Western Myall are found. Of special note are the beautiful *Hakea francisiana* and *Grevillea juncifolia*.

Western Section

Further west beyond Pinkawillinie Conservation Park is marginal farmland. Here the summers are hot and dry, with frosts in winter and 250–375 mm of rainfall, yet on sand hills north of Yaninee, for example, there is a treasure-trove of Australian plants to be found on private property - *Leptospermum coriaceum*, *Glischrocaryon behrii*, dune *Grevillea pterosperma*, *G. juncifolia*, the Sand Sage (*Dicrastylis verticillata*) and the rarely seen in this area, endemic *Pimelea subvillifera*, to name just a few. On the red soils of the plains there are *Melaleuca leiocarpa*, large dense shrubs with loose fluffy yellow flowers by low growing plants like *Ptilotus obovatus* var. *obovatus*, the leafless *Bossiaea walkeri*, the bright herb *Waitzia acuminata*, and beneath the mallees yellow and white everlastings. On to Pildappa Rock to find *Kennedia prostrata* under *Acacia beckleri*, *A. hakeoides*, *Dodonaea viscosa* ssp. *angustissima* with *Muehlenbeckia adpressa* scrambling over *Enchylaena tomentosa* and other species.

From Poochera, a town west of Yaninee, south to Port Kenny much of the moderately well-vegetated intervening mallee country is under Heritage Agreements forming a corridor for native fauna and conserving plants such as the dominant mallees, *Melaleuca lanceolata*, *Myoporum platycarpum*, *Exocarpos aphyllus*, *Scaevola spinescens* and *Westringia rigida*.

On unsealed roadsides a generous variety of species may be seen from tiny *Droseras* to *Correas*, *Boronias*, *Baeckneas*, love-creeper *Comesperma volubile*, and twining *Billardiera cymosa*, *Acacias* and *Sennas*. Where there has been no disturbance from road-works and no introduced weeds, orchids may be seen on roadsides in the area bordered by Streaky Bay, Calca, Port Kenny and Poochera, some in isolated patches, others widespread, *Caladenia* spp., *Pterostylis* spp., *Genoplesium* spp. and more occur.

Conclusion

Partly due to its isolation from agricultural development in early settlement days and now with the keen interest in Australian plants rare and endangered species are still being discovered on Eyre Peninsula, making it a truly interesting place to live and to visit.

Contributions for this article were received from Mary Kammerman of Wilmington, Mary McCormack of Poochera, Ellen Carey of Chandada, May Leiblich, Lyla Francis; Thelma Eatts of Kimba, Kimba APS group, Hazel O'Connor of Greenpatch, Janet Smyth of Coffin Bay, Colin Gill, Jane Hutchinson and Isabel Smith of Port Lincoln.

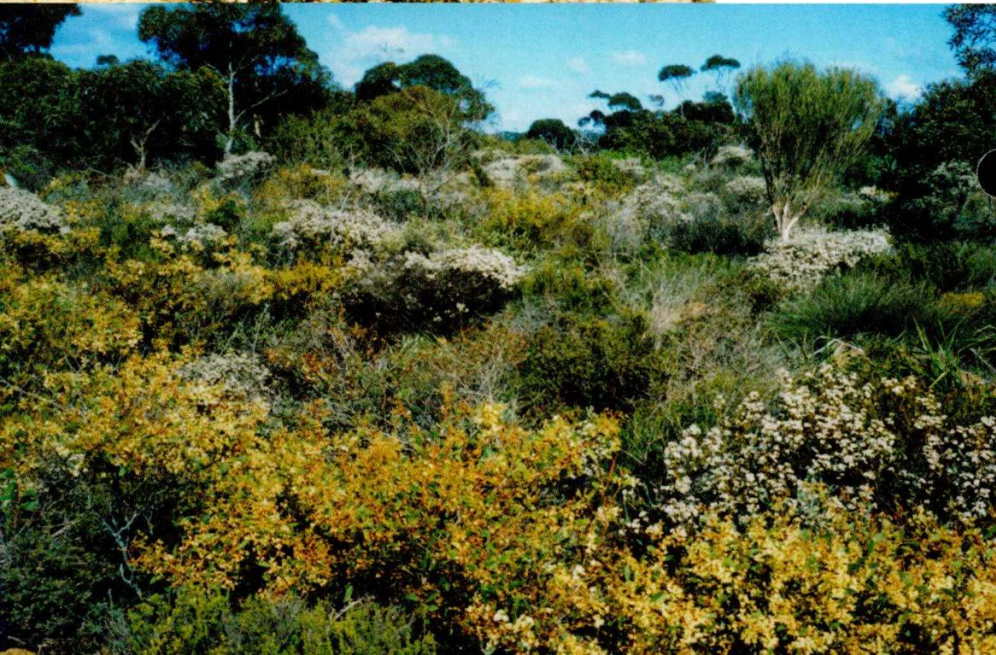


Above:
Revegetation contrast
in Coffin Bay N.P.
Photo: J Smyth



Left:
Lomandra
leucocephala at
Minnipa
Photo: M Kammerman

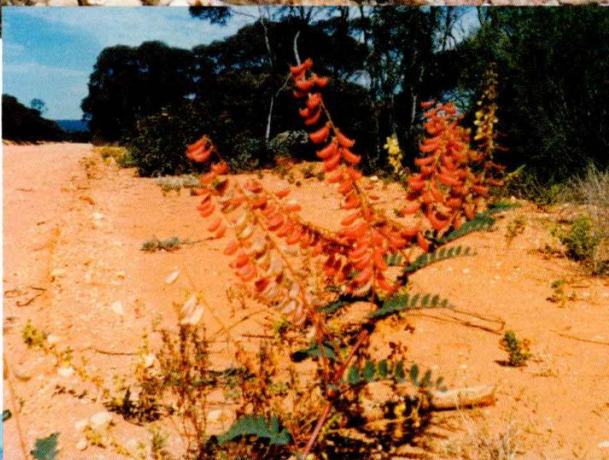
Below:
Species diversity at
Vanilla
Photo: J Smyth





Above:
Leucophyta brownii at Elliston
 Photo: J Smyth

Right:
Swainsona laxa - Whyalla Rd
 near Sinclair Gap
 Photo: L Francis



Below:
 Everlastings cover the Gawler
 Ranges
 Photo: T Eatts



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