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Editorial

_____ Manfred Wagner, Convenor - Publishing Committee

This edition carries a belated valediction to Alec Blombery, a stalwart of the cause of growing Australian plants, a prolific author and frequent contributor to this magazine. We are seeking a sponsor to preserve his slide collection.

Not taking water for granted: Currently a large part of Australia still remains in the grip of drought, although meteorologists are predicting widespread relief in the near future. Readers in towns and capital cities whose gardens have been decimated as a result of restrictions imposed should spare a thought for those that have had to truck water in, just to survive. (Ironically, the water our household had carefully saved during the restrictions was almost exactly that used for fire suppression when the bushfires came!) Drought is part of Australia's environment and with global warming the effects in some areas are predicted to become even more extreme, although the east coast is supposed to become wetter.

Given there is a standard for potting mixes, that each major electrical appliance comes with an 'efficiency' rating and cars are rated on fuel consumption, it is unfortunate that plants available at nurseries do not universally come with 'standard water use' ratings. Much of Australia's flora is well adapted to low water availability, which is one of several reasons why it should be used in gardens - in preference to exotics.

The experts suggest that Australia should be able to sustain a population of 50 million people (2.5 times that of current). While they may be right, I fail to see how this is possible with no new dams proposed and increasing urbanisation/farming of potential catchments. If part of their equations is the reduction of per capita consumption, then lawns may become a 'thing of the past' and water miserly plants will be in demand.

Maybe it is time the horticulture industry added 'drought tolerance' to their list of factors used in planting trials and added the rating to the plant labels.

Articles and photographs for this magazine and a new editor are sought.

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Front cover: *Placospermum coriaceum* - photo Jamie Plaza - see page 64.

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Bringing It Back:

The Wetlands Centre Story

Griff Foley, Newcastle APS District Group

Over the past 18 years Newcastle APS members have helped to restore a major wetland at Shortland to the north of the city, which had first become a garbage dump and then a football field. APS members and other volunteers have weeded, propagated and planted 34,000 natives. The Wetlands Centre is now a major environmental education facility which, with nearby Kooragang Island Reserve and in November 2002 achieved Ramsar listing, the wetlands equivalent of World Heritage status.

Paddy Lightfoot, a Life Member of NSW APS, a man whose passion for Australian plants enthuses others and has driven APS's involvement in Wetlands Centre. He says that 'we probably have to thank the breathalyser for saving the wetlands'. The Marist Brothers moved their rugby club to Shortland just as the police introduced random breath testing. Club membership fell away. In 1984 Max Maddocks, a local academic who agisted horses at Shortland, learned that the rugby club was for sale. Max and others persuaded Newcastle City Council and the RTA to drop plans to reopen the garbage dump and re-route a highway through the wetlands. The federal and state governments funded the purchase of the Marist Brothers' land and two adjacent blocks - 45 hectares in all. In 1985 the Shortland Wetlands Company, a non-profit corporation, was formed to manage the wetlands. The name has since changed to The Wetlands Centre (TWC). Paddy Lightfoot joined the board of directors as the APS (then known as SGAP) representative. He's been a member ever since. APS insisted that only natives are planted on the site, and this is enshrined in the TWC articles of association. This aim has been implemented through TWC Site Management Committee, on which APS currently has two out of ten members.

Initially, a flora inventory was undertaken to try to determine what plants were originally on the site. The site was then divided into three broad areas. Plants from anywhere in Australia were planted around the Visitors Centre (see site map). Hunter region flora was planted around two ponds built to attract birds. The rest of the site was planted with species local to the area. Later, a fourth area was added, a remnant rainforest along Ironbark Creek where an outdoor classroom had been constructed. Here Australian rainforest species have been planted as a student resource.

The site was further divided into 23 zones and a database developed to record plantings by locality, species and number. Initially, plant tube-stock was purchased. Then Rotary and the Department of Public Works provided a shade house, poly-house and holding benches. Today most plants are grown on site, however some tube-stock is still bought. This is on-sold at the Newcastle APS group's three major fund-raising events: World Wetlands Day, Total Small Farm Field Day and the Newcastle group's Spring Wildflower Spectacular. Plants are sold to the public on Thursday mornings.



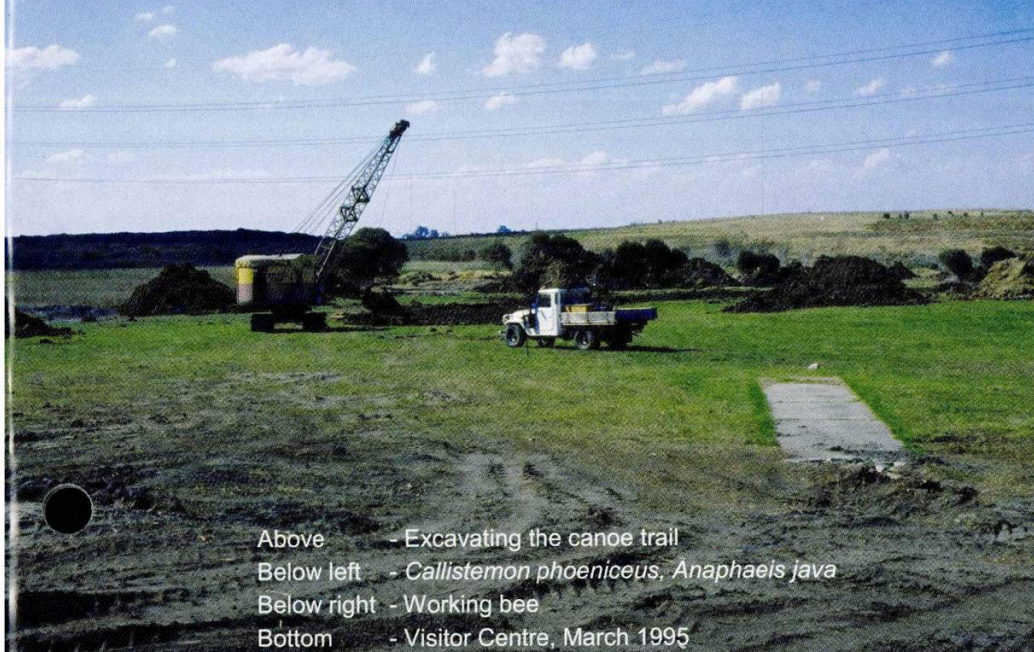
Above - Rugby Union building at take-over, 1986 (now the Visitor Centre)



Left - Aerial view of The Wetlands Centre, 1990

Below - Pond Excavation, June 1986
All photos on both pages Paddy Lightfoot





Above - Excavating the canoe trail
 Below left - *Callistemon phoeniceus*, *Anaphaeis java*
 Below right - Working bee
 Bottom - Visitor Centre, March 1995



TWC is the major environmental education facility in the Hunter, visited each year by 8,000 school students and 20,000 other visitors. It has eight staff, including two full time teachers, an accountant and a CEO who spends most of her time raising funds to plug the annual funding shortfall of around \$50,000. TWC would not be able to function without voluntary labour. In the early years Saturday morning working bees of up to 50 people planted up to a thousand tube-stock. All together, about 140 volunteers currently work in the wetlands. Since 1992 a group known as the Thursday Mob, most of who are APS members, has worked at the wetlands every week, weeding, planting and propagating.

The Thursday Mob weeds and plants in manageable sections, firmly establishing one area before moving on the next. The volunteers mulch new plantings with newspaper and wood chips. New plants are watered for a few weeks, but after that it's the survival of the fittest. Inevitably, because of the size of the project and its dependence on volunteer labour, in long dry periods some plants die.

The task of regenerating the Wetlands is huge. As Paddy puts it, 'I feel we have every weed introduced to Australia, since 1788, within our borders!' Predominant weeds include pampas grass (now virtually eliminated), kikuyu ('a menace', says Paddy, 'hard to eradicate'), lantana, bitou bush, madeira vine, blackberry and moth vine. Clearing and planting is hard work, especially in summer when heat is compounded by mosquitoes and ticks. But, the volunteers' enthusiasm keeps the work going, even in driving rain. 'They can see the results of their work', says Paddy. 'It was a derelict lantana-covered dump. Now we see all that we've planted growing up, and it keeps us going'. The social contact and the delicious slices provided over many years by propagation group member Val Walker, also helped.

The wetlands are continually developing. Initially, Brambles and BHP excavated the old rugby field to create two large ponds, which have attracted a variety of birds. A grant from the Steel Industries Assistance Program enabled the purchase of twenty canoes for hire, construction of a canoe shed, and excavation of a canal linking the Visitors' Centre to Ironbark Creek, thus creating 7.5kms of waterways navigable by canoe. The canoe trail has been planted with Ironbark Creek species so that it is now a natural extension of the creek, replacing stark excavated clay banks. Species planted include *Casuarina glauca*, *Crinum pedunculatum*, *Ficus coronata*, *Elaeocarpus obovatus*, *Callistemon salignus*, and several species of *Melaleuca*; *M. styphelioides*, *M. quinquenervia*, *M. nodosa*, *M. linariifolia* and *M. ericifolia*.

As well, 1,500 *Casuarina glauca* have been planted as a forest with a winding path. Visitors can hear the wind amongst these trees - a great Australian experience.

There is a small 'Wallum' zone with plantings of *Blandfordia*, *Callistemon citrinus* and *C. pachyphyllus*, *Gahnia sieberiana*, and *Banksia robur*. A belt of 3,000 trees forms a wildlife corridor running from the Melaleuca Swamp, near the buildings, down to Ironbark Creek. Local *Eucalypt*, *Acacia*, *Leptospermum*, *Ficus*, *Syncarpia*, *Alphitonia*, *Callistemon*, *Casuarina*, *Melaleuca* and many other genera are established and growing rapidly.

As you approach the Centre from Sandgate Road, you drive through an avenue of *Casuarina cunninghamii* and *Eucalyptus microcorys* that have reached an imposing height.

In 2002 a National Heritage Trust grant funded the excavation of three large frog ponds. Newcastle Rotary fenced the site and the Thursday Mob planted native grasses around the ponds: *Gahnia sieberiana*, *Carex appressa*, *Juncus kraussii*, *Juncus usitatus*, *Lomandra longifolia*, *Baumea articulata*, *Themeda triandra*, *Eleocharis acuta*, and *Danthonia* sp.

A few clear thinking and hard working people have driven the regeneration of Shortland Wetlands. In 1985 they brought local councillors and state politicians on site visits to persuade them of the merits of what was then a dream. In 1985, NSW Premier Neville Wran came with all his relevant ministers. Immaculately turned out as usual, Wran balked at wading into the mud. Someone ran down to the local Woolworths and bought him a pair of \$13 gum-boots. Wran saw the wetlands, and on request autographed the gum-boots, which were later auctioned, raising \$230.

In October 2002 150 APS members from Sydney, Central Coast and the Blue Mountains visited TWC. Many who had seen TWC in earlier years expressed their astonishment at the transformation. Degraded land has been restored to something like its original condition. The larger trees are now so tall that surrounding roads and houses can no longer be seen. Bird life has increased dramatically and local species like Whipbirds, Eastern yellow robins and Black cockatoos, exiled by the dump and football field, have returned.

The Newcastle APS group holds its well-attended meetings in The Wetlands Centre. As well as providing voluntary labour and thousands of plants, the group has donated funds for various projects. In April 2002, APS - NSW Region made a Lisle Pearce Memorial Award of \$6,200 towards the cost of the Wetlands Interpretative Trail.

The APS's work in the wetlands has been recognised by Paddy Lightfoot being awarded the runner up trophy in the ABC's 1999 Australian Gardener of the Year competition. TWC was featured on the ABC program Gardening Australia, providing great advertising for the Centre, the APS and native plants. TWC is also a major eco-tourism attraction, featuring in Hunter Valley tourism advertising and the Lonely Planet - the Backpackers' Bible.

APS members are welcome to visit the Wetlands. Entry fees are adults \$4.50, children \$2.00, concession \$3.00 and family \$9.00. There are tracks to walk, barbecues, picnic shelters, waterways to canoe, birds to watch - 40 species alone around the Visitors Centre. TWC is open 9 a.m. to 3 p.m. on weekdays and 5 p.m. on weekends except the Christmas week and Good Friday. Guided tours and breakfasts for groups, at a very reasonable rate, can be arranged through the Visitors Centre manager on (02) 4951 6466 or fax (02) 4950 1875.

WILDFLOWERS AT THE WETLANDS - Saturday & Sunday 30th & 31st August 2003. Entry \$5. Wildflower displays, native plant sales, environmental talks and activities, hot food and light refreshments and fun for children. For more information phone Janelle Harvey (02) 4957 5195 or 0419 918 543, or Carolyn Gillard (02) 4957 1392.

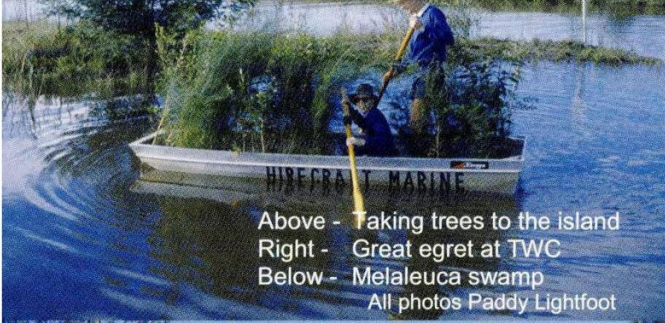
This article was written by Griff Foley, drawing on a draft paper by Paddy Lightfoot and an interview with Paddy (28/11/02).



Above - Completed canoe trail
 Right - Planting water plants
 All photos Paddy Lightfoot



Alec Blombery & Betty Maloney
 Photo Joan Wallace



Above - Taking trees to the island
 Right - Great egret at TWC
 Below - Melaleuca swamp
 All photos Paddy Lightfoot



Alec Blombery's Legacy

Cynthia Leech

Alec Morris Blombery, who died on the 11th September 2002, is sadly missed by his many friends both in the Australian Plants Society (APS) and the Stony Range Flora Reserve where he worked with so much energy and enthusiasm over a period of 45 years. His dedication to the range was kept up until a few weeks before his death. Although for some time suffering ill health, nothing was going to keep him away from his beloved Range, which he said 'kept him going'.

The June 1973 bumper edition, 64 pages rather than 48, of Australian Plants (Vol. 7 No.55) was entirely given over to the Stony Range Reserve and was a regular contributor to Australian Plants.

He joined Stony Range in 1956 after giving a talk on native plants to the members of the Warringah Fauna and Flora Society, who were the voluntary workers at the Range. His position as Building Inspector for the Rural Bank made him eminently suitable to be appointed Honorary Building Supervisor of the Range in 1960. He was responsible for the building of the meeting room and development of paths, bridges, ponds, fences and nursery area. However it was his knowledge of native plants, their ecology and propagation that was such a great asset and in 1962 Alec was put in control of all planting and remained so until his death. One of his greatest achievements was the planting of the beautiful rain forest, which must have been a great challenge in coastal Dee Why particularly in an area that was originally a quarry.

He was a keen skier, surfer and bush-walker and served in the army in New Guinea during WWII. He was not an academically trained botanist and had not really taken an active interest in native plants before the age of 40. It must have been due to these activities, an enquiring mind and amazing powers of memory recall that he became an acknowledged authority on native plants.

He published his first book: *Native Australian Plants, Their Cultivation and Propagation* in 1955, then in 1967: *A Guide to Native Australian Plants* followed by *What Wildflower is That?* in 1972. Since then there was a steady stream of books - the last one *Native Plants for Balconies, Courtyards and Townhouses* was published in 2000 - see review in *Australian Plants* Vol. 21 No. 169 December 2001 pp 195:196. He was even contemplating another book on pests and diseases a few months before his death. He wrote 20 books in all, many in association with Betty Maloney, a well-known botanical artist who passed away on 28 July 2001. Their limited editions book *The Proteaceae of The Sydney Region* being an acknowledged classic. Together they made many trips around Australia researching for their books - writing and photographing.

Alec has left a marvellous legacy to the Australian Plants Society: his entire slide collection consisting of over 16,000 images. Including Betty, in the 1970's he toured with other plant enthusiasts notably Peter Hind, leader of the

ASGAP Fern Study Group, on a trip of Cape York. Alec's particular interest on that occasion was the orchids of the rainforest. He was even planning a trip to North Queensland for June 2002, although he could barely walk - his energy and determination was legendary.

He joined the Australian Plants Society (then known as the Society for Growing Australian Plants) in the early days 30+ years ago and became Region President in 1977 and held the position for several years. He remained an active member of the Warringah Group of APS and was highly esteemed by its members - being in latter years our local 'National Treasure'.

Alec was an inspiration to those who had the opportunity to work with him over the years and was always keen to impart his knowledge. He remained youthful in his outlook and was just as keen to learn as to teach.

It is through his books that he reached a much wider public, influencing several generations of Australians to take a greater interest in native plants, which in turn has had the political spin-off in the growing awareness of our environment and the 'Green' movement. The books and Stony Range are a marvellous memorial to a delightful and remarkable man.

Alec Blombery's Books (a non-comprehensive list)

- *Native Australian plants: their propagation and cultivation*, Angus & Robertson, 1955
- *Australian native plants*, Sydney: Angus and Robertson, 1977 (Rev. ed.). First edition published as *A guide to native Australian plants*, Angus and Robertson, 1967
- *What wildflower is that?*, Hamlyn, 1972. Changed 1973 with introductory photographs by Reg Morrison; design by Hugh McLeod, Summit Books, 1979 (Rev. ed.). Republished Lansdowne Press, 1984
- *Australian complete book of flowers*, Stirling Macoboy & Alec Blombery, Hamlyn, 1975
- *Gardening with wildflowers*, Summit Books, 1980 (Rev. ed.) (First published as: *Australian wildflowers to cultivate*, Hamlyn, 1975)
- *The Proteaceae of the Sydney region*, with Betty Maloney, Kangaroo Press, 1992. (Prev. Angus & Robertson, 1981)
- *Palms: an informative, practical guide to palms of the world, their cultivation, care and landscape use*, with Tony Rodd & illustrations by Betty Maloney, Angus & Robertson, 1982
- *Growing Australian natives in pots: indoors & outdoors*, Kangaroo Press, 1983
- *Practical gardening & landscaping with Australian native plants*, with illustrations by Darian Causby, Angus & Robertson, 1984
- *The living centre of Australia*, Kangaroo Press, 1985
- *The flowers of Central Australia*, Kangaroo Press, 1989. Revised edition, JB Books, 2001
- *Guide to Kosciuszko*, with Betty Maloney, Kangaroo Press, 1992
- *Propagating Australian plants*, with Betty Maloney, Kangaroo Press, 1994
- *Kakadu to Broome: a guide to northern Australia*, Betty Maloney and Alec Blombery, Angus & Robertson, 1995
- *Growing Australian orchids*, illustrated by Betty Maloney, Kangaroo Press, 1998
- *Growing native plants for balconies, courtyards & townhouses*, with Betty Maloney, Kangaroo Press, 2000

Rhododendron lochiaie Renamed

Naming problems with Australian rhododendrons _____ Lyn A Craven
Australian National Herbarium, CSIRO Plant Industry, Canberra

Introduction

Recent taxonomic investigation of *Rhododendron lochiaie* resulted in the recognition of two species. The Type Specimen collected and described by Mueller proved to be a different species to the plant well known to botanists and horticulturists. Thus, conservation of the name *R. lochiaie* for the popularly cultivated plant, with a new Type, was proposed to maintain the conventional application of the name (4). The original type was renamed *R. notiale* Craven (6).

This proposal was not approved by the Committee for Spermatophyta (1), the relevant nomenclatural committee under the auspices of the International Union of Biological Sciences (IUBS), and its decision ratified by the other relevant fora. Following a query by the author, the secretary of the Committee reopened the case, but their decision remained (2). The first report (1) states that the 'name is not being changed for purely nomenclatural reasons; its application is being restricted for taxonomic reasons'.

Not uncommonly, species names have been successfully conserved in cases where misidentification has resulted in names being applied to taxa that do not include the nomenclatural types of those names (a few recent cases include *Andropogon bicornis* (Prop. 1417), *Peucedanum nodosum* (Prop. 1426), *Spartium capense* (Prop. 1439), *Cuseuta capitata* (Prop. 1440), (all in 3). The Committee seems to be saying that as far as the conservation of names is concerned there should be rigid separation between taxonomy and nomenclature *per se*. This seems inconsistent with their decisions on other proposals made to conserve species names with a new Type to preserve the nomenclatural *status quo*.

This is difficult to reconcile with the following statements in the *International Code of Botanical Nomenclature (Tokyo Code)*.

'The Section urges the General Committee ... to make full use of the options that the Code now provides ... to ensure nomenclatural clarity and stability' (7) and, '...the XY International Botanical Congress urges plant taxonomists ... to avoid displacing well established names for purely nomenclatural reasons, whether by change in their application or by resurrection of long-forgotten names...' (7)

The type method provides a way of unambiguously determining the application of names to plant taxa. However, strictly adhering to this method will sometimes force the users of plant names to make unnecessary and unwelcome adjustments. Ideally, taxonomic advances should have a minimal effect upon conventional nomenclature. Conservation of the name *R. lochiaie* F. Muell. with a new type as proposed (4) would have permitted new taxonomic information to be integrated seamlessly with the present majority application of the name and would have avoided the lamentable confusion that is likely to ensue.

However, as lamentable it is, a new name was provided for the plant in question (5). The current taxonomy of Australian rhododendrons is:

Rhododendron lochiaie F. Muell., Victorian Nat. **3**: 157 (1887 as '*R. Lochae*').
Azalea Lochae (F. Muell.) Kuntze, Rev. Gen. Pl. 387 (1891). Type: Qld. Mt Bellenden
Ker, Sayer 135 (cited in protologue as Sayer & Davidson, without number) (holo. MEL).

Syn.: *R. notiale* Craven, in Craven & Withers, *Edinb. J. Bot.* **53**: 33, fig. 3 (1996).
Type: Victoria, cultivated in garden at Montrose, Melbourne, 21 i 1993, Craven & Elliot
9105 (holo. CANB; iso. A, BRI, E, MEL). (Provenance: Mt Bartle Frere, Queensland,
1975, leg. DL Jones [unvouchered].)

Illustration: Craven & Withers, *Edinb. J. Bot.* **53**: 32, fig. 3 (1996), as *R. notiale*.

Distribution: *R. lochiaie* is known with certainty only from the Bellenden Ker
Range. It apparently also occurs on Bell Peak in the adjacent Malbon Thompson
Range (photograph only seen of flowering material). The distribution is given in fig. 2 in
Craven & Withers (1996) under the name *R. notiale*.

Habitat: Recorded as occurring as a terrestrial or lithophytic shrub to tree in stunted
montane forest, in montane heath amongst rocks, and on mossy granite boulders.
Altitude 1,200–1,520 m.

Rhododendron viriosum Craven, *Edinb. J. Bot.* **59**: 447–450 (2002). Type:
ACT, cultivated in the Australian National Botanic Gardens at Canberra, 22 ii 1994,
Craven 9354 (holo. CANB; iso. A, B, BRI, E, L, MEL, QRS). (Provenance: Qld: Mt
Windsor Tableland, 27 v 1989, Jones & Clements 4420 (CANB).)

Illustration: Craven & Withers, *Edinb. J. Bot.* **53**: 32, fig. 2 (1996), as *R. lochiaie*.

Distribution: *R. viriosum* occurs in four main regions: Mt Finnigan, Thornton Peak,
Mt Windsor Tableland, and Main Coast Range. In the last two it has been collected
from several locations in each but the degree of geographic discontinuity is not known.
The distribution is given in fig. 2 in Craven & Withers (1996) under the name *R. lochiaie*.

Habitat: Recorded as a lithophytic, epiphytic or terrestrial shrub in rainforest, in low
Borya herb field on boulder outcrop, in moss forest, in windswept mossy thickets
amongst bare rock exposures, and in simple notophyll vineforest with *Agathis*
emergents on granite soils. Altitude 910–1,330 m.

This is the plant that is well known in horticulture, *R. lochiaie* being a rare plant in
cultivation and poorly represented in herbarium collections. Not only is *R. viriosum*
widely grown in its own right but it has been used extensively in breeding programs with
other species of *Rhododendron* from Malaysia, Indonesia and Papua New Guinea. The
type collection of *R. viriosum* was made from asexually propagated plants derived from
wild-collected material. The specific epithet is derived from the Latin, *viriosus*, robust,
strong, in recognition of its qualities when used in hybridisation programs. Typically, the
F1 progeny have reddish to rose-pink corollas, its floral pigment genes apparently
always being dominant, and demonstrate good vigour. See photo page 92.

Key to the Australian species of *Rhododendron*

1. Corolla tube straight, the limb more or less at a right angle to the tube, filaments
pubescent, anthers dark red, presented around the throat with most
being in the lower half, style lying in lower part of corolla tube *R. viriosum*
2. Corolla tube curved, the limb strongly oblique to the tube; filaments glabrous,
anthers yellowish, presented in a cluster at the top of the throat,
style in upper part of corolla tube *R. lochiaie*

References

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863–872
2. Brummitt, RK (2000), Report of the Committee for Spermatophyta: 50. *Taxon* **49**:
799–808

(Continued opposite)

Book Review:

A New Image

for West Australian Plants - George Lullfitz _____ Casimir Liber

I'm depressed – living in humid Sydney means the climate is a considerable barrier to growing many of the plants in this book. However, the book is a fantastic achievement in presenting a mouth-watering selection of Western Australian Plants in all their glory.

George Lullfitz has been actively involved in the Australian Nursery and Floriculture industry for almost 40 years. He established his own nursery in Wanneroo, where it continues to develop to this day. His research into superior selections of plants has yielded great garden plants such as *Chamaelaucium uncinatum* 'Purple Pride' among others.

He opens the book with an interesting point; he is unhappy with the word 'Native', preferring to call them Australian Plants. He feels the word does injustice to our flora by lumping them into one basket (also with the negative connotation of an unpruned unruly garden) – call them by their names; Grevilleas, Banksias and Eucalypts, just as we have Azaleas, Camellias and Roses.

The photos are a highlight of the book. George has tried to show garden plants in groups, rather than singly, to get a clearer picture of the horticultural vistas presented; try *Adenanthos sericeus* as a formal hedge!

The book is of most value to a Mediterranean climate gardener; as one moves east, more plants listed become unsuitable. Many (Grevilleas, Banksias, Leptospermums, wattles), however, have eastern equivalents which may be substituted. Others will tolerate some east coast conditions (*Corymbia ficifolia* on good drainage, *Chorizema cordatum*, some *Anigozanthos* hybrids), and still others have been grafted successfully (Darwinias, Grevilleas, *Hakea bucculenta*) onto hardy eastern species. Still others may be treated as annuals. (*Lechenaultia* spp.)

Overall a wonderful read – available from good bookstores and directly from Lullfitz's nursery - PO Box 34, Wanneroo, Western Australia, 6946 Ph: (08) 9405 1607.

Rhododendron lochiai renamed

Continued from opposite page

3. Brummitt, RK (2001), Report of the Committee for Spermatophyta: 51. *Taxon* **50**: 559–568
4. Craven, LA (1996), Proposal to conserve the name *Rhododendron lochiai* F. Muell. (Ericaceae) with a conserved type. *Taxon* **45**: 135–136
5. Craven, LA (2002), A new name for an Australian species of *Rhododendron* (Ericaceae). *Edinb. J. Bot.* **59**: 447–450
6. Craven, LA & Withers, RM (1996), A second species of *Rhododendron* (Ericaceae) from Australia. *Edinb. J. Bot.* **53**: 27–37
7. Greuter, W, Barrie, FR, Burdet, HM et al (1994), *International Code of Botanical Nomenclature (Tokyo Code)* (Regnum Veg. vol. 131). Koeltz, Königstein

Proteaceae Subfamily Persoonioideae

Botany of the Geebungs, Snottygobbles and their relatives _____ Peter H. Weston
Royal Botanic Gardens and Domain Trust, Mrs Macquaries Road, Sydney

The vivid green new growth of *Persoonia stradbrokeensis*, *P. levis*, *P. juniperina* and a few other common species makes the geebungs a familiar feature of the coastal *Eucalypt* forests, woodlands and heathlands of eastern Australia. Similarly, residents of Perth are likely to recognise the sickle-shaped leaves of their commonest snottygobble, *Persoonia longifolia*. Many growers of Australian plants are also familiar with the frustration of being unable to acquire cultivated plants of these eye-catching species because of technical difficulties in propagating them. However, few enthusiasts are aware that the group to which these plants belong, the subfamily Persoonioideae of the family Proteaceae, includes over 100 species, varying from sub-shrubs of swampy heaths to rainforest trees up to 30 metre high. This article is an introduction to the diversity of this subfamily, with a few comments on the experience that horticultural staff at the Royal Botanic Gardens and Domain Trust have had trying to propagate and cultivate them.

Higher Classification

The most recently published classification of the family Proteaceae (Douglas 1995) includes seven subfamilies but more recently published molecular systematic research (Hoot and Douglas 1998) shows that three of these should be synonymised under a couple of the others, leaving just four subfamilies: Bellendoideae, Persoonioideae, Proteoideae (subsuming Eidotheoideae) and Grevilleoideae (subsuming Sphalmioideae and Carnarvonioideae).

Biogeography

The Proteaceae is a classic example of a 'Gondwanic group', a group that is thought to have diversified before the fragmentation of the ancient super-continent Gondwana. It achieved its present distribution across the southern hemisphere largely by drifting with the continents rather than by dispersing across ocean gaps (see Wrigley and Fagg 1989 for a brief explanation and Weston and Crisp 1996 for a detailed review of the evidence). There is also strong evidence that the subfamilies diversified well before the break up of Gondwana, implying that all of them, including the Persoonioideae, are well over 90 million years old. The ancestors of *Garnieria* and *Toronia* probably reached New Caledonia and New Zealand by overland dispersal rather than floating or flying there. The most striking disjunction of Persoonioideae within Australia, either side of the Nullarbor Plain, is shared with numerous other sclerophyllous plant groups (e.g. *Banksia*). This pattern probably dates from about 5–6 million years ago, when the rapid onset of aridity in southern-central Australia would have forced sclerophyllous plant communities out of the area north of the Great Australian Bight (see e.g. Bowler 1982).

Morphology

A couple of useful generalisations can be made about the Persoonioideae. Starting from below ground level, the root systems of Persoonioideae are unusual in the Proteaceae in lacking 'proteoid' roots. These distinct, dense

clusters of specialised, fine lateral roots are a conspicuous feature of the root systems of almost all other Proteaceae that have been examined (the only other exceptions being *Symphionema* and *Agastachys*, in the Proteoideae). Proteoid roots are thought to function in nutrient absorption, which prompts the question: "why do the Persoonioideae do so well without them"? Perhaps they have as yet undiscovered mycorrhizal associates in their roots? We do not know.

A unifying feature of the Persoonioideae that is invisible to most observers is the number and size of the chromosomes. Chromosomes are the microscopic structures in the nucleus of every cell that package DNA, the most important genetic molecule. All but one species of Persoonioideae have 14 chromosomes in each cell (the exception is *Toronia toru* which has 28, apparently the result of a relatively recent doubling in its immediate ancestor). The really notable thing about these chromosomes is their large size, amongst the largest found in the plant kingdom. The chromosomes of other Proteaceae are comparatively tiny and are usually more numerous. Apart from *Bellendena montana*, which has 10 chromosomes, all other Proteaceae have 20 or more in each cell.

Species in the tribe Persoonieae are characterised by having leaves that are simple and entire throughout the life cycle, exclusively bisexual flowers, and fruits that resemble plums in having an outer succulent layer and an inner bony layer surrounding the seed(s) (in botanical jargon, the fruits are drupes) (photo of fruits of *P. pauciflora* page 65). Inside the stones of these fruits are one or more seeds, consisting of a thin, brittle seed coat and an embryo, which in almost all species is bullet-shaped. An unusual feature of most species is an embryo with more than two cotyledons. I have counted up to nine cotyledons in some species of *Persoonia*. These produce easily identifiable, parasol-like seedlings (photo of *P. volcanica* page 65).

Unfortunately, seeds of all members of the Persoonieae are reluctant to germinate in cultivation. Dormancy can be broken by exposing excised embryos to high concentrations of GA (giberellic acid, a plant hormone) but this is a very fiddly business and the process by which GA breaks dormancy is not understood. In most species, the fruits take 10–12 months to ripen and are often found in large quantities on the ground under flowering plants.

Inflorescences in the Persoonieae are basically racemose, that is, they consist of a simple, unbranched shoot bearing lateral flowers. Some Persoonieae (e.g. *Toronia toru*, *Garnieria spathulifolia*, *Acidonia macrocarpa*, *Persoonia laurina*) resemble many other Proteaceae in that the raceme is terminated by a suppressed apical bud, a condition that has been given the jargon term 'anauxotelic'. In the Persoonieae the flowers in anauxotelic racemes are usually borne in the axils of scale leaves. Most species of *Persoonia*, however, differ from other Proteaceae in that the inflorescence grows on into a leafy shoot, a condition that has been given the jargon term 'auxotelic'. In the Persoonieae the flowers in auxotelic inflorescences are usually borne in the axils of foliage leaves. For want of more familiar but accurate words, I used the terms 'anauxotelic' and 'auxotelic' in my treatment of Persoonieae in *Flora of Australia* (Weston 1995), and have used them below too.

Flowers in the Persoonieae resemble those of most other Proteaceae in having four tepals, on the inner surfaces of which are attached the four stamens (see e.g. Wrigley and Fagg 1989 or Weston 1988 for more detailed descriptions of flower morphology in the Proteaceae). Like many Proteaceae, there are usually four nectary-glands inside the base of the flower, alternating with the tepals. In the centre of the flower is the pistil, with a basal or near-basal ovary and a straight or variously kinked or curved style, terminated by the stigma. Most species of Persoonieae have very similar flowers in which the bases of the anthers are bunched fairly tightly around the base of the style, enclosing the nectary-glands and ovary in a chamber in the base of the flower. Towards their tips, the anthers curve back away from the style, forming a cross-shaped 'landing platform' surrounding the tip of the style, which protrudes through the centre of the flower (photo of *P. asperula* flower with tepal removed to show pistil page 65). For ease of reference, let us call this morphology the 'standard form'. Various species diverge from this form in different ways as described under the species groups below.

Diversity within the Persoonioideae

The Persoonioideae is subdivided into two tribes, the Placospermeae, with one genus of one species, *Placospermum coriaceum*, and the tribe Persoonieae, with four genera, three of which consist of single species: *Toronia toru*, *Garnieria spathulifolia* and *Acidonia microcarpa*, and the fourth, *Persoonia*, which now includes 100 species. Recent, still unpublished phylogenetic research, which I have conducted in collaboration with Carolyn Porter at the Royal Botanic Gardens Sydney, has shown that the genera of Persoonieae will need to be slightly redefined.

Placospermum coriaceum (photos opposite) is a large tree, up to 30 m high, restricted to very wet lowland to montane rainforests, between Cooktown and Innisfail in north-eastern Queensland. It does not look much like a *Persoonia*, having large (to 80 cm long), deeply lobed juvenile leaves, branching (paniculate) inflorescences of dusky pink and cream flowers (photo of male flowers - see front cover) and dry, follicular fruits that split open at maturity, releasing numerous winged seeds. It resembles a number of other rainforest Proteaceae in producing two different kinds of flowers: smaller, more abundant male flowers and bisexual flowers. Only bisexual flowers go on to develop into fruits. The seeds germinate readily, developing into seedlings with two large, kidney-shaped cotyledons and simple, entire seedling leaves. *P. coriaceum* grows vigorously in well-watered but well-drained, frost-free sites. It grows to several metres high before branching. Trees planted at the Royal Botanic Gardens Sydney (RBGS) in 1987 are now up to 12 metres high but are still 'poplar-shaped'.

Toronia toru is endemic to New Zealand where it is restricted to the North Island, north of Lake Taupo. It is a large shrub or small tree to 10 m high, usually found in scrubby vegetation on recently disturbed sites. Most readers of *Australian Plants* would recognise its short anauxotelic racemes of yellow flowers with white anthers as 'Persoonia-like', although they differ from the 'standard form' in having more 'open' flowers in which the anthers do not touch the style, even at their bases (photo page 65). Recent phylogenetic research (Weston and Porter unpublished) shows that *T. toru* is most closely



Toronia toru (New Zealand)
See page 64 Photo A Douglas



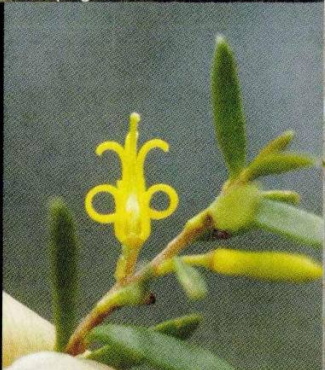
Toronia toru (New Zealand)
See page 64 Photo BS Weston



Persoonia pauciflora
See page 63 Photo PH Weston



Persoonia volcanica
See page 63 Photo PG Richards



Persoonia asperula
See page 64 Photo PH Weston



Placospermum coriaceum
Juvenile plant
See page 64 Photo PH Weston



Placospermum coriaceum
Pot of seedlings
See page 64 Photo PH Weston

related to a group of three species from south western Australia, which are presently included in *Persoonia* (the *Persoonia rufiflora* group – see below).

Garnieria spathulifolia is endemic to New Caledonia where it is widespread but rare in heathy, 'maquis' vegetation on ultra-basic soils. It is a large shrub or small tree to 10 m high which, although superficially resembling *Toronia*, is more closely related to *Acidonia* and most species of *Persoonia*. It produces short anauxotelic racemes of white flowers (photo on page 68) and large black fruits, each containing a stone enclosing up to 7 seeds. *Garnieria* should probably be taxonomically synonymised under *Persoonia*.

Acidonia microcarpa (photos on page 68) is restricted to heathy swamps and creek banks in the wettest part of south-western Australia between Margaret River and Albany. It is a very attractive shrub to 3 m high with linear leaves to 13 cm long, bearing numerous, lateral, condensed anauxotelic racemes of 1–4 bright yellow flowers, followed by small green fruits. The flowers differ from the 'standard form' in having incurved anthers that surround the style but which touch it only at their tips. Horticultural staff at RBGS and Mt Annan Botanic Garden (MABG) have found this species to propagate fairly reliably from cuttings and to be easy to grow as a potted plant. However, the longest they have managed to keep one alive in the ground is 30 months. *Acidonia* should probably be taxonomically synonymised under *Persoonia*.

Persoonia is endemic to Australia, where it is widespread in non-arid regions. One species, *P. pertinax*, is found only in the Great Victoria Desert, while a few other species venture into the arid zone, but most are concentrated in the subtropical to temperate parts of south eastern and south western Australia, including Tasmania. The most recent classification of *Persoonia* (Weston 1995) recognised 11 informal groups within *Persoonia* and I discuss these briefly below.

The *Persoonia rufiflora* group should probably be removed from *Persoonia* to either *Toronia* or a new genus. Its three species, *P. rufiflora*, *P. brevihachis* and *P. inconspicua*, are all restricted to south-western Australia. They are inconspicuous shrubs to 2.5 m high, bearing lateral condensed anauxotelic racemes of 1–3 small flowers with greenish yellow tepals and white anthers, in late winter and early spring (photos on page 68). The seeds have two cotyledons. I do not know of any attempts to cultivate these plants.

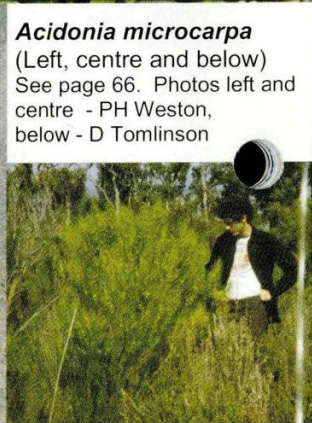
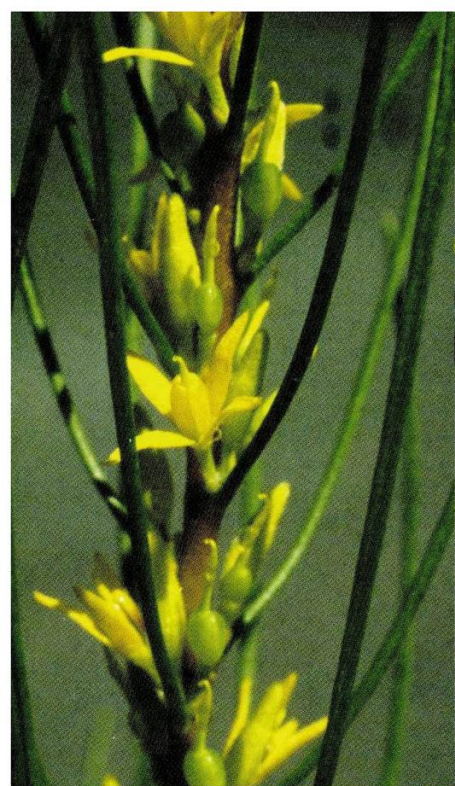
The *Persoonia laurina* group consists of three species from the coast and tablelands of south eastern Australia, between Newcastle and Gippsland: *P. laurina*, *P. silvatica* and *P. confertiflora*. They are lignotuberous shrubs to small trees 0.2–9 m high with elliptical (or similar) leaves. Flowers are borne in summer, in anauxotelic clusters, although *P. silvatica* also produces leafy, auxotelic inflorescences. They have bright yellow tepals and white anthers, although in *P. laurina* the outsides of the tepals are densely covered in rusty hairs. The fruits are green to dull purple in colour and the seeds have just two cotyledons. *P. silvatica* is the most floriferous of these species and also forms the largest, most attractive plant in this group. MABG has found both *P. laurina* and *P. silvatica* to strike fairly reliably from cuttings but plants have survived a maximum of six years once planted out.

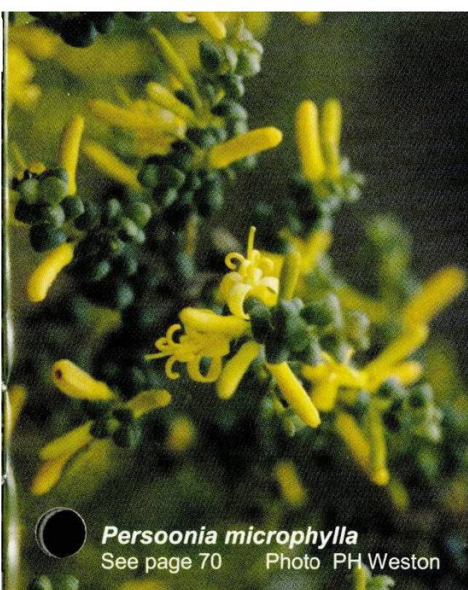
The *Persoonia longifolia* group includes two species, one of which, *P. elliptica*, turns out to belong elsewhere (in the *P. lanceolata* group). *Persoonia longifolia* is a common, attractive, large shrub or small tree to 5 m tall, of the Darling Range between Perth and Albany in south-western Australia (photo on page 68). It is lignotuberous and also has thick, papery bark that protects the epicormic buds from fire, allowing plants to resprout from the base, trunk and larger branches after fire. Remarkably similar bark is also found in three other, rather distantly related species of *Persoonia*. The flowers are borne in leafy auxotelic inflorescences in summer and have bright yellow tepals and anthers. The seeds are unusual in being C-shaped, with two cotyledons, rather like a tiny cashew nut. Wild-collected foliage of this species is becoming a common sight in flower arrangements sold in eastern Australian florists and supermarkets. MABG has experienced erratic to poor results trying to strike cuttings of this species, although, once propagated, the plants seem to have grown slowly but reliably in pots.

The *Persoonia arborea* group consists of two species, *P. arborea*, from the mountain ash forests east of Melbourne, and *P. subvelutina* from sub-alpine forests between Canberra and the Bogong High Plains. Both species have attractive, softly 'furry' foliage and produce leafy auxotelic inflorescences in summer. The tepals are pale yellow and the anthers white. The flowers of *P. arborea* are larger than most and are more 'open' than in the 'standard form' (photo on page 68). *P. arborea* is a small tree to 14 m tall, while *P. subvelutina* is a shrub to 5 m tall. Results of attempts to strike cuttings of both species at the RBGS have been disappointing. Transplanted seedlings have grown well in pots but have failed in the ground. *P. arborea* appears to be susceptible to *Phytophthora* infection.

The *Persoonia gunnii* group consists of three species endemic in Tasmania: *P. gunnii*, *P. muelleri* and *P. moscalii*. These are shrubs of sub-alpine forests and shrublands, although two subspecies of *P. muelleri* reach sea level on the cold, wet Southwest coast. All produce flowers on leafy shoots in summer to early autumn. The tepals and anthers are the same colour, varying from pale yellow to white and the flowers are more 'open' than most other species, apparently providing easier access to the nectaries (photo page 77). The fruits are purple to black. Mt Tomah Botanic Garden (MTBG) has had some success in propagating both *P. gunnii* and *P. muelleri* from cuttings and maintaining plants in the ground for at least seven years.

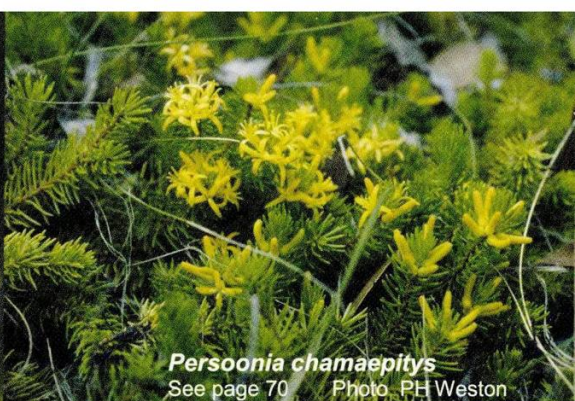
The *Persoonia lanceolata* group as originally defined (Weston 1995) consists of 54 species, including most of the species that have a history of cultivation. To this number should be added two new species, named since 1995 (*P. hindii* and *P. pauciflora*). On the basis of my recent phylogenetic research, *Persoonia elliptica* and the three species of the *Persoonia dillwynioides* group should also be added to this group while *P. tropica* should be removed from it. This group is most diverse in subtropical to temperate south-eastern and south-western Australia, with one species, *P. juniperina*, extending to Tasmania and another, *P. amaliae* (photo on back cover), extending into tropical eastern Queensland. Below is a complete listing of the redefined *Persoonia lanceolata* group, subdivided into eastern and western species:





Persoonia microphylla

See page 70 Photo PH Weston



Persoonia chamaepitys

See page 70 Photo PH Weston



Persoonia tropica

See page 71 Photos PH Weston

↓ & →



Persoonia helix - See page 70

Photo D Tomlinson



Persoonia chapmaniana ↓ & →

See page 74 Photos PH Weston



Eastern species: *P. acerosa*, *P. acuminata*, *P. adenantha*, *P. amaliae*, *P. asperula*, *P. bargoensis*, *P. brevifolia*, *P. chamaepeuce*, *P. chamaepitys*, *P. conjuncta*, *P. cornifolia*, *P. curvifolia*, *P. cuspidifera*, *P. daphnoides*, *P. fastigiata*, *P. glaucescens*, *P. hindii*, *P. hirsuta*, *P. iogyna*, *P. isophylla*, *P. juniperina*, *P. katerae*, *P. lanceolata*, *P. laxa*, *P. levis*, *P. linearis*, *P. marginata*, *P. media*, *P. microphylla*, *P. mollis*, *P. myrtilloides*, *P. nutans*, *P. oblongata*, *P. oleoides*, *P. oxycoccoides*, *P. pauciflora*, *P. pinifolia*, *P. procumbens*, *P. prostrata*, *P. recedens*, *P. rigida*, *P. rufa*, *P. sericea*, *P. stradbokensis*, *P. subtilis*, *P. tenuifolia*, *P. terminalis*, *P. virgata*, *P. volcanica*.

Western species: *P. baeckeoides*, *P. cordifolia*, *P. coriacea*, *P. cymbifolia*, *P. dillwynioides*, *P. elliptica*, *P. flexifolia*, *P. helix*, *P. leucopogon*, *P. pertinax*, *P. pungens*.

The 58 species of the redefined *Persoonia lanceolata* group are genetically very similar to one another, although morphologically very diverse. A consequence of their close genetic similarity and the fact that they share pollinators (see below) is the occasional (sometimes frequent) occurrence of recurring natural hybrids where two or more species grow together. In some cases, the parental species are quite dissimilar in appearance. The best example of this phenomenon is the natural hybrid between *Persoonia stradbokensis* and *P. tenuifolia*. *P. stradbokensis* is a large shrub or small tree to over 6 m tall, with flat leaves 3–11 cm long and 10–40 mm wide, while *P. tenuifolia* is a small shrub to 0.5 m tall, with fine leaves 1–2.5 cm long and 0.3–0.5 mm wide that are subterete and grooved on the upper surface. Not surprisingly, the hybrids do not closely resemble either parent and were mistakenly thought to be a rare, new, unnamed species for many years.

Flowers do not vary much in the *Persoonia lanceolata* group, almost all species producing flowers of the 'standard form' with bright yellow tepals and anthers. Inflorescences are usually auxotelic (e.g. *P. lanceolata*, *P. sericea*, *P. juniperina*, *P. elliptica*) but some species produce a mixture of auxotelic and anauxotelic inflorescences (e.g. *P. cornifolia*). *Persoonia pinifolia* has an unusual kind of anauxotelic inflorescence in which the flowers are subtended by very short foliage leaves.

Unlike their flowers, plant form and leaf shape in the *Persoonia lanceolata* group are spectacularly variable. The species vary from prostrate shrubs such as *P. chamaepitys*, through moderate sized decumbent, spreading or erect shrubs such as *P. oxycoccoides*, *P. hirsuta* and *P. pinifolia*, to trees such as *P. media*, which commonly reaches a height of 8 m, but which has been recorded from Dorrigo as a rainforest tree 25 m tall.

Variation in leaf form is even more impressive in the *Persoonia lanceolata* group. Several species (e.g. *P. microphylla* - photo page 70, *P. pungens*) have tiny, almost round leaves, others (e.g. *P. chamaepitys*, *P. pinifolia*) have fine, pine-like leaves, many (e.g. *P. lanceolata*, *P. elliptica*) have more 'normal looking' elliptical or lanceolate leaves but the leaves of *P. helix* win the award for most bizarre in the genus, resembling 'spiral' pasta (photo page 69).

One species, *P. mollis*, manages to cover much of the variation in plant and leaf form on its own. *P. mollis* subsp. *revoluta* is a prostrate shrub,

several subspecies are spreading to erect shrubs, while *P. mollis* subsp. *maxima* is a small tree to 7 m tall. *P. mollis* subsp. *leptophylla* and subsp. *livens* both have linear leaves with tightly revolute margins that may be less than 1 mm wide, while *P. mollis* subsp. *maxima* has flat, lanceolate leaves to 17 mm wide.

Horticultural staff at the Royal Botanic Gardens and Domain Trust have attempted to strike cuttings of many species in the *Persoonia lanceolata* group, with variable, but often unpredictable or disappointing results. Some particularly attractive or otherwise desirable taxa, such as *P. levis* and *P. mollis* subsp. *maxima* have consistently failed to strike under a variety of conditions. Others, such as *P. pinifolia* and *P. chamaepitys*, have produced strike rates approaching 50% in one year and then have failed in other years under similar conditions. I have been unable to find records for any species in this group that would suggest it would strike reliably from cuttings. Once propagated, all of them seem to grow well in pots.

Once planted out, species in the *Persoonia lanceolata* group vary in performance from vigorous to dire. Results for some species have varied between different sites. The only Western Australian species that we have planted out is the fantastic *Persoonia helix*, the most long-lived plant of which survived for only seven months in the ground at MABG. The taxa in this group that have performed best in the ground at RBGS, MTBG and MABG are *Persoonia amaliae*, *P. chamaepitys*, *P. cornifolia*, *P. kerae*, *P. levis*, *P. linearis*, *P. media*, *P. mollis* subsp. *mollis*, *P. oleoides*, *P. pinifolia*, *P. stradbrokeensis*, and *P. subtilis*.

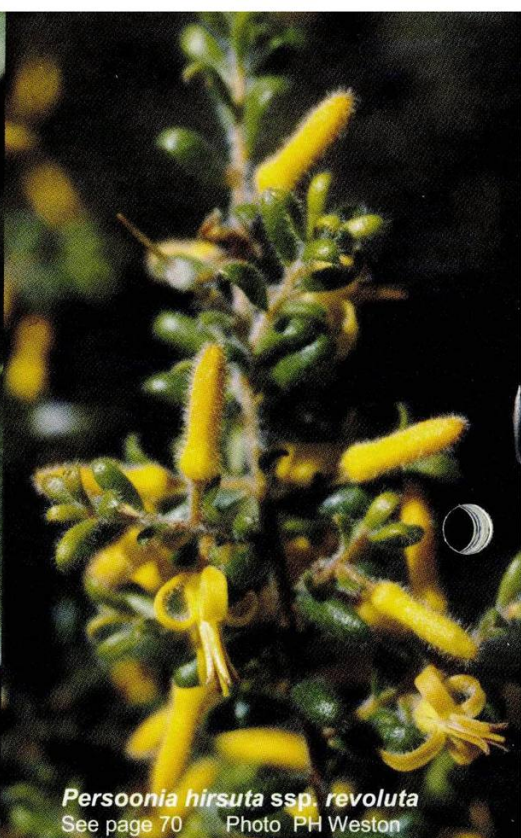
Persoonia tropica, a species that I have had to remove from the *Persoonia lanceolata* group in response to new phylogenetic knowledge, is endemic to the higher ranges of the Atherton Tableland and is one of only three tropical species of *Persoonia*. It superficially resembles the quite distantly related *P. media* and has in the past been mistakenly identified as that species. It differs from *P. media* most obviously in its short, anauxotelic racemes and in its white anthers (photo page 69). It also differs from all other species of *Persoonia* in its phenology, flowering and fruiting continuously throughout the year. *P. tropica* is an attractive shrub or small tree to 3.5 m tall with narrowly elliptic to oblanceolate leaves to 11 cm long. Propagation from cuttings is unpredictable, but sometimes quite successful. MABG has also found this species fairly reliable once planted out.

The *Persoonia graminea* group comprises two unusual, summer-flowering species from south-western Australia, *P. graminea* and *P. micranthera*. *P. graminea* is a weak, sprawling, almost herbaceous shrub of swamp heaths between Margaret River and Albany. The long, thin stems bear clusters of linear, grass-like leaves from which emerge long, anauxotelic racemes of tiny, nodding flowers. The tepals and anthers vary in colour from green to bright yellow, each of the straight anthers being tipped by a prominent, linear, black appendage. I grew a transplanted seedling of this species successfully in a pot until it was killed by frost (photo page 77). *P. micranthera* is a prostrate species resembling *P. graminea* in habit, but with shorter, wider leaves, shorter inflorescences and larger flowers.



Persoonia cornifolia

See page 70 Photo PG Richards



Persoonia hirsuta* ssp. *revoluta

See page 70 Photo PH Weston



Persoonia oleoides

See page 70 Photo PG Richards



Persoonia linearis and *Leioproctus* sp. (native bee)
See pages 70/75

Photo PG Richards



Persoonia laurina ssp. *intermedia*
See page 66

Photo PH Weston



Persoonia chamaepeuce
See page 70

Photo PH Weston

It is found only under the dense canopy of shrubs on the tops of several of the highest peaks in the Stirling Range. It is highly susceptible to *Phytophthora* infection and is perilously endangered. An interim recovery plan has been prepared for *P. micranthera* (Evans et al. 1999), which summarises knowledge of its distribution and ecology. No information is available yet on propagation of this species.

The *Persoonia chapmaniana* group is closely related to the *P. graminea* group and also comprises two species from south-western Australia, *P. chapmaniana* and *P. pentasticha*. Both species are rare shrubs with terete, pungent, finely ribbed leaves, bearing anauxotelic racemes flowers with bright yellow tepals and anthers in late winter and spring (photo page 69). *P. chapmaniana* produces unusual, warty fruits and is restricted to grassy woodlands near the margins of salt lakes in the northern wheat belt. *P. pentasticha* occurs in shrublands, further 'out' into the semi-arid zone, as far as Paynes Find and Mullewa. I have been unable to find any information on propagation or cultivation of these species.

The *Persoonia quinquenervis* group consists of 13 species that are restricted to sand heaths and Eucalypt woodlands of south western Australia: *P. acicularis*, *P. angustiflora*, *P. bowgada*, *P. filiformis*, *P. hexagona*, *P. papillosa*, *P. quinquenervis*, *P. rudis*, *P. scabra*, *P. spathulata*, *P. striata*, *P. sulcata* and *P. trinervis*. Most have linear, often longitudinally ribbed, sometimes pungent leaves and auxotelic inflorescences. The flowers differ from the 'standard form' in having anthers that 'hug' the style for most of their length, recurving only at their sterile tips (photos page 77). The fruits are often prominently striated with dull purple. An unusual feature of several species is vegetative spread by means of extensive, shallowly buried stolons. What appears to be a large population of *P. acicularis*, *P. striata* or *P. sulcata*, covering a hectare or more may in fact be a single clone. Our few attempts to propagate species of this group from cuttings have consistently failed.

The *Persoonia teretifolia* group includes the most widely distributed species of *Persoonia*, *P. falcata*, which stretches right across the Eucalypt woodlands and forests of non-arid tropical Australia from the Great Sandy Desert to the Blackdown Tableland. The other 9 species are restricted to the forests, woodlands and sand heaths of south-western Australia: *P. biglandulosa*, *P. brachystylis*, *P. comata*, *P. hakeiformis*, *P. kararae*, *P. saundersiana* and *P. stricta*, *P. saccata*, *P. teretifolia*. Leaf shape ranges from narrowly sickle-shaped in *P. falcata* to oblanceolate or linear, sometimes with longitudinal ribbing. These species have the most unusual flowers in the genus in that the pistil is greatly shortened and hooked, 'burying' the stigma in a shallow to deep 'honey-pot' in the lower tepal. The tepals are bright yellow in all species but the anthers vary in colour (white, yellow with white tips or plain yellow) and form (straight or with recurved sterile tips) between species (photos page 93). Inflorescences are usually auxotelic. Staff at both RBGS and MABG have been able to strike cuttings of *P. falcata* from transplanted seedlings. The plants have grown slowly but reliably in pots but have consistently failed when planted out. The few south-western species that have been tried have failed to strike from cuttings.

Ecology

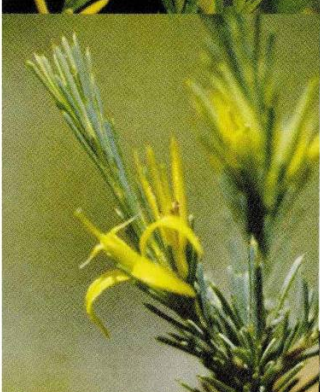
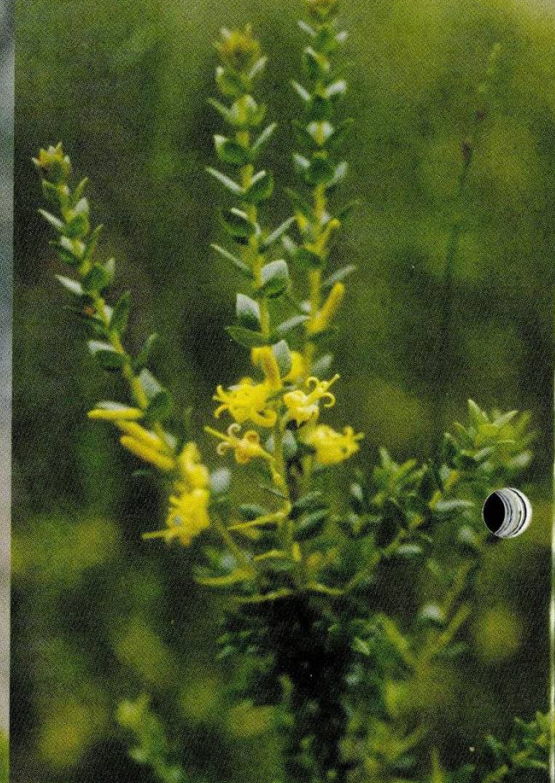
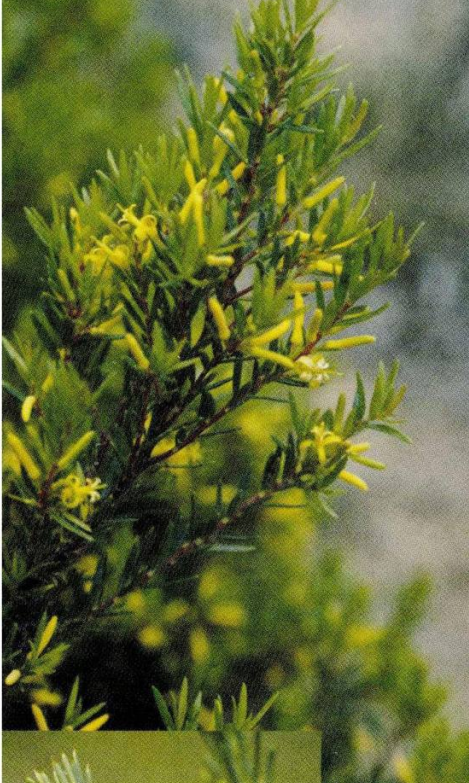
Like most Proteaceae, the great majority of species of Persoonioideae are plants of well-drained, acid, siliceous soils that are low in nutrients. Two south western species (*Acidonia microcarpa*, *Persoonia graminea*) grow in swampy habitats, three others (*P. acicularis*, *P. bowgada* and *P. hexagona*) tolerate mildly calcareous soils, and several south eastern species sometimes grow on basalt-derived soils, and but these are exceptional. The greatest diversity of species is found in areas with soils derived from sandstone and granite.

Little is known of the interactions between micro-organisms and species of *Persoonia*. Mycorrhizal associations have not been reported for any species of Persoonioideae. Several species of *Persoonia* (*P. elliptica*, *P. gunnii*, *P. longifolia*, *P. micranthera*, *P. muelleri*) are known to be highly susceptible to infection by an Oomycete, *Phytophthora cinnamomi*, in the wild and this pathogen is strongly suspected of being responsible for the deaths of many other species in cultivation. Whether any species of *Phytophthora* are really native to Australia is debatable, but *P. cinnamomi* is clearly an introduced pest.

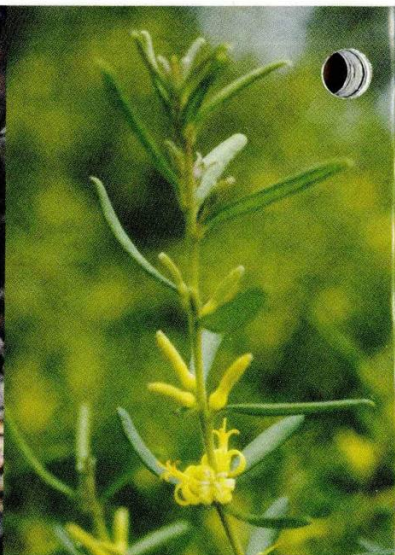
Placospermum coriaceum is the only species of Persoonioideae that usually completes its entire life cycle in rainforests. The others are basically plants of the shrubby strata of heathlands, and sclerophyll forests and woodlands. However, some species, such as *Persoonia arborea*, *P. media* and *P. amaliae* occasionally find themselves surrounded by rainforests that have replaced the sclerophyll communities in which the plants germinated.

The sclerophyllous communities in which *Persoonia* species usually live are fire-prone environments and, not surprisingly, *Persoonia* species are adapted to fires of moderate frequency. The most obvious adaptations are features that allow plants to survive fires, albeit in a more-or-less pruned state. Many species, especially in the south-west, are lignotuberous, resprouting from ground level after fire. Several also develop thick bark that protects epicormic buds, which resprout from trunks and large branches after fire. The most eye-catching of these are the four 'paper-barked' species: *P. falcata*, *P. levis*, *P. linearis* and *P. longifolia*. Branch resprouters with less conspicuous protective bark include *P. amaliae*, *P. elliptica*, *P. katerae* and *P. stradbokensis*. Fire-sensitive species survive fires as buried seeds, which tend to germinate prolifically after disturbance. These species seem to require an interval of at least eight years between fires, allowing newly germinated plants to reach reproductive maturity and establish a replacement seed bank. The natural patterns and processes involved in this kind of life cycle, including seed longevity, the environmental cues that stimulate germination, and even the time from germination to first flowering are still poorly understood.

The best studied interaction between animals and *Persoonia* species is that between the plants and their pollinators. All species that have been studied in detail have been found to be pollinated by a variety of native bees, but especially species of *Leioproctus* subgenus *Cladocerapis* (Colletidae), which rarely visit any plants but *Persoonia* (see Maynard 1995, Bernhardt and Weston 1996). The behaviour of these bees on *Persoonia* flowers is quite predictable.



Above left - ***Persoonia recedens*** See page 70
Above right - ***Persoonia oxycoccoides*** See page 70
Left - ***Persoonia sulcata*** See page 74 Photo D Tomlinson
Below left - ***Persoonia mollis* ssp. *revoluta*** See page 70
Below right & bottom left on opposite page -
Persoonia mollis* ssp. *ledifolia See page 70
All photos except where noted PH Weston

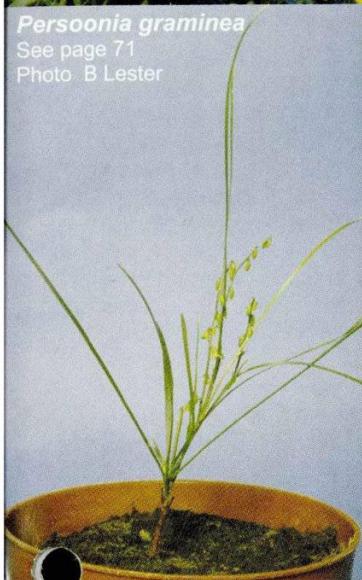


Persoonia quinquenervis See page 74
Photos: Left - PH Weston, right - BS Weston



Persoonia graminea

See page 71
Photo B Lester



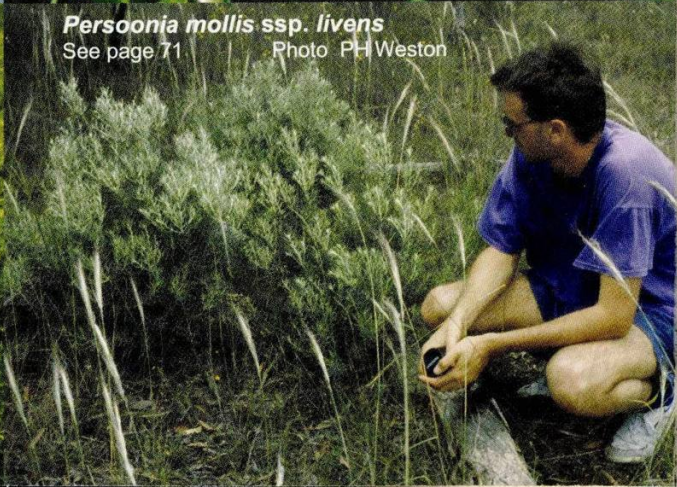
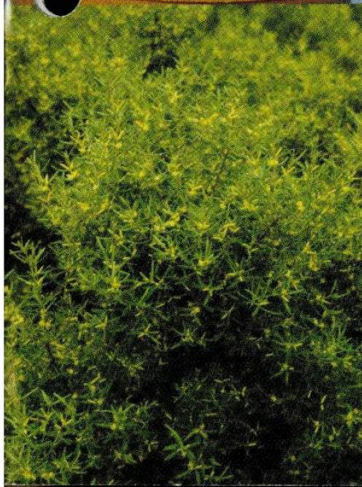
Persoonia gunnii

See page 67 Photo Mary Hancock



Persoonia mollis* ssp. *livens

See page 71 Photo PH Weston



Both males and females alight on the cross-shaped 'platform' formed by the recurved anther tips, orient themselves to be facing one of the anther/tepals, then slide, face first, down between the anther and the style to reach the two glands at either side of the base of the tepal, and drink the nectar from them. Females gather pollen grains with their legs while drinking nectar. The insect then withdraws to the top of the flower, makes a 180° turn, then repeats the process on the other side of the flower. Another species group in *Leioproctus*, subgenus *Filiglossa*, also specialises in feeding on *Persoonia* flowers but these smaller bees seem to be nectar and pollen 'thieves', not effective pollinators. The introduced honeybee, *Apis mellifera* is also a frequent visitor of *Persoonia* flowers at most sites but it is still unclear whether this species is an effective pollinator.

The fleshy fruits of *Persoonia* species are clearly adapted for animal dispersal but it is still unclear whether mammals such as possums and wallabies or large flying birds such as currawongs are the most important dispersal agent. Another group of birds, parrots, also consume *Persoonia* fruits, but they eat the seeds in unripe fruits and so their interaction with *Persoonia* is predatory rather than symbiotic.

Conclusions

We now know much more about the biology of Proteaceae subfamily Persoonioideae than we when the first species were described at the end of the 18th century. We know with a high degree of confidence what named species belong to this group and we have made great progress recently in reconstructing the evolutionary relationships between different major groups in the subfamily. We have probably discovered and named the great majority of species that exist. However, there are still huge gaps in our knowledge. The taxonomy of some species complexes and relationships within the species groups are still poorly understood. Basic aspects of the ecology of *Persoonia*, such as the processes involved in seed dormancy and germination are still unknown. Knowledge of such processes would be very helpful in wildlife management, especially for the many rare and threatened species. There is still plenty of interesting and worthwhile scientific research to be done on the biology of the Persoonioideae!

Acknowledgements

Tim Entwisle and Linda Gunn provided helpful comments on the manuscript. I am grateful to the late Charles Chapman, Mary Handcock, James Indsto, Bert Lester, Peter Richards and David Tomlinson for providing some of the photographs used in this article.

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(Continued on page 91)

Our Garden No 40: Cheree's Garden

Cheree Hall, Elanora Heights, New South Wales

This garden is part of Australia's Open Garden Scheme. Approximately 95% of the garden are Australian native plants and one of approximately 5 that are open to the public in the Sydney region. A lemon tree, vegetable patch, a couple of ground covers and the immovable Norfolk Island Pine preclude it from being 100% native. The purpose for being in the Scheme is to educate the general public about using Australian native plants in the home garden. You do not need to be a landscape gardener nor do you need to be a horticulturist – you just need good old common sense, an ability to laugh and learn from your mistakes and keep experimenting until you are happy with the end result! Most of all you need to have fun while you're at it. I have been a member of the Society for several years and also belong to the Design Study Group. I also take part in bush regeneration and plan and maintain native gardens at our local school.

You can create an Aussie garden in the middle of suburbia – it does not have to be adjacent to a bushland reserve. Ours is located on a corner and is triangular in shape. Our only bordering property to the south has no gardens at all! (See following diagram). I feel it would have been much easier though if we did have the bush as a backdrop. The main part of our garden (we call it the backyard) was totally exposed to the public and still is in part. Every time I go out there to weed people stop to chat as they are on their daily walk.

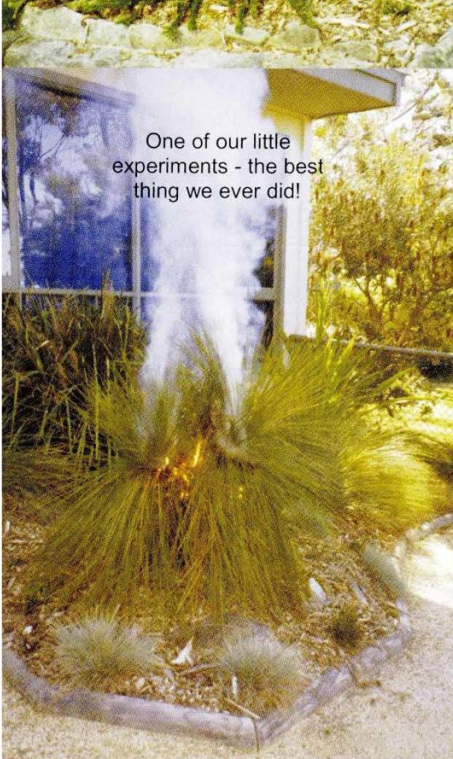
Our backyard and rear courtyards enjoy semi-shade whilst the front receives full sun once it rises above neighbour's trees. We have sandy soil with clay approximately 1 foot below and the entire block has a slight slope from the rear to the front. I use this slope to place plants that need more water on the lower sections and ones requiring less to the rear. We have root competition from the Norfolk Island Pine and two other gums not to mention the trees on the footpath at our rear. This assists in drainage but creates a challenge when it comes to watering during dry weather. We have experimented with adding compost only to some beds, a small amount of commercial mix in others and crushed sandstone to make mounds in another section – all had varying results.

When we arrived here there were approximately 10 or so shrubs, a couple of trees and two small garden beds at the front. One bed running the length of the drive contained exotics with thorns. A small circular shaped garden on the top of the drive also filled with exotics and in bad need of an upgrade.

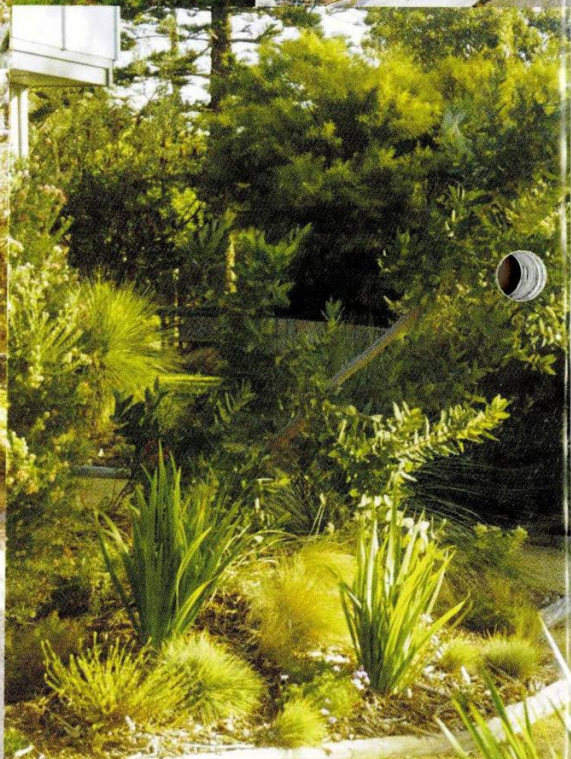
Initially I drew plans of where the garden beds were to be located, and where paths would be placed eventually. During this time I studied the amount of light the garden received, the drainage and where I wanted to place screen plants to obstruct things I did not want to view when looking out from the garden. An order of priority as to which sections to tackle first was established and slowly the grass was removed by hand, donated to neighbours on occasion and treated pine edging installed.



All photos Cheree Hall



One of our little experiments - the best thing we ever did!



The oldest section is enjoying its seventh birthday and major plantings are now complete. Naturally the garden will never be finished really!

This garden certainly does not resemble the bush. It is semi-formal and has been designed to allow both adults and children to enjoy it. The tougher plants were placed where there is - shall we say - a high mortality rate from passing children whilst the front section has more delicate plants. The garden has several high flowering times a year instead of one main event in spring. The idea of this was to try and create a constant food source for birds, reptiles and fauna on their visits.

Most importantly local species were also included in the overall design. I tried to ensure the garden has year-round interest by using foliage contrasts and colours instead of just flowers. Shades of greens and greys, fine foliage next to heavy, grasses erupting out of flat ground covers - all these things were taken into consideration to make the garden a pleasant place to be in all year round. I thought of how the wind moves through the plants creating a rippling effect which displays the grey underside of some plants and that same grey is then picked up in grasses and groundcovers placed further on to continue the theme.

We painted the house in a grey/green colour with darker green trim deliberately to allow it to sit back and blend with the garden and picked specific plant foliage to echo the shade thus tying it in. When the flowering times arrive the garden becomes more enhanced by that dominating species placed throughout the garden. For example there is a time when the Banksias are on show, Acacias come through, and Anigozanthos another. Grevilleas and Callistemon appear several times of the year not forgetting the grasses whose seed heads add further contrast.

Existing trees already created enough canopy so ground-covers, small shrubs and grasses plus larger shrubs were added. Grasses have been a real blessing due to their ability to withstand soccer balls and the like! As the family matures, the grasses will have a less important role. Some beds have been raised with the use of treated pine, others mounded so as to allow more scope in plant selection.

In the extremely sunny areas at the front of the house appropriate species such as *Anigozanthos*, *Actinotus*, *Xerochrysum* and *Brachyscome* give a cottage garden feel. We still have grass in our side yard for the children but we think it looks appropriate with the way the gardens surround it. The little back courtyard area has a few Nepean river pebble gardens interplanted with small lomandras, poas, carex, and *Restio tetraphyllus*. A tiny fern garden exists on the southern side of our laundry making use of a shady micro climate.

Species have been planted in groups of say 3-5 if space allows, usually ground covers and grasses. Those groups have then been repeated where similar conditions apply thus helping to tie the whole garden together. The garden has been mulched with a 'leaf mulch' product and is usually topped up twice a year (prior to garden openings) but of course as groundcovers spread the need for mulch decreases. The mulch does have a tendency to mat but

as we have a long-nose bandicoot in residence the need to break up the mulch periodically is fulfilled.

On the construction side our garden fence was the most urgent requirement to keep our first son from running onto the roads, followed by the compost bin recycled from the inadequate existing fence. Then came the sandpit again using recycled fencing and a tree-house. A small dry creek bed was created a few years ago – it actually operates as a creek in wet weather because we designed it to collect the rainwater from a drainage hole in our balcony. Back then we couldn't find an example of one so we made it up as we went using leftover sandstone from a garden we re-modelled. We recently added a water feature (another story in itself). The front paths are made of decomposed granite but without adding cement and are wide enough to allow wheelbarrow (or wheelchair) access.

A possum, bandicoot, blue-tongues and more recently a baby water dragon have adopted this exposed yard so we feel the garden is working for the environment also. Certain pests are still about though and hopefully as thickets are developing more birds etc will be lured in to help control these. Night stalking is a favourite activity with the children especially when there are signs of overzealous insects. We are out with torches to the amusement of neighbours finding out who the culprits are and dealing with them. Very little if any pesticides are used – we have tried to let nature take control but on the odd occasion a pyrethrum spray is necessary to help control scale. Unfortunately curl grubs have been quite active although the bandicoot is trying to keep that under control to the detriment of the *Actinotus* and other delicate species.

Osmocote for Natives is applied at the time of planting and if I remember sprinkled around and lightly scraped into the soil around spring-time. Sometimes just compost is used and mixed with the soil. We are really experimenting with the fertilising aspect and have found the general public who visit are as horrified at the idea of fertilising Australian natives as they are about pruning them. I am a vicious pruner!

As animals etc would be grazing on foliage or fires periodically coming through to help regenerate the act of pruning to me is one way of trying to mimic this. Sometimes it can be tip-pruning and on other occasions up to one third of the plant is removed. We recently burnt our pride and joy – a double headed *Xanthorrhoea* to watch how it recovers after fire – the children were enthralled and we are watching it re-shoot at present. We lived on acreage at Ingleside during the 1994 bushfires (we moved in 2 weeks prior to the fires) so we have had the pleasure of watching regeneration after a fire firsthand - a great way to get rid of an exotic garden and replace it with natives! We have experimented with chain-sawing a grevillea to the ground and that worked well also.

The garden is constantly changing and evolving. Loss of plants including large species through drought, windstorm or animals have recently provided us with planting opportunities we were not particularly happy about.

(Continued on page 91)

Persoonias in Cultivation

notes compiled by Casimir Liber

Propagation remains a major barrier to the use of Persoonias, both in horticulture and in revegetation. However, there have been some interesting developments around Australia.

Perth

Alec Hooper, of Zanthorrea Nursery reports that they have had available the local species *Persoonia elliptica*, *P. longifolia* and occasionally *P. saccata* as well as *P. oxycoccoides* and *P. nutans* from the east. Propagation has been difficult and long-term viability in Perth Gardens remains unknown.

George Lullfitz, of Lullfitz Nursery hasn't stocked them due to difficulties with propagation. He adds that the only one in demand locally is *P. longifolia*, which is still cut from the bush for its foliage. He could see this being quite a popular garden plant one day if it became widely available.

Persoonia longifolia has been germinated from seed with some success. The method resulting in up to 40% germination when using fresh seed that had been treated with gibberellic acid (GA3) after having part of the endocarp chipped away, sown on the soil surface and watered twice daily in an ambient temperature glasshouse in winter/spring. (Further details can be found in the reference provided at the end of this article.)

Albany

Max Luscombe adds... I lightly burn the undergrowth around naturally occurring plants near the nursery. This burns the top layer of thick mulch and germination occurs. Tips taken from these seedlings will also strike. Suckers will also strike but are slower and should not be kept too long under mist - hardening off can promote root formation.

I have also tried taking cuttings from basal shoots from trees that had been slashed and have started resprouting. Cuttings using fleshy and young would be placed in coarse sand, after dip in 3% Clonex gel and at 22° bottom heat started forming callus in four weeks. By eight weeks, the majority had developed callus and 50% some kind of root formation. Misting 3-4 times daily for a 2 minute interval. It appears autumn and spring are suitable times to take cuttings. Removal of cuttings from coarse sand is difficult and cuttings in pots with minimal disturbance would be more suitable. They do benefit from removal from heat and mist after callus formation.

The species used was mainly *P. longifolia*. I have also tried with *P. elliptica*, though with less success. There are a few *P. longifolia* plants in cultivation. They have survived in the ground so far and are fast growing. *P. elliptica* seems better suited to cultivation in pots.

Sydney

Mark Ferrington, of Sydney Wildflower Nursery West, reports *Persoonia chamaepeuce*, *P. chamaepitys*, *P. nutans*, *P. oxycoccoides* and *P. pinifolia* are readily available. They are fairly reliable in well-drained soils and tolerate a fair degree of shade.

Richard Johnstone reports on trials at the nursery at Mt Annan Botanic Gardens... Propagation of *Persoonias*, as elsewhere, has been problematic. Cuttings of several varieties of have been tried with extreme variation in results, which do not seem to correspond to time of year or concentration of rooting hormone used. However, generally higher concentrations of IBA seem to work better with *Proteaceae*. It must be stressed that all observations thus far are on limited number of samples (thus concrete extrapolation is premature).

Cuttings are taken at varying times during the year and placed in standard cutting mix of half coir, half perlite, with bottom heat and mist. If successful, they generally take 3–4 months to strike. Clonex red or purple is used, or intermediate strengths of IBA.

One species with horticultural potential which has struck consistently 40–50% of the time is *Acidonia microcarpa*, taking 2 months to strike. Specimens have grown well in pots, but died within weeks of being planted in the ground.

Other species tried include *Persoonia helix* with 10-50% success, *P. rigida* (~30%), *P. curvifolia* (0-10%), *P. stradbokensis* (0-80%(!)), *P. rufa* (~10%), *P. cornifolia* (~10%), and *P. marginata*, which usually struck about 10% of the time, but occasionally 50% success was recorded. No success was had with either *P. pinifolia* or *P. levis*.

Until now, propagation by seed has not been tried but trials will be undertaken soon using Gibberellic Acid.

Peter Antoniazzi, a bush regenerator in Sydney, has had some success with *P. laurina* cuttings and recalls... Soft tip cuttings from lateral shoots were taking early in the morning in September. They were sprayed with water and placed in a plastic bag until I was able to plant them that afternoon.

Leaves were stripped except for the top two, and at the base a clean cut was made just below a leaf node. Cutting length was about 12 cm. Half of the cuttings were dipped in a root hormone powder that I bought from Bi-Lo. The mix I used was 3:1 Nepean river sand and coco peat. They were planted to a depth of 1/3 of the length of the cutting and watered very sparingly. I housed them in 3 x 20 cm pots covered with white plastic shopping bags. The pots were placed on 3 house bricks under a bench in a nursery hothouse.

Good root formation occurred in about 4 weeks, thick white roots began to show through the bottom of the pots after about 6 weeks. There were few if any losses. Those without hormone had struck equally well. The cuttings were planted out in Amgrow native plant mix and hardened in a shade-house for two weeks. Note: The sparing amount of water used may be the trick. When I potted the cuttings on it was still possible to see traces of the hormone powder on the stem above the root ball. Being under the bench I forgot all about them. I can only recall watering once after the initial planting.

South Australia

Gill Muller reports... That availability in South Australia is very limited. I have only seen *Persoonia oxycoccoides*, *P. chamaepitys* and *P. pinifolia* for sale, and never on a regular basis.

I know of a number of plants of *P. pinifolia* growing in the neutral to acidic soils of the Adelaide Hills and Foothills, the general opinion was none would grow well in the alkaline soils of most of SA. Those growing are very drought tolerant, one in particular in Belair being 3 metres tall after 20 years, and receiving no additional water other than rainfall.

The only *Persoonia* found in SA, *P. juniperina* is hard to find, and never seen in nurseries.

Arthur Pratt is the head of the Grower's Committee, and co-ordinator of plants at all our plant sales (we have up to 1500 species, and 45,000 plants at a good sale). He doesn't remember seeing a *Persoonia* go though the plant sales for many years.

He checked back on the records, 2 *P. pinifolia* were listed for sale in Autumn 1997 but didn't show up at the sale, and in Autumn 1993 2 each of *P. nutans* and *P. oxycoccoides* were listed, but again didn't arrive at the sale.

Melbourne

Evan Clucas, who propagates for Kuranga Nursery in Melbourne, reports... Apart from *Persoonia pinifolia*, *Persoonias* are under appreciated and under-utilised in the home garden and have considerable potential as garden subjects. Some of the 30 or so species we have propagated have been only recently tried by us, while others have been produced in such small quantities that the results are rather meaningless.

Generally, propagation is done by cuttings; several years ago some seed of Western species was tried with no luck, and they have been getting seedlings of *Persoonia pinifolia* arising in disturbed soil around established garden plants. (This is useful as *P. pinifolia* is difficult to propagate from cuttings.)

Tip cuttings are generally taken from soft tips of new growth in March and dipped in Purple Clonex, then into a mixture of mostly Perlite and polystyrene with a little vermiculite and a 'sniff' of peat, and then placed into a propagation house under mist with bottom heat.

We have found the following species to be consistently difficult to produce from cuttings: *P. arborea* (to date we have unsuccessful with this species), *P. brevifolia*, *P. comifolia*, *P. glaucescens*, *P. juniperina* (reasonable success can be had with this one), *P. lanceolata*, *P. levis* (this species also we have not succeeded with), *P. linearis*, *P. pinifolia*, *P. procumbens*, *P. rufa*, and *P. stradbokensis*.

I expect *Persoonia elliptica* will also prove to be difficult, but the results from this newly acquired species remain to be confirmed.

The following species have consistently proved over a number of years to be relatively easy to produce from cuttings: *P. chamaepeuce*, *P. chamaepitys* (both the yellow form and the orange-flowered Rylstone form), *P. daphnoides* (success rates with this one have been quite inconsistent), *P. dillwynioides*, *P. gunnii*, *P. mollis* (both subsp. *leptophylla* and the prostrate *revoluta*), *P. myrtilloides*, *P. nutans*, *P. oxycoccoides*, *P. recedens*, *P. silvatica* and *P. tenuifolia*.

A range of other newly acquired species have also been propagated in recent years but we haven't produced these in sufficient quantity for the results to be meaningful.

These species include: *P. acerosa*, *P. cuspidifera*, *P. isophylla*, *P. laurina* subsp. *laurina*, *P. laurina* subsp. *leiogyna*, *P. mollis* subsp. *caleyi*, *P. mollis* subsp. *mollis*, *P. oblongata*, *P. sericea* and *P. virgata*.

In the wild I have observed considerable variation and intergradation within and between certain species, which can make identification difficult.

There are many examples of spontaneous hybrids occurring in the field, and often the parentage is difficult to ascertain. We are growing a small number of purported hybrids, including some that have arisen in garden situations. One attractive garden plant appears to be a cross of *P. juniperina* and *P. pinifolia*. Interestingly, cuttings from this latter plant appear to strike readily unlike either of its parents.

Doug Pocock of Bindelong Nursery in Victoria is one nurseryman who has had some success (~60%) with *P. pinifolia*. He reports that patience is the key, with some cuttings taking up to 18 months to strike. Cuttings are taken from May onwards, using Induce No. 2 rooting hormone and a standard 3:1 sand peat mixture, with no bottom heat, in a poly house with mist. He has found *P. chamaepeuce* and *P. oxycoccoides* relatively easy but *P. chamaepitys* very difficult using this technique.

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Persoonias in Pots

— Gill Muller, leader - Australian Plants in Containers Study Group

Gill writes of her trials & tribulations with Persoonias in containers...

I have *P. pinifolia*, *P. nutans*, *P. chamaepitys*, *P. oxycoccoides*, *P. recedens*, *P. daphnoides* and *P. juniperina* in pots, the last three being bought from Kuranga Nursery in Melbourne. I have lost in pots *P. myrtilloides*, *P. tenuifolia*, *P. gunnii*, *P. mollis* (prostrate form) and *P. chamaepeuce*, all bought from Kuranga.

I find they have to have excellent drainage in pots, including being up on pot feet, and making sure the pot has enough good size drainage holes. I am very light on with Osmocote for Natives, but I find they yellow, particularly *P. pinifolia*, and it is nitrogen they need, not iron when this happens. I use a Richgro product, IBDU, N 31% and I buy it in 25 kg bags through work. It is very gentle, no burning, but you can see results in a couple of weeks.

I haven't tried planting any in my garden as I am in the Hills, but I get access to so few of them I'm scared to lose them if I do!

Domestication of 'Golden Cascade'

The progress and possibilities

Beng Tan and Kacung Hariyono

Department of Environmental Biology, Curtin University of Technology

Evolution, with the helping hand of early agriculturists millennia ago, has shaped modern-day cereals and other grain staples. Many of our more familiar garden ornamentals are, on the other hand, a legacy of intrepid explorers and botanists from a bygone era. Modern plant breeding has merely 'added icing on the floral cake'.

In contrast to established exotics, cognisance of the horticultural potential of Western Australia's unique wildflowers is relatively recent. Not surprisingly, relatively few species have been domesticated for commercial cultivation, the few notable successes being the kangaroo paws (*Anigozanthos*), wax flowers (*Chamelaucium*), *Banksia* and a selection of native daisies. It is somewhat surprising that, despite the endowment with vast genetic resources at the doorsteps, not many more native species are brought into popular cultivation. Part of it may be related to difficulty in their propagation.

An example of constraints to domestication is the unique yellow-flowered myrtle, *Corynanthera flava* or 'Golden Cascade', as it is known in the native cutflower trade. Its unusually slender, lacy flower stems lend themselves to Japanese Ikebana-style floral arrangements. Although the wildflower is a premium in Japan, commercial cultivation of this wildflower has yet to be realised. Plant stocks are unavailable and there is inadequate knowledge of suitable cultivation practices.

Natural distribution and characteristics

Corynanthera flava is endemic to the floristically-rich northern heath sand-plains in a 70 km range, from Tathra National Park to Watheroo National Park, some 200 km north of Perth. Only one species of *Corynanthera* is known; the specific name refers to the flower's yellow hue.

JW Green of the WA State Herbarium described the botanical characteristics of *Corynanthera* in detail in 1979. The genus refers to 'club-like' appendages on the anthers, which is unique among flowering plants; the two different forms of this stamen appendage are also unusual. Only one species of *Corynanthera* is known. When all the taxonomic characteristics are considered, *Corynanthera* is thought to be closely related to two other small myrtle genera, *Thryptomene* and *Micromyrtus*.

For all of its horticultural finesse and reputed commercial value, 'Golden Cascade' is harvested exclusively from wild populations. Harvesting of flower stems is however permitted only on private properties, but no more than 20% of the available flower stems may be picked in any one flowering season as a conservation measure.

Plant densities of natural stands are highly variable. This is not unexpected for, as a small shrub, it is easily outgrown by bigger shrubs in undisturbed sites and, as a re-seeder, regeneration and plant density are dependent on bushfire frequency as well as harvesting practices. A burn

cycle of approximately 8 years is believed to yield optimum harvestable flower stems. According to available information (Prof. Byron Lamont, per. comm.), the average interval between fires on the sand-plains is 15 years (range: 7–30 years). Flower stem quality will also be wanting in dry years.

Undeterred by this anecdotal failure, we investigated initially seed quality and germination, but extended the research to clonal propagation using stem cuttings and tissue culture techniques. It should be possible, from this broad study, to assess the prospects of domesticating this unique small myrtle.

Parameters for successful seed germination

A typical 'seed' (strictly speaking, fruit) lot, whether hand harvested or purchased from a seed merchant, comprises mainly chaff (approx. 65% by weight) and 'empty' seed (collapsed and endosperm-less) (25%); seed proper (i.e., containing an endosperm and embryo) is only about 10%.

An immediate problem relating to excessive inert seed material is their potential inhibitory effect on germination, for members of Myrtaceae are notoriously allelopathic. Root exudates, and rain washing off leaf and bark tissues, for example, effectively create a 'zone of exclusion' around dominant individual *Chamelaucium* shrubs and *Eucalyptus* trees; volunteer seedlings of the same and other species can be observed only several years after their demise. The lack of success in early nursery sowings of *Corynanthera* could conceivably stem from the inhibitory effects of chaff material, although low seed viability could be another factor. This corroborates our initial glasshouse experience where no germination was observed with uncritical mass sowing of unsorted seed lots.

Residual viability of plump seed was also examined. In a series of biochemical tests for indicative viability, seed viability was found to decline by about 15–20% with each year of storage at room temperature. Thus seeds that have been kept under similar conditions for several years are not worth persevering with. The decline in seed viability will be much steeper in natural seed banks, which are characterised by high summer ambient and soil temperatures. This suggests that a sizeable and accumulative seed bank is paramount for population rejuvenation, as seedling recruitment will depend on the next fire and favourable moisture conditions.

As a prolific seeder adapted to the fire-prone sand-plains, germination in *Corynanthera* may be cued by heat or smoke in its natural habitat. Not surprisingly, we obtained good germination after pre-soaking plump seeds in smoke water for 18 hours. Germination was conducted *in vitro* (on agar or filter paper) as well as by conventional sowing using a light sandy mix. Under laboratory conditions, germination was observable after about five weeks with final germination approximating indicative seed viability. In essence, germination can be achieved if clean, viable seeds are separated from chaff material and pre-soaked in smoke water.

Propagation from stem cuttings – differential responses

Many small myrtles (e.g. *Baekia*, *Chamelaucium*, *Scholtzia*, *Thryptomene*, *Verticordia*) are successfully propagated in commercial wildflower nurseries from stem cuttings. *Corynanthera* should not be any different. Our first trial in December 1998 using bulked material from several shrubs was successful in



Photo K Hariyono



Photo K Hariyono

Above - *Corynanthera flava* in natural bush habitat

Left - Post-fire recruitment of *C. flava* seedlings

Below left - Unsorted bulk seed lot of *C. flava*, including extraneous material

Below - A seed lot sorted into 4 components: seeds with an embryo constitutes only 9% by weight



Photos B Tan



obtaining a 70% 'strike' rate but all rooted cuttings eventually perished due to extreme summer temperatures during the hardening-off stage. In a more recent trial conducted in spring about 20% of treated cuttings rooted overall, and these survived with better after-care and benign temperatures.

The relative ease of root induction ('strike') is not uncommonly related to genotype of the donor plant and quality (physiological status) of the cutting material, the latter being influenced by nutrition and season when cuttings are taken. The importance of donor plant genotype is highly demonstrable in *Corynanthera*; for example, cuttings from certain individual shrubs rooted consistently while others from within the same or different populations, failed to root at all in replicated trials. Many more individual easy-to-root shrubs will have to be obtained, as reliance on a limited number of clones is not a sound long-term proposition in the domestication process.

Tissue culture propagation – a futile exercise ?

In vitro shoot cultures could be established successfully from field-collected material. Shoot multiplication *in vitro* was exceptionally prolific and roots could be induced without difficulty. Plantlet survival after deflasking, however, was disappointing, despite considerable attention to misting and several modifications to the protocol, for example, gradual dehumidification of the culture jar before deflasking. Plantlets generally appear 'soft', lacking wax and are highly prone to desiccation.

In vitro shoot cultures were also established after germinating zygotic embryos, and by regeneration from embryogenic calluses. But the outcome was similar, namely, no rooted plantlet survived after deflasking despite all the care. Chemical hardening of plantlets with Paclobutrazol during the *in vitro* stages also failed to achieve plantlet survival.

The cause(s) of non-survival of tissue-cultured *Corynanthera* plantlets was investigated comparing the leaf tissues of normal seedlings, stem cuttings of field material and tissue cultured plantlets. Whereas the leaves of seedlings and cuttings have functional stomates and a decent wax layer on the leaf surface, the stomates of tissue cultured plantlets are collapsed and dysfunctional and leaf wax layer is either thin or variable. It is little wonder that they are so vulnerable to desiccation after deflasking, even with regular misting in a propagation tent.

Clearly, tissue culture propagation of *Corynanthera* will be a fruitless exercise unless the underlying cause(s) for loss of leaf wax and stomatal functions during the *in vitro* culture phase are better understood and rectified. This may involve gross modification to *in vitro* culture conditions, such as near-autotrophic nutrition and better jar venting to reduce internal humidity.

Summary and Conclusions

Successful propagation from seed requires fresh, clean seeds and pre-treatment with smoke water. Success with vegetative propagation using stem cuttings is dependent on donor plants, as there appears to be a strong genetic component determining rooting response. Cloning by tissue culture is severely constrained by zero plantlet survival after deflasking; the cause appears to be acute proneness to desiccation stemming from dysfunctional leaf stomates and a lack of leaf bloom.

Further research is required to overcome this 'bottle neck'.

In perspective, the domestication of *Corynanthera* with a view to eventual commercial cultivation is achievable as long as cloning is not a *desiratum per se*. When successfully domesticated, 'Golden Cascade' has the potential to be the proverbial "Golden Fleece" for the fledgling wildflower industry.

Acknowledgement

We would like to acknowledge the generosity of Mrs Diana Jewell of Eneabba WA in providing seed and stem materials for this study.

Our Garden No 40: Cheree's Garden (continued from page 82)

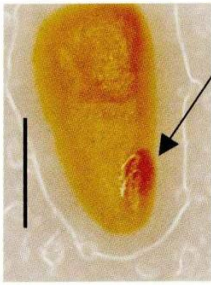
On this vein there is also the question of what to do if a plant you own becomes a weed in our local bushland and appears on your council list of plants to be removed/avoided. For us *Acacia podalyriifolia* (Mt Morgan Wattle) was it! This beautiful small grey foliated tree provided the centrepiece for one of the front garden beds and it is now removed. We had three in total and one remains - this will be removed in due course. Many of our neighbours have these plants and think they shall remain. The plants are prolific seeders and as a bush regenerator I can see the reason these plants have become a pest in our area. *Acacia cultriformis* is one of the suggested replacement plants so that is the one I chose. So far it needs to grow another 3 metres in a hurry to reach the height of its predecessor - I am measuring it daily!

Therefore I can honestly say our garden is really an ongoing experiment and somewhere along the line order seems to have crept in. We've even managed to pick up a few garden awards on the way. The fun continues and the opportunity to open to the general public to show how zealous amateurs can do it is an honour. The garden (really its owners) has been resting and should re-open around spring 2003. I urge as many Australian native garden owners as possible to contact the Open Garden Scheme and see if you too could throw open your gate and help encourage the public to plant a native or two for the good of the environment - before our children think Mondo Grass, Agapanthus, Buxus and the like are Australian plants!

Proteaceae Subfamily Persoonioideae (continued from page 78)

1. Hoot, S B, and Douglas, AW (1998), Phylogeny of the Proteaceae based on *atpB* and *atpB-rbcL* intergenic spacer region sequences. *Australian Systematic Botany* **11**: 301–320
2. Maynard, GV (1995), Pollinators of Australian Proteaceae. *Flora of Australia* **16**: 30–33
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5. Weston, PH & Crisp, MD (1996), Trans-Pacific biogeographic patterns in the Proteaceae. Pp. 215–232, in Keast, A & Miller, SE (eds.) *The Origin and Evolution of Pacific Island Biotas, New Guinea to Eastern Polynesia: Patterns and Processes* (SPB Academic Publishing, Amsterdam)
6. Wrigley, JW, and Fagg, M (1989), *Banksias, Waratahs & Grevilleas, and All Other Plants in the Australian Proteaceae Family* (Collins Australia, Sydney)

Germination of *Corynanthera flava*
See page 67. (Bar = 1mm) Photos B Tan

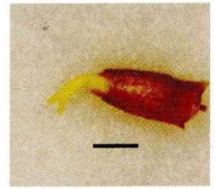


Position of embryo revealed by chemical staining



Imbibed fruit

Incipient germination



***In vitro* germination and seedling development**

Photos K Hariyono

Emergence of cotyledons from endosperm



Protrusion of young seedling

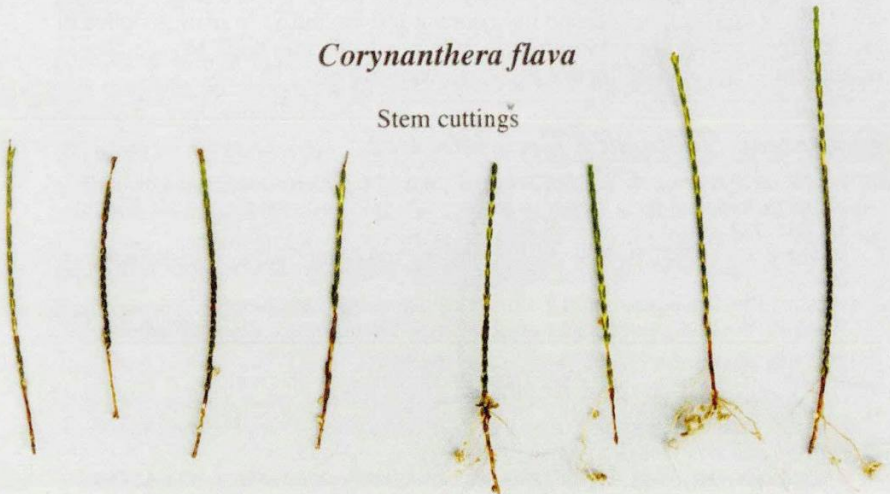


Prolific leaf development



Corynanthera flava

Stem cuttings



Control

Clonex

Rooting induced ('strike') in field-collected stem cuttings: control (no rooting hormone) versus Clonex (IBA) treated

Photo B Tan



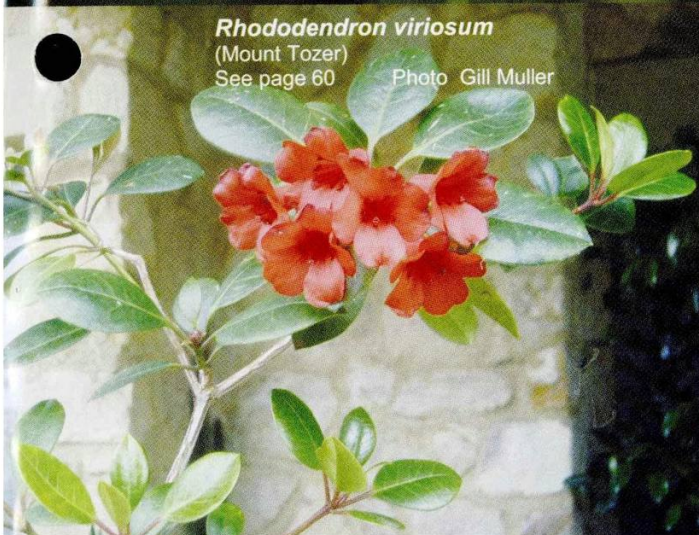
More of Cheree Hall's garden See page 79 Photos C Hall



Persoonia stricta

See page 74

Photo PH Weston



Rhododendron viriosum

(Mount Tozer)

See page 60

Photo Gill Muller



Persoonia saccata

See page 74

Photo D Tomlinson

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

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

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

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

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

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Persoonia amaliae See Page 67 Photo PG Richards