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Australian Plants is recognized throughout the world as the best reference to the Australian flora presented in non-scientific terms. Reports of recent scientific research, locked away in scientific libraries, are represented in a readable form for the benefit of the interested public. We will continue to update accepted references with the latest research, a service not available elsewhere. This also applies to the accepted reference books on *Banksia*, *Grevillea*, orchids, ferns, cycads, etc., books that the society has taken action on to maintain in print.

We will continue to promote the cultivation of Australian wildflowers for horticulture with practical proven advice on cultivation practices and describe new plants recommended for cultivation. As the only world-wide reference in this regard we are performing an important function. This applies particularly to the commercial production from the flora providing significant export earnings with emphasis on the cutflower trade.

A major emphasis is on conservation of our unique flora that is rapidly becoming extinct, a crisis that is going unnoticed by our "responsible" leaders. All our native creatures are dependent on the flora they have become adapted to and their extinction is reaching crisis proportions with no real concern being paid by those we have entrusted to ensure our survival. Our recommendations for the development of appropriate management practices have been ignored. We are puzzled over indifference to this crisis, especially by politicians and government servants. We are the leaders in this area of conservation and our concerns will continue to be reflected in *Australian Plants* with practical suggestions for action.

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COVER PLATE, Honey Pots, *Dryandra lindleyana*, the *mellicula* variety of the type form, is a low-growing, procumbent to erect plant with aerial stems to 45 cm tall. The leaves are 10–15 cm long, 5–10 mm wide. The photograph is about full size and shows the flower heads typical of the group of plants allied to *Dryandra nivea* and leaves typical of those in the group. Photograph by Margaret Pieroni.

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The 'Honey-pot' Dryandras

The Series *Niveae* of the Genus *Dryandra*

Margaret Pieroni and Tony Cavanagh
Dryandra Study Group*

One of the most attractive of the smaller dryandras for many home gardeners has always been *Dryandra nivea*. Unfortunately, as we discovered many years ago, 'Dryandra nivea' is incredibly variable. There are prostrate forms, both clumping and spreading, and upright forms. Some have a lignotuber and survive fire; others are killed by fire and regenerate from seed. The wide variety of leaf forms is also characteristic — from broad to very narrow, from bright-green to distinctive blue-green and from flat to distinctly V-shaped. One feature which is relatively constant is the shape of the inflorescence or flower head.

The individual flowers arise from a receptacle which is noticeably convex. They are arranged around the circumference of the receptacle with the styles curving inwards, forming a central "hole" which contains the nectar, hence the common name "honey-pots". However, the colour of the inflorescence is not constant, even within a recognizable form. They can be yellow, orange, red, pink, golden brown and shades in between so it is not usually possible to identify the various forms by this means. Small wonder, then, that Alex George in his revision of *Dryandra* (*Nuytsia* 10(3): 313–408 (1996)) states that this group is "One of the most difficult series taxonomically: the floral and fruit morphology are remarkably uniform, species being separated largely on the basis of habit and leaf morphology. — The series deserves a great deal more study."

The name *Dryandra nivea* has been used to describe what is now recognized as a number of distinct species. In the course of his revision, Alex George reinstated a number of old names that had been considered as synonyms in earlier revisions. These include *Dryandra brownii*, *D. stenoprion*, *D. tortifolia* and *D. arctotidis* while *D. lindleyana*, also an old name, now covers a range of widespread, variable species subdivided into five subspecies. A new species, *D. cypholoba*, is recognized as well as a new subspecies of *D. nivea*.

We have prepared this article to try to remove some of the mystery surrounding this group of very attractive plants. The scientific descriptions have been provided by Alex George and we thank him for his interest and support. The leaf drawings, photographs and field descriptions should help to distinguish at least the major groups, but unfortunately, these plants hybridize in the field, adding just another layer of difficulty to positive identification. Many such hybrids have been supplied to gardeners mis-labelled as various species.

*Dryandra Study Group. Our study groups comprise members who are particularly interested in the cultivation or research of a particular group of plants. This group is well regarded in professional botany to the extent that it collaborates with scientists in the study of Dryandra. A newsletter is produced regularly and reports on experiences of members in the propagation and cultivation of Dryandra, recent research on them and seed of species. Direct enquiries to the Study Group Leader, Margaret Pieroni, 16 Calpin Crescent, Attadale, Western Australia 6156. These groups operate mainly by correspondence and a small charge is made for paper and postage, in this case \$6. It is one of the many services available to members anywhere in Australia.



△ *Dryandra nivea*, the type form of the **Honey Pots**, showing the habit of growth of this group of plants, photographed from above. See page 173 for a description. Photographs by Margaret Pieroni.

▽ *Dryandra lindleyana*, the *mellicula* variety shown on the front cover, showing how these plants act as a ground cover, producing 'honey pots' in season.





Dryandra stenoprion, the flower and plant which forms a smaller clump, the leaves being revolute, that is rolling back along the margins to the extent that, at the ends of the leaf, they overlap to form a tube. They have a thick yellow midrib that shows just as in the photograph.



Table 1: The group of species allied to *Dryandra nivea* giving their names, collectors and collection locality in chronological order of description.

Year Described	Name	Collector and Year	Collection Locality
1810	<i>D. nivea</i> (Labill.) R.Br.	Labillardiere (1792)	Near Esperance Bay
1830	<i>D. arctotidis</i> R.Br.	Baxter (1829)	Near King George Sound
1845	<i>D. brownii</i> R.Br.	Preiss 509 (1840)	Near Mt. Willyung
1845	<i>D. lindleyana</i> Meisn.	Preiss 511 (1839)	?Point Walter, Swan River
1855	<i>D. tortifolia</i> Kippist. ex Meisn.	Drummond 6:211 (1850–1851)	South western WA
1855	<i>D. stenopryon</i> Meisn.	Drummond 6:212 (1850–1851)	South western WA
1996	<i>D. cypholoba</i> A.S. George	A.S. George 16777 (1986)	Nr Alexander Morrison N.P.
1996	<i>D. lindleyana</i> Meisn subsp. <i>lindleyana</i> var. <i>lindleyana</i>	Preiss 508 (n.d.)	South western WA
1996	<i>D. lindleyana</i> subspecies <i>lindleyana</i> variety <i>mellicula</i> A.S. George	A.S. George 17210 (1994)	Chittering Valley
1996	<i>D. lindleyana</i> subspecies <i>pollostia</i> A.S. George	A.S. George 17002 (1993)	W. of Moora
1996	<i>D. lindleyana</i> subspecies <i>media</i> A.S. George	A.S. George 16808 (1993)	S. of Eneabba
1996	<i>D. lindleyana</i> subspecies <i>agricola</i> A.S. George	A.S. George 17219 (1994)	Near Jubuk, 60 k E. of Brookton
1996	<i>D. lindleyana</i> subspecies <i>sylvestris</i> A.S. George	A.S. George 11621 (1977)	E. of Mayanup, S.E. of Boyup Brook
1996	<i>D. nivea</i> subsp. <i>ulliginosa</i> A.S. George	A.S. George 17117 (1993)	Governor Broome Rd. Scott River plain

The species in this group (Series 24. Niveae) with affinities to *Dryandra nivea*

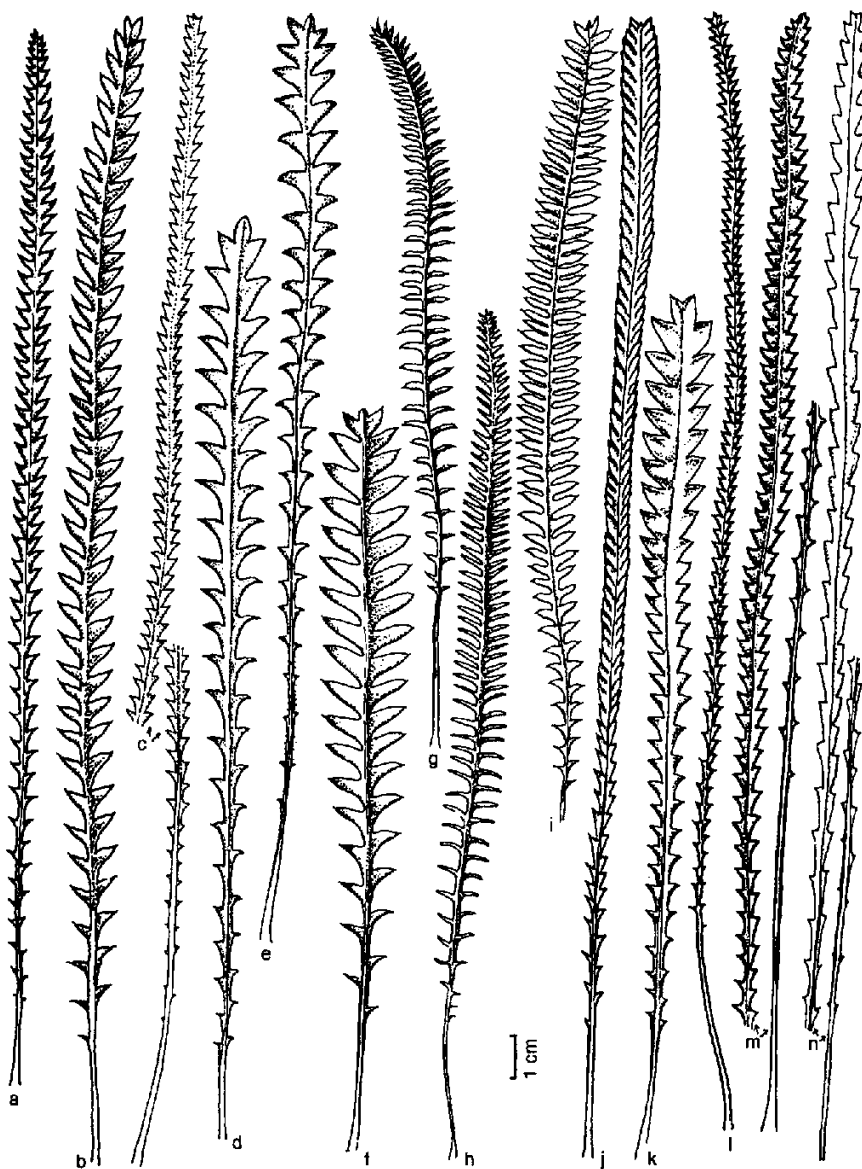
For each species there is a short botanical description in smaller type followed by more general notes of interest based upon field observations on the species.

***Dryandra* ser. *Niveae* Benth., *Fl. Austral.* 5: 564, 574 (1870)**

Shrubs with prostrate or shortly erect, divaricately branched stems, with or without lignotuber. Leaves linear, pinnatifid, pinnatipartite or pinnatisect. Inflorescence terminal, sometimes subtended by succeeding year's branchlets; involucre bracts shorter than flowers, flat; receptacle markedly convex; flowers at anthesis forming a circle leaving a central hole; floral bracts linear, obtuse, variously hairy and with apical papillae or curled hairs. Perianth straight, the limb inflexed before anthesis. Pistil longer than perianth, those of outer flowers longer than inner, strongly incurved; pollen presenter scarcely enlarged. Flowers persistent. Follicles obovate, sometimes markedly narrowed towards base, loosely attached. Seed wing not notched.

The species and forms are listed in Table 1, all previously known as *Dryandra nivea*, all with remarkably uniform floral characteristics, see opposite. They are separated largely on the basis of habit and leaf morphology. All six species are described from page 167. They are widespread between Geraldton, Cape Leeuwin and Israelite Bay and inland to Corrigin.

Continued on page 167

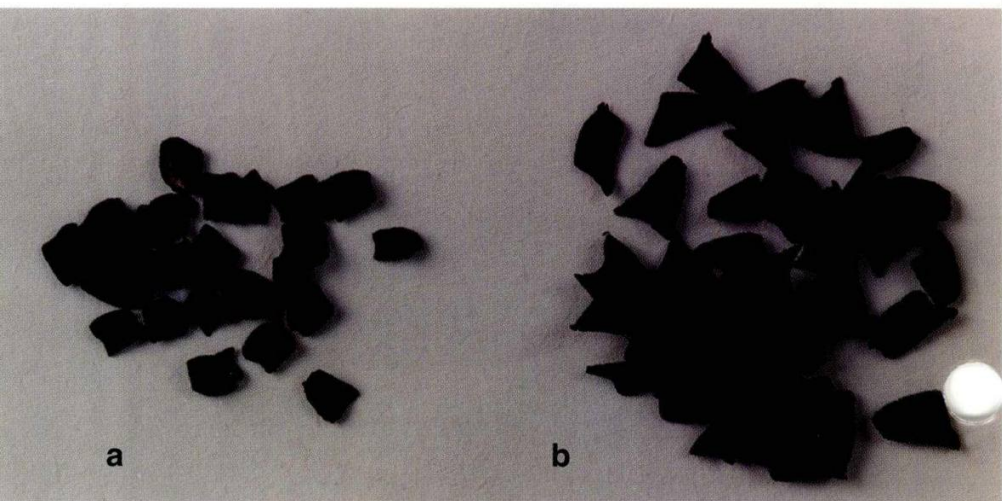


Leaf drawings of the "honey-pot" dryandras

Dryandra lindleyana the type form subsp. *lindleyana* var. *lindleyana* in a, and its variety *mellicula* in b, its subspecies *pollostia* is c, its subsp. *agricola* is e and its subsp. *sylvestris* is f.

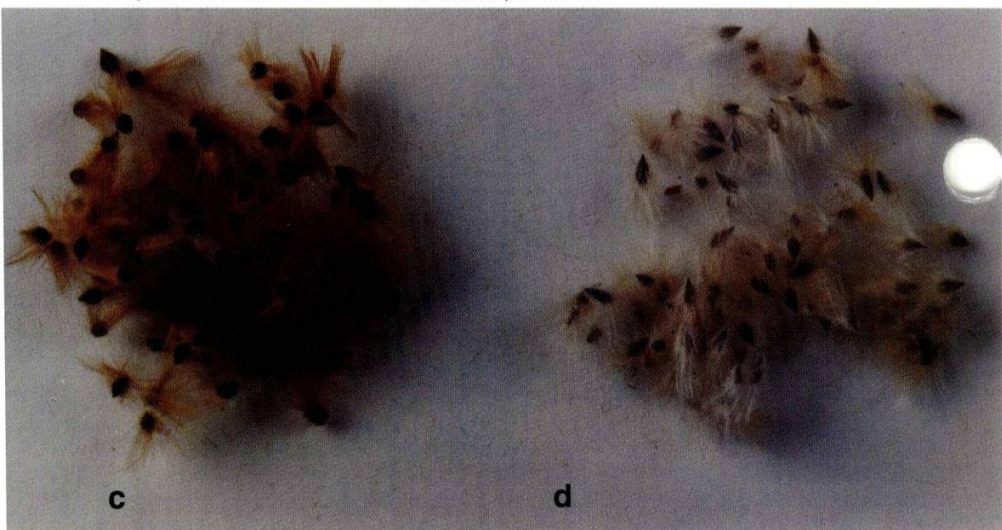
Dryandra arctotidis leaf is g, — *D. tortifolia* is h, — *D. brownii* is i, — *D. stenoprion* is j, and *Dryandra cypholoba* is k.

Dryandra nivea subspecies *nivea* is l, subsp. *vilginosa* is m and the form 'Morangup' is n.



△ **Examples of *Dryandra* seed**, (a) *Dryandra polycephala* and (b) *Dryandra quercifolia*. The seed of many Proteaceae look like these although those that are dispersed by wind such as *Banksia*, *Hakea* and *Telopea*, have a papery "wing" to help them on their way. For suggestions as to the collection of *Dryandra* seed from growing plants, see page 151.

▽ **Examples of *Isopogon* seed**, (c) *Isopogon cuneatus* and (d) *Isopogon trilobus*. The seed of other Proteaceae are smaller and are also carried by the wind but this time by a clump of "hairs" attached to the seed. When you see an *Isopogon* plant where the dead flowers, shaped like a drumstick, are beginning to get "fluffy", this is when the seed is about to blow away. Crushing the fluffy drumstick will cause it to disintegrate into very many particles, half of which are seed as shown below with the dark seed head and fluffy tail, and half will be the hard remains of the seed "capsule" that can be sorted out and disposed of.



Dryandra and Isopogon

Seed germination

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Most of the 20% of the 25,000 species of flowering plants native to Australia which are in horticultural use are disseminated and propagated from seed. The reliance on seed propagation is not confined to the horticultural industry alone, mine site rehabilitation and conservation of rare and endangered species also rely heavily on this. Knowledge of the requirements for germination are essential in these areas as many species are difficult to germinate. Thus until other methods of propagation are perfected and used widely such as micropropagation, cuttings and grafting, propagation by seed will continue to dominate these areas.

The true physiological definition of seed germination is that germination begins with the imbibition of water (water uptake) and ends with the start of elongation by the embryonic axis, usually the root. The factors that influence seed germination are complex. In order for a seed to germinate its chemical and physical environment must be right. These incorporate the presence of water for imbibition, oxygen for respiration, and an absence of inhibitory substances. The temperature must be appropriate to promote germination and in some cases light quality and quantity are important.

Even in favourable conditions seeds sometimes will not germinate due to dormancy, a state requiring some other factor to break it. Dormancy can be controlled internally, relating to the embryo and seed coat, or externally, relating to temperature and light. For different species different treatments will break dormancy. For example, in Quandong (*Santalum acuminatum*) germination responded well to infiltration of the embryo with the plant hormone gibberellin. Species of the family Asteraceae varied in their response to different treatments, *Leucochrysum stipitatum* germination benefitted from seed coat scarification, *Brachyscome iberidifolia* from exposure to gibberellic acid and *Rhodanthe stricta* germination was stimulated by light. For the Emu Bush or Poverty Bush, *Eremophila maculata*, leaching of inhibitory substances, soluble aromatic glycosides, from the fruit during heavy rain promoted germination of seeds. The breaking of dormancy by chilling is also a good stimulator of germination, especially for species in the northern hemisphere.

Plants used in this study

Based upon their current or potential floricultural use a selection of species from the *Dryandra* and *Isopogon* genera was made. The species chosen are described below. Seed (Plate 1) was purchased from Nindethana Seed Services, Western Australia in 1994.

***Development of Australian Proteaceae as a cut flower crop.** This is the second article in this series by Professor Margaret Sedgley and her team, the first being New *Banksia* Released, *Banksia* as a cut flower crop, volume 20, page 43.

Other references are: "Proteaceae, their ecology with implications for their cultivation" by Dr. Byron Lamont in volume 7, page 47; "*Dryandra*, a growers guide for beginners" volume 18, page 11 and "*Dryandra* as garden plants", volume 11, page 342, both by Tony Cavanagh, and "Landscaping with *Dryandra*", volume 18, page 3, by Margaret Pieroni.

Dryandra with potential as cut flowers

Dryandra squarrosa, previously *D. carduacea* Lindl., photograph on page 160. Endemic to south-west Western Australia. A tall erect shrub up to 4 m high and 2 m wide. Pale yellow flowers are borne on short lateral branches. Excellent cut flower which dries well and lasts indefinitely, also a colourful screening plant.

Dryandra carlinoides Meisn.: Endemic to south-west Western Australia, it is a rounded compact shrub (1.5 m high) with terminal well displayed pink/cream flowers and has potential as a cut flower. Photo in *Australian Plants*, volume 18, page 16.

Dryandra formosa R. Br. has been coined the Showy Dryandra due to its terminal golden flowers, photograph in *Australian Plants*, volume 18, page 1. It is a medium to large shrub with less pungent leaves than many other *Dryandra* species. Distribution is restricted mainly to the Stirling Ranges, WA.

Dryandra hewardiana Meisn, photograph on page 160. Endemic to gravelly soils in open Eucalyptus wandoo woodland, Western Australia. A tall open shrub (5 m high, 2 m across) with yellow flowers on short axillary branches. This species is fast growing and flowers within two years. It is a useful cut flower (fresh/dry) and can be grown from cuttings.

Dryandra nivea (Labill.) R. Br.: As previously known is the most widespread of the prostrate *Dryandra* undershrubs growing in many habitats of Western Australia. The revision defines six species, described on page 139, with a range of cream to orange terminal flowers. We cannot be sure which species is involved in this study but it is thought that it was most likely collected from plants of *D. lindleyana* (photograph on pages 137 and 140). It is likely that all will respond in a similar way as it concerns propagation. They are all good rockery plants and are hardy in cultivation.

Dryandra nobilis Lindl.: Erect plant up to 3 m high with very large orange gold flowers borne along stems on short axillary branches. A good garden plant growing well in winter rainfall areas and in sandy or heavy soils in south-west WA. A colour photograph is in *Australian Plants*, volume 14, page 260.

Dryandra polycephala Benth., photograph on page 156. The distribution of this species is widespread and is found growing on gravel or gravelly soils. It is a tall, sometimes open shrub (4 m high, 3 m wide). Its yellow flowers are borne terminally on short lateral branches. A difficult species to cultivate and is threatened in its native habitat of deep sands. This species would make an excellent garden plant if a little more were known about methods of cultivation.

Dryandra praemorsa Meisn.: A rounded to erect medium sized shrub found in jarrah forests of Western Australia. Flowers are terminal and are large and yellow/green or pink. One of the easier species to cultivate.

Dryandra proteoides Lindl., photograph on page 156. Grows on gravelly soils in the south-west of Western Australia. A small to medium sized shrub possessing the largest inflorescences of the genus. Its foliage is attractive and it is worth growing for this reason.

Dryandra quercifolia Meisn. or Oak Leaf Dryandra is found on rocky hills of quartzite, laterite or shale near the south coast from the Gairdner Range to East Mount Barren extending inland to the Ravensthorpe Range, Western Australia. It has yellow flowers and toothed obovate leaves. Photograph, volume 11, page 345.

***Isopogon** (Drumsticks), with potential as cut flowers**

Isopogon axillaris R. Br.: Found in the lower south-west of WA. It is a medium-sized, erect shrub and showy when in flower. It is rare in cultivation and requires good drainage. Is best suited to areas of winter rainfall.

Isopogon anethifolius (Salisb.) Knight: An erect bushy shrub that grows well in sclerophyll forests in coastal southern New South Wales. Its yellow flowers are held in terminal globular heads. Currently cultivated in the UK and USA and is one of most reliable *Isopogon* species in cultivation. Photo, volume 19, page 65.

Isopogon cuneatus R. Br.: Grows in stony lateritic hills or on gravelly sand in shrub lands of south Western Australia. It is a bushy shrub which may grow to 2 m high. Its mauve-pink flowers are large and borne terminally. It has been in cultivation in the UK since 1829 and is grown in New Zealand. A prized cut flower that is being farmed to a limited degree. Photo, volume 19, page 96.

Isopogon dubius (R. Br.) Druce: This species grows in gravelly and granitic soils in eucalypt wandoo and jarrah forests, Western Australia. It is a dense well rounded shrub up to 1 m high and 1 m across. The mauve-pink flowers are borne terminally. It is one of the hardiest of the western species and has been in cultivation since 1840. Propagation is from seed.

Isopogon formosus R. Br.: An erect or spreading Western Australian shrub. Flowers are borne terminally and in leaf axils and are mauve-pink. This beautiful shrub is readily cultivated in winter rainfall areas. Propagation is by seed and grafting onto more reliable eastern stock is preferred. Photo, volume 19:80.

Isopogon latifolius R. Br.: This species grows in sandy soils, often among rocks of the Stirling Ranges, Western Australia. It is a rounded shrub up to 2 m high. The terminal flowers are very large, showy and mauve-pink in colour. This is probably the most spectacular *Isopogon* and is highly prized as a cut flower as shown in a colour photograph in volume 19, pages 49 and 68. It has been successfully farmed in South Australia on acid sand over limestone.

Isopogon trilobus R. Br.: Found in southern Western Australia this species is a compact, small shrub growing to about 1 m high. Its creamy flowers are borne terminally. This species is in limited cultivation and is mainly of interest because of its large fruits. Propagation is from seed.

Seed germination of *Dryandra* and *Isopogon* under controlled temperature

In February 1995, 800 seeds of each of *Dryandra formosa*, *D. praemorsa*, *D. quercifolia*, *Isopogon cuneatus*, *I. dubius* and *I. trilobus* were sterilised and placed in incubators set at: 5°C, 15°C, 25°C or 35°C.

Sterilisation of seeds was conducted in a laminar flow cabinet. Each seed was placed in 70% ethanol for two minutes, 1% White King Household Bleach (4% available chlorine) for three minutes, then washed three times in millipure water. For each temperature and species 20 sterile petri dishes were prepared with autoclaved filter paper. Ten seeds were distributed evenly across the filter paper and watered using RO water (200 seeds/species/temperature). Petri dishes were wrapped in Parafilm to reduce water loss, covered in aluminium foil to exclude light and placed in cabinets set at the appropriate temperature.

*All species of *Isopogon* are described and illustrated in *Australian Plants*, volume 19, page 63.

Light has previously been observed to have little influence on germination and so was excluded to reduce experimental variables. Every week petri dishes were checked, the number of seeds germinating recorded and the filter paper re-wetted. A seed was considered germinated once the rootlet could be seen emerging from the seed coat (>3 mm long). Seed affected by fungal infection was removed and the petri dish and filter paper replaced.

Results were collected for twelve weeks commencing from the time of incubation and continuing until the number of seeds germinating failed to increase for three weeks. Results were assessed in terms of the cumulative germination of seeds over time for a given temperature and species and the percentage germination and represented in the graphs opposite.

Seed germination in the glasshouse

In February 1995, 50 seeds of each species were planted at 1 cm depth in sterilised seed flats containing sterile vermiculite. Approximately 200 ml of the fungicide Previcur (3 ml in 2 L water) was sprayed onto seeds and then gently watered in. Temperature readings (maximum/minimum) within the glasshouse were recorded. The number of seedlings emerging each day was recorded for ten weeks. Measurements ceased when this number failed to increase after three weeks.

Table 1: Mean maximum and minimum temperatures recorded in the glasshouse over the experimental period (mean±std. dev.)

Week	Max. Temp. (°C)	Min. Temp. (°C)
1	25.8±6.0	18.5±0.7
2	30.0±1.9	20.6±1.9
3	30.1±1.7	21.6±2.2
4	32.8±1.9	22.0±0.8
5	28.4±3.9	21.4±0.5
6	28.3±2.1	20.2±1.5
7	27.7±0.5	19.0±1.4
8	26.4±0.5	18.3±1.3
9	24.7±0.9	19.3±1.9
10	25.1±0.2	19.8±0.5
Mean	27.9±0.8	20.1±0.4

Statistical analysis

For *Isopogon* the Kolmogorov-Smirnov Two-Sample Test was applied to determine significant differences between cumulative distribution functions of pairs of species. For *Dryandra* this test was also used to compare germination at either 15°C or 25°C for a given species and for pairs of species at a given temperature. A comparison of the effect of temperature compared to glasshouse germination was made for each species using a Chi-square analysis. This test was also used to compare the final percentage germination for each species within a given temperature.

Results for *Dryandra* Seed germination under controlled temperature

At 15°C there was seed germination for each *Dryandra* species (Figure 1). Germination was reduced at 25°C (Figure 2) and no germination was recorded at 5 or 35°C. At 15 and 25°C the rate of germination differed; at 15°C by three weeks all species had significant germination, whereas at 25°C germination was slower. *Dryandra polycephala* (Figure 2) was the only species to show a strong germination response at 25°C but germination was slow. Species showed significant differences in their pattern of cumulative seed germination. Compared to the glasshouse results, germination numbers at least doubled at 15°C for all species. *Dryandra polycephala* in particular showed marked improvement in germination at 15°C compared to the glasshouse, although it appears to have a broad range of temperatures at which germination is possible (15–25°C).

Results for *Dryandra*

Seed germination in the glasshouse

The temperature during the experimental period ranged from 33–25°C (daily maximum) to 22–18°C (daily minimum).

The final percentage emergence of *Dryandra* species ranged from 0% in *D. proteoides* to 40% in *D. formosa*, *D. praemorsa* and *D. quercifolia*. Most emergence occurred 4–6 weeks after sowing (Figure 4). For those species with higher final percentage emergence (*D. formosa*, *D. praemorsa* and *D. quercifolia*), seedlings continued to emerge until weeks nine and ten.

Results for *Isopogon* Seed germination under controlled temperature

Germination of seeds for *Isopogon* was recorded at 15°C only. At this temperature *Isopogon trilobus* showed the highest final percentage germination followed by *Isopogon dubius* and *I. cuneatus* (Figure 3). There were significant differences between the cumulative germination patterns between species.

Results for *Isopogon*

Seed germination in the glasshouse

Three species of *Isopogon* failed to emerge over the experimental period (*Isopogon axillaris*, *I. cuneatus* and *I. latifolius*) and the highest final percentage emergence occurred in *I. formosus*. This species commenced emergence at week three and continued until week seven (Figure 5).

Discussion

Dryandra and *Isopogon* seed germination was promoted at 15°C and to a lesser extent for *Dryandra* only, at 25°C, and was completely inhibited at 5 and 35°C. Seeds subjected to constant temperatures of 15°C showed the highest percentage germination and highest rates of germination compared to other temperatures.

After three weeks at 15°C *Dryandra* seed germination reached high levels, with germination commencing soon after sowing. Growth curves for this genus displayed a generally sinusoidal pattern suggesting that within seed batch variation was low, most seeds germinating at the same time. High seed viability was reflected by the high final percentage germination. At 25°C germination rates were much slower and *Dryandra polycephala* was the only species to show significant germination at this temperature. Possibly germination of this species is effective over a wider range of temperatures due to its more northerly distribution compared to *D. quercifolia* and *D. formosa*, both of which occur on the south coast of Western Australia where lower temperatures are experienced. Differing temperature optima for germination relating to species distribution has been reported for three species of *Banksia*. Of these *Banksia aemula* had the highest temperature requirement for germination and correspondingly had the most northerly distribution, ranging as far as Proserpine in North Queensland.

Isopogon species also showed germination at 15°C, no germination was recorded at other temperatures. Seed germination was slower and more prolonged in the *Isopogon* species and did not reach as high final percentage germination as the *Dryandra* species at this temperature.

Germination of *Dryandra* and *Isopogon* species in the glasshouse met with mixed success. *Isopogon formosus* was the only species to show strong seedling emergence, and for the majority of species seedling emergence was 40% or less.

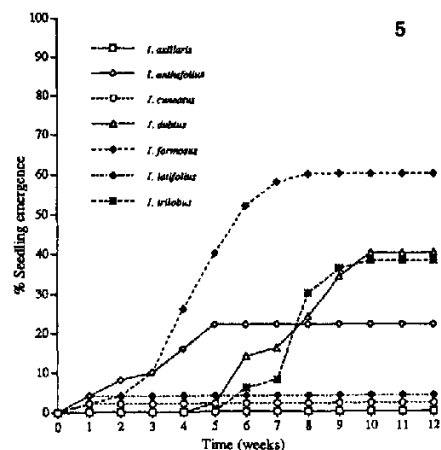
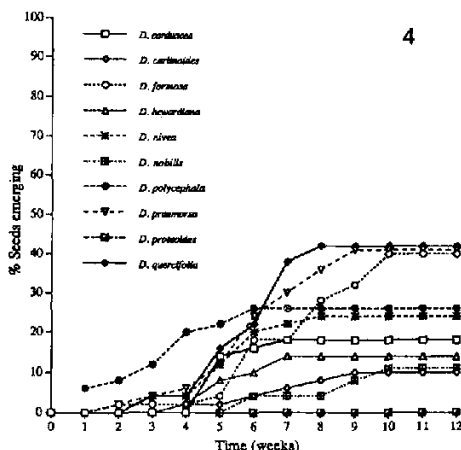
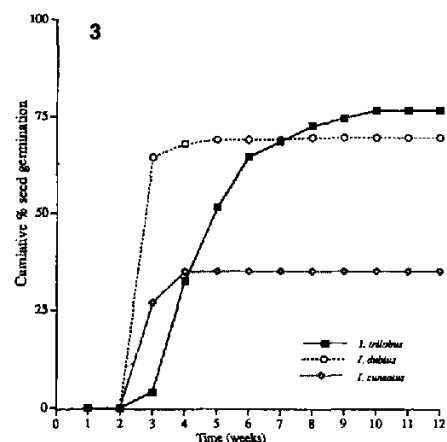
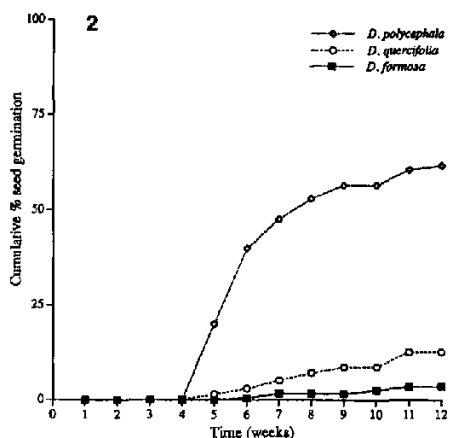
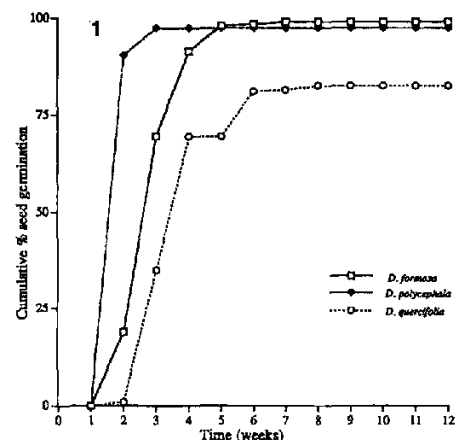


Figure 1: Cumulative % seed germination of three *Dryandra* species at 15°C. Maximum standard error 0.45.

Figure 2: Seed germination of the same species of *Dryandra* at 25°C. Maximum standard error 0.41.

Figure 3: Cumulative seed germination of three *Isopogon* species at 15°C. Maximum standard error 0.53.

Figure 4: Emergence of seedlings of ten *Dryandra* species under glasshouse conditions. Zero seedling emergence was observed for *Dryandra proteoides*. The final percentage emergence for *Dryandra quercifolia*, *D. formosa* and *D. praemorsa* was 40% and for *D. nobilis* and *D. carlinoides* was 10%.

Figure 5: Emergence of seedlings of seven *Isopogon* species under glasshouse conditions. Zero seedling emergence was observed for *Isopogon cuneatus*, *I. axillaris* and *I. latifolius*.

The percentage emergence values obtained for *Dryandra* species was low compared to the same species germinated by SGAP in 1991. They obtained values of percentage emergence greater than or equal to 57%. These differences may be the result of different media or temperatures.

This information that seed germination of *Dryandra* and *Isopogon* species is enhanced at temperatures of 15°C can be used to increase the efficiency of propagation of these species for the horticultural industry. Further studies on the effect of smoke on the germination of these and other species may also be beneficial to this industry.

Reference, SGAP. 1991. *Dryandra* Study Group Newsletter No. 20. July.

Acknowledgements, Thanks to the Charles John Everard Scholarship and the International Protea Association for support.

Dryandra, first get the seed

by Tony Cavanagh

Extraction of seed can be a major problem as most species hold their seeds in hard, woody protective capsules that are retained within the dead flower head. They split to reveal the seed only after a fire. The capsules are often glossy and dark-coloured but in some species are matte or covered with fine hairs. As usual, there are exceptions and these include the recommended species on page 146, *Dryandra squarrosa*, *D. nobilis*, *D. polycephala*, *D. praemorsa* as well as *D. sessilis*; they shed some or all of their seed between seasons. If you obtain seed capsules, there are several ways you can that them to extract the seed.

The capsules may be heated in an oven at between 130°C and 170°C for 20 minutes and then cooled. Do not use a microwave oven as they will cook the seeds and ruin them. The capsules will usually split and the seed, normally only one, rarely two, can be extracted with tweezers. For stubborn seeds, this may need to be repeated. A second method is to cut around the capsule with a pair of sturdy nail clippers and force open the portion containing the seed; this reduces the risk of overheating sensitive seeds. Yet another way is to place the capsules inside a dark green or brown glass jar and that jar is put into a clear one about half as big again. The lot is left in the sun with the jars lying on their sides as long as it takes for the capsules to open.

Seed sowing and potting up

I have described this in volume 18, page 14 (December 1994). *Dryandra* Study Group members have had greatest success with sowing the seed in containers in the open and not in a glasshouse. Autumn is usually the best time in southern Australia and extensive studies of Keith Alcock and David Randall have established that for the majority of species, and with good quality seed, germination in excess of 50% is usually achieved. Nevertheless, similar levels of success have been achieved in laboratory germination by Anne Cochrane and Anne Kelly at the Threatened Flora Seed Centre, WA herbarium. They used incubation cabinets maintained at constant 15°C and a 12 hour photoperiod. In 47 tests with 28 species, only four failed to exceed 50% and many were about 80%. While for practical purposes amateur growers will continue to germinate seeds in the open, and thereby expose them to the vagaries of the weather, germination under controlled conditions may be successful, providing the seed is viable and low temperatures around 15°C are maintained. ■

New garden plants

as released in the nursery trade, W. H. Payne

Actinotus helianthi 'Summer Cloud'TM, a developed compact form of flannel flower with masses of short stalked white flowers mid-spring to late summer. A 200 mm container will produce in excess of 60 flowering heads and is ideal as a container plant or as massed plantings on banks or along borders.

Bracteatum 'Goldups Gold'TM, is one of the many rich golden paper daisies available on the market.

Ceratopetalum gummiiform 'Alberys Millennium Red,' bright red "flowers"; 'Promises' a floriferous form of 'Alberys Red'; 'Mirrabooka' with unique pale lime-green flowers.

Derwentia arenarid 'Blue Magic' is a selection from a hardy long-flowering perennial of the New England Tablelands and is thus highly frost tolerant. Especially suited for massed displays, as a rockery plant, or as a showy container plant, the flowering period for these blue/violet flowers is September to May, when most other plants have faded, makes it a valuable garden plant. Its use as a cut flower is also promoted. *Derwentia* small delicate plants from cooler climates with 8 species from higher altitude or cooler areas from Queensland to Tasmania.

Eremophila nivea 'Spring Mist' is a compact growing form of the species, a plant that is desired by anyone who sees it whether in flower, a delicate blue, or just as a grey coloured bush. Everyone will be waiting with keen anxiety to see if George Lulfitz has done it again, selected a form of a stunning wild-flower that is hardy than most available. He calls it an extremely hard shrub.

Eucalyptus maculata 'Imagine'TM is a selection from an eucalypt tree species which has a striking variegation of the leaves. Bright-pink new growth fades to cream and then to two-tone green and cream in mature leaves. This upright tree with drooping two-toned foliage appears in different shades in different conditions and does not grow as tall as *Eucalyptus maculata*. It is a very hardy small tree as it is grafted on to hardier stock to maintain its features.

Eucalyptus ficifolia 'Summertime'TM is a tissue cultured from a carefully selected good flowering form of the well known red-flowering Gum of Western Australia. The deep red flowers will appear, true to colour in the first 12 months and continue to flower continuously for five months. The form of this small tree to 5 m high has dense foliage with the trunk branched almost from the base and responds to pruning. Propagated from a spectacular specimen adapted to Sydney, eastern Australia, climate, this plant seems almost too good to be true. Very well worth a trial; contact the editor in two years and report experiences.

Gahnia aspera 'Red', a hardy, compact dense-clumping grass-like plant to 1 m tall with stiff red-brown seedheads. Used for as a hardy feature in rockeries, on banks or understory plantings.

Grevillea laspicula 'Wee Jasper Spider' is a selection from a very attractive species that is widely grown. The flowers of the culture are very appealing, the bright red styles adding stark colour to the otherwise white flowers. It can be kept to a neat shrub with lime-green foliage. Bred in Canberra, it could prove to be quite hardy over a range of conditions, including alkaline soils.



△ A wildflower garden designed for year-around display. The blue clumps are *Lechenaultia biloba* with colours from white to purple; yellow is *Conostylis*, mainly *aculeata* and *Hibbertia amplexicaulis*; white is a daisy and *Xanthosia rotundifolia*; there are Kangaroo Paws in the front and the larger bright red flowered shrub in the rear is *Grevillea bronwenae*.

A wildflower garden you should go and see at 9 Wildflower Drive, Pomonal, Victoria at any time of the year. There will be flowers throughout the year. Plan a visit, Philip Vaughan is pleased to welcome visitors and he can supply a wide range of plants, including the widest range of grafted plants all at reasonable prices. There will be more about this creditable garden in our next issue with a discussion on how you can grow these plants, or similar ones, in your garden.

▽ The blue flowered bush is Blue Smokebush, *Conospermum dorrenii*. This would be a plant in most demand on the cutflower market, you can sell all you can grow. It has been difficult to propagate and to grow. Thanks to smoke assistance, see page 174, and growing techniques given in our next issue the problems could be solved. The *Acacia* behind has not been named yet but is typical of many dwarf wattles that are available for horticulture.



Grevillea 'Margaret Grace'TM, is a dense, small, spreading shrub to 80 cm high and 1.5 m across. The toothbrush type flowers are red.

Grevillea rhyolitica 'Deua Flame' is another release from the Canberra area and of the Eurobodalla Regional Botanic Gardens. A recently described species from the Deua National Park, previously a form of *Grevillea victoriae*, it has elliptical leaves with a smooth upper surface and hairy but not felty underneath.

Grevillea saccata 'Starburst' is another Lullfitz selection. *Grevillea saccata* certainly is a showy little shrub with bright orange flowers throughout winter and spring. To have a good form selected, hopefully following growing trials for more than usual hardiness, a plant only to 30 cm with 1m spread can be a real service.

Grevillea williamsonii 'Grampians Gem' is another plant bred for high frost tolerance and a range of conditions. An attractive feature is the yellow buds that change to a good red on maturity, the flower is of the clothes-brush type.

Isotoma axillaris 'Wellington Wonder'TM, a small compact perennial to 30 cm high with masses of blue star-shaped flowers that cover the plant right through the summer. Although it will seed itself and produce many more plants for the next summer, it will not become a pest or invasive in the bush without moisture.

Leucophyta brownii 'Silver Nugget' is a compact selection of a plant very widely grown for many years. The tiny yellow-button flowers are attractive in mass, but this plant is grown because it forms a compact dome of silver-grey foliage that provides a pleasing contrast in any garden or rockery situation. Easy to propagate by cuttings, you can have little grey-silver clumps growing in all the sunny areas.

Lomandra spicata 'Joey'TM is a broad-leaf grass-like clumping plant forming a dome 30 cm across, a selected form of a very hardy species used widely in landscaping projects destined for only casual maintenance.

Olearia exillaris 'Little Smoke' is a dwarf, compact-growing plant with soft grey foliage to 75 cm high, providing an excellent foliage contrast in any landscape.

Pimelea 'Pink Cloud' is a selected pink flowered form of *Pimelea* that is usually white in the wild. It can grow to form a dome-shaped shrub 1 m across.

Sollya heterophylla 'Tricolour'TM, a small climber with flowers that change colour from white to soft blue, to mauve during a long period through the warm months.

Adopt a caterpillars scheme, a conservation project for you

The Richmond Birdwing Conservation Project, "Adopt a Caterpillar Scheme" is an exciting new initiative of CSIRO's Double Helix Science Club supported by Bayer Australia in a bid to save this endangered species. This scheme encourages school children and community members to plant Richmond Birdwing vines, the Butterfly's natural food source. When the vines are large enough, they can adopt and raise Richmond Birdwing caterpillars. Gain a better understanding of life cycles of insects and an awareness of importance of scientific research to preserve threatened species. **Scientific information generated by school children.** The vivid green, blue and black wings of the Richmond Birdwing Butterfly were once common sight in the back gardens from Graton in northern New South Wales to Maryborough in southern Queensland. In recent times the butterfly has disappeared from two-thirds of its original habitat, see opposite.

A unique feature of this conservation project is that it can be done in your own backyard. Members of the community often feel powerless to tackle conservation issues, but this project will allow them to take an active role in the conservation of a threatened species. Bayer's sponsorship of the project has permitted a wider application of the "Adopt a Caterpillar Scheme" and enabled the CSIRO to construct a flightcage for rearing the young caterpillars.

Richmond Birdwing Butterfly

How your garden can help save the Richmond Birdwing Butterfly

Brisbane CSIRO Science Education Centre*

Richmond birdwing caterpillars only feed on two rainforest vine species (see photos on page 157), *Pararistolochia praevenosa* (occurs in lowland and coastal rainforests) and *Pararistolochia laheyana* (occurs only at high altitudes in the rainforests of the Queensland/New South Wales border ranges). Extensive clearing of rainforests in southeastern Queensland and northern New South Wales has resulted in less than 1% of the original rainforest remaining. With the loss of food for their caterpillars the Richmond birdwing butterfly is now extinct from $\frac{2}{3}$ of its original range and the remaining populations are very fragmented.

You can help bring back the beautiful Richmond birdwing butterfly by growing Richmond birdwing vines in your backyard.

Richmond birdwing vines are very slow growing and will take about three years before they are large enough to support a birdwing caterpillar. The vines grow naturally on alluvial soils edging streams and rivers. The vine flowers in spring. The flowers are small, usually only 20 to 30 mm in length. They have a tubular shape with a swollen base with pale pink-purple markings. The lip of the flower is maroon and the throat is yellow with maroon markings. The seed pods are green and in autumn turn a rich golden orange.

In the home garden you need to choose a site where the vines will be in semi-shade. While the vines are young they need to be watered regularly. The soil needs to be rich and well-drained so make sure the garden is higher than the surrounding ground. It would be best to dig up an area in a shady part of your garden and dig in plenty of mulch and leaf litter.

The vines need some form of support such as a trellis or wire mesh on a fence or over a stump. Should you wish to grow your vine up a tree it is best not to plant it too close, as the tree will deprive the vine of nutrients. Instead, plant it a metre or so out from the base of the tree and tie some twine or rope from a branch down to a stake next to the vine. This will support the spiralling stems as they seek out the sunlight above. They are not a vigorous creeper and won't take over the tree or your garden.

If you don't think your garden soil is suitable these vines also grow very successfully in tubs. Obtain a large tub or bucket and cut some holes in the bottom. Position the tub in a shady part of your garden where the vine will have something to grow up. Fill the tub with good soil and mulch or good potting mix.

*Brisbane CSIRO Science Education Centre, P.M.B. 3, Indooroopilly, Qld, 4068; telephone 07 3214 2860, fax: 07 3214 2883, for more information where to obtain Richmond birdwing vines, caterpillars and to participate in the "Adopt a caterpillar Scheme"

Dutchman's Pipe Vine — the "fatal attraction"

Killer Vine

BEWARE — There is an introduced species of vine, *Aristolochia elegans*, commonly known as the Dutchman's Pipe. The female birdwing butterfly is tricked into laying her eggs on the leaves of this species in preference to the native species. However, the leaves of the Dutchman's Pipe Vine are toxic to the caterpillars and if they feed on these leaves they die.



Dryandra proteoides (Photograph Keith Alcock)



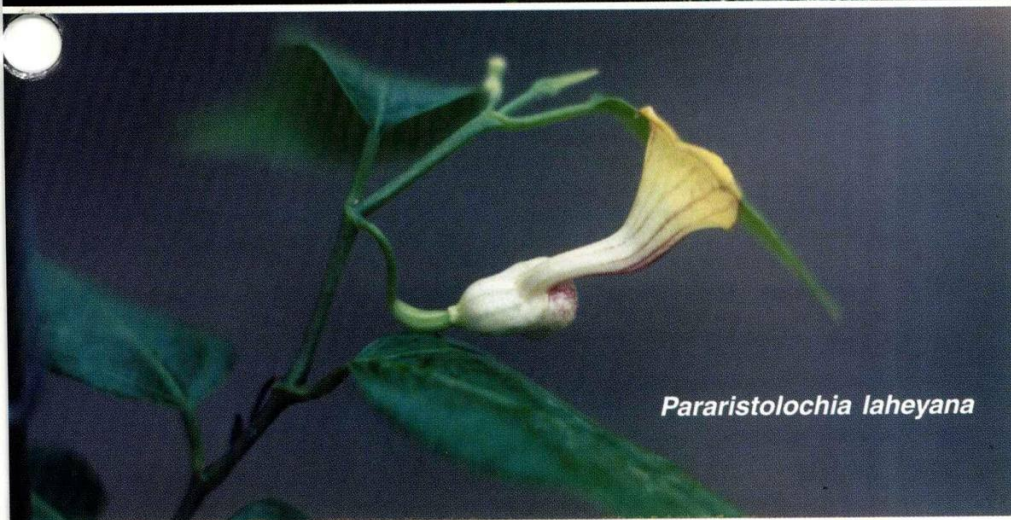
Dryandra polyccephala (Photograph Keith Alcock)



Richmond Birdwing Butterfly



Pararistolochia praevenosa



Pararistolochia laheyana



Dutchman's Pipe Vine, Killer Vine

The Dutchman's Pipe vine has soft grey-green or pale green heart shaped leaves and distinctive, large maroon coloured flowers. It has a distinctive unpleasant odour. The leaves are also poisonous to humans and gloves should be worn when removing it. Careful identification is needed for eradicating *Aristolochia elegans*, the Dutchman's Pipe vine infestations in bushland areas as a number of native vines also have heart shaped leaves; but so do other imported nasties.

The vine butterflies need to survive

Richmond Birdwing Butterfly vine, *Pararistolochia praevanosa** can be distinguished from the killer vine by its leaf shape (to 25 cm long) as shown above and the colour photograph on page 157. The tubular flowers are 2 cm long and purplish in colour. *P. laheyana* has yellow-green (with purple veins) flowers as shown on page 157 and smaller leaves. As noted below this butterfly will eat all but one *Aristolochia* species.

The Richmond Birdwing Butterfly

The Richmond Birdwing Butterfly was once common from the Clarence River in northern New South Wales to the Mary River in Queensland. It is closely related to the larger Cairns Birdwing, which occurs from near Mackay to north of Cooktown. The wings of the Richmond birdwing males are velvety green and black on the upper side, with vivid blue, green and gold patches on the hindwings on the underside. They have a wingspan of about 12 cm. The female is larger, with a wingspan around 14 cm. They are dark grey or brown with white and yellow patches on the upper and underside. Both male and female have distinctive red patches on their bodies beneath the base of the wings. The usual flying period is in the warmer months from September to April on the coast and November to February in the Border Ranges.

Continued on page 162.

**Aristolochia* has recently been split up into *Pararistolochia* (fleshy fruit) and *Aristolochia* (dry capsule fruit). There are 12 named species with a few more as yet not named.

Richmond birdwing caterpillars feed on two rainforest vine species — *Pararistolochia praevenosa* and *P. laheyana*. Female Richmond birdwing butterflies lay pale yellow eggs on the underneath of the leaves of the food plant vines. The eggs hatch within 8 to 13 days and the tiny caterpillars emerge. The caterpillars are black with fleshy black spines except for two bright yellow spines half-way along their bodies. As they develop the caterpillars can change colour. They can be black, brown or creamish-grey. After about 25 to 46 days the caterpillar is fully developed and spins its chrysalis. The Richmond birdwing chrysalis is apple green and the birdwing stays in the chrysalis throughout winter. The Richmond birdwing is the only birdwing butterfly that has a green chrysalis.

The caterpillars have enormous appetites. Each caterpillar consumes about 1 square metre of leaves to develop fully. They are cannibals the large caterpillars eating the small ones, mostly by accident and often one caterpillar develops on each vine. Those the same size will survive unless the food runs out. ■

How experienced butterfly breeders nurture the Richmond Birdwing Butterfly

from Garry Sankowsky*

The effort to build up the populations of the Richmond Birdwing by encouraging people to plant the vine *Pararistolochia praevenosa* in their gardens has not produced much of a result and many people have been disillusioned by the fact that their vines simply grow too slowly. I have been approached by a number of gardeners who said, "It is a waste of time, the vine will not grow". *P. praevenosa* is a very slow growing vine and will only grow at a reasonable rate if it has very rich soil and plenty of moisture. To maintain enthusiasm I advocate the growing of *Aristolochia tagala*, instead of *P. praevenosa* although it is not its natural host plant. Within twelve months this vine is large enough to support birdwing larvae. Butterfly breeders use nothing else when breeding all the Australian birdwings. *A. tagala* grows fast and recovers very fast from caterpillar attack. In fact, there is only one species of Australian *Aristolochia* that the Richmond Birdwing cannot eat, and that is *Aristolochia chalmersii*, which is found in vine thickets on Cape York Peninsula.

Aristolochia tagala has a fight-back mechanism against birdwing eggs. When a birdwing egg (especially that of a Richmond Birdwing) is laid under an *A. tagala* leaf the glue from the egg causes a reaction from the leaf which causes sap to weep from the leaf and cover the egg. Mould then develops on the egg and kills it. Birdwings have evolved a counter attack to this and deposit most of their eggs on the leaves of the tree over which the *Aristolochia* vine is climbing. So, the simple solution is to always grow the vine on a tree.

Even when growing species of *Pararistolochia* they should be grown on a tree as eggs placed off the vine will not be eaten by larvae. When a birdwing larva moults it prefers to leave the vine and attach itself to the leaf of the support tree. At night time it does the same, and again when it makes its pupa this procedure is copied. I advise that the host vines should **never** be grown on a fence or trellis. However, in southern areas this practice is said to work well.

**Australian Tropical Plants, Volume 1* by Garry Sankowsky is a compact disc available from the Yurunga Nursery, PO Box 210, Tolga, Queensland for \$40 plus postage of \$3. It contains vast amounts of data on 524 species of Australian tropical plants (including 9 species of *Aristolochia* / *Pararistolochia*, one of which is reproduced on page 157) with over 1200 true-colour pictures, up to three for each species. There are lists of plants based on flower colour, perfume, for a specific area such as yours, bush tucker, attracts birds and butterflies, use as shade trees, ground covers, information available on your printer screen or on a print out. Editor.



Dryandra squarrosa (Photograph Keith Alcock)



Dryandra newardiana (Photograph Keith Alcock)



Platysace lanceolata 'Valentine Lace'

Valentine Lace

Platysace lanceolata as a cut flower

by David Hockings*

'Valentine Lace' is a cultivar developed from *Platysace lanceolata* for the cut flower trade. The flowering period from late January extends past St. Valentine's Day a period when other flowers are in short supply or out of season. The cultivar has been developed to produce long straight stems surmounted with an array of small branches carrying heads of dainty white flowers. There are about 400–500 small flowers in each flower head known as a compound umbel each head resembling a lacy doyley.

It is a perennial shrub growing 1.8 to 2 metres high producing many flower stems each year. Following harvest and pruning, plants re-shoot for the next year's crop. They are planted in single rows with 2 metres between rows and 0.7–1 m between plants, the inter-row spacing being dependent upon the equipment used for mowing, spraying, etc. The rows can be maintained weed-free with careful use of glyphosate or weedmat and mowing between rows.

Acidic (pH 5.5–6.5) free-draining, deep loamy or sandy soils are recommended. To assure good drainage plant on formed hills or ridges. 'Valentine Lace' is not sensitive to phosphorous. However, if you are growing it in rotation with phosphorous plants, the application of fertilizers containing phosphorous could build up undesirable levels for succeeding sensitive plants.

The initial growth should be pruned to 30 or 40 cm to promote many strong erect stems. After harvesting any remaining weak stems should be shortened. Remove sprawling branches to allow good air circulation and drying of the soil surface. Drip irrigation is recommended. Check water quality as alkaline and salty water is detrimental. 'Valentine Lace' will tolerate frosts to at least -2°C .

Pests and diseases can be controlled with good house-keeping. Nematodes (Root Knot) can be the major problem. The soil should be drenched with Nemacur as a preplant (or soon after planting) and twice a year. Soil applications of composted sawdust have shown promise in trials so far. Stem rot (*Sclerotinia sclerotiorum*) can attack plants in wet weather where mulch or accumulated leaf litter has built up around the base of plants. Aphids may attack young shoots. Flower beetles may need control prior to and during harvest with Lorsban.

*Plants are available at \$2 each in commercial quantities. Further details and support is available from David Hockings, PO Box 530, Maleny, Queensland 4552, Ph/Fax (07) 5494 3385.

Platysace is a genus of 25 species endemic to Australia and species occur in all states except Tasmania. The genus is in the plant family Apiaceae which contains other plants of interest such as the Flannel Flower *Actinotus*, and common food plants such as carrots, parsnips and celery. The Flannel Flower is in a group of plants in the family that have a compact head of many flowers surrounded by large conspicuous bracts resembling petals whereas *Platysace* is in a group of genera where the flowers are in a compound umbel, other Australian genera being *Apium*, *Daucus* and *Gingidia*.

Platysace lanceolata grows in woodland, heath and dry sclerophyll forest often on sandy soil and is widespread along coastal areas from southern Queensland to Victoria. I have the Sydney form growing and flowering quite well. It does not mind the shade of my forest garden and is hardy. It is very easy to propagate from cuttings. 'Valentine Lace' is a form that David Hockings has developed for the cut flower trade and is a superior plant to mine in flower colour. Editor.

Terrestrial orchids

Some Terrestrial Orchids of the Royal National Park, Sydney

by Margaret Bradhurst

The Royal National Park, south of Sydney, is Australia's oldest National Park (first gazetted in 1879) and covers an area of 15,014 hectares. It has a great range of features and scenery, from heathland on the plateaux, to woodlands on the upper slopes, tall open forests and rainforest in the gorges and deep gullies. It is home to a wide variety of vegetation and many species of native orchids.

Pterostylis nutans is also known as the **Nodding Greenhood** or **Parrots Beak** Orchid. It is a common widespread species and can be found in all Eastern Australian states and SA. It can form quite large colonies in a variety of habitats including moist forest and shady heathland. It flowers from May to October.

The pollination of a greenhood orchid is a fascinating process. The visiting insect will land on the protruding lip of the orchid, known as the **labellum**, and start to descend into the flower. The labellum is attached to the flower by a very irritable hinge and when it feels the insect it immediately snaps shut and the insect finds itself trapped inside the body of the flower. The only escape route is through a narrow opening, and in order to reach that opening the insect must brush past the **pollinia**. This pollen is sticky and is transferred to the departing insect and then carried with it on to the next flower. As a result, pollination will have occurred. It takes about 30 minutes for the labellum to be reset.

Caleana major is also known as the **Flying Duck Orchid** because of its remarkable resemblance to a duck in flight. It is an example of an orchid which is upside down — the head of the duck is the labellum and the body, the dorsal sepal. Normally when an orchid flower is in the bud stage, the labellum points up and as the flower opens it twists around and the labellum points down. It becomes the attractor or landing pad for the insects which come to pollinate the flower. The labellum of the Flying Duck Orchid is also on a very irritable claw and it will snap shut and so imprison an insect in the body of the "duck" (dorsal sepal). In the ensuing struggle to escape, the pollinia is transferred to the back of the departing insect. *Caleana major* grows in loose colonies in open forest and sandy soils and often amongst rock outcrops. It is found in the eastern states and SA and flowers from September to January.

Prasophyllum elatum is the **Tall Leek Orchid** and is one of Australia's tallest terrestrial orchids, often reaching one metre in height. It can bear numerous flowers in a dense spike and is found in all Australian states except the NT. It flowers from August to December in a range of habitats, usually damp coastal heath and forest. The Tall Leek Orchids are said to mimic the *Xanthorrhoea* or grasstrees. Both are pollinated by the same insects, both flower well after bushfires and seen from a distance they seem to have a similar cream flowering spike. A *Prasophyllum* orchid is an example of an orchid which is upside down.

Spiranthes sinensis or **Austral Ladies Tresses** has its tiny pink and white flowers arranged in a dense spike. It likes damp, swampy situations in heath and open forest and is found in all Australian states except WA and NT. It is a summer flowering orchid and loses its leaves for only a short period of time.



Prasophyllum elatum



Caleana major
Photography by Margaret Bradhurst



Pterostylis nutans



Calochilus paludosus



Thelymitra media

Photography by Margaret Bradhurst



Spiranthes sinensis

Most other terrestrial orchids have a dormant period over the summer months. The leaves and flowering stem will begin to wither after the flowering period and the plant will remain underground during the summer months, living off nourishment stored in its tuberoids. After good autumn rains the leaves and flowering stem will begin to shoot and prepare for the next flowering season.

Thelymitra media is quite a robust plant and is known as the **Tall Sun Orchid**. It flowers from October to December in NSW, Vic. and Tas., and can be found in damp open forest and coastal scrub. As the name implies, sun orchids need the sun to fully open their flowers and many species will only open on a very hot still day. Some species have the ability to self-pollinate and are very reluctant to open. In Sun Orchids it is the column in the centre of the flower which needs to be examined for identifications purposes. The column varies from species to species. Some have projecting arms, hair tufts, colourful hoods or finger-like projections which vary from species to species.

Calochilus paludosus is the **Red Beard Orchid**. The Bearded Orchids get their name from their outstanding feature which is the labellum or beard with its colourful hairs. *Calochilus campestris* (Copper Beard Orchid) and *Calochilus robertsonii* (Purple Beard Orchid) are also found in the Royal National Park. *Calochilus paludosus* with its glistening red hairs is the most common of the three species and can be found in moist heathland or drier open forests. It only opens widely in hot sunny conditions. It can be found in all Australian states except WA and is in flower from September to December.

Mundulla yellow — a new plague to threaten native vegetation?

Margaret Lee, Australian Plant Society, South Australia
and a CCSA Native Vegetation Working Group

Mundulla Yellow is a disease impacting on native trees and shrubs. It has been identified in five states and in numerous parts of SA, including Adelaide. Anyone driving through the south-east will have noticed the yellowing and dying eucalypts on the roadsides. Common symptoms are patches of yellowing vegetation in the crown, die back, prolific regrowth along the branches (epicormic shoot production) with yellowing of that regrowth. It takes between 10 and 15 years to kill a tree and no vegetation with the disease has been known to recover.

The disease is now recognized as a serious threat; revegetation projects near Mundulla are now showing symptoms of infection and questions are being raised about the future viability of revegetation and plantation projects in areas affected. Some research has been undertaken by Professor John Randles, Dr. David Paton and the Department of Environment but this is limited by lack of funding. There is an urgent need to gain funding for further research.

A workshop was held at Mundulla on 16.9.98 to review the problem and one paper made the alarming statement below*. The Conservation Council (CCSA) has since held a Seminar on the disease in 1999. For information telephone (08) 8223 5155. We will publish a further report shortly.

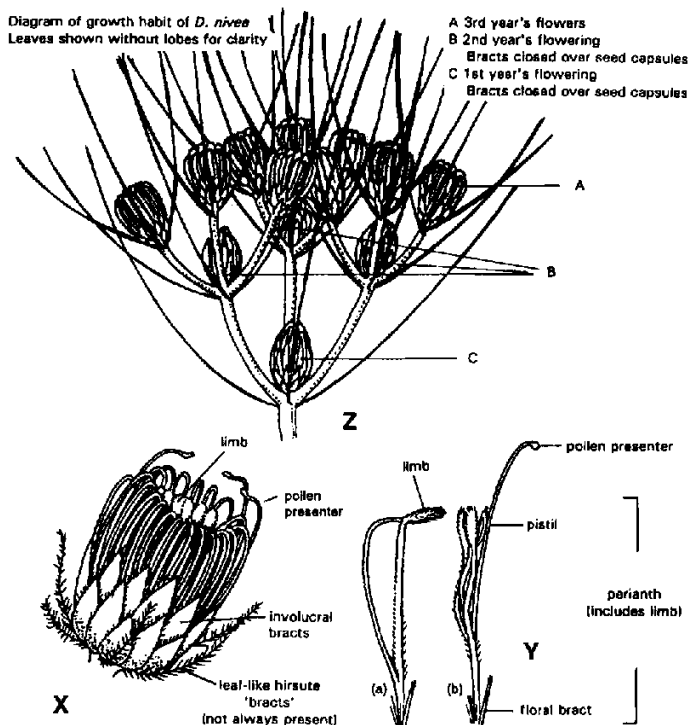
We are very concerned about the loss of trees, particularly large isolated trees which are hard to replace. It is effecting wide areas of Australia.

"i know of no other disease of woody plants which is so inexorably lethal . . . on eucalypts, far more threatening than *P. cinnamomi* and i see no sign of resistance to this plague . . ." F. D. Podger.

The 'Honeypot Dryandras'

continued from page 142

The first *Dryandra* to be collected was discovered by the French botanist Jacques-Julien de La Billardiere in December, 1792, inland from Esperance Bay. He called it '*Banksia nivea*' and noted in his description "The species of *Banksia* that I call 'nivea' is remarkable in its very long leaves, very deeply toothed and white underneath." This is the type species of *D. nivea*, named in 1810 by Robert Brown who correctly identified it as a *Dryandra*. Brown also named a specimen collected by William Baxter in 1829 from near King George Sound as another new species, *D. arctotidis*. Similarly, the Swiss botanist Meisner described *D. brownii* and *D. lindleyana* in 1845 and *D. stenoprion* and *D. tortifolia* in 1855. Finally, Alex George, in his revision in 1996, included a new species, *D. cypholoba*, a new subspecies of *D. nivea* and five subspecies within *D. lindleyana*, listed in Table 1. The growth habit of *D. nivea* showing development of dense, mounded habit is shown below and descriptions of all its forms and similar species follow.



Floral characteristics of *Dryandra* flowerheads and its parts

As in *Banksia*, the *Dryandra* flowerhead is made up of a large number of individual flowers. In the *Nivea* group, they arise from a receptacle with the styles curving inwards, forming a central "hole" which contains the nectar, hence the name 'honeypots'. Individual flowers are shown enlarged; flower (a) is still developing with the style held by the limb. However, the wiry style, tipped by the pollen presenter/stigma, eventually breaks away when the limb divides and splits the perianth tube (flower b).



△ *Dryandra arctotidis*

Photographs by M. Pieroni

▽ *Dryandra tortifolia*



***Dryandra arctotidis* R.Br., Suppl. Prodr. Fl. Nov. Holi. 39 (1830)**

Shrub with short underground fire-tolerant stems, to 70 cm across. **Leaves** pinnatipartite, V-shaped in cross section; lamina 8–15 cm long, 5–8 mm wide; lobes 25–45 each side, linear, pungent; margins revolute; sinuses 2–5 mm across; petiole 1–3 cm long. **Inflorescence** subtended by filiform hirsute 'bracts'; outer involucre bracts ovate, inner oblong, obtuse, glabrous or pubescent, with densely ciliate margins, 20–25 mm long; flowers 75–100 per head; floral bracts linear, lengthening to 9–11 mm in fruit. Perianth 26–31 mm long, hirsute above base including limb, cream; limb 2.5–2.8 mm long, broader in upper half. Pistil 39–45 mm long, the ovary long-hirsute, otherwise glabrous, yellow; pollen presenter cylindrical to narrowly ovoid, slightly swollen at base, 0.7–1 mm long, green. **Follicles** obovate with narrowed base, sometimes curved or one side $\pm$ straight, 10–14 mm, sparsely hirsute on top, otherwise glabrous.

Leaves are distinctive, the lobes are very narrow and almost parallel-sided, not triangular, angled to the midrib forming a V in cross section, 8–15 cm long. It is a prostrate plant with mostly underground stems forming clumps to 70 cm across. Flowerheads are similar to *Dryandra lindleyana* but typically all yellow. In populations where it grows with *D. brownii* colour variations occur and leaf lobes are somewhat wider, suggesting that some hybridization occurs. *D. arctotidis* possibly also hybridizes with *D. lindleyana* which would account for small, "tufted" plants with narrow, triangular lobes which occur towards the northern limits of *D. arctotidis*. The species occurs from south-east of Newdegate to Ongerup, in the Stirling Ranges and south towards Albany, growing in sand or sand over gravel. Flowering is in September. Distinguished from *D. tortifolia* by its shorter leaves, southern location, and earlier flowering and flower colour.

***Dryandra tortifolia* Kippist ex Meisn., Hooker's J. Bot. Kew Gard. 7: 121, 1855**

Shrub with short underground fire-tolerant stems. **Leaves** pinnatipartite, broadly channelled along midrib on upper surface; lamina 10–17 cm long, 7–13 mm wide; lobes 40–85 each side, linear, pungent, twisted so that upper half of lobe is horizontal; margins tightly revolute; petiole 1–3 cm long. **Inflorescence** terminal, subtended by a few filiform hirsute 'bracts'; involucre bracts obtuse to shortly acute, appressed-pubescent to hirsute with densely ciliate margins, to 20 mm long; flowers 70–90 per head; floral bracts linear, 4–5 mm long, hirsute, lengthening to 11–15 mm in fruit. Perianth 27–34 mm long, long-hirsute, cream and pink with greenish cream limb; limb 3–3.5 mm long, usually evenly elliptic. Pistil 38–54 mm long, glabrous except ovary, pale yellow; pollen presenter 1–1.1 mm long. **Follicles** obovate, 12–14 mm long, glabrous except long hairs across apex.

This species is very similar to *D. arctotidis*. It usually forms a larger clump than *D. arctotidis*, to 1 metre across. It grows in sand and sand over laterite in heathland between Cataby and Eneabba and flowers in October.

***Dryandra stenoprion* Meisn., Hooker's J. Bot. Kew Gard. Misc. 7: 122 (1855)**

Shrub with short underground fire-tolerant stems. **Leaves** pinnatisect, V-shaped in cross section; lamina 12–20 cm long, 3–9 mm wide; lobes 40–85 each side, narrowly triangular to $\pm$ elliptic, acute, the lower margin revolute, slightly overlapping the slightly recurved upper margin of lobe below; lower surface usually woolly only in pits; petiole 1–3 cm long. The **inflorescence** is terminal, with no or very few subtending filiform 'bracts'; involucre bracts obtuse, to 20–25 mm long, rusty-pubescent; flowers 60–90 per head; floral bracts linear, 6–7 mm long, hirsute at base, glabrous above except small apical papillae, longer in fruit. Perianth 28–35 mm long, shortly hirsute above base, the claws pubescent to hirsute, straw-coloured, golden, pale mauve or purple; limb 3 mm long, $\pm$ evenly elliptic, hirsute. Pistil 38–41 mm long, glabrous, cream to pale yellow; pollen presenter slightly swollen at base and apex, 1–1.2 mm long. **Follicles** broadly obovate, 12–15 mm long, $\pm$ glabrous.

Distinguished by its stiff leaves with a thick, yellow midrib, the leaf revolute towards the top where they overlap those below. A clump to 75 cm across it occurs with *D. tortifolia* and *D. nana*, where it hybridizes with both, in sand and laterite from Badgingarra to Eneabba, flowers from June to August. Photo, page 141.

***Dryandra cypholoba* A. S. George, *Nuytsia* 10: 392 (1996)**

(From the Greek *kyphos* — bent, humped and *lobos* — a lobe, a reference to the recurved, hump-like leaf lobes which are a distinguishing feature of this species).

Shrub with short underground fire-tolerant stems. **Leaves** pinnatipartite, the lobes usually markedly convex; lamina 12–20 cm long, 8–20 mm wide; lobes 25–40 each side, broadly triangular, obtuse to acute, the upper margin usually incurved to apex; petiole 1–4 cm long, pubescent, glabrescent. **Inflorescence** terminal, commonly subtended by hirsute dwarf leaf-bracts; involucre bracts narrowly ovate-lanceolate, acute, passing to broadly linear and obtuse, 20–28 mm long, rusty-pubescent, green and orange-brown; flowers 50–60 per head; floral bracts linear, 5–7 mm long, with long spiral basal hairs, then glabrous except apical papillae, lengthening to c. 16 mm in fruit. Perianth 27–37 mm long, shortly appressed-hirsute above base, passing to appressed-pubescent claws, pale pinkish brown; limb 3–4 mm long, hirsute with shaggy apex. Pistil 41–47 mm long, glabrous, lemon yellow; pollen presenter narrow, 1.3–1.5 mm long. **Follicles** obovate, 13–16 mm long, glabrous except apical and marginal hairs.

Flowers are bright yellow with a pale, pinkish-brown or yellow limb, appearing in August. The distribution of this species is fairly restricted. It occurs in the Tathra and Alexander Morrison National Parks. It grows in sand and gravelly loam, forming a clump to 50 cm across. Seed capsules are smaller and blunter than those of *D. lindleyana*. It is distinguished from *D. lindleyana* subsp. *media* by the softer leaves with recurved lobes.

***Dryandra lindleyana* Meisn., in J. G. C. Lehmann (ed.), *Pl. Preiss.* 1: 598 (1845)**

Shrub with fire-tolerant underground stems, sometimes with short aerial stems. **Leaves** linear, pinnatipartite or pinnatisect; lamina 6–20 cm long, 2–20 mm wide, hirsute but glabrescent above, white-tomentose below; lobes 10–80 each side, obliquely triangular to oblong, obtuse; margins $\pm$ equally recurved to revolute; petiole 1–12 cm long, tomentose, glabrescent. **Inflorescence** terminal; involucre bracts lanceolate (outer) to broadly linear and obtuse (inner), appressed-pubescent to glabrous except ciliate margins, the hairs commonly rusty, the innermost to 15–25 mm long; dwarf leaf-like hirsute 'bracts' also sometimes present (subsp. *agricola*); flowers 30–70 per head; floral bracts linear, 3–4 mm long, hirsute at base, then glabrous except apical papillae, lengthening to 6 or more mm in fruit. Perianth 20–35 mm long, shortly hirsute, then appressed-pubescent, cream, golden or pink; limb 2.8–3 mm long, hirsute. Pistil 30–40 mm long, cream at base, cream, pink or pale maroon above; pollen presenter not or slightly thickened, 0.8–1.3 mm long, green. **Follicles** obovate, narrowed or rounded at base, 7–13 mm long, glabrous except marginal hairs.

Dryandra lindleyana is widespread between Geraldton and Albany. This species includes taxa that for many years have been included within a broadly circumscribed *D. nivea*. The type of the latter is from near Esperance Bay and is non-lignotuberous. Apart from the other taxa here recognized at specific rank, all forms with underground, fire-tolerant stems and small, $\pm$ triangular leaf lobes are here included in *D. lindleyana*, a name published in 1845 but until recently placed in synonymy under *D. nivea*. A variable species with five subspecies:

- 1 Leaf lobes obliquely oblong or narrowly triangular; subsp. *sylvestris*
- 1: Leaf lobes essentially broadly triangular and:
 - 2 Leaves divided almost or quite to midrib
 - 3 Leaf lobes $\pm$ regularly triangular, although upper margin usually shorter than lower
 - 4 Leaves 3–8 mm wide; lobes 30–60 each side of leaf; widespread from Mt Adams to Cape Naturaliste including Darling Plateau subsp. *lindleyana*
 - 4: Leaves 2–3 mm wide; lobes 60–80 each side of leaf; Watheroo National Park to Moora subsp. *polifosta*
 - 3: Leaf lobes with lower margin shallowly S-shaped or concave, half strongly recurved giving a twisted aspect; leaves 7–10 mm wide; Eneabba to Mingenew. subsp. *media*
 - 2: Leaves divided $\frac{1}{2}$ to $\frac{3}{4}$ to midrib; central wheatbelt subsp. *agricola*

Dryandra lindleyana* Meisn. subsp. *lindleyana

Stems prostrate, mainly underground but commonly shortly erect. **Leaves:** lamina 10–20 cm long, 3–8 mm wide; margins recurved to revolute; lobes 30–60 each side, triangular with the upper side shorter, commonly curved upwards, obtuse; sinuses V-shaped, 2–5 mm across; petiole 1–3 cm long. Involucral bracts to 15–23 mm long, glabrous to densely pubescent, densely ciliate; flowers 50–70 per head; floral bracts 4 mm long, woolly at apex, elongating to 10–13 mm in fruit. Perianth 22–30 mm long. Pistil 24–40 mm long; pollen presenter scarcely thickened at base, 1–1.3 mm long.

A variable subspecies with two varieties recognized here; the type variety *lindleyana* is found from Geraldton to Cape Naturaliste, a more-or-less coastal species growing in sand often over limestone or in banksia woodland. It is a plant with most stems procumbent, mainly underground, the aerial part less than 10 cm long, the leaves 10–20 cm long, 3–8 mm wide. It flowers in July–August. The seed capsule is dark brown. As with all the taxa described here, it has one seed per capsule and the separator is papery.

The variety *meillicula* (from the Latin *melliculus* — a little honey, a reference to the common name ‘honey pots’) grows in laterite gravel on the Darling Plateau and scarp, east of Perth and south to Cape Naturaliste. It is occasionally found in sand in woodland. Flowers are similar to those of var. *lindleyana* with flowering occurring from July to September. It is low growing, procumbent to erect with aerial stems to 45 cm tall. The leaves are 10–15 cm long, 5–10 mm wide.

***Dryandra lindleyana* subsp. *poliosta* A. S. George, *Nuytsia* 10: 396 (1996)**
(From the Greek *pollostos* – smallest, least, because of the small leaf lobes).

Leaves pinnatipartite, ± flat except margins; lamina 13–20 cm long, 2–3 mm wide; lobes 60–80 each side, obliquely triangular, obtuse, white-tomentose below; sinuses oblique, V–U-shaped, 1–3 mm across; petiole 1–4 cm long, tomentose, glabrescent. Involucral bracts lanceolate (outer) to broadly linear and obtuse (inner), appressed-pubescent to glabrous except ciliate margins, the innermost to 15–22 mm long; flowers 35–45 per head. Perianth 25–30 mm long, shortly hirsute above base, then appressed-pubescent; limb 2.8–3 mm long, hirsute. Pistil 32–37 mm long, pale maroon; pollen presenter slightly thickened, 1 mm long.

The subspecies *poliosta* has very narrow leaves with small lobes similar to *D. nivea* from which it can be distinguished by its prostrate habit. With short underground stems, it forms clumps to 1 metre across. It occurs in sand in woodlands or laterite and sand in heathland from the Moore River National Park, west of Gillingarra and to Moora and Watheroo National Park. South of its distribution, it apparently grades into subsp. *lindleyana*. Flower-heads are similar to those of subsp. *lindleyana* but with fewer flowers per head. Flowers in August.

***Dryandra lindleyana* subsp. *media* A. S. George, *Nuytsia* 10: 395 (1996)**
(*Media* — refers to the intermediate morphology of the subspecies).

Leaves broadly linear, pinnatipartite; lamina 15–20 cm long, 7–10 mm wide; lobes 25–40 each side, broadly triangular, obtuse, the lower margin usually shallowly S-shaped with its distal half more strongly recurved giving a twisted aspect; sinuses 3–10 mm across; petiole 1–3 cm long. Involucral bracts to 20–25 mm long, rusty; flowers 50–65 per head. Perianth 26–30 mm long, cream-pink. Pistil 35–40 mm long, cream at base, pink above; pollen presenter swollen at base, 1.3 mm long, green.

The leaves are a bluish-green colour, similar to *D. cypholoba*, but can be distinguished by their stiff and non-curling lobes. The underground stems are fairly short and plants form clumps to 50 cm across. It grows in sand between Eneabba and Mingenew. Flowers are yellow with golden-brown bracts in July to August.

***Dryandra lindleyana* subsp. *agricola* A. S. George, *Nuytsia* 10: 397 (1996)**

Leaves broadly linear, pinnatipartite, glaucous above, densely hirsute when young; lamina 10–17 cm long, 8–13 mm wide, white below; lobes 15–30 each side, $\pm$ triangular, $\pm$ flat; margins $\pm$ equally recurved to revolute; sinuses obliquely curved-V-shaped, 3–8 mm across; petiole 2–4 cm long. **Inflorescence** with subtending dwarf hirsute leaf-bracts; involucre bracts oblong to broadly linear, appressed-pubescent and densely ciliate, 18–20 mm long; flowers 50–60 per head. Perianth c. 20 mm long, hirsute above base, passing to pubescent claws and limb, pale yellow. Pistil 33–35 mm long, pale yellow; pollen presenter not enlarged, 0.8 mm long.

This subspecies is found in the agricultural (wheat belt) area of the South West and only a few populations are between Corrigin and Traysurin. The leaves, 8–13 mm wide, are fairly short, to 17 cm, rigid and a dark bluish-green colour. It grows in sandy loam and laterite in heathland. Short stems are mostly underground forming small clumped plants. The flowers are all yellow. The late flowering period, September–October is distinctive. The seed follicles are smaller and blunter than other subspecies.

***Dryandra lindleyana* subsp. *sylvestris* A. S. George, *Nuytsia* 10: 396 (1996)**

(From the Latin *sylvestris* – of woods or forests).

Leaves broadly linear, almost pinnatisect; lamina 6–16 cm long, 10–20 mm wide; lobes 10–35 each side, obliquely oblong to narrowly triangular, acute, pungent, the margins convex towards apex, almost flat; sinuses obliquely V-shaped to narrowly U-shaped; petiole 5–12 mm long. Involucral bracts to 20–24 mm long; flowers 30–40 per head. Perianth 22–25 mm long, hirsute, golden. Pistil 30–37 mm long, glabrous; pollen presenter slightly swollen at base, 1 mm long.

Again, the name indicates the habitat of this subspecies. It grows in jarrah-marri forest on the Darling Plateau. Plants in southern populations have shorter leaves with narrower lobes and form dense clumps resembling, except for the colour, *D. nana*. The latter has blue-green leaves. In the forest south-west of Perth, plants are often more sprawling, with leaves of varying widths and lengths on the same plant. Leaf lobes tend to be wider. Where I have observed this feature, along Albany Highway, the forest is regularly burned. This may have a bearing on the plant form as it has to resprout almost every year. Normal plants have short underground stems and form small clumps. Flowerheads are similar to those of subsp. *lindleyana* with all colour variations present. It is distinguishable by the wide, bright green leaves and late, September–October flowering period.

***Dryandra brownii* Meisn., in J. G. C. Lehmann (ed.), *Pl. Preiss.* 1: 595 (1845)**

Shrub to 70 cm without lignotuber, much-branched and bushy. **Leaves** pinnatisect or almost so, dark green; lamina 15–35 cm long, 10–16 mm wide; lobes 40–75 each side, $\pm$ oblong, the upper margin strongly curved in to apex, acute to obtuse, white-tomentose below; margins shortly recurved; sinuses V-shaped, 3–8 mm across; petiole 1.5–3 cm long, commonly hirsute. **Inflorescence** subtended by filiform hirsute 'bracts'; involucre bracts oblong, obtuse, to 22–25 mm long, pubescent to $\pm$ glabrous; flowers 55–70 per head; floral bracts linear, 4–5 mm long, hirsute at base, glabrous above but with apical papillae, lengthening to 12–14 mm in fruit. Perianth: 28–39 mm long, hirsute in lower half with dense, curled hairs along midrib, appressed-hirsute in upper half, the limb coarsely hirsute, pink; limb 2 mm long, grey-brown. Pistil 41–54 mm long, deep red; pollen presenter thickened at base, 0.6–0.8 mm long. **Follicles** obovate, narrowed at base, 12–14 mm long, glabrous except a few long apical hairs.

Most easily distinguished by its growth habit, this is a dense shrub to 70 cm $\times$ 1 m, without a lignotuber and hence is killed by fire. The very attractive leaves are dark blue-green, 15–35 cm long, and wider than most species in the group. Plants growing in the eastern Stirling Ranges have wider leaves, up to 25 mm. Leaf-lobes are more obtuse than triangular (pinnatisect).

Dryandra brownii grows with *D. arctotidis* and various colour forms occur, suggesting some hybridization. In "pure" populations, the flower colour is dull pink. Flowerheads are larger than in most members of subgenus *Niveae*. Flowering is in August. It occurs from Cranbrook to the Fitzgerald National Park. Common in the Stirling Ranges, it has sometimes been misidentified as *D. nivea*. Some collections however, have narrower leaves with more triangular shaped lobes and are possibly hybrids as *D. nivea* subsp. *nivea* has recently been collected from near Woogenillup.

Dryandra nivea (Labill.) R.Br., *Trans. Linn. Soc. London* 10: 214 (1810)

Rounded shrub to 1.3 m high and wide, without lignotuber, dichotomously much-branched. **Leaves** linear, pinnatipartite, silky-tomentose above but glabrescent, white-tomentose below; lamina 20–45 cm long, 3–10 mm wide; lobes 45–85 each side, $\pm$ triangular, rounded-obtuse; margins shortly revolute; petiole 1–6 cm long. **Inflorescence** terminal but usually subtended by new branches; involucre bracts ovate to oblong, obtuse, to 18–22 mm long, appressed-hirsute or almost glabrous except ciliate margins; flowers c. 70–90 per head; floral bracts linear, 4–5 mm long, hirsute at base, glabrous above except apical papillae, lengthening to 9–10 mm in fruit. Perianth 25–38 mm long, hirsute in lower half, then appressed-pubescent, cream with brown limb; limb 2–3 mm long, hirsute. Pistil 32–45 mm long, glabrous, cream or red; pollen presenter not or slightly thickened at base, 0.7–1.1 mm long. **Follicles** obovate, $\pm$ acute at base, 9–13 mm long, almost glabrous.

Widespread through south-western WA from Lake Indoon to Ongerup and E almost to Israelite Bay. Distinguished from most species of ser. *Niveae* in the non-lignotuberos, much-branched habit, and from the non-lignotuberos *D. brownii* by the narrower leaves with triangular lobes. The leaves are typically longer than those of related species. There is a subspecies *uliginosa* that differs from the type species that is widespread Eneabba to Cape Arid, in dry soil; it is found on, winter-wet flats near Busselton and the Scott River and has larger leaves, 45 cm long, 7–10 mm wide, as against those of the type species of 35 cm long, 3–8 mm wide and it has flowers with a longer pistil, 41–45 mm long.

Dryandra nivea (Labill.) R.Br. subsp. *nivea*

Shrub less than 1 m tall. **Leaf** lamina usually 20–35 cm long, 3–8 mm wide; lobes 45–85 each side, obliquely triangular, obtuse; petiole 1.5–6 cm long. Involucre bracts ovate to oblong, to 18–22 mm long; flowers c. 70–90 per head. Perianth 25–38 mm long. Pistil 32–40 mm long; pollen presenter 0.7–1.1 mm long.

The distinctive form of this shrub makes a neat, dense shrub to 1 metre. The flower heads are very numerous, albeit almost hidden among the leaf bases. Leaves are 20–35 cm long, very narrow, with many small triangular lobes. Subspecies *nivea* is common and widespread in various soil types but is usually found, in association with other dryandras, in laterite. It is non-lignotuberos and hence killed by fire. The flowerheads are generally smaller than those of the lignotuberos species. All colour forms and variations occur including all yellow. Flowering is from July to September. Seed capsules are similar in shape to those of *D. lindleyana* subsp. *lindleyana* but smaller.

Dryandra nivea subsp. *uliginosa* A. S. George, *Nuytsia* 10: 399 (1996)

Shrub to 1.3 m. **Leaf** lamina 20–45 cm long, 7–10 mm wide; lobes 60–80 each side, obliquely triangular, obtuse; petiole 1–3 cm long. Involucre bracts ovate to oblong, to 20 mm long; flowers c. 70 per head. Perianth 29–38 mm long. Pistil 41–45 mm long, glabrous; pollen presenter 0.7–0.9 mm long.

Subspecies *uliginosa* (from the Latin *uliginosis* – full of moisture, hence marshy) referring to the winter-wet habitat is a dense shrub to 1.5 m tall. Its growth habit is the same but the much longer leaves, to 45 cm, make this subspecies a much bigger plant. The preferred habitat for *Dryandra nivea* subspecies *uliginosa* is winter-wet clay pans in a few locations east of Busselton, in the Whicher Range and Scott River Plain. It is currently gazetted a rare plant. Flowering is in September and it can be distinguished from subsp. *nivea* by the longer leaves with coarser lobes.

***Dryandra* “Morangup”**

A possible additional subspecies is an un-named form, referred to as “Morangup”, known from only one location at present. It grows in a winter-wet gravel loam situation but the population extends to a higher laterite rise. The leaves are bright green to 35 cm long, wider and with larger, blunter lobes than subsp. *nivea*. The flowerheads are completely hidden at the base of the leaves, but numerous. They are fairly small, with fewer flowers per head than subsp. *nivea*. Throughout the population, they are uniform in colour. The style is deep pink and the limb is pure white. The almost glabrous bracts are yellow-green. It is unusual in the flowering period which is in April.

Restoration of habitat

Propagating the difficult plants

Including rare and endangered plants

by Dennis Cooper

Restoration of areas damaged by development pressures can be very frustrating. This applies especially to plants that previously were almost impossible to propagate from seed. My experiences with a local reserve may be of wider interest. On Ambergate Reserve I could only find one plant of *Conospermum teretifolium*, so I decided to try to grow it and plant more. It has a single seed with no skin, inside a hard ovary shell, still with bits of old flower attached. These were planted in three trays, smoked and put in the greenhouse on 17th March '97. In about 6 weeks they started coming up and at the end of July I potted up the last of them, 121. Because these plants grow in very poor white sand, I am adding a lot extra sand in my usual mix. The sand in any mix does two things, it opens up the mix a little and also adds weight so that pots do not blow over.

Verticordia were tried. Five seeds came up but only two survived and are growing well, about 30 cm high. This is the first time I have had any success with either seed or cuttings with this one. It is Rare and Endangered.

This year we have done some direct seeding of understorey plants in the reserve. Most of the seed was smoked a few days before. The plots were lightly cultivated, seed spread and a tree branch dragged across to help form a cover over the seed. Small branches were then spread across the beds to stop seed being blown away and young plants being sand blasted. A small sample of each seed type was not smoked and was spread in a separate marked plot as a control. *Acacia* and *Kennedia* seed were heat treated before being sown.

Preparation for planting out. When the plants get their first true leaves and are big enough to handle, I prick them out and put them into 200 ml. Yogurt containers with drainage slots cut in the bottom edge. These containers have sloping sides so they come out easily. Plastic tube pots are too straight and hard to empty without breaking up. A week or two on the shelf in the greenhouse and they are growing with roots to the bottom of the pot. They are then planted into one litre milk cartons, with the bottom corners cut off for drainage. After a few days on the bench to stabilize they go outside in the open, baited for snails, they love them. These cartons will last up to 12 months. If roots start through the bottom, just fill another carton with potting mix, take the bottom off the old one and push it into the top of the new one. This will provide an extra deep root system and the plant can take care of the first dry summer much better when planted out. Three or four of the double cartons need to be tied together so as not to fall over. Next winter holes will be dug on the reserve, the base of the carton removed with plant and carton placed in the hole. As the soil is replaced in the hole the cartons are slipped up and off. If the plant spread is too great the carton is split up one side and again slipped up as soil is replaced. Very little watering of new plants is done and most take OK.

My Potting Mix. When I first started, the mix I used dried out too quickly. I experimented until I got one that drained excess water quickly, but retained moisture for several days. It comprised:— 2 parts sawdust, 2 parts grit and, ½ part black peat. To a 10-litre bucket of this I add a small handful of long acting Osmocote and a measured spoon of complete trace elements. The grit is a local granite sand. About half of it will pass through a flywire sieve and the rest is up to 4 mm diameter. Sawdust is straight from the mill, usually a Jarrah, sometimes with Marrie, *Eucalyptus calophylla* mixed with it.

Smoking Seed to aid germination. I have tried planting the seed in the tray of potting mix and lightly covering with grit before smoking and watering. I have put the seed only in an open container and smoking it. I have tried putting a lid on it till next day and then planting. Seems to work just as well either way. This year I have smoked seed for 45 minutes, closer to the time King's Park do it.

Smoke, smoked water

Its use in propagation

Kings Park, Perth, have been the leaders in Australia in the development of the use of smoke to aid germination. They have produced an exceptional, colourful, compact disc on the subject, available from them, Kings Park, Perth, Western Australia 6005 for \$20 including postage. For further information contact Nola Waterhouse on (08) 9480 3614 or e-mail nolaw@kpbw.wa.gov.au. It is a valuable educational tool and contains information of general interest all beautifully presented.

The compact disc will be of special value to those wishing to regenerate bush in natural areas. It gives detailed advice of how to set up a tent, "smoke" an area and germinate any seed lying dormant. Much seed is difficult to germinate, then to rear and plant and get establish. It will be well worth while to get the special equipment described and even to scatter seed on a site and smoke in-situ.

Some readers have had experience with the use of smoke, directly or in a prepared water to propagate seed. It is time we collated this valuable data. There are products on the market but how good are they really. Contact me, Editor *Australian Plants*.

Banksia plagiocarpa

A *Banksia* of the monsoon tropics

by W. H. Payne (from information received)

Banksia plagiocarpa is a shrub or small tree to 5 m, with a short trunk and spreading canopy. The bark is a corky fissured grey-brown, characteristic of a number of eastern species. Similar in appearance to *Banksia integrifolia*, which is widespread along the eastern coast but it is distinctive in two ways that make it a suitable plant for the cut flower trade; the flower heads are large, to 14 cm long, 5–6 cm wide, and are mostly terminal allowing a long stem for floriculture use, and the new growth is an attractive rusty red as shown in the photograph.

The flower heads, as shown in the photograph, are not brightly coloured but forms have been described as bluish to mauve tinged and it is no doubt these forms that have been selected for the cut flower trade. If you want to grow them commercially, be sure that you get forms specially selected for this purpose.

Over zealous bureaucrats* have created a major problem for Queensland growers. The species is classified as *rare*, which it is to a degree, being found only on Hichinbrook Island and adjacent coast. Queensland legislation prohibits the sale of plants and flowers may not be harvested for the cutflower trade in Queensland even for crop-grown plants. Despite this the plant is being widely cultivated and amendments of legislation to cover this species, as has been done for other *Banksia* species, are needed for a cultivated crop. Bush picking must be stopped but cultivation on registered, inspected crop farms should be encouraged.

Northern Queensland *Banksia*

Banksia robur with its equally large terminal flower heads and more attractive leaves is an attractive candidate for floriculture. There are some excellent forms.

Banksia dentata occurs in drier country of far North Queensland and could be an attractive prospect for cultivation where other crops could not survive. Terminal flowering forms with a good orange colour and size would need to be selected.

Banksia spinulosa, the form from the Pyramid area, produces orange/yellow flowers with dark purplish styles, but mostly at right angles to the stem.

Banksia integrifolia is very hardy, occurring over a wide range along east coastal Australia. The variety *aqualonia* occurs as far north as Cooktown, producing small cream to greyish mostly terminal flowers.

***Banksia plagiocarpa* as a cut flower.** This report from Shirley Doull, Malanda. The flower heads are cut in the bud stage, the best colour being when it is probably too immature to open. They have a long vase life and then gradually dry out, retaining their silver-grey colour. I do not supply to florists once they start to open. The styles are a creamy yellowish colour and I feel they look untidy and not as attractive as in the bud stage.

*Environment Australia – Wildlife Protection Act 1982 has a sensible approach suggesting "where cultivation of a species is to such an extent that it has increased the population and the species range and the population in the wild is generally not subject to collection....." As cultivated plants/seed are now widely available the attitude, the officious attitude of certain officers, is being watched. The industry in Cairns and other rural areas of Queensland needs support and it is hoped common sense will prevail. Plants are readily available in NSW.



△ *Banksia plagiocarpa*

Photography by David Hockings

▽ *Banksia dentata*



Hakea, Banksia and Dryandra, Flora of Australia, Volume 17B

This is a very valuable reference book presented, as with others in this series, in scientific language but that can be readily translated, with a little persistence, over the various features of interest to a horticulturalist; available from CSIRO Publishing, PO Box 1139 (150 Oxford Street), Collingwood, Victoria, 3066. Telephone (03) 9662 7666 for details of dispatch by post.

Hakea. The 149 species found only in Australia, are described. Admirably, this large number of plants has been presented in groups of similar species. For instance the following well known and widely grown group of six species are now easily recognized; those with leaves less than 3 mm wide are *Hakea maconochieana* and *Hakea bucculenta*; those with wider leaves and cream flowers, *Hakea minyma*, and those with wider leaves and the flamboyant red or pink flowers, *Hakea francisiana* with the longest head (of up to 500 flowers) to 9 cm long and those with shorter heads of up to 150 flowers, *Hakea multilineata* and *H. grammatophylla*. A feature of *Hakea* is that they hold their fruiting capsules on the bush for a long time and this provides a valuable guide to identification of species, especially using the sketches provided.

Now this volume is available, readers are invited to send notes on their experiences of cultivation of *Hakea*. Will someone who is willing to prepare sketches please contact the Editor.

Banksia. The 76 species are described in groups of similar species. For those who have the recent edition of The Banksia Book, there is no new information. A number of species have been described since its first publication, *Banksia aculeata*, *B. benthamiana*, *B. cuneata*, *B. elegans*, *B. laevigata*, *B. oreophila*, *B. pulchella* and *B. verticillata*. They will be in a future issue, any notes or photos.

Dryandra. This issue of *Australian Plants* commences a series, with easily read descriptions, of one of the groups of the 93 species, courtesy of our Dryandra Study Group. Other groups of *Dryandra* will be described in future issues.

Australian flora, its conservation and commercial production

Bureaucrats in Queensland go mad with restrictive practices

We can be proud of our politicians and legislators for the enlightened legislation that is being currently enacted, to conserve our flora. In some areas it does not go far enough. Why allow commercial bush picking at all, of threatened species such as Waratah or Christmas Bells when adequate supplies of better more suitable flowers are now available from flower forms especially created to produce a valuable export earning crop.

Environment Australia is proposing a sensible approach to the Wildlife Protection Act 1982: "Where cultivation of the species is to such a large extent that it has increased the population and species range and the population in the wild is generally not subject to collection..."

One Act has the fine words "this plan seeks to minimize statutory controls" and the Queensland regulations have a special category RF-F for flowers being commercially cropped. They have missed two important plants described in this issue, *Banksia plagiocarpa* and a selection of *Playsace* developed for horticulture and marketed as 'Valentine Lane'. This species is so widespread as to be almost regarded as weed so why some small minded official has targeted it for restrictions appears ridiculous.

Bureaucrats gone mad? It is the implementation of the legislation that concerns the sceptics. In Queensland for instance the proliferation of forms and charges from the many departments only vaguely related to the flora is beyond understanding. They should be fostering local/country industry. Why cannot the many departments talk to each other and agree on a common form processed by one department. People are too ready to blame our politicians. It is department heads and their advisers that seek to make conditions oppressive.

A recent visit to Queensland has revealed frustration and concern as expressed above. Editor.

Conservation policy

of Australian Plants

Most readers are concerned about conservation. We are meeting this concern in practical ways on a national level concentrating on matters that directly effect the native flora. All creatures native to Australia are critically dependent upon the natural flora, a factor that seems to be overlooked by many. We shall be making a significant contribution to the future health and wealth of Australia. The Australian flora is a vast, valuable resource for the future survival of the human race, but it is rapidly becoming extinct. There is a lot of fuss (justifiably) about plants that are rare and endangered and we play a vital role but the whole flora is rapidly becoming extinct. *Australian Plants* hopes to prevent "doomsday":

1. Learning how to grow Australian plants. Nobody really believes you will save our flora from becoming extinction by growing it in our home gardens. However, you could be involved in a much "bigger picture" to save the world. The flora can only be saved by careful management of vast natural areas that are rapidly diminishing in number and size. Plants will need rehabilitation into areas not being devastated by development to support the growing human population.

2. Australian Flora National Botanic Gardens. The establishment of botanic gardens in a range of climatic and geographical regions will be in the next issue.

3. One of the biggest threats to certain flora is bush picking for the lucrative cut flower trade. Sanctions to stop this practice are impracticable and/or the relevant government authority actually supports the practice by licensing. The society has been active in promoting wildflower cultivation farms solely to supply this trade worth millions in export income. By producing better, more attractive flowers, free of pests and blemishes, better prepared and packed, it has been shown that the overseas customer is preferring the cultivated product.

4. Promotion of research into factors that will aid conservation practices, revegetation schemes and wild area management.

5. The commercial development of the Australian flora for products such as timber and special products and for food production. Rather than devastate marginal areas permanently by production of traditional gains, we promote the development of foods from Australian plants sympathetic to the natural ecology.

6. The mass planting of trees is well catered for by specialist organizations such as Greening Australia. We applaud and support their work. Survival of their efforts is being seriously jeopardized by natural factors and predators. As on page 166 we are taking action to ensure survival of revegetated areas.

7. Revegetation is actively promoted by members with projects such as those mentioned here. We encourage projects under the Landcare Scheme.

8. The support and promotion of landcare schemes, a very fine concept with adequate funding that is not being supported in many conservation areas.

9. The basic soil of all types throughout the land is being progressively degraded. This involves the destruction of natural organizations that have evolved over the ages to bind it together and make it productive. The restoration of the balance of nature above and below the ground is essential for survival.

These are all practical, national initiatives being actively promoted in *Australian Plants*. If any reader has anything to add with positive suggestions for implementation I will be very pleased to hear from them. Please define specific projects or activity when answering.

How hardy is *Xanthorrhoea*

by Norman and Shirley Kemble

In a word, very! We bought ours, the fine-leaf variety of *australis*, about ten years ago when we lived in Tumby Umbi on the Central Coast. It was nearly two feet tall and carried a certificate to say it had been in the pot over a year, indicating that it wasn't going to drop dead on us, some comfort, as it cost \$90!

So we took it home proudly and after a while, carefully re-potted it into a larger pot and gave it some T.L.C. (watering and very occasional fertilizer) in our courtyard, where it looked very decorative but refused to flower. After about five years, we decided to put it into the ground in a special bed nearby, suitably enhanced with a few well-chosen rocks — even more decorative!

We made the difficult decision to move and there was no way we would leave our Grass Tree. So, back into the pot it went and it moved with us to Kincaid (still on the Central Coast) without turning a hair. There it stayed in its pot, more T.L.C., moved into the sun in winter from the South-facing porch. Quite happy but still no flower. We heard of a specimen in the Canberra National Botanic Garden flowering after ten years so we're still hoping.

After about four years came the trauma of another move, this time to Mildura, Victoria. Squeezed into the back of our station wagon, it suffered the indignity of having its "hair" tied into a bundle with an old stocking and bent sideways. However, it survived the trip and soon recovered its normal shape. On the later short move to our new abode it overturned in the back of the same wagon (not so well packed!) and had to be hastily stuffed back into its pot. Not a problem.

Then came the Summer heat! Somehow it got overlooked and after a couple of 40°+ days, it looked very sad indeed. Much panic! A severe haircut was decided on and thankfully it responded to this plus more water and a more sheltered position. In a month or so it had returned to its former glory. Landscaping has begun and it has settled in quite happily, as shown opposite. ■

Garden Escapees become environmental weeds

What not to plant in the Ipswich District

Some ornamental plants introduced into the Ipswich district, for their beauty, or resilience, are now adversely affecting our natural environment. Invasion of areas of native vegetation is modifying the natural ecosystem, and threatening indigenous flora and fauna. This migration into urban bushland can be by winged seeds, blown at the mercy of the winds; fruit containing seeds, eaten by birds or flying foxes; seed collected and dispersed by ants; seed adhering to humans, animals, or vehicles, by way of mud, sticky exterior or barbs and the more usual methods of fruit or seed carried by water runoff from residential areas, along drainage lines, into bushland and garden rubbish being dumped illegally in bushland. Prudent choices of alternative local native species will reduce this threat to our natural environment.

A notice was circulated by the Ipswich Group of the society that lists the plants that are escaping into their surrounding bushland and for each offending plant an alternative plant was suggested, an Australian plant of course. The list is quite extensive and as well as the widespread offenders such as *Asparagus* fern, *Camphor Laurel*, *Mulberry* and *Pine trees*, there are many Australian plants such as *Privet*, *Umbrella Tree* and *Eucalyptus torelliana*. Join us. ■



△ Garden at Mildura with our Grass Tree; a progress report to come in 2 years. Readers are invited to take photographs of an attractive part of their garden and send them for all to see what you have achieved, whether by good luck or good management, Editor.

▽ Garden featuring Grass Trees. You can visit this garden any time of the year when in Victoria, you will be made very welcome. There is also a wide range of plants available at reasonable prices, including grafted plants, see page 153. The garden is designed for all-year display. Here we see in the centre background *Isopogon formosus*, the large red bush, a very spectacular plant described on page 147; *Grevillea stenobotrya*, the large cream flowered shrub to the right, and below it the red prostrate plant is *Grevillea* 'Wakiti Gem'.



Let us all attack the weed problem

Editor

The report over the page is a lesson here for us all. Plants are escaping into the wild and causing serious degradation and they are increasing in number each year. The Ipswich Group has shown the way. Let all groups prepare a similar list of plants that are a problem in their area, publishing it in the local paper and propose remedial action. At least prepare the list and if you cannot take action yourself initiate it by calling on the local council and service clubs such as Lions and Rotary to nominate a day for joint community action. Have a day for the school pupils to go out and show their concern. Rallying the young and the old, with local council aldermen giving their support, can result in a local event equivalent to "Clean up Day". Most councils have a plant give-away scheme and planning a year ahead could result in the distribution of the best plants. District groups, plan ahead and advise the state secretary of what is planned to get it into the local newsletter. Well done, Ipswich Group.

Wildflower Nurseries in Queensland

Fairhill Plants and Botanic Gardens — Huge range; rainforest plants, grafted grevilleas, rare plants, wildflowers, ferns, orchids, revegetation trees. Extensive display gardens. Open every day 8.30 a.m.–5.00 p.m. Fairhill Native Plants, Fairhill Rd, Yandina, Qld 4561. Tel. (07) 5446 7088.

Nielsen's Native Nursery — Over 500 species including grafted grevilleas, eremophilas, eucalypts and brachychitons, also Foxtail Palms, cycads, rainforest, Bush Tucker plants. Display garden. Open 8.00 a.m. to 5.00 p.m. every day. 49–51 Beenleigh Redland Bay Rd, Loganholme, Qld 4219. Tel. (07) 3806 1414.

Wildflower Nurseries in New South Wales

Annangrove Grevilleas — 98 Annangrove Rd, Kenthurst 2156. Tel. (02) 9654 1380. Wide range of natives including hundreds of different species in tubes — many hard to get. Ten percent discount to SGAP members.

Bryants Native Plant Nursery — Cosy Camp Rd, Bex Hill, N.S.W. 2480. Tel. (02) 6628 4323. 15 kms north of Lismore. Open 7 days (from 11 a.m. on Sundays). Extensive range. Excellent quality and service.

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

Illawamba Native Growers — P.O. Box 89, Cobargo, N.S.W. 2550. Tel. (02) 6493 7398, mail order specialist. Send 2 x 45¢ stamps for catalogue of our large range including rare species.

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

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

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

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

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

Wildflower Nurseries in South Australia

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

Wildflower Nurseries in Tasmania

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

Wildflower Nurseries in Victoria

Kuranga Native Nursery — Australia's largest range of Australian plants. Delivery Australia-wide. Free stocklist on request. The Kuranga Handbook of Australian Plants now available RRP \$19.95. A comprehensive guide on plants stocked at Kuranga, 393 Maroonah Highway, Ringwood 3134. Tel. (03) 9879 4076. Open 7 days.

Australian Wildflower Seed Suppliers

R. Horner — 1 Grundy St, Alice Springs, N.T. 0870. Seed of trees and shrubs of Central Australia. Please sent 45¢ stamp for a list.

Wildflower Society of Western Australia (Inc.) — P.O. Box 64, Nedlands 6009. A range of seeds available, labelled and packed, at \$1.00 (plus postage) per packet. Send for a 1997/98 Descriptive Seed List (\$1.95 posted) to: The Seed Sales Officer, Eastern Hills Branch, 65 Swan View Road, Swan View, WA 6056. Also available a book "Hints on Growing Native Plants" \$4.00 posted.

Birds, all native creatures depend upon plants

"Wrens of Australia's northern and southern forests and gardens"

A series of three limited edition prints, 465 mm x 400 mm, (18" x 15") are available direct from the artist, Ian Roberts, Medika Gallery, 16 Moore Street, Blyth, South Australia 5462 each for \$65 including postage. Portion of one of these prints is shown on our rear cover. For those who prefer unique personal cards to send to friends, there is a range of cards featuring birds, \$3 each or \$16 for a pack of 14.

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Blue Wrens on *Hakea francisiana*, see page 183