grouped in deep pits, which would easily be blocked by water, thus depriving the leaf of CO_2. Similar conditions may well occur in other fine-leaved evergreens, e.g. *Boronia megastigma*.

Successful use of the closed mist system depends upon careful attention to two factors. The first is aeration of the propagation medium and drainage, since there is a high level of water entering the system, water must be able to drain freely from the propagation medium and bench. The system in use at NZNRC uses a peat/pumice (1:2 v/v) mixture in trays on a heated, drained capillary bench to ensure that these conditions are met. The second is the need for careful weaning of cuttings from the system. This has been accomplished with most species by gradual removal of the polythene cover over about 7 days, coupled, if possible, with a gradual reduction in misting frequency toward the end of this period.

The enclosed mist system is still in relative infancy and much more remains to be found out in the light of experience. No doubt, in the process of gaining that experience we will find further modifications being developed, meanwhile it offers a new opportunity for cuttings which have problems in water economy.

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COLLECTING, SELECTING, AND PROPAGATING AUSTRALIAN PLANT INTRODUCTIONS

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The Australian flora is often referred to as being unique, but this is not an accurate description, as most of our Australian plants belong to families that are widely distributed throughout other parts of the world.

The Australian flora is closely linked with the world flora, and the endemic species have evolved since the continent was isolated. The flora can be roughly divided into three main elements:

1. *Asian*. Many species from the Kimberleys, Western Australia, Northern Territory, northern and eastern Queenland, coastal New South Wales and far eastern Victoria have links with the Pacific and Asian region, especially those found in rainforest areas.
2. *Antarctic*. The relationship with New Zealand, sub-antarctic islands, and South America is obvious in south-eastern Australia, especially Tasmania.
3. *Australian*. The unique development of endemic plants has occurred since isolation, especially in Western Australia, due to the dry barriers of central Australia and the Nullarbor Plain.

The Australian flora is currently recognized as containing about 20,000 species, but it is projected that a final total will be in excess of 25,000 species (2).

It is at the genera and species levels that we find there is a high degree of endemism. About 30 to 40% of Australian genera are endemic. At the species level, about 75 to 85% do not occur outside this continent (5).

HISTORY OF CULTIVATION

Australian plants have been cultivated since the 17th century, when Dampier visited the western Australian coast. After the visits by Banks and Solander during the 18th century the botanical and horticultural worlds showed immense interest in the curious and diverse flora of Australia. They found the world's tallest flowering plants, as well as minute ephemeral herbs.

Australian plants grown in England prior ot 1788 inlcude *Acacia verticillata*, *Allocasuarina torulosa*, *Eucalyptus obliqua*, and *Leptospermum lanigerum* (4). Thus was the beginning of a tremendous upsurge of interest in the introduction and cultivation of Australian plants. The garden fashion of that era was to grow as many rare plants as possible, and this gave the wealthy of the day an opportunity to achieve their goal.

It is interesting to delve into horticultural publications of the early 18th century and find the following:

Boronia pinnata, (hawthorn-scented boronia). Greenhouse shrub from Australia, introduced 1795. Flowers from March-May, pink. Cultivation sometimes makes a plant valuable or otherwise, so it is with this little odoriferous shrub. If sparingly watered, kept at all times under glass, and thoroughly drained, it will usually florish (3).

Selections of *Epacris impressa* seedlings were at their peak

during the 1870's with over 70 highly valued varieties under greenhouse cultivation.

Much cultivation, selection, and propagation has been done since that time, with an ever-growing interest in the cultivation of Australian plants. Considerable credit must go to the Parry family of "Floralands" Gosford, New South Wales; George Althofer, then of Nindethana Nursery, Dripstone, New South Wales; the Boddy family of Eastern Park Nursery, Geelong, Victoria; and to Alf Gray, who spent many years collecting in Queenlands, New South Wales, Victoria, South Australia, and Western Australia. All these and other enthusiasts have contributed greatly to the ongoing domestication of Australian plants.

Current exploration and collection is leading to the discovery of more species, and many of these are being introduced to cultivation by botanic gardens, nurseries, and enthusiasts.

It is difficult to state an exact figure for the number of Australian plants that have been introduced to cultivation. Current research by D.L. Jones and the author leads us to believe it to be well over 8000 species.

COLLECTION AND SELECTION

What are the criteria for collection and selection? Basically these are the same for all plants, whether they be chance seedlings, sports, or plants developed through breeding programs. The following criteria are extremely important, and must be kept uppermost in one's mind if we are involved in introducing new plants to cultivation.

1. **Is it an endangered species?** The cultivation of endangered species is paramount, provided every precaution is taken to ensure that the natural population is not further endangered by our eagerness to bring it into cultivation. Experience gained in the propagation and cultivation of endangered plants may help us to understand the needs of such species, and thus provide the basis for an adequate management program to ensure the continuity of the species in its natural habitat. It is worth mentioning here that there are inherent problems with the introduction of plants from the wild. A major problem is that collectors are often too eager for their own interests, and do not take into account the need for conservation values.
2. **An assessment of overall aesthetic quality** — especially as a mature plant. Your personal choice is often biased, but hopefully others will agree with you.

3. **Proposed or suitable uses.**

a) In amenity horticulture —

i) As a home garden plant

ii) As a container or pot plant (for local sales and export.)

iii) For broad landscape planting.

iv) As an indoor plant.

b) Has it potential for any other specific uses?

As a windbreak and shelter plant, for use in the control of salinity, waterlogging or soil erosion, for food, cut flower or drug production, for timber products, or for wildlife conservation value.

c) Will the selection prove adaptable to a wide range of conditions, or will it have specific requirements? This consideration is of utmost importance, and can include aspects such as tolerance to drought, waterlogging, frost and smog. Features such as fire retardant properties may also be of considerable significance in assessing the proposed uses for a species.

4. **It is likely to become a weed once introduced to cultivation?**

This is often a difficult question to answer, but we should be guided by how related species or genera have behaved, once grown away from their natural habitats. People responsible for the introduction of plants should never underestimate the importance of whether a plant has the potential to become a noxious weed.

5. **How is the selection going to adapt to nursery production?**

This involves several aspects including ease of propagation and the good development of young plants to the point of sale. The final answer to this question may not be gained until thorough trials are undertaken.

COLLECTION OF PROPAGATION MATERIAL

Basically there are three alternatives from which to choose.

1. **Seed.** Seed is often difficult to collect unless you happen to be in an area where mature seed is present on plants. Many species will shed their seed on maturity, e. g. *Acacia*, *Anigozanthos*, *Grevillea*, *Hakea*, and *Kunzea*. There are, however, others that usually retain mature seed, e. g. *Banksia* (most species), *Callistemon* (most species), *Calothamnus*, *Eucalyptus*, *Isopogon*, *Leptospermum*, *Melaleuca*, and *Regelia* (1).

2. **Cuttings.**

Collection: Collection of initial propagation material

can pose problems. Undoubtedly many people here today have experienced the frustration of trying to collect good quality cutting material from wild plants. In some cases it is nearly impossible to gain even a few suitable sprigs.

It is often a case of gathering from what is available and hoping that some success in rooting will eventuate. If you have easy and regular access to wild material a judicious pruning program can help to rejuvenate the plant. The resultant new growth can then be used, and success is much more likely to be achieved.

Storage: It is elementary that cutting material must be kept in first rate condition. The material should be kept at a low temperature, and with a small amount of moisture to maintain humidity.

Some collectors use plastic bags which are tied securely. Others wrap the cutting material in moist newspaper and then place the bundles in a plastic bag. ONE WORD OF CAUTION — Some people place cuttings in portable refrigerators, or in the small units that are commonly used in caravans. These can be very efficient refrigerators and temperatures can drop to below 0º C. In such an event the damage can be irreversible.

One good practice is to place bags of cutting material in the open air during a cool night. Of course, this is not recommended if frosts are imminent. Placing the cuttings in a protected situation so that they will not be subject to the early morning sun is also important.

Excess moisture and high temperatures provide optimum conditions for the development of pathogens and sweating can also occur, thus damaging the plant material.

The storage of material in tight bundles is to be deplored, especially if it is despatched in that manner from far-away regions. Usually after arrival most of the material is best thrown straight into the rubbish bin.

Despatch. It is most important to use the fastest method of getting the material to its destination, so it can be processed as soon as is possible. Australia Post now offers a service that can have packages delivered to a destination within 24 hours from many parts of Australia.

3. *Division of live young plants.* Similar coments as stated under *Cuttings* are relevant here.

PROPAGATION

The results of propagation from cuttings collected in the wild is usually most variable. Some species will root in a

couple of weeks, whereas others will take more than 12 months before there is any evidence of roots.

At our nursery, propagation methods and structures are relatively simple and unsophisticated. There is not a great reliance on so-called high technology. We find that we get excellent results wih most species under the existing conditions.

The greatest step to success in propagation from cuttings is to use material that is in top condition. If you can choose the right material you have a much better chance of gaining roots on the cuttings.

The *propagation medium* which we find satisfactory is
10 parts coarse granitic sand.
1 part good quality mountain loam.
2.5 parts peat moss.

Each cutting is dipped in a hormone powder (0.3%IBA or 0.8%IBA) and placed in a separate 5 cm tube.

Our *propagation structures* are polythene tunnel houses. The single skin coverings are not taut, thus producing air movement in the tunnels when the skin moves. The tunnels are on a slightly southward slope, which also means that air movement is activated by the hot air being released from the northern end, and thus fresh air enters from the southern end.

Trays of cuttings are placed at ground level on a 15cm bed of crushed rock, which also acts as a heat bank.

Watering is through coarse misting nozzles, which are opeated by an Irri-Trol MC-4R irrigation control unit. During mid-summer watering occurs at hourly intervals over the hottest part of the day. Hand watering helps to overcome any dry spots.

EXAMPLES OF SELECTIONS PROPAGATED AT AUSTRALIAN TUBE PLANTS NURSERY

The majority of these selections have been introduced by us, whilst others have proved troublesome to propagate for many years. The species and cultivars listed below are chosen not merely because we were involved in their introduction, but because of our first-hand knowledge of their performance under propagation and cultivation.

Commersonia pulchella (Sterculiaceae)

A lovely dwarf shrub from north of Perth, Western Austrlia. It produces its small, white flowers for most of the year. Plants can sucker lightly and this material is ideal for propagation.

Conostylis bealiana (Haemodoraceae)

A tufting perennial herb from Western Australia, with brilliant golden yellow tubular flowers produced from autumn to late winter. Propagated by division of rhizomes, best done during April to July.

Dampiera linearis forms (Goodeniaceae)

Presently we are studying various forms of this wonderful blue-flowered species. Other *Dampiera* species are also propagated. Suckering growth is found to produce best results.

Epacris impressa (Epacridaceae)

We have been involved in a limited selection program with this show species. A naturally occurring form from the Grampian mountains, Victoria, 'Spring Pink' produces masses of small pale pink bells during spring.

Another selection tentatively known as 'Bushy Pink' is a garden seedling which develops much bushier growth than most forms cultivated. It has deep pink flowers.

Best results are gained using soft new growth. This also applies to most Epacridaceae species.

Eriostemon australasius (Rutaceae)

A highly sought-after New South Wales species. We propagate from a clone introduced to cultivation many years ago. Many propagators experience problems in rooting this species. Most of our stock plants are grown in 20 cm pots and kept hard-pruned and well fertilized so that vigorous growth is promoted. We have found it best to use this growth while the tips are still floppy.

Hibbertia longifolia (Dilleniaceae)

This small clumping species from hear Herberton, Queensland, show great potential with its large yellow flowers, slight suckering habit, and reddish winter foliage. Suckering growth roots readily.

Leptospermum lanigerum 'Pendulous' (Myrtaceae)

A garden cultivar with arching branches and greyish foliage. It becomes covered with white flowers in early to mid-spring. No problems in propagation.

Persoonia pinifolia (Proteaceae)

For many years propagators have tried to produce plants of this most attractive New South Wales species. Personally, many cutting batches ended in failure until cuttings were taken from young seedlings. The seedlings germinated after a parent tree had died in a suburb of Sydney. This led to the establishment of stock plants which are now pruned severely to produce flushes of new growth. This very soft new growth

is used without removing the floppy top growth. With the tip growth removed we experienced dieback which ran rampant through the cuttings. Cuttings can produce roots within 4 weeks, but is more common for roots to appear after 10 weeks, with the majority rooted within 20 weeks.

Prostanthera lasianthos 'Kallista Pink' (Lamiaceae or Labiatae)

This deep, pink-flowered form originated on a property at Kallista in the Dandenong Ranges, Victoria. It presents no propagation problems.

Rhododendron lochae 'Mt. Bartle Frere' (Ericaeceae)

This form has more vigour and paler coloured flowers than the typical form from Mt. Bellenden Ker in Queensland. It strikes well without retaining a node at the base of the cutting.

Thomasia pygmaea (Sterculiaceae)

This species occurs naturally near the Stirling Range in Western Australia. It is a delightful species that is becoming increasingly popular in cultivation as it is proving adaptable to a wide range of soils and climatic conditions. The new growth becomes firm very quickly, and is best collected for propagation before this occurs.

Thryptomene saxicola 'Mingenew'

Various forms of *T. saxicola* are well known in cultivation. This selection from near Mingenew (north of Perth), Western Australia, has a compact arching habit and larger flowers. Propagates well from semi-hardwod cuttings.

CONCLUSIONS

Our Australian flora has tremendous potential for cultivation. Without being biased it is recognized by many people both within Australia and from overseas that Australian plants will become amongst the most popular plants in cultivation over the next decade. People are beginning to realize that the diverse and curious flora of this continent is different in so many ways from the plants of other regions. They are, therefore, eager to be involved in the cultivation of these species.

There is also a greater awareness now of the importance of using indigenous plants in their local areas, and this opens a further horizon regarding the cultivation of Australian plants. To date little selection work has been undertaken in this regard, but some important work is being done by a commercial organization, "Ecological Horticulture".

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RECENT DEVELOPMENTS IN THE PROPAGATION AND ESTABLISHMENT OF PLANTS FROM SEED.

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Investigations dealing with horticultural seeds continue to occupy growers, researchers, educationalists, and others all over the world. The range of topics being investigated becomes wider each year and over the last four years more than 2000 abstracts on seeds have been cited in Horticultural Abstracts. This review paper looks at some of the recent work in the areas of dormancy and germination inhibition, and also considers developments in seed treatment.

DORMANCY AND GERMINATION INHIBITION

The effects of low temperatures during seed stratification on breaking dormancy have been investigated extensively with many fruit and ornamental plants. Work with peaches (27) has confirmed the effect of the endocarp (stone) and testa on dormancy. Stratification for 12 weeks at 4.4°C was required to break dormancy of seeds within uncracked endocarps, whereas removal of the stone before cold treatment reduced the period to 4 weeks. Cold treatment of excised peach embryos overcame dormancy in only 2 weeks. Leaching unstratified excised embryos in water stimulated germination even more rapidly. The endocarp inhibits germination by preventing water uptake and also interferes with the leaching of inhibitors from the testa and embryo.

Indian workers (9) demonstrated that lignins extracted from the bark of a number of trees will inhibit germination of lettuce very effectively. On the same topic, workers in Japan (10) isolated and identified phenolic compounds as germination inhibitors in beetroot seed clusters.