



*fostering research into
the biology and cultivation
of the Australian flora*

Newsletter

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New Series

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President's Report 2010

Here is the President's Report presented to the Foundation's Annual General Meeting by Dr Peter Goodwin on 22nd November 2010:

There have been a number of highlights this year:

1. The Treasurer suggested, and Council accepted, that a year's free membership of the Foundation be offered to all grantees over the past 5 years. This led to us acquiring 15 new members, a welcome addition to our numbers, and we hope they will represent a dynamic addition to the Foundation.
2. In a further step to promote the Foundation we set up the Australian Flora Foundation Essay prize for University students. The winning essay came from Amy Prendergast, University of Western Australia.
3. We have approved a total of \$52,651 in research grants for the 2010/11 financial year, of which \$28,091 was for continuing grants, and \$24,560 for new grants. The new grants are to:
 - a. Karen Johnson, University of Tasmania, for a project titled 'Determining the pollinators of rare and endangered *Epacris* species: implications for conservation'.
 - b. Melinda Perkins, Centre for Native Floriculture, University of Queensland, for a project titled 'Techniques for improving *Phytophthora* resistance in potential new floricultural crop *Newcastelia interrupta*'.
 - c. Sean Roche, School of Plant Biology, University of Western Australia, for a project titled 'Functional diversity of mycorrhiza in Kwongan sandplain heath species (Ericaceae), in Western Australia: implications for restoration of rare species'.
4. Final reports on Australian Flora Foundation research projects have been received from:
 - a. Matthew Denton, University of Western Australia: Harnessing native Fabaceae for agriculture - the importance of mycorrhizal fungi.
 - b. Tony Page, James Cook University: Breeding behaviour of *Santalum lanceolatum*: self-, intra- and interspecific cross-compatibility.
 - c. Phillip Ainsley, South Australian Seed Conservation Centre: Developing a screening procedure to determine impact of climate change on seed germination of threatened native plant species.

5. The final reports, as well as summaries and interim reports, publications arising from grants, details of grants, the essay which won the Australian Flora Foundation Essay prize, details of Young Scientist awards, Newsletters and much else can be found on the Australian Flora Foundation website <http://www.aff.org.au/>

And finally my thanks to each member of the Foundation, and particularly to those on the Council, for all your efforts towards fostering the aims of the Foundation.

Peter Goodwin
22nd November 2010

Winning Essay in the Australian Flora Foundation Essay Competition

As mentioned in the President's Report, the winning essay in the 2010 Australian Flora Foundation essay competition was by Amy Prendergast, University of Western Australia. It was judged to cover all the main issues in the conservation of Australian plants, and to be well written and well presented. The title of Amy's essay was *Priorities for conservation of Australia's native flora: achievements and proposals for improvement*. The full essay can be viewed on our website <http://www.aff.org.au/>.

Here is the essay's concluding paragraph.

Conclusion

Persistence of Australia's amazing and unique floristic diversity is dependent upon concerted and integrated conservation involving research, *ex situ* conservation and habitat protection. Crucially, ecological conservation plans need to be designed involving conservation management for not only individual plant species, but also targeted at ongoing monitoring and protecting of ecological communities, including mycorrhizal networks, cycling processes, microbial communities, seed dispersal agents and pollinators. Only by adopting an integrated multi-dimensional approach can we effectively conserve the many species warranting conservation protection. Approaches must be responsive to current threats but be proactive, considering future threats and be flexible and adaptive to environmental and economic fluctuations.

The Australian Flora Foundation's Treasurer, Dr Jennifer Jobling, recently attended the International Horticultural Congress in Portugal, and writes here of her impressions.

International Horticultural Congress an outstanding success

The 28th International Horticultural Congress (IHC) took place in Lisbon, Portugal, in late August 2010. Lisbon was a great venue and more than 3500 participants from about 80 different countries attended. There were colloquia (8), symposia (18), seminars (14) and workshops (28) addressing every issue and specialisation of horticultural science and industry. At times it was difficult to decide which session to attend with so many concurrent presentations.

The colloquia session that I thought was most interesting was called "Plants, People, Places". The colloquia focused on the value of plants in the home, workplace, and recreation for human mental and psychological health.

Tim Smit spoke on the Eden Project in England, which is of sufficient scale and impact to describe how connections are made between people and plants and the importance of plants affecting diet, health, and welfare through an enormously successful recreational and educational project. Eden on average attracts some 1.5 million visitors per annum and represents an investment of £150 million or more returning about £200 million into the economy of the South West of England. Eden is most certainly the largest and most effective horticultural project in Great Britain, and probably Europe.



Picture from <http://commons.wikimedia.org/wiki/File:EdenProject>

Virginia Lohr, who has studied psychology, spoke on the importance of plants for human psychological and mental health and welfare. She presented research on horticultural plants and their role in promoting human psychological well-being and welfare. She explained how people don't understand all the subtle positive benefits plants have on them. There is evidence which shows that having a view of plants/trees from a hospital window increases the rate of recovery and reduces the need for pain medication and that walking in a forest has a positive health benefit in terms of lowering stress – measured by lowering cortisol, pulse and blood pressure. She also showed that ADHD affected children that were allowed to play in a

park/woodland every day had a lower need for medication. Just 5 minutes in a green area improves people's mood.

Another important colloquia session was on "Educating the Next Generation of Professional Horticulturists". A major concern of all horticultural industries is attracting young, talented employees. Horticulture is difficult to "sell" to young people as a career as it is a fragmented industry which dilutes the appeal. Plants are also not as "interesting" to the media as stories on animals and technology which means that horticulture does not get very much positive air time. The issue is how to improve the image and interest in horticulture for the next generation.

Jennifer Jobling

Summaries of Final Reports

Each year the Australian Flora Foundation funds a number of grants for research into the biology and cultivation of the Australian flora. While the grants are not usually large, they are often vital in enabling such projects to be undertaken. Many of the projects are conducted by honours or postgraduate students, hopefully stimulating their interest in research into Australia's flora. This work is only made possible by the generous support of donors and benefactors.

Presented here are summaries of recently-completed projects. The full reports of these projects and of others can be viewed on the Foundation's website <http://www.aff.org.au/>.

Reproductive biology and improvement of Australian tropical sandalwood (*Santalum lanceolatum*)

Tony Page and Hanington Tate, School of Marine and Tropical Biology, James Cook University, Cairns, Queensland

In Queensland, sandalwood (*S. lanceolatum*) has long been commercially exploited for its powdered heartwood used in funeral pyres and incense. Harvesting natural sources of sandalwood in Cape York commenced after 1900 and continued until the early 1930's, stimulated mainly by demand from China. With recent identification of high quality *S. lanceolatum* in Cape York (Page et al. 2007) there is opportunity to develop this resource for commercial agroforestry plantings. This will depend on the development of forms suited to commercial production, with high growth rates yielding high volumes of heartwood containing concentrated oils with high levels of α - and β -santalol.

The implementation of a successful breeding programme for any sandalwood species will depend upon knowledge of its breeding system and its crosscompatibility with related species that are a source for potentially useful characters. Given also the continued exploitation of *S. lanceolatum* in Queensland, a knowledge of its breeding system will assist those developing strategies aimed at conserving current wild populations and establishing new plantings within its natural distribution. Information on the breeding system and patterns of gene flow are important for planning germplasm collection, designing and managing seed orchards and for maintaining genetic diversity in breeding populations. The objectives of the present study were to determine levels of (i) self- and (ii) cross-compatibility within *Santalum lanceolatum*, *S. album* and *S. austrocaledonicum* and (iii) cross-compatibility between these three sandalwood species.



S. album

S. lanceolatum

S. austrocaledonicum

Santalum lanceolatum may be considered to have a facultative allogamous (incomplete outbreeding) breeding system. This study found variation between genotypes in the level putative self-incompatibility, where some (20%) were found to set seed following self-pollination, while the remaining 80% had no seed development with such pollinations. However, a significantly greater proportion of genotypes developed seed following intraspecific cross pollination (62%) compared with selfpollination (20%). In accession 2 where sufficient self and cross pollinations were performed no significant differences were found between them in percentage seed set. The seed set from self-pollination were successfully germinated and have been growing for two years without any substantial morphological distinction between inbred and outcrossed seedlings.

While total geographic isolation and significant morphological divergence exists between *S. lanceolatum* with each of *S. album* and *S. austrocaledonicum*, this study found no indication of reproductive barrier(s) between them. No significant differences were found in the percentage seed set among *S. lanceolatum* intraspecific crosses (7.5%) compared with reciprocal *S. lanceolatum* x *S. austrocaledonicum* interspecific crosses (7.6%). Germination of seed derived from intraspecific outcross pollinations was found to be low (41%) relative to interspecific pollinations with each of *S. album* (114% - with many seeds producing two seedlings) and *S. austrocaledonicum* (70%). Therefore while seed set from intraspecific outcross pollinations was greater than for reciprocal *S. lanceolatum* x *S. album* crosses (4.3%), no significant differences were found for the percentage of seedlings developed from these two pollination types (2.5% and 4.8% respectively).

The results of this study have implications for both the domestication of *S. lanceolatum* for its commercial production and for conservation of its natural stands.

The use of genetic variation present within the high quality *S. album* and *S. austrocaledonicum* could be used for the improvement of *S. lanceolatum* and vice versa. However, inappropriate planting of foreign sourced plants of each of these species within their natural ranges is likely to result in gene exchange among them and affect the genetic integrity of these natural populations.

Can the phenology of Australian wild relatives of cultivated rice be modified for human use?

Brian Atwell and Margaret Morgan

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Oryza meridionalis is a wild relative of cultivated rice (*Oryza sativa*) and is endemic to tropical Australia. As a vigorous summer-growing plant, it has potential for agriculture. We report a number of novel findings relating to the reproductive development of wild rice. The photoperiod requirement of three *O. meridionalis* accessions from tropical Australia were compared, based on observations that flowering times differed under natural daylengths. While panicles initiated in the accession from Western Australia after just 53 days, even with a 13-hour daylength, accessions from the Northern Territory and Queensland required a 12-hour day or less to initiate and took three weeks longer to do so. That is, plants from the driest region (Western Australia) were photoperiod-insensitive, maybe as an adaptive phenomenon. Grain yield was compromised in the wild rice by small individual grains and a harvest index of about 10%. The grain of *O. meridionalis* had high inorganic nutrient levels, particularly copper and zinc. Nitrogen levels were also high, suggesting a protein-rich grain in wild rice.

Amino acid composition was not remarkable except for a higher methionine level in the wild rice relative compared to *O. sativa* and wheat.

The Australian Flora Foundation is a not-for-profit voluntary organisation with the sole objective of fostering scientific research into Australia's flora.

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