

# **Biodiversity of *Rhododendron* Subgenus *Vireya* in New Zealand and the potential contribution to international conservation**

**A research project supported by the Sir Victor Davies Research Scholarship**

**Project report September 2010**

Corresponding author: Marion MacKay<sup>1</sup>

In this project we are investigating the diversity of *Rhododendron* subgenus *Vireya* in collections in New Zealand and considering the role of those collections in international *ex-situ* conservation. *Rhododendron* is a genus of about 1250 species which is broadly divided into about 900 temperate species, largely found in mainland Asia, and about 350 subtropical species of Subgenus *Vireya* which are found in various countries throughout the Malesian archipelago and into northern Australia. Subgenus *Vireya* has a high level of endemism, which coincides with occurrence in countries where habitat loss and deforestation are problems, yet only three species had previously been red-listed (BGCI, 2008). A recent conservation assessment (BGCI, 2008) indicated that about 40% of *vireya* species will be red-listed, underpinning the need to investigate the presence and diversity of those species in cultivation. Previous work indicated that New Zealand has a significant diversity of *vireya* (MacKay, 2007, Smith 2009), including wild-source material and conservation red-list species, suggesting our collections may be important in *ex-situ* conservation programmes (MacKay, 2008). Our research team proposed four objectives to investigate these issues.

*The research team for this project comprises the author (Massey University), Mr Ahmed Fayaz (PhD student), Dr Susan Gardiner and Dr Claudia Wiedow (Plant and Food Research), Mr Graham Smith (Pukeiti Rhododendron Trust), and Ms Sara Oldfield (Secretary General of Botanic Gardens Conservation International, London).*

## Objective One: Determine priority species from the red-list conservation assessment

Underpinning this work was the red-list assessment for *Rhododendron* that was conducted in Singapore in 2008 by Botanic Gardens Conservation International (BGCI) of London. In that exercise the 370 *vireya* species were examined and either determined to be of “Least Concern” or to have a conservation problem and be assigned a red-list rating (BGCI, 2008). Around 40% of *vireya* species were red-listed – a high proportion compared to other recently assessed genera (MacKay et al., 2010). We used the red-list assessment to select the species we would study; red-listed species being of higher priority. Using that hierarchy, we then needed to know which of the red-list species were present in New Zealand and to what extent.

## Objective Two: Investigate the range of *vireya* species in New Zealand collections

We already knew that there was a wide range of exotic woody plant species in New Zealand collections, and that *Rhododendron* was well represented, especially in the Pukeiti Rhododendron

---

<sup>1</sup> Marion MacKay, Institute of Natural Resources, Private Bag 11-222, Palmerston North 4442, New Zealand.  
Email M.B.MacKay@massey.ac.nz.

Trust collection (MacKay, 2005; Smith, 2009) but we did not know the extent to which vireya species were found in other collections across New Zealand. In 2009 a survey of vireya collections was conducted – to identify both collections and the range of species within them. This survey revealed less information than expected, but it emphasised that the Pukeiti collection is the most extensive collection of vireya species in New Zealand. The data shows presence of; (i) species that Argent (2006) considers to be “not in cultivation”, (ii) a range of species as extensive as any in the world, (iii) wild-source material, and, (iv) red-list species. About 160 vireya species were found in New Zealand, of which 63 were of known wild source and 44 were red-listed - but we still did not know what how useful they might be for conservation, so further investigation of diversity, taxonomy and relationships was needed.

#### Objective Three: Identify taxonomic issues for red-list species

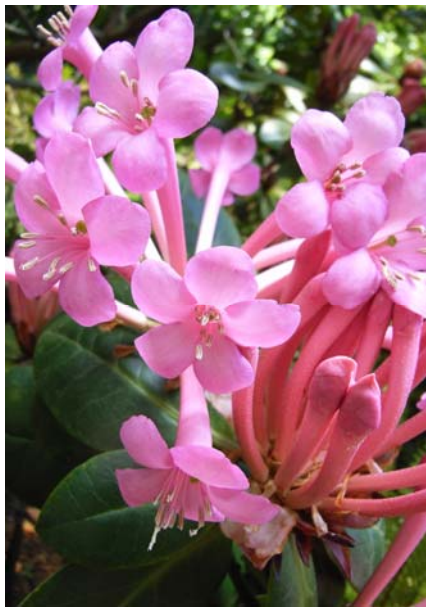
Conservation action for vireyas is confounded by taxonomic complexity. A comprehensive (morphologically based) taxonomy is provided in Argent’s monograph (Argent, 2006) and that taxonomy is complex with 11 series, many subspecies, and frequent queries over separation of species and assignment to subgroups. Recent molecular research further complicates the picture by querying hitherto accepted relationships (Brown et al., 2006; Craven et al., 2008; Goetsch et al., 2005) but those molecular studies do not cover all the queries raised in the classical studies. Rearrangement of species relationships may have a marked influence on conservation action; for example, if species A is red-listed, but is not clearly distinguished from species B, should species B also be conserved? Or, can species A be omitted from conservation action because it is not distinguishable from the common B, and the larger population of B does not need conserving? The subgenus of 370 species has many unresolved taxonomic complexities that may, or may not, impact on conservation action – we addressed this problem by identifying taxonomic relationship issues and then using DNA fingerprinting to study those issues. The classical taxonomy (Argent, 2006) was used to construct a series of relationship charts in which red-list species were grouped with other species that they were closely related to, hybridise with, or are hard to distinguish from (Fayaz, undated; MacKay et al., 2010). The red-list species could be studied in concert with their ‘associates’, with the intention of revealing broader relationships.

#### Objective Four: DNA fingerprinting

DNA fingerprinting, using microsatellites, is being used to study the selected vireya species and their associates. This work will reveal the extent of variation within any one species, and the nature of the relationship between red-list species and their associates – which both inform conservation action. About 130 samples were collected, mostly from Pukeiti Rhododendron Trust but also from collections in Palmerston North and New Plymouth, along with a further 18 samples imported from the Rhododendron Species Foundation in America. Each sample has been fingerprinted with 27 DNA markers, which has resulted in a large data set for study. At the time of writing this is still a work in progress but there appear to be some interesting preliminary results.

- *R. jasminiflorum* and *R. jasminiflorum ssp. oblongiflorum* appear to be distinct entities rather than one continuum. If the *R. jasminiflorum* subspecies are distinct this may have conservation implications for *R. jasminiflorum ssp. copelandii*, which was red-listed, while other subspecies were not red-listed.

- Analysis indicates a close relationship between *R. loranthiflorum* and *R. luraluense*. Argent (2006) had already proposed this relationship and the DNA work supports it, which is potentially important as *R. luraluense* was red-listed and *R. loranthiflorum* was not.
- It appears that *R. lochiaie* (syn. *R. notiale*) is distinct from the closely related *R. viriosum*, but at the same time there appears to be a gradation of types within the *R. viriosum* samples.
- Data suggests a relationship between *R. archboldianum* and *R. herzogii* (which is in different series). Argent (2009) proposed that *R. archboldianum* might be a hybrid between *R. herzogii* and *R. culminicolum* – the relationship to *R. herzogii* seems to be supported by the fingerprinting work, but there does not appear to be any close relationship to *R. culminicolum*.



Is *R. archboldianum* (left) a hybrid of *R. herzogii* (top right) and *R. culminicolum* (bottom right)?



When this work is complete we will have a much greater understanding of the qualities of the vireya rhododendron collections in New Zealand and whether or not they can be used in *ex-situ* conservation. For example, if *R. loranthiflorum* and *R. luraluense* are closely related, perhaps we have a much greater germplasm resource than we thought to support conservation of *R. luraluense*. At the same time, a greater understanding of the relationships between species will inform conservation planning for the vireya group worldwide and this work will be a valuable contribution to those conservation programmes.

#### *Acknowledgements*

*This work has been supported by Plant and Food Research, Massey University, Pukeiti Rhododendron Trust, the Sir Victor Davies Foundation, the American Rhododendron Association, the Peter Skellerup Plant Conservation Award, and Botanic Gardens Conservation International. We are most grateful to those institutions and their staff for their support.*

#### **Bibliography**

Argent G. 2006. *Rhododendron of the subgenus vireya*. The Royal Horticultural Society and The Royal Botanic Garden Edinburgh.

- Botanic Gardens Conservation International, 2008. *Draft red-list assessment for Vireya Rhododendron*. Botanic Gardens Conservation International, London.
- Brown G.K., Nelson G., and P.Y.Ladiges. 2006. Historical biogeography of *Rhododendron* section *vireya* and the Malesia archipelago. *Journal of Biogeography*, 33: 1929-1944.
- CBD 2002. *Global Strategy for Plant Conservation*. Published by the Secretariat on the Convention for Biological Diversity, and Botanic Gardens Conservation International. (Target 2: preliminary assessment of conservation status of plant species. Target 8: aim to have 60% of conservation species in ex-situ collections by 2010.)
- Craven L., Goetsch, L.A., Hall, B.D. and G.K. Brown. 2008. Classification of the *Vireya* group of *Rhododendron* (Ericaceae). *Blumea*, 53(2): 435-442.
- Fayaz A. 2009. Classification and conservation of *Rhododendron* section *Vireya* (Vireyas) using DNA fingerprinting. *Bulletin of the New Zealand Rhododendron Association*, 97: 35-44.
- Fayaz A. (undated.) *Biodiversity of Rhododendron section Vireya (Ericaceae) collections in New Zealand and their potential contribution to international conservation*. Ongoing PhD study, Massey University.
- Goetsch L., Eckert A.J. and B. Hall. 2005. The molecular systematics of *Rhododendron* (Ericaceae): a phylogeny based on RPB2 gene sequences. *Systematic Botany*, 30(3):616-626.
- MacKay M.B., Fayaz, A., Gardiner, S.E., Wiedow, C., Smith, G. and S. Oldfield. 2010. *Meeting Target Eight: Rhododendron subgenus Vireya in New Zealand as an example of ex-situ conservation*. (In press.) Proceedings of the 4th Botanic Gardens Congress, 14-18<sup>th</sup> June, Dublin.
- MacKay M.B. 2009. The *Rhododendron* red-list workshop: Singapore 2008. *Bulletin of the New Zealand Rhododendron Association*, 97: 20-30.
- MacKay M.B. 2008. *New Zealand Rhododendron collections: potential for ex-situ conservation?* Oral presentation to the *Rhododendron* conservation assessment workshop. Singapore, 28 July – 1 August 2008.
- MacKay M.B. 2007. *Unpublished data on Rhododendron in collections and trade in New Zealand*.
- MacKay M.B. 2005. *The value of ex-situ woody plant collections in New Zealand: management and conservation issues*. At the conference “Saving Threatened Tree Species – International Progress in Tree Conservation” on 8 Sept 2005, at the Cambridge University Botanic Garden, UK.
- Smith G. 2009. *Inventory of the Pukeiti Rhododendron collection*. Pukeiti Rhododendron Trust.