

DAVIS EXPEDITION FUND

REPORT ON EXPEDITION / PROJECT

Expedition/Project Title: Biogeography and Systematics of South American *Vicia* (Leguminosae)

Travel Dates: 28/09/2010 – 12/11/2010

Location: Northern Chile and northern Argentina

Group Members: Paulina Hechenleitner

Aims: Collection of research material of *Vicia* in the form of herbarium specimens, habitat data, digital images, silica-dried leaf samples, and base-line data on the IUCN conservation status of *Vicia*.

Outcome (not less than 300 words):-

See attached report.

Report for the Davis Expedition Fund

Biogeography and Systematics of South American *Vicia* (Leguminosae)

Botanical fieldwork to northern Chile and northern Argentina
28th of Sep to 12th of November 2010

Paulina Hechenleitner January 2011

Introduction

Vicia is one of five genera in tribe Fabeae, and contains some of humanity's oldest crop plants, and is thus of great economic importance. The genus contains around 160 spp. (Lewis *et al.* 2005) distributed throughout temperate regions of the northern hemisphere and in temperate S America. Its main centre of diversity is the Mediterranean with smaller centres in North and South America (Kupicha, 1976). The South American species are least known taxonomically.

Vicia, together with *Lathyrus* and a number of other temperate plant genera share an anti-tropical disjunct distribution. This biogeographical pattern is intriguing (Raven, 1963): were the tropics bridged by long distance dispersal between the temperate regions of the hemispheres, or were once continuous distributions through the tropics severed in a vicariance event? Do the similar patterns seen in other genera reflect similar scenarios or does the anti-tropical distribution arise in many different ways?

The parallels in distribution, species numbers and ecology between *Lathyrus* and *Vicia* are particularly striking. This pair of genera therefore present an excellent opportunity to study the anti-tropical distribution pattern. The biogeography and phylogeny of *Lathyrus* were studied by Steele & Wojciechowski (2003) and Kenicer (2007), who showed *Lathyrus* to be nested inside *Vicia*. Indeed *Pisum* (the peas) and *Lens* (the lentils) are also nested with a paraphyletic *Vicia* (Steele & Wojciechowski, 2004), but the relationships among these genera are still unclear. *Vicia* is therefore the key genus in our understanding of this tribe of economically important grain legumes.

There is no complete taxonomic revision for *Vicia* in South America. Zuloaga *et al.*'s (2008) checklist of the 'Southern Cone' (Southern South America) lists 38 species of *Vicia*, with 10 of these introductions from Europe. There is consensus amongst legume systematists that a taxonomic revision of *Vicia* is urgent because many of these species do not appear to be distinct (Gwilym Lewis, Royal Botanic Gardens, Kew, pers comm.). Furthermore, in order to fully understand the phylogeny of *Vicia*, this key group will need a complete taxonomic revision, to guide taxon sampling.

Objectives

Botanical fieldwork to northern Chile and northern Argentina is imperative to fill crucial gaps in knowledge concerning the native and poorly known endemic species of *Vicia* in South America, which are essential for the reconstruction of a complete taxonomic revision and species-level molecular phylogeny of the genus for S America. My PhD project aims to

produce a dated phylogeny for *Vicia*, with a focus on South American species, allowing biogeographical and evolutionary inferences to be made about the anti-tropical distribution of the genus, and its complex relationship with the economically important legume genera *Pisum*, *Lens* and *Lathyrus*. The main aims of the fieldwork were to collect research material of *Vicia*, in the form of herbarium specimens, habitat data and digital images; to collect silica-dried leaf samples for DNA extraction and sequencing, and to collect base-line data on the IUCN conservation status of *Vicia*.

Outcomes

The field trip to northern Chile and northern Argentina took place between the 28th of September and the 12th of November 2010. After consultation with local botanists and exhaustive herbarium research at Royal Botanic Gardens Kew, the originally proposed travelling dates were postponed slightly from August and September to October and November, that seemed to be the optimum flowering period for *Vicia* in both countries. These months also seemed to be towards the end of the flowering period so that specimens in fruit could also be collected, both for their taxonomic importance and for propagation. The fieldtrip had a duration of six weeks and included fieldwork and herbarium research work. In the field it soon became clear that the new timing of the fieldtrip was perfect for the predicted phenology – that seemed normal and undisrupted by any climate fluctuation. Most of the species were in full flower which made it easier to localize them, whilst the majority were starting to fruit.

During the six weeks spent on fieldwork, herbarium specimens, habitat and ecological information was gathered together with digital images. At the same time efforts were made to collect and photograph any *Rhizobium* nodules on each of the collections made. In northern Chile, the two weeks limited fieldwork was focused in areas around La Serena and Valparaiso, where most of the Chilean endemic *Vicia* are concentrated. In northern Argentina the fieldwork lasted four weeks concentrated in the coastal provinces of Buenos Aires, Entre Rios, Corrientes and Misiones, where most of the endemic Argentinean *Vicia* occur.

Altogether 120 comprehensive herbarium specimens of *Vicia* and 40 herbarium specimens of other genera in the RBGE focus groups were collected in quadruplicate. All collections were georeferenced and accompanied with ecological notes, digital photos and silica-gel dried leaf samples for DNA extraction.

Base-line data on the IUCN conservation status of all *Vicia* species collected was also gathered that included: frequency, habitat threats and presence in historically known collection sites. Additionally, one herbarium was visited in Chile (Herbario Museo Nacional de Historia Natural (SGO)) and two herbaria in Argentina (Herbario Darwinion (SI) & Herbario Universidad del Nordeste (CTES)), where all historical herbarium specimens of *Vicia* species were examined prior to going into the field, in order to verify locations and gather additional information for the taxonomical revision. The cooperation with local staff in each of the home herbaria in Chile and Argentina was crucial, as they all contributed to improving the collecting route and the locality names mentioned on herbarium voucher labels in order to be able to find more species.

The fieldtrip to northern Chile and northern Argentina was very successful as specimens of *Vicia* were collected from most known localities and also several new sites.

DNA from the collected *Vicia* material has already been extracted, amplified and sequenced with *matK*, and it is subject to preliminary phylogenetic analysis.

Herbarium specimens are being prepared and will be shortly incorporated into the two herbaria of the Royal Botanic Garden Edinburgh and Royal Botanic Gardens Kew. Furthermore the duplicates destined for Latin America will be sent at the end of the study to the home countries main herbaria in Chile and Argentina mentioned above.

At present the botanical data related to each of the *Vicia* species collected during this fieldtrip is being use to produce a taxonomical revision of South America *Vicia*.

Acknowledgements

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