

MSc Biodiversity and Taxonomy of Plants



THE UNIVERSITY
of EDINBURGH



Royal
Botanic Garden
Edinburgh

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Introduction

Over the last year I've been fortunate enough to be a part of the MSc course held at the Royal Botanic Gardens Edinburgh and the University of Edinburgh, titled Biodiversity and Taxonomy of Plants. The year has flown by and it's somewhat perplexing to look back on the vast amount of work that I'm very proud to have done. Over the course of the year nine modules were taught covering a wide range of topics from conservation and sustainability, the evolution and biodiversity of cryptogams, phylogenetics and population genetics, and plant taxonomy to name a few.

The various backgrounds of my classmates and their expertise in different fields of study brought further value to the course and greatly enhanced the experience as I'm sure we all learned much from one another. For me personally, developing my knowledge of phylogenetics, population genetics and biogeography was especially rewarding. Coming from a horticultural background I feel that these particular subjects are often misunderstood and overlooked, but with continuing advances in technology, genetic research is becoming ever more accessible and relevant. In terms of horticulture and botany, phylogenetics is essential towards furthering our knowledge of evolution and the intricate relationships between different species and has become particularly important for informing the classification of species.

Diving in at the deep end

The first subjects to be taught were phylogenetics, plant evolution, plant taxonomy, angiosperm biodiversity, and the evolution and biodiversity of cryptogams with a number of pieces of coursework set to be completed by early December. Each subject is just as fascinating as the next although having to complete so much work in such a short period of time was a real challenge, a theme that ran through the entirety of the course! Getting to grips with all the software needed to conduct phylogenetic analyses was initially very daunting but once overcome is an incredible tool; and putting together an entire floral revision of *Hedysarum* L. for the Flora of Nepal within just three weeks was a real test but very rewarding.

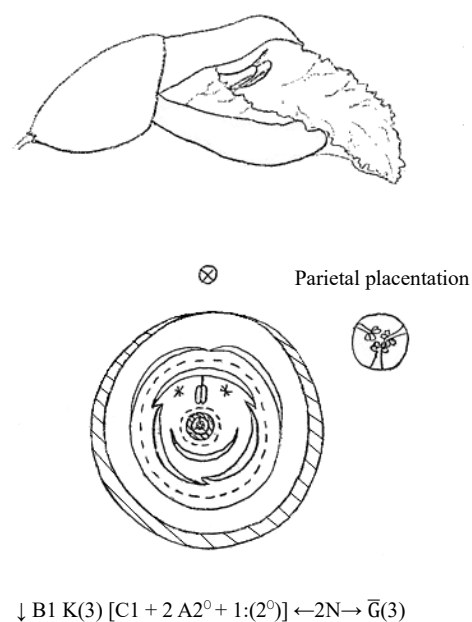


Figure 1. Studying the floral morphology of *Alpinia*, Zingiberaceae. Left: A partially dissected flower with some parts removed. Right: A floral diagram showing the position/orientation of each floral organ, complete with a floral formula below.

During the angiosperm biodiversity module our lecturer Dr Louis Ronse de Craene taught us in depth about the morphological traits of each of the main clades and orders of the angiosperms with a particular focus on floral morphology. In total around 55 different families of angiosperms were studied spanning the evolutionary history of this group, each of which was studied using freshly collected floral material that could be dissected from which detailed floral diagrams could be made (Fig. 1). As part of this module an essay on a particular family, the *Primulaceae*, was required for which a detailed report on the complex taxonomy of the family was produced and a presentation given. I chose to give a talk on one particular genus, *Lysimachia* Tourn. ex L. (Fig. 2) due to its interesting position within the family and unique morphological characters.



Figure 2. Me giving a talk on the genus *Lysimachia* to a class of my peers, discussing the morphological traits of the genus and its taxonomical classification.

In addition to plants, fungi were studied extensively during the first half of the first semester with a focus on algae and mosses later on during the evolution and biodiversity of cryptogams module. A couple of forays to Dawyck Botanic Garden, home to the world's first Cryptogamic Sanctuary were made to observe and collect fungi and lichen specimens (Fig. 3) and to study their ecology in the wild. This was a fantastic opportunity not only to see a wide range of fungi and lichens but to also explore the beautiful gardens of Dawyck, famous for its impressive tree collections containing some of the largest conifers in the country such as the impressive Douglas Firs.



Figure 3. A basket full of fungi specimens which were taken back to the laboratory at RBGE for further study.

Later in the course a range of investigative studies were conducted such as a cytology investigation looking at chromosome numbers across a six different *Tulbaghia* L. clones in order to identify their ancestral histories (Fig. 3). This was an absolutely fascinating study and to see chromosomes, ‘the vehicles which carry DNA from cell to cell and from plant to plant’ as described by Adrian Dyer, with my own eyes was quite something!

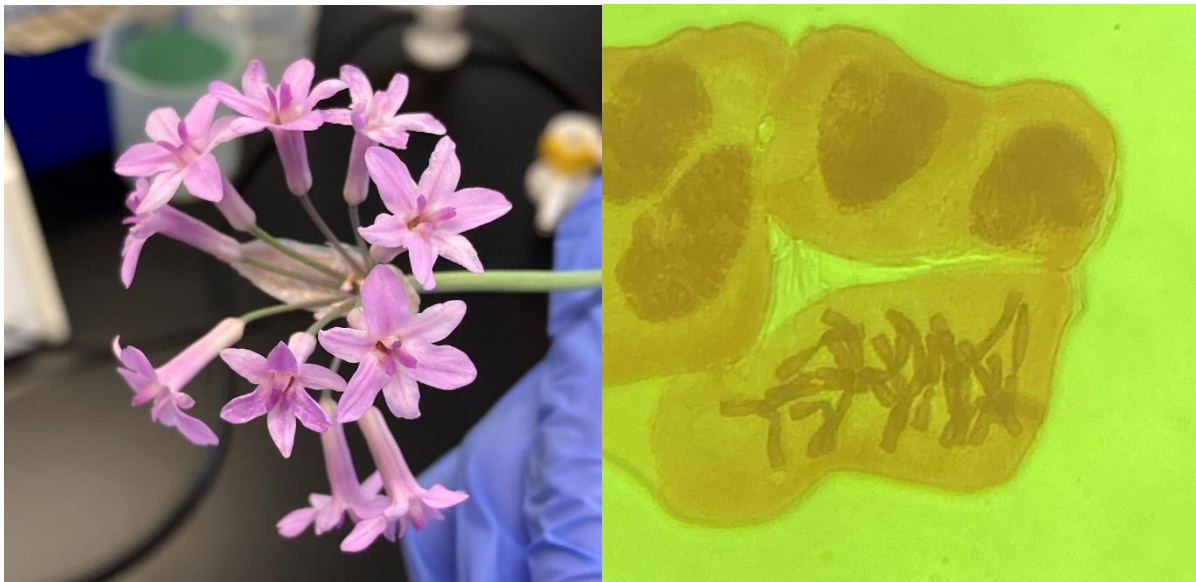


Figure 3. Photographs taken from a cytology investigation with six unnamed *Tulbaghia* clones showing visible chromosomes at prophase. Clone 3 shown here was determined as *T. violacea* based upon both morphological characters and chromosome count, whereas three other clones analysed showed abnormal chromosome counts, two of which were revealed to be hybrids and

one an artificially created tetraploid. Cytological analysis of the hybrid clones made identification of the hybrid clones and their parents possible.

The final exams were held in early April prior to the start of the thesis projects and consisted of two plant identification exams, one looking in particular at tropical plant families and identifying them from vegetative material only, whereas the other focussed on the identification of plant families and the orders within which they belong from floral material. Another examination on Cryptogams was held specifically testing our knowledge of algae, mosses and liverworts.

The Botanic Garden

Of course one of the privileges of studying with RBGE is access to the living plant collections and this was one of the reasons why relocating to Edinburgh was so appealing to me as the plant collections are in some ways quite different from those that I know well from my time working at RBG Kew due to both climatic differences and a focus on collections from particular areas such as China and New Zealand. Scotland is well known for its *Rhododendrons* (Fig. 4) and the extensive collection at RBGE has certainly been a highlight for me, many of which are original specimens collected by the likes of Reginald Farrer, Frank Kingdon-Ward, E.H.Wilson and Joseph Rock.



Figure 4. Top left: The impressive tree forming *Rhododendron arizelum* (Forrest 21862). Bottom left: *Rhododendron lanigerum* (KW 8251), a beautiful collection from Kingdon-Ward with attractive rounded trusses of pink flowers, centred with dark pink nectar droplets. Right: *Rhododendron morii* (E.H. Wilson 10955), a species I'd not come across before forming a small to medium sized tree with exquisite flowers opening from deep pink buds and fading to very pale pink-white with a speckled red blotch on the upper of the perianth tube.

In addition to the species *Rhododendrons* I was particularly looking forward to the flowering of the *Meconopsis* collections which did not disappoint (Fig. 5). These showy plants grow particularly well up here, whereas the much drier and hotter summers in the south of England are not so suitable. Whilst in Edinburgh I discovered a number of very active plant groups such as The Meconopsis Group from who I've learned a great amount! Likewise, the Scottish Rock Garden Club puts on a programme of regular talks which I've thoroughly enjoyed attending. The alpine collections at RBGE are admirable with the climate suiting their cultivation very well; the encrusted *Saxifragas*, *Primulas* and plethora of cushion plants are the highlights of the collections forming beautiful specimens with the magnificent Rock Garden forming the ideal habitat for a range of rarely cultivated species from around the world (Fig. 6). The cold winters and long summer days provide ideal conditions for such plants. Whilst wondering the gardens I had not before noticed the number of champion trees present at RBGE and it has been wonderful to spend a whole season in the gardens to see how they grow throughout the year as with all the other plants.



Figure 5. Top left: A mass planting of *Meconopsis* 'Slieve Donard' in full flower. A lovely fertile hybrid between *M. baileyi* with *M. grandis* subsp. *grandis*. Bottom left: The delicate *Meconopsis betonicifolia* native to North-Western Yunnan and Northern Myanmar. Right: *Meconopsis dhowjii*, a beautiful dwarf species native to Southern Tibet and Nepal.



Figure 6. Top left: *Celmisia angustifolia*, native to the southern Island of New Zealand, a genus that grows well in cultivation in Scotland. Bottom left: A selection of *Primula allionii* forms on display in the Alpine Glasshouse. Right: *Cassiope* 'George Taylor', a very robust hybrid between *C. fastigiata* and *C. wardii* forming large clumps in the Rock Garden.

MSc Thesis

An integral element of the MSc is of course the independent study, accounting for 50% of the course marks. For my thesis I was very fortunate to be able to work with Dr Mark Hughes, an expert on the genus *Begonia*, as my main supervisor as well as Bioinformatician Dr Flávia Pezzini, and Dr Kate Armstrong, Assistant Curator of the Institute of Systematic Botany at New York Botanic Garden, on a very exciting project to investigate the ancestral origins of the flora of Northern Myanmar, an area of the world I've long had an interest in. My thesis serves as the first study to do such work utilising molecular data obtained from herbarium material from a range of newly sequenced taxa native to the Hkakabo Razi region in Northern Myanmar. To work closely with a variety of genera and species from this region and to be able to contribute new research to further our understanding of this flora has been most exciting and a great privilege (Fig. 7). The title of my thesis is 'First steps towards untangling the floristic assembly of the Hkakabo Razi-Hpongan Razi hotspot in Northern Myanmar: a herbarium genomic approach' and within the next few months it should be available to read online via the research-scotland.ac.uk website so please feel free to have a look if you are interested.

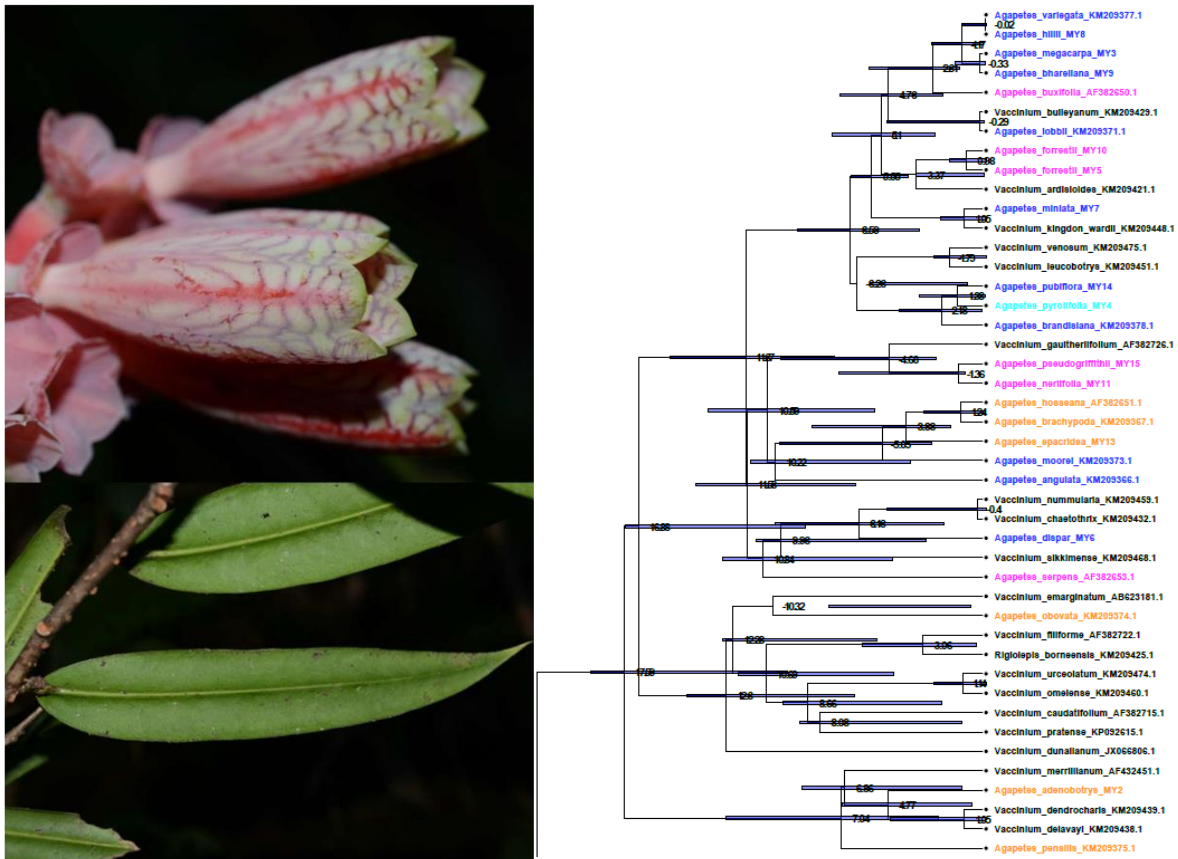


Figure 7. Excerpts from my thesis showing the flowers and foliage of *Agapetes nerifolia* (photos courtesy of Kate Armstrong NYBG) and part of a larger dated phylogeny created for the genus and allied taxa.

I'm extremely proud to have been awarded a distinction for my MSc and can't thank all those enough who have supported me along the way. I've learned a great amount over the last year and look forward to all the future opportunities that await. My place on this course wouldn't have been possible without the generous support of the Hardy Plant Society. I am so grateful to all those who given their support both financially and otherwise.