DAVIS EXPEDITION FUND

REPORT ON EXPEDITION / PROJECT

Expedition/Project Title:	**Understanding patterns of plant rarity in the northern Andean biodiversity hotspot on the ground**
Travel Dates:	5th July - 19th August
Location:	Colombia
Group Members:	Peter Moonlight, Adolfo Jara-Muñoz, Daniel Franco, Tiina Sarkinen, Sandra Knapp
Aims:	In this one month-long fieldwork expedition and an additional two-week research stay in Colombia I aimed to increase our knowledge of the geographic ranges of Solanum and Begonia species in the department of Santander. Begonia and Solanum are two megadiverse plant genera and ideal study groups to investigate the rarity and extinction risk in a tropical context. The project aimed to fill important data gaps for both genera, which will enable me to produce meaningful results for conservation and science, such as an annotated checklist of Solanum and Begonia species in the department in the future. The fieldwork allowed me to learn from an experienced team of botanists and gain fieldwork experience in a tropical context for the first time. I was able to establish

Photography consent form attached: (*please refer to your award letter)*

☒ Yes
☐ No

Background

Due to the limited collection effort within northern South America, there are still important data gaps regarding the distribution of most plant species. In July 2023, Dr Peter Moonlight (Assistant Professor of Botany, Trinity College Dublin, second supervisor of my PhD project) lead a fieldwork expedition to the department of Santander in Colombia in collaboration with Dr Adolfo Jara-Muñoz (Assistant Professor, Universidad Nacional de Colombia).

The department of Santander is located in central-northern Colombia (Fig. 1). The department covers an area of approximately 30,537 km^2, which is comparable to the combined size of the Scottish Highlands and the Cairngorms national park (30,185 km^2). The department is divided in two distinct geographical compartments. The western site is mostly flat, with an average temperature of 29℃. The eastern part of the department is covered by the Andean Mountain chain (Cordillera Oriental). The forests on the western slopes of the mountain range are a hotspot of diversity. This is where the fieldwork will take place (Fig. 1).

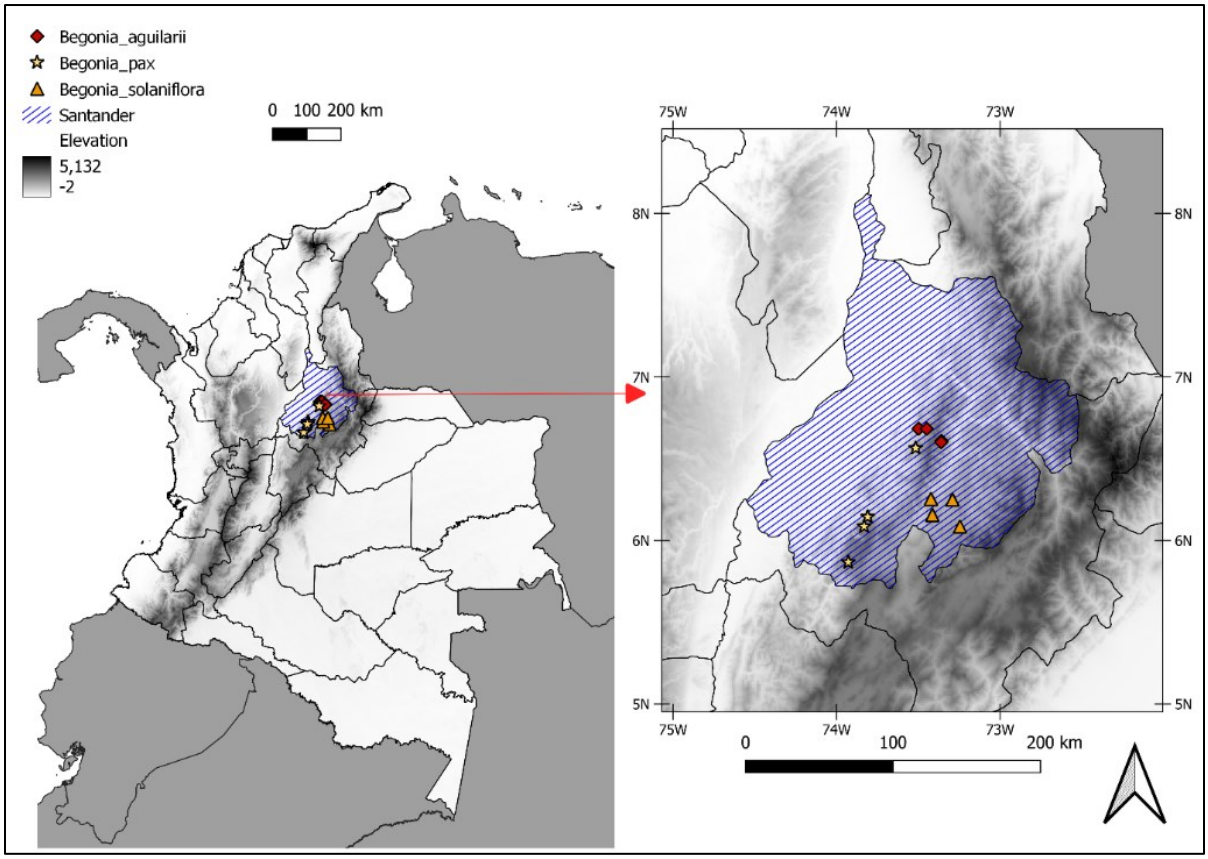

Figure 1. *Map of Colombia in northern South America showing target locations in the department of Santander that were visited during the field trip.*

In total at least 63 *Solanum* (51) *and Begonia* (12) species have been recorded in the department (Fig. 2). To date, only 230 georeferenced specimens of *Solanum and Begonia* have been collected there. This amounts to less than four specimens per species, with the average specimen collected more than 50 years ago. Our data also already show that the department has a higher species richness than expected, while being under-collected (3rd in species richness but only 19th in collections per km^2). This highlights the need for more recent collections to update species distributions and to determine rarity and threat in this area. Compared to other poorly collected departments (Cauca, Putumayo, Norte de Santander), the department of Santander is politically stable, while other departments that border Santander (Boyacá) are similar in their species diversity and geography. Together, this makes the department of Santander an ideal study area.

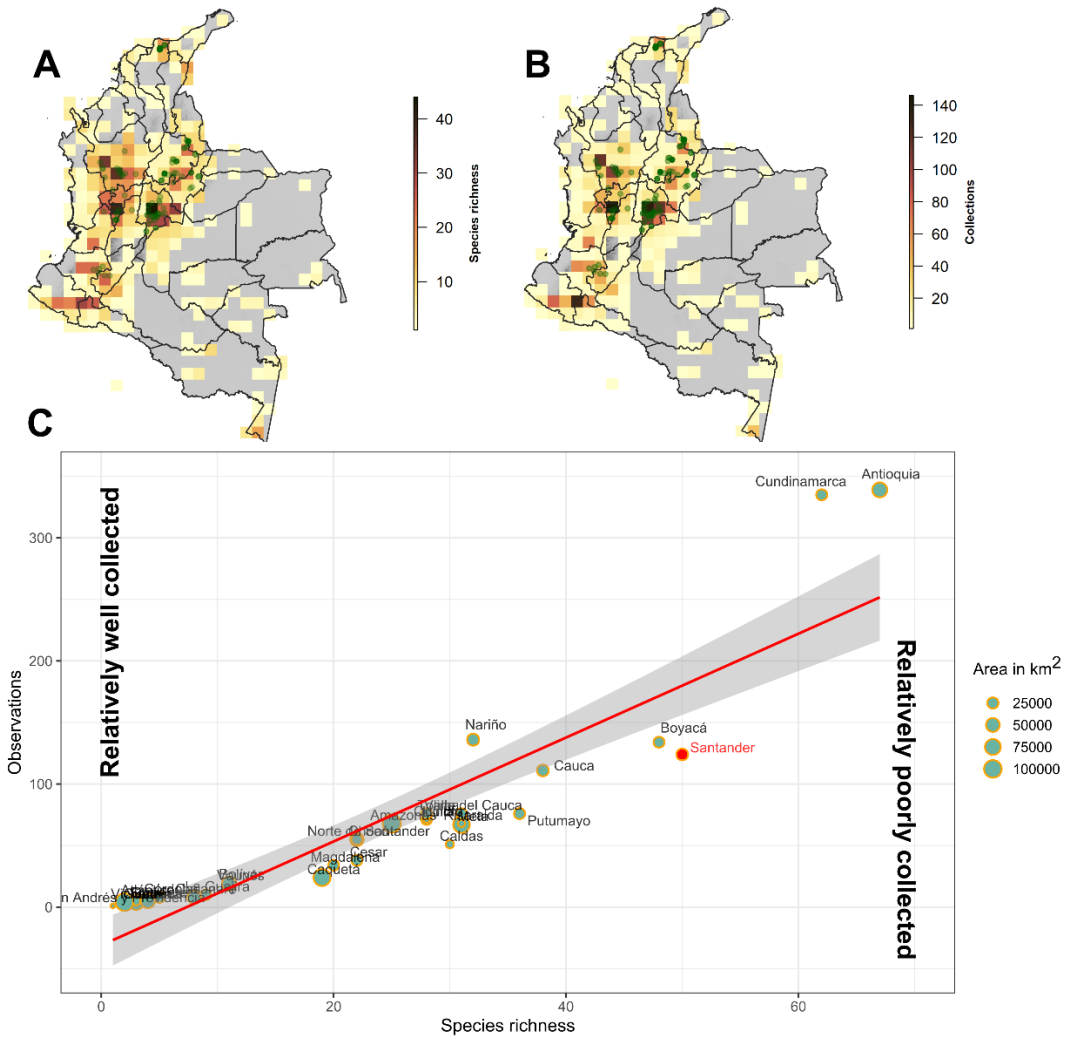

***Figure 2**. Species diversity (A) and collection density of Solanum and Begonia in Colombia. Correlation between species diversity and collection density for the two genera (C).*

Objective

The main aim of this project was to increase our knowledge of the geographic ranges of *Solanum* and *Begonia* species and create an annotated checklist, with preliminary threat assessments, for the species present within the department of Santander in Colombia by collecting new samples in the field and by visiting local herbaria (identifying and digitising collection data).

Outcomes

The Davis Expedition fund allowed me to interlink with Dr. Moonlight's expedition to gain data on plant distribution patterns in the northern Andes by making new herbarium collections of *Solanum* and *Begonia* species in the field and identifying specimens in local herbaria. In total we collected more than 250 new herbarium specimens during fieldwork which included a Begonia species previously unknown to the department (*Begonia foliosa*) and several *Solanum* species from the

underexplored Torva group. We were also able to discover new populations of the range-restriced endemic *Begonia solaniiflora* (Fig. 2, bottom) in the region.

Two duplicates of each specimen were collected to deposit voucher specimens in-country and overseas to enable continuing collaboration with the identification of species. Aside from fulfilling the aims of the project we were also able to film highly specialized pollination mechanisms in *Begonia solaniiflora* and *Begonia pax* and collect a species of bee previously unknown to science.

Figure 2. *Top: Illustrative photograph of fieldwork environment. Bottom: The rare species Begonia solaniiflora one of the focus species in this field trip.*

Following the field work period, I was able to visit three local herbaria in Villa de Leyva (FMB), Bogota (COL) and Medellin (HUA) respectively. This allowed me to add taxonomic verifications to plant specimens, as well as the identification of previously undetermined specimens. In total, I was able to add more than 400 specimens to the taxonomically verified databases hosted at the Royal Botanic Garden Edinburgh (https://padme.rbge.org.uk/Begonia) and the Natural History Museum (https://solanaceaesource.myspecies.info/). The work enabled me to identify new occurrences of species previously unknown from the region and increase our understanding of the geographic distribution of species within the department.

Figure 2. *Illustrative images of herbarium work environment. From left to right: COL (Universidad Nacional de Colombia), FMB (Instituto de Investigación de Recursos Biológicos Alexander von Humboldt), HUA (Universidad de Antioquia)*

In addition to the improving the data availability in the region, I was able to expand my scientific network during these activities. Through interactions with local researchers, I was able to gain a much better understanding of how I can contribute to ongoing research and thereby help conserve rare plant species in the Colombia remotely. I hope that the connections made during this field trip can result in future collaborations.

I now also have a much better understanding of the environmental challenges rare species face in the tropical Andes. Incorporating these experiences in my PhD will allow me to produce much more accurate predictions of the determinants of plant rarity in the tropics in my future research.

Future work

As part of my ongoing research, the results will enable me to create an annotated checklist, as well as preliminary threat estimates, of all *Solanum* and *Begonia* species

occurring in the department of Santander. This work is on-going and will hopefully contribute to our scientific understanding of the region and local conservation efforts in the future.