

Davis Expedition Fund

Fieldwork in Colombia for the project “Explaining the differences in African and South American species richness by comparing diversification rates: The Andean orogeny hypothesis.” Second Expedition.

Extended report



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28th October 2014

Expedition/Project Title: Fieldwork in Colombia for the project “Explaining the differences in African and South American species richness by comparing diversification rates: The Andean orogeny hypothesis.” Second Expedition

Travel Dates: 10th October 2013 – 7th November 2013

Location: Colombia (Antioquia, Valle del Cauca)

Group Members: Eugenio Valderrama

Aims: Plant collection of Colombian species within *Renealmia* genus (Zingiberaceae) for biogeographical study

Project description

The high richness in tropical forest is not uniform with Africa being species-poor when compared to Southeast Asia and the Neotropics. Alwin Gentry proposed that the Neotropics are more species-rich because of recent speciation attributed to the opportunities for speciation that the uplift of the tropical Andes offered (1). In spite of the accumulating evidence supporting the importance of the Andean orogeny in the diversification of Neotropical organisms (2-7) few attempts have been made to test Gentry’s “Andean orogeny” hypothesis (8). Gentry identified ‘Andean centred genera’ that contributed to the high species diversity in the Neotropics and cited the genus *Renealmia* (Zingiberaceae) as being a model example (1).

The Amphi-Atlantic distributions of some tropical plant lineages are ideal scenarios to test the Andean orogeny hypothesis, where we could expect higher diversification rates in Neotropical lineages associated with the final Andean uplift periods than in the African distributed ones. *Renealmia* is unusually well-represented on both sides of the Atlantic with c. 15 species in Africa and 61 Andean centred taxa in the Neotropics (9-12). Although some evidence supporting the influence of Andean orogeny in the diversification of this genus is available (8), increased taxon sampling and molecular markers are needed to accurately compare the speciation rates between Neotropical and African lineages.

I aim to test Gentry’s hypothesis with several phylogeny based methods in *Renealmia*. I will first complete the taxon sampling in *Renealmia* and determine variable molecular markers to resolve the relationships among the species in the genus. Secondly I will test the Andean orogeny hypothesis by estimating diversification rates in the Neotropical and African lineages taking into account the stochasticity inherent to diversification processes (13-15). Finally I will gather available data from additional organisms distributed in the Neotropics and Africa with species-level phylogenies to test whether multiple lineages support the Andean orogeny hypothesis.

Fieldwork in Colombia objectives

To collect material (herbarium specimens, silica dried leaves, seeds, spirit samples, photos) of Colombian *Renealmia* species.

Methods

Within the Neotropical region where most of *Renealmia* diversity occurs (c. 61 species), Colombia is the country where more *Renealmia* species are found (c. 30 species) (9). Colombian species encompass a big range of the elevation gradient found in the Andean ridges (from sea level to 3000 m.). I sampled the areas of the Andean Western Ridge in Colombia and its western slope where I could maximise the number of species collected and where more fieldwork is needed. Following a first expedition funded by Davis in 2012, some of the localities of the previous expedition were visited again to gather enough material for the description of the three new species I discovered with the assistance of Maria Pinilla-Vargas. I also sampled localities in the Andean Central Ridge (including both slopes and a significant proportion of the gradient of elevation) that improve the coverage of my previous sampling. Finally Dr. Paul J.M. Maas and Dr. Hiltje Maas (Naturalis Biodiversity Center, Netherlands), authors of the taxonomic revision and experts on the genus were part of the 2013 expedition (and covered part of the expenses) following the interesting collections made on 2012. Dr. Roy Erkens from Maastricht University (Netherlands) also joined the fieldtrips in Valle del Cauca.

I visited the following localities. The former three correspond to the Central Ridge (both slopes). The later four cover the Western slope of the Western Ridge of the Colombian Andes and the Pacific coast (Figure 1.)

1. Reserva Natural Cañón del Río Claro. San Francisco – Antioquia. Tropical rain forest c. 500 m. of elevation.
2. Road Caldas to Angelópolis. Vereda La Valeria. Angelópolis – Antioquia. Andean cloud forest, c. 2000 m.
3. Road Barbosa to Porce II, motorway Barbosa to Amalfi. Yolombó – Antioquia. Sub-Andean dry to moist forest, c.1000 m.
4. Reserva Cerro El Inglés, Corporación Serraniagua. Border between Valle del Cauca and Chocó departments, El Cairo - Valle del Cauca. Andean cloud forest, c. 2200 m.
5. Corregimiento Chucheros, Ensenada del Tigre. Campamento La Loma. Buenaventura – Valle del Cauca. Tropical rain forest, c. 50 m.
6. Corregimiento El Queremal, Old Road Cali-Buenaventura. Dagua – Valle del Cauca. Andean cloud forest, c. 1400 m.
7. Corregimiento La Elvira, Road to Dapa, Finca Zingara. Cali – Valle del Cauca. Andean cloud forest, c.1800 m.

Travels among fieldwork localities were made in a rented 4x4 vehicle, which allowed access to remote places and disposition of required materials. However, travelling by boat from Buenaventura was necessary to reach Corregimiento Chucheros. Local guides were hired in every place and asked for advice on the best places to look for *Renealmia* with pictures of the plants and descriptions of its habitat. Samples of fertile plants were collected in the field for herbarium specimens. Full description of the plant, surrounding habitat, locality (including accurate latitude and longitude values for each point) and photos were made for each collected plant. Samples of young and healthy leaves for each specimen were stored in tea bags and dried with silica gel for high quality DNA extractions. Spirit collections of flowers or fruits were

made for each plant when they were available. When possible the collections were kept alive until preparation in the local herbarium.

The herbarium specimens and associated material were properly deposited in the Museo de Historia Natural de la Universidad de los Andes (ANDES), Herbario del Jardín Botánico de Medellín (JAUM) and Herbario de la Universidad del Valle (CUVC). Duplicates for RBGE herbarium and for Dr. P.J.M. and H. Maas of the Naturalis Biodiversity Center (Netherlands) will be sent as soon as exportation permits are processed. When possible we visited different herbaria (COL, SINCHI, MEDEL, HUA) where the available collections of *Renealmia* were curated, included in a database and used to take measurements of the more relevant characters for classification.

Schedule:

10th to 12th October: Drive from Bogotá to Reserva Natural Cañón del Río Claro, fieldwork in the reserve. Dr. Alvaro Cogollo, scientific director of the Jardín Botánico de Medellín joined us during these days.

13th to 20th October: Drive to Medellín, preparation of specimens in Jardín Botánico de Medellín. Contact local botanists in the herbaria (JAUM, HUA, MEDEL). Collection of plants in Angelópolis, Yolombó and preparation of specimens in the JAUM herbarium.

23rd to 25th October: Drive to Reserva Cerro el Inglés where more plants were collected. Drive to Cali to process the specimens and contact local botanists in Universidad del Valle.

26th to 28th October: Drive to Buenaventura and boat to Corregimiento Chucheros to collect. Return to Cali where specimens were processed and deposited in the CUVC herbarium.

29th to 30th October: Collection of specimens in the Corregimiento Queremal, Finca Zingara and surroundings. Specimens were processed and deposited in the CUVC herbarium.

1st to 7th November: Drive from Cali to Bogotá for the final preparation of the collected specimens in the herbarium ANDES. Talk to the students and members of the Laboratorio de Botánica y Sistemática, Universidad de los Andes with the results of the expedition.

Results

We collected 10 *Renealmia* species in the visited localities (Table 1.) plus other individuals of the families Melastomataceae, Gesneriaceae and Gentianaceae. In the Central Ridge of the Colombian Andes (corresponding to localities 1, 2 and 3) we found four *Renealmia* species. In the western slope of the Western Ridge we found eight species and a remarkable higher diversity of my focal genus in the region, especially in the locality number six where we found five species (of which just 2 where shared with the other sampling points).

Taking into account that in Colombia occur c. 30 described species we consider that the expedition was fruitful in terms of number of species. Three of the species we found don't fit in the available descriptions (9-12) (*Renealmia* sp. nov in Table 1) and are new species. The material collected during the 2012 and 2013 expeditions plus

the work in the herbaria will constitute the volume of The Flora de Colombia, family Zingiberaceae and will include the description of the three new species. The volume will be published in collaboration with Dr. H. and P.J.M. Maas.

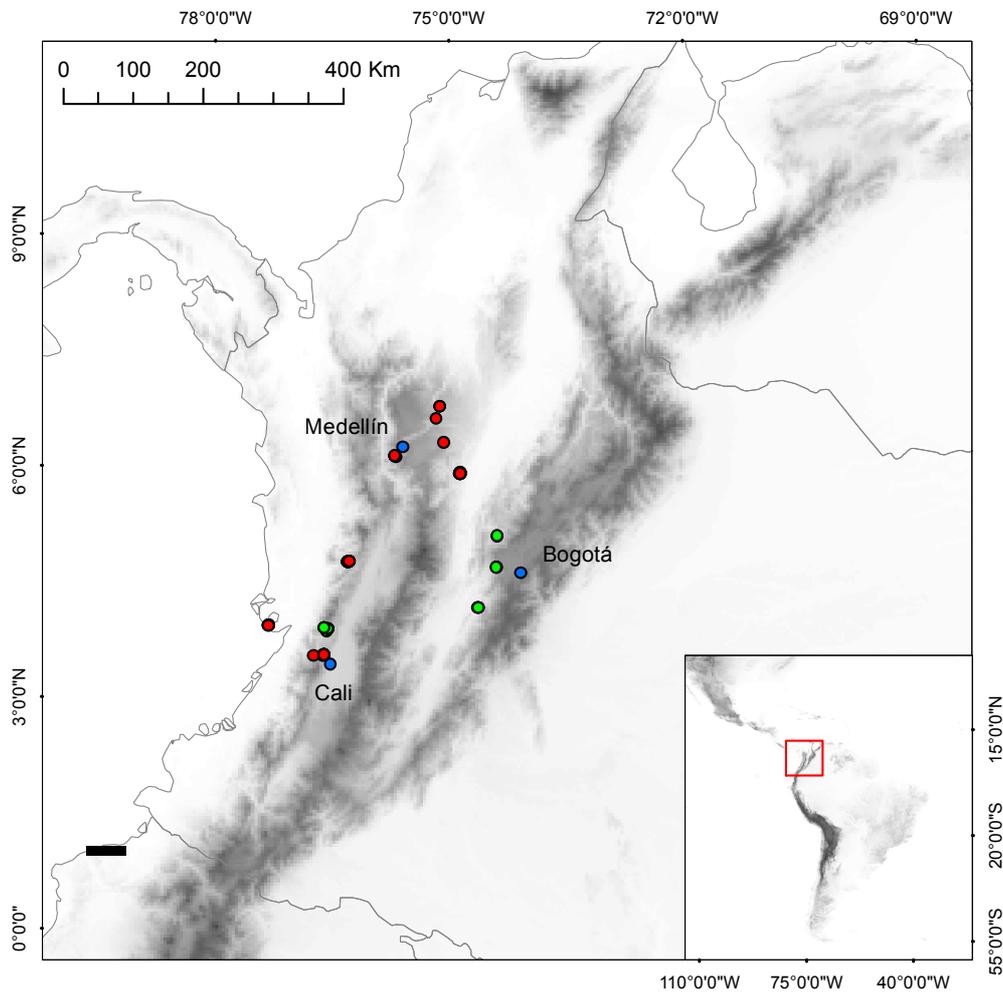


Figure 1. Geographical location of the sampling localities (red points) as listed in the Methods section and main cities (labelled blue points) used as stations between fieldwork periods. Some of the localities where also visited in the previous expedition (2012). The places that were only sampled in the 2012 expedition are shown (green points) to illustrate the final coverage of the fieldwork.

Table 1. Sampling locality, number of individuals, elevation and availability of fruits/flowers for each species.

Taxon	Locality	Individuals	Flowers/Fruits	Elevation (m.a.s.l.)
<i>R. alpinia</i>	1,3	2	Flowers/Fruits	301–1051
<i>R. aromatica</i>	3	1	Flowers	951
<i>R. cernua</i>	1,5	2	Flowers/Fruits	57-406
<i>R. cuatrecasasii</i>	5	1	Flowers/Fruits	50
<i>R. foliifera</i>	6	1	Flowers/Fruits	1346
<i>R. ligulata</i>	2,4,6,7	5	Flowers/Fruits	1841-2084
<i>R. lucida</i>	4,6	2	Flowers/Fruits	1346-2126
<i>R. sp. nov. flaviflora</i>	4	2	Flowers/Fruits	2193-2217
<i>R. sp. nov. pungens</i>	4	1	Flowers/Fruits	2222
<i>R. sp. nov. verrucosa</i>	4	3	Flowers/Fruits	2015 - 2209

Final Budget

Description	Colombian Pesos	£*
Road tolls	206,100	66.7
Parking	37,050	12.0
Materials	296,480	96.0
Communication	130,000	42.0
Petrol	60,000	19.4
Accommodation	1,607,250	519.8
Transport	2,243,424	725.6
International banking	NA	107.1
Flight Tickets	NA	990
Food	625,856	202.4
Travel Insurance	NA	84.5
Accommodation (airport)	NA	57.4
		Total: £ 2922.9

David Expedition Trust: £3,000

Remaining funds: £77.1

* Currency exchange rate £1 = 3,092 COP

Acknowledgements

I would like to thank the Davis Expedition Trust for the funds that made this fieldwork possible and to Hiltje and Paul Maas for sharing their knowledge and company with me. I am grateful to Santiago Madriñán and members of Laboratorio de Botánica y Sistemática, Universidad de los Andes for advice and logistic support. Dario Sánchez, Álvaro Cogollo, Norberto Lopez and the people of the Jardín Botánico de Medellín helped us a lot in the field and in the herbarium. Felipe Estela and the people in HUA where great hosts and guides in the field. Julián Perdomo and Philip Silverstone where very helpful in CUVC and in the fieldtrips. Several people helped in the different localities: Alexis of Corporación Serraniagua for their guidance and support and Yanensi in Chucheros for all the help and amazing food. Finally I would like to thank Fundación Humedales for renting one of their cars to me.

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Renealmia flaviflora sp. nov. flower from Reserva Cerro El Inglés. Photos: Eugenio Valderrama