

ANDEAN VEGETATION AND ORCHID DIVERSITY

The majority of Lehmann's active plant hunting took place in the northern Andes of Colombia and Ecuador. The account of the region, its vegetation and orchid diversity that follows sets the scene for the account of his life that follows.

Geography

Colombia is the fourth largest country in South America with a land surface of about 1,138,600 km², whereas Ecuador, straddling the Equator, is much smaller at about 238,500 km². Despite their disparity in size, they have much in common. Each has a distinct lowland western region, an Andean region of Cordilleras dissected by deep inter-Andean valleys, and an eastern lowland region. I will consider each in turn. The majority of the population, in both countries, lives in the mountains, and the lowlands are relatively less populated.

The western lowlands

A coastal plain runs more or less all the way from Ecuador's southern border with Peru to the north-western border of Colombia. It is variable in width, and its soils are partly alluvial and partly volcanic. In Ecuador, the region is called the Costa and runs for 685 km north to south and up to 100 km in width between the sea and the western Cordillera. This area of 263,000 km² is immensely bio-diverse with an estimated 5,100 species growing there. In the south it is dry with a rainfall of about 2000 mm south of the Equator, influenced by the Humboldt Current that keeps most of coastal Peru arid. The vegetation in the drier areas comprises tropical thorn scrub and even desert. Rainfall rises to 8,800 mm on the Colombian border and, in the wetter areas, the forest cover changes from tropical dry forest to tropical moist forest north of Quevedo. Unfortunately, only a single national park has been gazetted in this region. It is, nowadays, intensively cultivated and very little of the original vegetation remains outside this protected area (Dodson and Escobar 1993).

The western lowlands of Colombia are more extensive and in a better state of preservation. For 320 km north of the Ecuadorian border the lowlands are wide, marshy and sparsely inhabited. Lehmann collected extensively in these forests, especially on the Rio Dagua and Rio Timbiqui, and found many rarities there. He also met his untimely end while trying to cross the latter. The Serrania de Baudó runs along the coast north of Buenaventura. East of this range the forested lowlands taper into a narrow region, the Choco, which drains south into the Pacific by the Rio San Juan and north into the Caribbean by the Rio Atrato. The climate is hot and rainfall high with torrential daily rain so that lowland forests are well developed there.

A narrow strip of perhumid cloud-forest clothes the lower Andean slopes of Ecuador between 300 and 900 m elevation, merging into the Choco forests of Colombia where the forests are more extensive.

The sierras

Above 900 m elevation, extensive areas of montane habitat exist in both Ecuador and Colombia forming a mountainous backbone to both countries. In Ecuador, two ranges of mountains, cordilleras, run north to south, separated by a broad, dry central valley. Both ranges boast high volcanoes: Chimborazo at 6310 m is the highest but several others, including Cayembe, Illiniza, Altar, Cotopaxi, Tunguragua, Antisana and Sangay, top 5000 m. Tunguragua (5016 m), overshadowing the town of Baños, and Sangay (5230 m) are currently extremely active. The western slopes are somewhat drier than the eastern ones and have suffered almost as much deforestation as the western lowlands. The forests of eastern flanks of the Eastern Cordillera are in far better condition, protected by a number of national parks and reserves. Lehmann traversed the Ecuadorian cordilleras many times while collecting. The mountains around Quito, Baños and Loja proved to be especially rich and rewarding for masdevallias and odontoglossums.

Ecuador's inter-Andean valleys, ten basins in all, lie between 2100 and 2750 m elevation, often lie in the rain-shadow of the cordilleras, suffering periodic droughts. Grassy páramo vegetation covers extensive areas but most of the flatter areas and many of the steeper ones are now cultivated.

In Colombia, the two Ecuadorian ranges persist into the southern part of the country, and the valley between

them is filled with volcanic ash. Lehmann was based at Popayan, which lies at the head of a fertile alluvial, black-soil valley that runs northwards to Cali and Cartago, draining to the north by the Cauca River. Many of his collections came from the mountains and riverine forests of the region. A low pass west of Cali crosses the western cordillera and links it to Buenaventura on the coast. Lehmann traversed it many times, often en route to deliver his plant collections to the ships that would transport them to Europe. He collected as he travelled and found many fine orchids, especially huntleyas, bolleas and pescatorias here. In the Western Cordillera only five peaks are 4000 m or more high, and none reaches 5000m. At Cartago, the two cordilleras approach each other and form a steep gorge that runs all the way north to the Caribbean lowlands.

In the Central Cordillera, Medellin, the capital of Antioquia, lies at an elevation of 1540 m and is the centre of coffee production. North of Medellin, it splits into three branches separated by rivers that all run into the Caribbean. This region, in the state of Antioquia, proved to be a fertile collecting ground for Lehmann and produced fine cattleyas, odontoglossums and masdevallias in abundance.

The Eastern Cordillera arises some 2° N of the Ecuadorian border and moves north, bifurcating at 7° N into two branches, one becoming the western rim of the Maracaibo basin, the other running north-east into Venezuela. The Magdalena River separates the Eastern from the Central Cordillera and runs north into the Caribbean at Barranquilla. Some of the peaks of the Sierra Nevada de Cocuy in the Eastern Cordillera rise to over 5200m, Ritacuba Blanca being 5493 m high. Bogota, the capital, lies in a high fertile basin of the Eastern Cordillera at more or less the same latitude as Cartago.

The Sierra Nevada de Santa Marta lies isolated from the main Andean cordilleras and on the shores of the Caribbean. Its greatest peaks, the highest in Colombia, rise to 5800 m and are less than 50 km from the sea.

The Eastern lowlands

About a third of Ecuador and over half of Colombia lie to the east of the Andes. In both Ecuador and Colombia, the country drops abruptly east of the Eastern Cordillera to the lowlands of the Amazon and Orinoco basins. Most of these areas are very wet. The soils on the Andean slopes can be rich and in the high rainfall can support fine rain-forests. The Amazon basin in Ecuador begins at the 300 m contour and runs all the way to the Atlantic Ocean, while the Orinoco basin runs all the way to the Caribbean. Both regions are characterized by poor thin soils in the lowlands. Tall forests follow the meandering river margins and are interspersed with ox-bow lakes, seasonally wet grasslands and swamp forests. Rainfall is high, and temperatures are hot. Lehmann seems to have spent little time and effort collecting in these regions which are relatively poor in orchid diversity, although he did navigate the Orinoco to its mouth en route to the Caribbean, collecting plants (but few orchids) along the way.

Orchid diversity

Colombia and Ecuador are undoubtedly amongst the most biodiverse countries in the world. They are also rich in orchids, containing between them an estimated fifth to a quarter of all the world's species. The latest figure shows that Ecuador has 3,259 species in 214 genera (Dodson and Escobar, 1993), but Luer (2003, 2004) has alone already added 200 new species of *Stelis*. Colombia has currently fewer described species, but Dodson (1994) estimates that it will be as rich as, if not richer than, Ecuador. The orchids account for an estimated 10% of the floras of each country (Kress, 1986).

Orchids are distributed in every habitat from the coast to the permanent snow-line on the highest mountains. Factors driving orchid evolution have been the tremendous variety of available habitats, the diverse topography and climate of the region, the unstable geology and the availability of pollinators, and mycorrhizal fungi. It seems likely that hybridisation and possibly polyploidy have also been influential.

Three Andean cordilleras in Colombia merge into two in Ecuador Andes. The precipitation varies greatly in each cordillera and in the inter-Andean valleys depending upon prevailing winds and the rain-shadow effect of neighbouring mountain ranges.

Some orchids are widespread, especially lowland species but, in the Andean cordilleras, most are more

restricted in their distribution and some are narrowly endemic. Dodson and Escobar (1993) have estimated that only about 8% of the orchids of Ecuador are found in the lowland forests below 300m whereas about 18% occur above the 3000m contour. Thus almost three-quarters of all the orchids are found between 300 and 3000 m in less than half the surface area of the country. The same would apply in Colombia.

Endemism

Gentry (1982) defined endemics as those plant species confined to a distribution range of less than 75,000 km². As Dodson and Escobar (1993) indicate, most Andean orchids are much more restricted in their distribution, many to less than 20,000 km² and often occur in only one or two ecologically appropriate forest types. Both Gentry (1982) and Dodson and Escobar (1994) estimate that 20% of the flora of western Ecuador is endemic, the same figure approximately applying to both the dry and the wet forests.

However, in the mountains, endemics can be far more restricted in their distribution. Many of these narrow endemics have been described as new to science by authors such as Luer and Dodson and their collaborators in recent years. The recent discovery by Lou Jost (2004) of many new species of *Teagueia*, a genus previously represented by only six species, on a mountain in east-central Ecuador confirms suspicions that the northern Andes are particularly rich in endemics. Dodson (1994) gives a vivid example from the Centinela Ridge in western Ecuador where 10% of the plant species were endemic in an area 20km by 1 km in extent and ranging from 500 to 800m in elevation. The area is now deforested, and species' extinctions have certainly occurred.

Lehmann's main collecting areas

Lehmann covered a remarkable area while collecting orchids in South America, from the Ecuadorian border to the Colombian Caribbean coast and east to the Venezuelan capital of Caracas. He travelled by boat or ship, using the extensive river network in the lowlands but mule or horse in the highlands.

The state of Antioquia in Colombia proved to be amongst his most prolific hunting grounds. He first collected there between September and November 1884, returning from August to December 1891 and in November 1896. The region produced fabulous cattleyas, including *C. aurea*, *C. trianaei* and *C. warscewiczii*, and odontoglossums such as *O. harryanum*, *O. lindleyanum*, *O. luteopurpureum* and *O. wallisii*. *Dracula chimaera*, *D. pholeodytes* and *D. velutina*, *Masdevallia bicolor*, *M. cucullata*, *M. torulosa*, *M. peristeria*, *M. ventricularia*, *M. molossus* and *M. platyglossa*. Fine forms of *Phragmipedium schlimii* were also collected in the forests around Frontino and Medellin. Other notable discoveries in the region included *Trichopilia rostrata*, *Rodriguezia lehmannii*, *Otoglossum coronarium*, *Anguloa ruckeri*, *Oerstedella wallisii*, *Oliveriana egregia*, *Cyrtochilum fallens* and *Stanhopea wardii*. The spectacular orange-brown flowered *Neomoorea wallisii* was found on the Rio Nuz between Pavas and Alto Grande. But perhaps his finest collections here were of *Miltoniopsis vexillarius*, the pansy orchid. Lehmann noted: "This plant, distributed all over Antioquia, varies rather strongly in different localities. The plants occurring on the western salient of the West Cordilleras – around Uruma, Musinga, Frontino, Urrao etc., produce the largest flowers. The latter are of a very pale lilac-pink colour, occasionally almost white. The plants growing around Ituango, on the Rio San Jorge, above San Andres, and around Briceno, have somewhat smaller flowers but these are of a much deeper pink, and the plants are considerably stronger and usually larger. The plants growing below Sonson and around Amalfi, produce the smallest flowers, but these are the most vividly coloured. The latter variety agrees almost completely with the variety *rubellum* from Cauca."

He extensively explored the Cauca valley and was richly rewarded, especially with masdevallias and draculas: including *Masdevallia amanda*, *M. bicolor*, *M. stenantha*, *M. maculata*, *M. pachyantha*, *M. racemosa* and *M. pantherina*, and *Dracula chimaera* and *D. vespertilio*. Other notable collections included *Coryanthes mastersii*, *Pescatoria klabochorum* and *Cattleya chochoensis*. The mountains around Cali produced *Bollea coelestis*, *Ada chlorops* and *Dracula chimaera*. But it was the Popayan highlands, his base from 1878 onwards, that yielded some of the finest orchids, including *Odontoglossum pardinum*, *O. ramossissimum*, *O. angustatum* and *O. luteopurpureum*, *Maxillaria lepidota*, *M. grandiflora*, *Comparettia falcata*, *Eriopsis biloba*, *Warrea tricolor* and *Cyrtochilum undulatum*. His most notable discovery thereabouts was in the Andes west of Popayan where he

discovered in 1896 the strange green-flowered epiphyte *Trevoria chloris*, the type of a new genus exuberantly described by Lehmann in the *Gardeners' Chronicle* of the following year.

Closer to the Ecuadorian border, the Tuquerres highlands, visited first in September 1877 and several times subsequently, produced *Odontoglossum angustatum* and *O. pardinum*, *Helcia sanguinolenta*, *Pescatoria lehmannii*, *Chondrorhyncha chesteronii* and *Phragmipedium caudatum*.

On his frequent visits to the western lowlands, especially en route to Buenaventura and to his mine on the Rio Timbiqui, he found *Miltoniopsis roezlii*, *Huntleya citrina*, *Pescatoria klabochorum*, *Dracula inaequalis*, *Phragmipedium longifolium*, *Peristeria elata* and *Chondrorhyncha chesteronii*.

Some of Lehmann's earliest collections came from the area around Quito in the Ecuadorian Andes where he first arrived in May 1876. There he found *Cyrtorchilum genuiculatum*, *Cochlioda vulcanica* and *Maxillaria lehmannii*. Farther south, the eastern slopes of the Andes between Sigsig and Cuenca were rich in masdevallias and other choice species, such as *Odontoglossum cirrhosum*, *O. cruentum*, *O. angustatum*, *Maxillaria lehmannii* and *Cyrtorchilum macranthum*,

To reach the Ecuadorian highlands, Lehmann used the ports of Esmeraldas and Guayaquil. His collections from the Ecuadorian lowlands included *Huntleya wallisii*, *Stanhopea tricornis*, *Coryanthes wolfii*, *Cycnoches lehmannii* and *Odontoglossum denticulatum*. Lehmann's label notes of *Cattleya maxima* state "The species occurs here [in north-western coastal Ecuador] on *Rhizophora mangle*, in brackish marshes. Further to the south, around Pichota and Jipijapa, the lowermost boundary begins only at 200-300m above the sea, and reaches up to 1000m. To the south from Guayaquil it occurs only very seldom below 1000m. The so much sought-after variety "*Backhouseana*" grows around Zaruma in south-east Ecuador."

The highlands of southern Ecuador were one of Lehmann's earliest and most productive hunting grounds to which he returned many times. Between June and November 1876 he first collected in the eastern Andes around Loja and Zamora, a region which yielded many masdevallias and also *Phragmipedium boissierianum*, *Phragmipedium wallisii*, *Cyrtorchilum retusum* and *Cochlioda rosea*. The Tunguragua volcano, first visited in March 1877, proved particularly rich in showy orchids with many species growing in abundance on the old lava flows, including *Phragmipedium lindenii*, *Cyrtorchilum macranthum*, *Brassia longicuspis*, *Cochlioda vulcanica*, *Odontoglossum cristatellum*, *Chrysocycnis lehmannii* and *Oncidium tunguraguense*.

Lehmann considered the beautiful *Masdevallia rosea* to be one of the most valuable and desirable plants that he collected. He first found it in June 1877, growing on Tunguragua at 3100m, and later between Loja and Zamora and in the east Andes of Cuenca.

LITERATURE CITED

- Dodson, C. and Escobar R., R. (1993). *Native Ecuadorian Orchids*, Vol. 1. Colina, Medellin, Colombia.
- Gentry, A.H. 1982. Patterns of Neotropical plant diversity. *Evolutionary Biology* 15: 1-84.
- Jost, L. 2004. *Teagueia* explosion: an unexpected orchid species radiation in the Andes of Ecuador. *Orchid Digest* 68: 8-13, 40.
- Kress, N. J. 1986. The systematic distribution of vascular epiphytes: an update. *Selbyana* 9: 2-22.
- Luer, C. 2003, 2004. *Icones Pleurothallidarum XXIV & XXV*. Monographs in Systematic Botany, 24 & 25. Missouri Botanic Garden, St. Louis, Missouri.