Diversity of Colombian Passifloraceae: biogeography and an updated list for conservation

Colombian Passifloraceae were listed, gathering and georeferencing 3,930 records, from herbaria, literature, and field observations. It includes 167 species, 165 of them native, which is equivalent to 27% of the family. Forty-two produce an edible fruit, and nine are commercially cultivated. Our list brings more details on species distribution and presents 26 species new to Colombia. Most of the 58 endemic species, including 36 narrow endemics, are Andean species of subgenus Tacsonia and Decolaba.

Applying the IUCN criteria, 70% of the species appear threatened and three extinct. When compared with other regions, the Andes of Colombia and Ecuador constitute the center of Passiflora diversity, whose elevational distribution shows a small peak below 500 m, and two higher ones at 1,000-2,000 and 2,500-3,000 m. This pattern corresponds to divergent adaptive trends among infrageneric divisions, subgenus Tacsonia contributing markedly to the highest peak.

Most common species thrive in disturbed habitats, such as borders of roads, cultivated plots, and secondary forest. Colombia may still harbor many unknown species in poorly explored departments. The urgent task of conserving this threatened richness must target the conservation of these resources as well as their habitat. Both aspects may be combined if Passifloraceae can be used as an indicator of biodiversity in the Andean region, which seems justified by their multiple ecological interactions with many organisms.

**Distribution, diversity and in situ conservation of Colombian Passifloraceae**

Analysis was made of 3,930 records of 165 wild Passifloraceae to assess the distribution of their diversity in Colombia, identify collection gaps, and explore their potential as indicator species. Despite variable collection density among and within biogeographic regions, the Andean region clearly presents a higher species richness, particularly in the central coffee growing zone.

The analysis on 19 climatic variables showed that the two principal variance components, explaining 77% of the total, are respectively associated with temperature and precipitation, without influence of seasonality. Distribution parameters allow recognizing more than 36 narrow endemics. Prediction of species distribution showed nine areas with very high richness (predicted sympathy of 41 to 54 species) in the Andean region, three of which correspond to collection gaps.

Their striking correspondence with coffee growing zone ecotopes imposes a strategy integrating agricultural and environmental management at the landscape level for preserving this threatened richness as well as a region of particular importance for the country. Both aspects may be combined if Passifloraceae can be used as an indicator of biodiversity in this region, which seems justified by their diversity and characteristics, including multiple ecological interactions with many organisms.

A similar selection of 32 qualitative traits, and four categorized quantitative traits, allowed classifying our sample consistently. Most discriminating characters include size of stems and leaves, presence of tendrils, number and distribution of extrafloral nectaries, dimensions and general shape of bracts, width and length of flowers and corona complexity.

**Chloroplast and mitochondrial DNA variation in the genus Passiflora L. (Passifloraceae) as revealed by PCR-RFLP**

The chloroplast and mitochondrial DNA diversity of 213 genotypes belonging to 151 Passiflora species and 15 subgenera recognized by Kilip was studied by PCR-RFLP, identifying 280 haplotypes for cpDNA and 372 for mtDNA. The principal co-ordinate analysis on cpDNA data allowed visualizing a strong separation of subgena Apodogyne, Decolaba, Murucija, Pseudomurucija and Pallanthis (constituting the ‘Decolaba group’), while the neighbor-joining cluster analysis showed three well-supported clusters within Passiflora, corresponding to the three major divisions of the taxonomy proposed by Feuillet & MacDougal.

The first one, the ‘Passiflora group’, includes subgenera Calopothanthus, Decolambis, Distephana, Dysosmia, Dysosmioides, Manicata, Pasiffora, Tacsonia, and Taconeides, with a very loose substructure and considerable intraspecific variation. The second one includes subgenus Astrophyse, and the third is the ‘Decolaba group’. The outgroup species, take an undefined position among the Passiflora clusters.

The phenogram from mtDNA data separates four moderately supported clusters. As for cpDNA, a first one corresponds to the ‘Decolaba group’. The other are different, as subgenera Astrophyse and Tryphonostemmatales appear integrated within the ‘Passiflora group’, while subgenus Tacsonia forms a uniform distinct cluster, close to another one comprising species of Passiflora series Kernessiae, Simpliphilae, Lobatae, and Menisparmiflorae.

The analyses of cpDNA and mtDNA give different pictures of the Passiflora diversity, in the position of the outgroup, the relative position of four subgena, and the relationships between species, which we attribute to different rates of evolution and modes of transmission of the chloroplastic and mitochondrial genomes, combined with reticulate evolution in the genus.

**Conclusions**

Breeding programs aimed at producing interspecific hybrids involving the cultivated species of Passiflora should therefore focus on the species belonging to the same clade as subgenus Passiflora. According to our results, the ‘Decolaba clade’ and subgenus Astrophyse do not constitute interesting genetic resources for passion fruit breeding.

These results constitute potentially crucial inputs for the development of a coherent strategy for the conservation and use of these genetic resources. Studies of Passiflora diversity in the Andean countries, and the maps presented here, will be used in future prospecting and identifying sites for in situ conservation, and more generally guiding government conservation strategies.

**References**


Contact: escampejohn@gmail.com