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# Diversity of Syrphidae in the Tropical Andes

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## Abstract

The Paramos or tropical alpine ecosystems are isolated mountain systems located above the tree line ( $\sim > 3,000$  m of altitude) of Colombia, Venezuela, Ecuador, Peru, and Bolivia. The Paramos form an archipelago of continental biogeographic islands on mountain tops, surrounded by high Andean cloud forests and disturbed areas (open and homogeneous areas, modified for livestock activities and agricultural crops). The region has been an obligatory route for many organisms and is characterized by an intricate vegetation structure, heterogeneous topography, and complex geographical history triggered by environmental change and global cooling, constituting the "global epicenter of biodiversity". In the past, the Paramos were presumably widespread and connected during the glacial periods while highly fragmented during the extreme interglacial periods. These intermittent connectivity cycles (climatic variations due to glacial/interglacial periods) as well as the altitudinal isolation (topographic barrier due to orogeny), favored one of the most recent and fastest adaptive radiations by allopatric speciation, triggered by island-like ecological opportunities in the mountain tops. The availability of new habitats and harsh environmental conditions (high radiation, extreme winds, and low temperatures) favor the colonization, establishment, adaptation, and diversification of unique and specialized fauna. In consequence, Paramos are currently recognized globally for their high endemism and unmatched species richness concentrated in a relatively small isolated area but are among the ecosystems most threatened by global warming and increasing anthropogenic pressures (e.g. large-scale metal mining, fracking, indiscriminate and constant application of pesticides, deforestation for timber extraction, as well as rampant arson of land around the forest to clear land for agriculture and the expansion of extensive cattle ranching), that have resulted in the ecosystem fragmentation into small mosaics of isolated highland islands and forest patches in which only a few remnants of primary vegetation remain, projecting a high extinction risk. These factors generate singular patterns of continental insularity, whose impacts on biodiversity remain to be examined, making biodiversity research a priority to help understand this fragile ecosystem. Given that more than 43% of the Neotropical Syrphids diversity is concentrated in the Tropical Andes, the endemic and restricted groups should be considered as a flagship for conservation planning and management. Therefore, the origin, diversification, composition, and diversity of emblematic Tropical Andes Syrphids groups will be discussed in the context of conservation and climate change. The challenges and future direction of research on the flower fly fauna in the Tropical Andes will also be enumerated and debated. Acknowledgments: Thanks to Entomology Group, University of Antioquia (GEUA). Funds were provided by COLCIENCIAS (Convocatorias 745–2016, 647-2014, 1030-2021). Thanks are also due to the IRD and the symposium organizing Committee which made the participation to the Syrphidae symposium feasible.

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