



Melastomataceae of the Sierra Nevada de Santa Marta (Colombia): floristic affinities and annotated catalogue

MARCELA ALVEAR¹, GILBERTO OCAMPO¹, CARLOS PARRA-O², EDUINO CARBONÓ³ AND FRANK ALMEDA¹

¹ – Institute for Biodiversity Science and Sustainability, Department of Botany, California Academy of Sciences, 55 Music Concourse Drive, Golden Gate Park, San Francisco, CA 94118, USA; malvear@calacademy.org; gilberto.ocampo@gmail.com; falmeda@calacademy.org

² – Instituto de Ciencias Naturales, Universidad Nacional de Colombia Carrera 30 No. 45-03, edificio 425, Bogotá, Colombia; caparrao@unal.edu.co

³ – Herbario UTMC, Universidad del Magdalena, Carrera 32 No. 22–08 Avenida del Ferrocarril, Santa Marta, Magdalena, Colombia; eduinoc@yahoo.com

Abstract

The Sierra Nevada de Santa Marta (SNSM), the world's highest coastal mountain range, has long been recognized for its high levels of biological diversity and endemism but no exhaustive inventory of the flora exists today. Here we present an annotated catalogue of the angiosperm family Melastomataceae from this diverse massif. The annotated species list is based largely on the treatment of Melastomataceae for the forthcoming Catalogue of the Plants of Colombia together with several floristic data sources, confirmed specimen records held in different herbaria, and recent field work. The catalogue of Melastomataceae presented here includes 20 genera and 86 species, 21 of which are endemic to Colombia and 15 of those are endemic to the SNSM. We also include floristic similarity analyses to compare the species of Melastomataceae from the SNSM with those from other Colombian biogeographic regions and other Neotropical countries or regions.

Key words: biodiversity hotspots, endemism, neotropics, similarity indices, South America, Tropical Andes

Resumen

La Sierra Nevada de Santa Marta (SNSM), la cordillera costera más alta del mundo, ha sido ampliamente reconocida por sus altos niveles de diversidad biológica y endemismo, sin embargo en la actualidad no existe un inventario exhaustivo de su flora. Aquí presentamos un catálogo comentado de la familia de angiospermas Melastomataceae de este macizo diverso. El listado anotado de las especies se basa principalmente en el tratamiento de la familia Melastomataceae para el Catálogo de las Plantas de Colombia junto con varias fuentes de datos florísticos, registros de especímenes confirmados depositados en diferentes herbarios y en trabajo de campo reciente. El catálogo de Melastomataceae aquí presentado incluye 20 géneros y 86 especies, 21 de las cuales son endémicas de Colombia y 15 de éstas son endémicas específicamente de la SNSM. También incluimos análisis de similitud florística para comparar las especies de Melastomataceae de la SNSM con las de otras regiones biogeográficas de Colombia y con otros países o regiones neotropicales.

Introduction

The Melastomataceae (including Memecylaceae), with 5,400 + species, is one of the world's ten largest families of flowering plants. Members of the family may be annual or perennials herbs, shrubs, trees, vines, epiphytes, or hemiepiphytes and are distributed throughout tropical and subtropical regions worldwide. The family has about 170 genera with over 3,500 species in the neotropics, 1000 in tropical Asia, 240 in Africa, and 225 in Madagascar (Clausen and Renner 2001, Almeda *et al.* 2013). Within the neotropics, Colombia stands out as a major center of diversity for Melastomataceae with 58 genera and 982 species (excluding cultivated taxa). Three genera (*Allomaieta*, *Catocoryne*, *Kirkbridea*) and about 35% of the species are endemic to the country (Almeda *et al.* 2013, Almeda *et al.* in press).

Acknowledgements

We thank the curators and staff at CAS, COL, CUVC, FMB, HECASA, HUA, MO, NY, US, and UTMC for access to the collections under their care; José David García for his help with the database and acquisition of herbaria information; Fundación Proaves for their help and permission to work in the Reserva Natural de Aves El Dorado. This research was supported in part by the California Academy of Sciences, the M. Stanley Rundel Charitable Trust, and a grant from the U.S. National Science Foundation (DEB-0818399-Planetary Biodiversity Inventory-Miconieae). We are grateful to the Ministerio de Ambiente y Desarrollo Sostenible and Autoridad Nacional de Licencias Ambientales (ANLA) in Colombia for granting the research permits to collect members of the Melastomataceae for the project “Sistemática y filogenia de la tribu Miconieae (Melastomataceae)”.

References

- Adams, M. (1973) Ecological zonation and the butterflies of the Sierra Nevada de Santa Marta, Colombia. *Journal of Natural History* 7: 699–718.
<http://dx.doi.org/10.1080/00222937300770601>
- Aedo, C., Aldasoro, J.J., Sáenz, L. & Navarro, C. (2003) Taxonomic revision of *Geranium* sect. *Gracilia* (Geraniaceae). *Brittonia* 55: 93–126.
- Aedo, C. (2009) A new species of *Geranium* (Geraniaceae) from Colombia. *Journal of the Torrey Botanical Society* 136: 289–292.
- Aide, T.M. & Cavelier, J. (1994) Barriers to lowland tropical forest restoration in the Sierra Nevada de Santa Marta, Colombia. *Restoration Ecology* 2: 219–229.
- Almeda, F. (2009) Melastomataceae. In: Davidse, G., Sousa-Sanchez, M., Knapp, S. & Chiang, F. (eds.) *Flora Mesoamericana* 4 (1): 164–338.
- Almeda, F., Alvear, M. & Mendoza-Cifuentes, H. (2013) *Colombia, biodiversity hotspot and major center of diversity for Melastomataceae*. Scientific Abstracts no. 276. Botany 2013, New Orleans, Louisiana, USA.
- Almeda, F., Berry, P.E., Freire-Fierro, A., Gröger, A., Holst, B.K., Luckana, N.G., Michelangeli, F.A., Morley, T., Penneys, D.S., Renner, S.S., Robinson, O.R., Wurdack, J.J. & Yatskievych, K. (2007) Melastomataceae. In: Funk, V., Hollowell, T., Berry, P., Kelloff, C. & Alexander, S.N. (Eds.) *Checklist of the plants of the Guiana Shield (Venezuela: Amazonas, Bolivar, Delta Amacuro; Guyana, Surinam, French Guiana)*. Contributions from the United States National Herbarium, Washington D.C., pp. 397–417.
- Almeda, F., Mendoza-Cifuentes, H., Penneys, D.S., Michelangeli, F. & Alvear, M. (In press) Melastomataceae. In: Bernal R., Gradstein, R. & Celis, M. (Eds.) *Catálogo de las Plantas de Colombia*. Instituto de Ciencias Naturales - Universidad Nacional de Colombia - University of Göttingen.
- Alvear, M. (2010) *Systematics of the genus Monochaetum (DC.) Naudin (Melastomataceae) in Colombia*. MsC. Thesis in Biology: Ecology and Systematics, San Francisco State University, San Francisco, CA, USA, 296 pp.
- Alvear, M. & Almeda, F. (2014) Three new species of *Monochaetum* from Colombia. *Phytotaxa* 163(1): 27–38.
<http://dx.doi.org/10.11646/phytotaxa.163.1.3>
- Ayers, T.J. & Boufford, D.E. (1988) Index to the Vascular Plant Types Collected by H. H. Smith Near Santa Marta, Colombia. *Brittonia* 40(4): 400–432.
<http://dx.doi.org/10.2307/2807652>
- Bálint, Z. & Wojtusiak, J. (2006) Contributions to the knowledge of Neotropical Lycaenidae: Notes on Thecloxurina with the description of three new species (Lepidoptera: Theclinae: *Eumaeini*). *Genus* 17 (4): 585–600.
- Bartels, G. (1984) Los pisos morfoclimáticos de la Sierra Nevada de Santa Marta. In: van der Hammen, T. & Ruiz, P.M. (Eds.) *Studies on tropical Andean ecosystems, ECOANDES Vol.2: La Sierra Nevada de Santa Marta (Colombia) - Transecto Buritaca-La Cumbre*. J. Cramer, Berlin, Stuttgart, pp. 99–130.
- Baumgratz, J.F.A., Bernardo, K.F.R., Chiavegatto, B., Goldenberg, R., Guimarães, P.J.F., Kriebel, R., Martins, A.B., Michelangeli, F.A., Reginato, M., Romero, R., Souza, M.L.D.R. & Woodgyer, E. (2013) Melastomataceae. In: *Lista de Espécies da Flora do Brasil*. Jardim Botânico do Rio de Janeiro. Available from: <http://floradobrasil.jbrj.gov.br/jabot/floradobrasil/FB161> (accessed 15 April 2014).
- Bernal, A. & Roze, J. (2005) Lizards of the Genus *Anolis* (Reptilia: Polychrotidae) from Sierra Nevada de Santa Marta, Colombia, with description of two new species. *Novedades Colombianas* 8 (1): 9–26.
- Bernal, R. (2009) *Valeriana neglecta* (Valerianaceae), a new species from Colombia. *Kew Bulletin* 64: 723–725.
<http://dx.doi.org/10.1007/s12225-009-9161-z>

- Bernal, R., Gradstein, R. & Celis, M. (Eds.) (2014) *Catálogo de las Plantas de Colombia*. Instituto de Ciencias Naturales - Universidad Nacional de Colombia - University of Göttingen. Available from: <https://sites.google.com/site/rgbernalg/home2> (accessed 15 April 2014).
- Brako, L. (1993) Melastomataceae. In: Brako, L. & Zarucchi, J. (Eds.) *Catalogue of the Flowering Plants and Gymnosperms of Peru. Monographs in systematic botany from the Missouri Botanical Garden* 45: 472–707.
- Camero, R.E. (2010) Two new species of *Dyscolus* Dejean (Coleoptera: Carabidae: Platynini) from high altitude forest from Colombia. *Elytron* 24: 19–25.
- Carbonó, E. & Lozano-Contreras, G. (1997) Endemismos y otras singularidades de la Sierra Nevada de Santa Marta, Colombia. Posibles causas de origen y necesidad de conservarlas. *Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales* 21(81): 409–419.
- Cardona, A. & Ojeda, G.Y. (2010) Special volume: Geological evolution of the Sierra Nevada de Santa Marta and adjacent basins, Colombian Caribbean región. *Journal of South American Earth Sciences, Special Issue: Sierra Nevada de Santa Marta and adjacent basins* 29(4): 761–763.
<http://dx.doi.org/10.1016/j.jsames.2010.06.001>
- Cardona, A., Valencia, V.A., Bayona, G., Duque, J., Ducea, M., Gehrels, G., Jaramillo, C., Montes, C., Ojeda, G. & Ruiz, J. (2011a) Early-subduction-related orogeny in the northern Andes: Turonian to Eocene magmatic and provenance record in the Santa Marta Massif and Rancheria Basin, northern Colombia. *Terra Nova* 23: 26–34.
<http://dx.doi.org/10.1111/j.1365-3121.2010.00979.x>
- Cardona, A., Valencia, V., Weber, M., Duque, J., Montes, C., Ojeda, G., Reiners, P., Domanik, K., Nicolescu, S., Villagomez, D. (2011b) Transient Cenozoic tectonic stages in the southern margin of the Caribbean plate: U-Th/He thermochronological constraints from Eocene plutonic rocks in the Santa Marta massif and Serranía de Jarara, northern Colombia. *Geologica Acta* 9 (3–4): 445–466.
<http://dx.doi.org/10.1344/105.000001739>
- Carvajal-Cogollo, J., Cárdenas-Arévalo, G. & Castaño-Mora, O. (2012) Reptiles de la región Caribe de Colombia. In: Rangel, J.O. (Ed.) *Colombia Diversidad Biótica XII: La región Caribe de Colombia*. Universidad Nacional de Colombia - Instituto de Ciencias Naturales. Bogotá D.C., pp. 791–812.
- Castro-López, P.A. & Cardona Molina, A. (2010) Algunos intentos de comprensión del origen geológico de la Sierra Nevada de Santa Marta durante el siglo XIX: los casos de Joaquín Acosta y Jorge Isaacs. *Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales* 34 (133): 498–511.
- Cavelier, J., Aide, T.M., Santos, C., Eusse, A.M. & Dupuy, J.M. (1998) The savanization of moist forest in the Sierra Nevada de Santa Marta, Colombia. *Journal of Biogeography* 25: 901–912.
- Clausing, G. & Renner, S.S. (2001) Molecular phylogenetics of Melastomataceae and Memecylaceae: implications for character evolution. *American Journal of Botany* 88(3): 486–498.
<http://dx.doi.org/10.2307/2657114>
- Cleef, A.M. & Rangel, J.O. (1984) Vegetation of the páramos of the northwestern part of the Sierra Nevada de Santa Marta. In: van der Hammen T. & Ruiz P.M. (Eds.) *Studies on tropical Andean ecosystems, ECOANDES Vol.2: La Sierra Nevada de Santa Marta (Colombia) - transecto Buritaca-La Cumbre*. J. Cramer, Berlin, Stuttgart, pp. 203–266.
- Cleef, A.M., Rangel, J.O., van der Hammen, T. & Jaramillo-Mejía, R. (1984) The forest vegetation of the Buritaca transect. In: van der Hammen, T. & Ruiz, P.M. (Eds.) *Studies on tropical Andean ecosystems, ECOANDES Vol.2: La Sierra Nevada de Santa Marta (Colombia) - transecto Buritaca-La Cumbre*. J. Cramer, Berlin, Stuttgart, pp. 267–395.
- Dalström, S. (2012) A new *Cyrtochilum* (Orchidaceae: Oncidiinae) from Sierra Nevada de Santa Marta in Colombia. *Lankesteriana* 12(3): 143–145.
<http://dx.doi.org/10.15517/lank.v0i0.11686>
- Davidse, G., Soreng, R.J. & Peterson, P.M. (2009) *Agrostopoa* (Poaceae, Pooideae, Poeae, Poinae), a New Genus with Three Species from Colombia. *Novon*: 19(1):32–40.
<http://dx.doi.org/10.3417/2007132>
- Díaz-Piedrahíta, S. & Bueno, M. (1997) Nuevas especies y variedad de *Pentacalia* Subgen. *Microchaete* (Asteraceae, Senecioneae) de la Sierra Nevada de Santa Marta, Colombia. *Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales* 21 (80): 201–204.
- Dice, L.R. (1945) Measures of the amount of ecological association between species. *Ecology* 26: 297–302.
- Donegan, T.M., Miles McMullan, W., Quevedo, A. & Salaman, P. (2013) Revision of the status of bird species occurring or reported in Colombia 2013. *Conservación Colombiana* 19: 3–10.
- Fernández-Alonso, J.L. (2002) Bombacaceae Neotropicae Novae vel Minus Cognitae III. Nuevas especies de *Matisia* y *Quararibea* de Colombia. *Novon* 12: 343–351
<http://dx.doi.org/10.2307/3393077>

- Fernández-Alonso, J.L. (2003) Estudios en Labiatae de Colombia IV. Novedades en *Salvia* y sinopsis de las secciones Angulatae y Purpureae. *Caldasia* 25(2): 235–281.
- Fernández-Alonso, J.L. & Cuadros-Villalobos, H. (2012) *Sanguisuga*, un género nuevo neotropical de Cytinaceae y una conexión sudamericana en la familia. *Caldasia* 34: 291–308.
- Forero, E. (1988) Botanical Exploration and Phytogeography of Colombia: Past, Present and future. *Taxon* 37 (3): 561–566.
<http://dx.doi.org/10.2307/1221099>
- Foster, R.C. (1958) A catalogue of the ferns and flowering plants of Bolivia. *Contributions from the Gray Herbarium of Harvard University* 184: 1–223.
- Goldenberg, R., Almeda, F., Caddah, M.K., Martins, A.B., Meirelles, J., Michelangeli, F.A. & Weiss, M. (2013) Nomenclator botanicus for the neotropical genus *Miconia* (Melastomataceae, Miconieae). *Phytotaxa* 106 (1): 1–171.
<http://dx.doi.org/10.11646/phytotaxa.106.1.1>
- Hammer, Ø., Harper, D.A.T. & Ryan, P.D. (2001) PAST: Palaeontological Statistics software package for education and data analysis (version 2.12, October 2011). *Palaeontologia Electronica*, 4(1): 9.
- Hammer, Ø. & Harper, D.A.T. (2006) *Paleontological data analysis*. Blackwell Publishing, Maiden, Massachusetts, 351 pp.
- Hernández-Camacho, J., Hurtado-Guerra, A., Ortiz-Quijano, R. & Walschburger, T. (1992a) Centros de endemismo en Colombia. In: Halffter, G. (Comp.) *La diversidad biológica de Iberoamérica I*. Acta Zoológica Mexicana, pp. 175–190.
- Hernández-Camacho, J., Hurtado-Guerra, A., Ortiz-Quijano, R. & Walschburger, T. (1992b) Unidades biogeográficas de Colombia. In: Halffter, G. (Comp.) *La diversidad biológica de Iberoamérica I*. Acta Zoológica Mexicana, pp. 106–151.
- Hernández-Camacho, J. & Sánchez, H. (1992) Biomas terrestres de Colombia. In: Halffter, G. (Comp.) *La diversidad biológica de Iberoamérica I*. Acta Zoológica Mexicana, pp. 153–173.
- Hernández-Camacho, J., Walschburger, T., Ortiz Quijano, R. & Hurtado Guerra, A. (1992c) Origen y distribución de la biota suramericana y colombiana. In: Halffter, G. (Comp.) *La diversidad biológica de Iberoamérica I*. Acta Zoológica Mexicana, pp. 55–104.
- Idárraga-García, J. & Romero, J. (2010) Neotectonic study of the Santa Marta Fault System, Western foothills of the Sierra Nevada de Santa Marta, Colombia. *Journal of South American Earth Sciences, Special Issue: Sierra Nevada de Santa Marta and adjacent basins* 29(4): 849–860.
<http://dx.doi.org/10.1016/j.jsames.2009.11.004>
- Irving, E.M. (1975) Structural evolution for the northernmost Andes, Colombia. *United States Geological Survey* 846: 1–47.
- Jaccard, P. (1912) The distribution of the flora of the alpine zone. *New Phytologist* 11: 37–50.
- Jiménez-Ferbans, L., Amat-García, G. & Reyes-Castillo, P. (2012) Nueva especie de *Passalus* Fabricius, 1972 (Coleoptera: Scarabaeoidea: Passalidae) de la Sierra Nevada de Santa Marta, Colombia. *Acta Zoológica Mexicana* 28 (3): 607–612.
- Kaplan, M. (1997) A New Species of *Colostethus* from the Sierra Nevada de Santa Marta (Colombia) with Comments on Intergeneric Relationships within the Dendrobatidae. *Journal of Herpetology* 31 (3): 369–375.
<http://dx.doi.org/10.2307/1565665>
- Kreft, H. & Jetz, W. (2007) Global patterns and determinants of vascular plant diversity. *Proceedings of the National Academy of Sciences USA* 104: 5925–5930.
<http://dx.doi.org/10.1073/pnas.0608361104>
- Kury, A. & Pérez, A. (2002) A new family of Laniatores from northwestern South America (Arachnida, Opiliones). *Revista Ibérica de Aracnología* 6: 3–11.
- Leistikow, A. (2001) A new species of terrestrial Isopoda from the Sierra Nevada de Santa Marta, Colombia (Crustacea: Oniscidea: *Crinocheta*). *Studies on Neotropical Fauna and Environment* 36 (2): 151–158.
<http://dx.doi.org/10.1076/snfe.36.2.151.2140>
- Le Saout, S., Hoffmann, M., Shi, Y., Hughes, A., Bernard, C., Brooks, T.M., Bertzky, B., Butchart, S.H.M., Stuart, S.N., Badman, T. & Rodrigues, A.S.L. (2013) Protected areas and effective biodiversity conservation. *Science* 342: 803–805.
<http://dx.doi.org/10.1126/science.1239268>
- Lozano-Contreras, G. (1984) Comunidades vegetales del flanco norte del cerro El Cielo y la flora vascular del Parque Nacional Natural Tairona (Magdalena, Colombia). In: van der Hammen, T. & Ruiz, P.M. (Eds.) *Studies on tropical Andean ecosystems, ECOANDES Vol.2: La Sierra Nevada de Santa Marta (Colombia) - transecto Buritaca-La Cumbre*. J. Cramer, Berlin, Stuttgart, pp. 407–422.
- Lynch, J.D. & Ruiz-Carranza, P.M. (1985) A synopsis of the frogs of the genus *Eleutherodactylus* from the Sierra Nevada de Santa Marta, Colombia. *Occasional papers of the museum of Zoology University of Michigan. Ann. Arbor* 711: 1–59.
- MELNames (2013) A Database with Names of Melastomataceae -Melastomataceae.Net. Available from: <http://www.melastomataceae.net/MELnames/> (accessed January–July 2013).
- Michelangeli, F. & Cotton, E. (2008) Melastomataceae. In: Hokche, O., Berry, P.E. & Huber, O. (Eds.) *Nuevo Catálogo de la Flora Vascular de Venezuela*. Fundación Instituto Botánico de Venezuela, Caracas, pp. 466–484.
- Michelangeli, F. & Bécquer-Granados, E. (2012) Melastomataceae. In: Acevedo-Rodríguez, P. & Strong, M.T. (Eds.) *Catalogue of Seed*

Plants of the West Indies. Smithsonian Institution. Scholarly Press. Washington, pp. 531–562.

- Michelangeli, F., Nicolas, A., Reginato, M., Kriebel, R., Ocampo, G., Almeda, F., Judd, W. & Goldenberg, R. (2013) Biogeography of the tribe Miconieae (Melastomataceae) reveals a complex pattern of dispersal and repetitive colonization of new environments. *Scientific Abstracts no. 694. Botany 2013*, New Orleans, Louisiana, USA. July 27–31.
- Mittermeier, R.A., Robles-Gil, P., Hoffmann, M., Pilgrim, J.D., Brooks, T.M., Mittermeier, C.G. & Fonseca, G. (2004) *Hotspots Revisited: Earth's Biologically Richest and Most Endangered Ecoregions*. Second Edition. Cemex, Mexico, 391 pp.
- Montero-Abril, F. & Ortiz-Pérez, M. (2010) Descripción de los estados inmaduros de *Morpho rhodopteron nevadensis* (Lepidoptera: Nymphalidae: Morphinae). *Tropical Lepidoptera Research* 20(2): 73–78.
- Montes, C., Guzman, G., Bayona, G., Cardona, A., Valencia, V. & Jaramillo, C. (2010) Clockwise rotation of the Santa Marta massif and simultaneous Paleogene to Neogene deformation of the Plato-San Jorge and Cesar-Rancheria basins. *Journal of South American Earth Sciences, Special Issue: Sierra Nevada de Santa Marta and adjacent basins* 29(4): 832–848.
<http://dx.doi.org/10.1016/j.jsames.2009.07.010>
- Morales, J.F. (2006) Estudios en las Apocynaceae neotropicales XXIII: una nueva especie de *Mandevilla* (Apocynoideae, Mesechitae) y nuevos reportes en las Apocynaceae (Apocynoideae, Rauvolfioideae) de Colombia. *Anales del Jardín Botánico de Madrid* 63 (1): 51–54.
<http://dx.doi.org/10.3989/ajbm.2006.v63.i1.17>
- Morillo, G. (1990) Veinte Asclepiadaceae sudamericanas nuevas para la ciencia y una nueva combinación. *Anales del Jardín Botánico de Madrid* 47 (2): 350–54.
- Muller, H.G. & Heimer, S. (1988) Spiders from Colombia VII. A new species of *Symphysa* from the Sierra Nevada de Santa Marta (Arachnida, Araneida, Agelenidae) *Bulletin of the British Arachnological Society* 7 (7): 209–210.
- Muñoz-Saba, Y. & Hoyos-R., M.A. (2012) Los mamíferos del Caribe Colombiano. In: Rangel, J.O. (Ed.) *Colombia Diversidad Biótica XII: La región Caribe de Colombia*. Universidad Nacional de Colombia - Instituto de Ciencias Naturales. Bogotá D.C., pp. 703–721.
- Neill, D.A. & Ulloa Ulloa, C. (2011) *Adiciones a la Flora del Ecuador: Segundo suplemento, 2005–2010*. Fundación Jatun Sacha – Missouri Botanical Garden, 202 pp.
- Ojeda, G.Y. & Cardona, A. (Eds.) (2010) Sierra Nevada de Santa Marta and adjacent basins. [Special Issue] *Journal of South American Earth Sciences* 29(4): 761–870.
- Parra-O., C. (2001) Una nueva especie de *Calypttranthes* Sw. (Myrtaceae) de Colombia. *Caldasia* 23 (2): 435–439.
- Parra-O., C. (2012) Una nueva especie de *Myrcianthes* (Myrtaceae) de Colombia. *Caldasia* 34 (2): 277–282.
- Peaklist (2014) WORLD TOP 50. Available from: <http://www.peaklist.org/WWlists/WorldTop50.html> (accessed May 2014).
- Pérez-Preciado, A. (1984) Climatological aspects of the Sierra Nevada de Santa Marta. In: van der Hammen, T. & Ruiz, P.M. (Eds.) *Studies on tropical Andean ecosystems, ECOANDES Vol.2: La Sierra Nevada de Santa Marta (Colombia) - transecto Buritaca-La Cumbre*. J. Cramer, Berlin, Stuttgart, pp. 33–44.
- Prance, G.T. & Campbell, D.G. (1988) The present state of tropical floristics. *Taxon* 37 (3): 519–548.
<http://dx.doi.org/10.2307/1221097>
- Rangel, J.O. & Garzón, A. (1995) Sierra Nevada de Santa Marta. In: Rangel, J.O. (Ed.) *Colombia Diversidad Biótica I*. Universidad Nacional de Colombia - Instituto de Ciencias Naturales. Bogotá, pp. 155–170.
- Rangel, J.O. & Jaramillo-Mejía, R. (1984) Lista comentada del material herborizado en el transecto Buritaca – La Cumbre (Sierra Nevada de Santa Marta). In: van der Hammen, T. & Ruiz, P.M. (Eds.) *Studies on tropical Andean ecosystems, ECOANDES Vol.2: La Sierra Nevada de Santa Marta (Colombia) - transecto Buritaca-La Cumbre*. J. Cramer, Berlin, Stuttgart, pp. 155–176.
- Renner, S. (1999) Melastomataceae. In: Jørgensen, P.M. & León-Yáñez, S. (Eds.) *Catalogue of Vascular Plants of Ecuador. Monographs in Systematic Botany from the Missouri Botanical Garden* 75: 561–585.
- Renner, S. (In press) Melastomataceae. In: Jørgensen, P.M., Nee, M.H. & Beck, S.G. (Eds.) *Catálogo de las plantas vasculares de Bolivia. Monographs in Systematic Botany from the Missouri Botanical Garden*.
- Renner, S.S. & Hausner, G. (2000) New Species of *Siparuna* (Siparunaceae) III. Three New Species and One Newly Ranked Entity from Colombia, Ecuador, and Peru. *Novon* 10: 134–143.
<http://dx.doi.org/10.2307/3393014>
- Robinson, H. (2006) New species of *Ageratina* from Andean South America (Eupatorieae: Asteraceae). *Phytologia* 88 (2): 154–175.
- Romoleroux, K. (2009) New Species of *Lachemilla* (Rosaceae) from South America. *Novon* 19(4): 502–506.
<http://dx.doi.org/10.3417/2006054>
- Särkinen, T., Pennington, R.T., Lavin, M., Simon, M.F. & Hughes, C.E. (2012) Evolutionary islands in the Andes: persistence and isolation explain high endemism in Andean dry tropical forests. *Journal of Biogeography* 39: 884–900.
<http://dx.doi.org/10.1111/j.1365-2699.2011.02644.x>
- Sawyer, N.W. (2007) *Deprea nubicola* (Solanaceae), a new species from northern Colombia. *Brittonia* 59: 54–56.
- Shi, G.R. (1993) Multivariate data analysis-in palaeoecology and palaeobiogeography -a review. *Palaeogeography, Palaeoclimatology,*

Palaeoecology 105: 199–234.

- Sklenář, P. (2008) Two New Species of *Cerastium* (Caryophyllaceae) from the Equatorial Andes. *Novon* 18(1): 104–108.
<http://dx.doi.org/10.3417/2006009>
- Solari, S., Muñoz-Saba, Y., Rodríguez-Mahecha, J.V., Defler, T.R., Ramírez-Chaves, H.E. & Trujillo, F. (2013) Riqueza, endemismo y conservación de los mamíferos de Colombia. *Mastozoología Neotropical* 20(2): 301–365.
- Sørensen, T. (1948) A method of establishing groups of equal amplitude in plant sociology based on similarity of species content. *Biologiske Skrifter, Kongelige Danske videnskabernes Selskab* 5: 1–34.
- Stančík, D. (2003) New endemic taxa of *Festuca* from the Colombian Sierra Nevada de Santa Marta. *Preslia* 75: 339–347.
- Strewe, R. & Navarro, C. (2004) New and noteworthy records of birds from the Sierra Nevada de Santa Marta region, north-eastern Colombia. *Bulletin British Ornithologists Club* 124 (1): 38–51.
- IPNI (2013) The International Plant Names Index. Available from <http://www.ipni.org> (accessed January–July 2013).
- Tschanz, C., Marvin, R., Cruz, J., Mehnert, H. & Cebula, E. (1974) Geologic evolution of the Sierra Nevada de Santa Marta. *Geological Society of America Bulletin* 85: 273–284.
- Ulloa Ulloa, C. & Neill, D.A. (2005) *Cinco años de adiciones a la flora del Ecuador: 1999–2004*. UTPL, Missouri Botanical Garden, Funbotanica. Editorial Universidad Técnica Partícula de Loja, Loja, 75 pp.
- Ulloa Ulloa, C., Zarucchi, J.L. & León, B. (2004) *Diez años de adiciones a la flora del Perú: 1993–2003*. Arnaldoa, Edición Especial, Nov. 2004, pp. 1–242.
<http://dx.doi.org/10.5962/bhl.title.63538>
- Van der Hammen, T. (1976) The Pleistocene changes of vegetation and climate in tropical South America. *Journal of Biogeography* 1: 3–26.
<http://dx.doi.org/10.2307/3038066>
- Wallnöfer, B. (1997) A revision of *Styrax* L. section *Pamphilia* (Mart. ex A. DC.) B. Walln. (Styracaceae). *Annalen des Naturhistorischen Museums in Wien* 99B: 681–720.
- Wasshausen, D.C. (1985) *Kalbreyeracanthus kirkbridei* (Acanthaceae), a new species from Colombia. *Brittonia* 37: 199–202.
<http://dx.doi.org/10.2307/2806110>
- Weigend, M. (1996) Notes on *Loasa* III: proper use of the name *Loasa grandiflora* Desr. and a new species from Colombia. *Sendtnera* 3: 236–253.
- Weigend, M. (1997) *Nasa and the conquest of South America*. Ph.D. Thesis, Ludwigs-Maximilians-Universität, Munich, 249 pp.
- Weigend, M. (2006) Validating subfamily, genus and species names in Loasaceae (Cornales). *Taxon* 55: 463–468.
<http://dx.doi.org/10.2307/25065594>
- Wurdack, J.J. (1976) Endemic Melastomataceae of the Sierra Nevada de Santa Marta, Colombia. *Brittonia* 28(1): 138–143.
<http://dx.doi.org/10.2307/2805565>
- Wurdack, J.J. (1978) Certamen Melastomataceis XXVII. *Phytologia* 38: 287–307.
- Wurdack, J.J. (1993) Melastomataceae (Topobea). In: Görts-van Rijn, A.R.A. (Ed.) *Flora of the Guianas*. Series A. Phanerogams 99, Issue 13. Koeltz Scientific Books, Königstein, pp. 298–300.
- Wurdack, J.J., Morley, T. & Renner, S. (1993) Melastomataceae. In: Görts-van Rijn, A.R.A. (Ed.) *Flora of the Guianas*. Series A. Phanerogams 99, Issue 13. Koeltz Scientific Books, Königstein, pp. 1–425.