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

MARCELA ALVEAR[1], GILBERTO OCAMPO[1], CARLOS PARRA-O.[2], EDUINO CARBONÓ[3] AND FRANK ALMEDA[1]

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 (Clausing 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).

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The Sierra Nevada de Santa Marta (SNSM), the world's highest and steepest coastal mountain is an isolated massif of 12,000 km^2 in northern Colombia (Figures 1, 2) that rises abruptly from a Caribbean seafloor depth of approximately 4,000 m below sea level to a height of 5,775 m above sea level at its summit. This massif with perennial snowy peaks (Pico Cristóbal Colón is the highest in Colombia) is a displaced fault-bounded block which is isolated from the continuous Andean ranges by wide alluvial plains which are almost at sea level (Tschanz *et al.* 1974, Pérez-Preciado 1984, Cardona & Ojeda 2010, Idárraga-García & Romero 2010, Cardona *et al.* 2011a). The SNSM is located only about 50 km from the coast and is the world's fifth most prominent summit (Peaklist 2014). The geomorphology and geological evolution of the SNSM is among the most complex in Colombia because of a unique combination of different rock origins and uplift ages (see Tschanz *et al.* 1974, Irving 1975, Bartels 1984, Montes *et al.* 2010, Ojeda & Cardona 2010, Cardona *et al.* 2011a, 2011b). The complexity of the massif results from its position near the leading (northwest) corner of the westward-drifting Mesozoic continent and near the intersection of the subduction systems along Pacific and Caribbean margins. The SNSM massif is therefore an extreme, small-scale example of a much larger regional structural mosaic (Tschanz *et al.* 1974). Recent studies suggest that the SNSM massif was part of a continuous Andean Cordillera, and later became fragmented from the previous Cordillera Central-Santa Marta massif province around the Paleogene by Cenozoic Caribbean tectonics (Castro-López & Cardona-Molina 2010, Montes *et al.* 2010, Cardona *et al.* 2011a, 2011b). On the other hand, the history of its uplift is divided in different phases during the Cenozoic, with the major uplifts occurring in the Paleocene-Eocene (between 65 and 45 mya), in the Oligocene (between 25 and 8 mya) and Late Miocene (from 8 mya) (Castro-López & Cardona-Molina 2010, Montes *et al.* 2010, Cardona *et al.* 2011b).

The SNSM is part of the Tropical Andes biodiversity hotspot (Mittermeier *et al.* 2004). This hotspot comprises several distinct biomes, where high overall species diversity has been associated with the distinct evolutionary history of their floras and physiographic heterogeneity (Kreft & Jetz 2007, Särkinen *et al.* 2012). In this context, the SNSM is an important component of the Tropical Andes biodiversity hotspot because its extensive topographic relief and microclimatic gradients contribute to its complex environmental heterogeneity. Thus, the massif contains a mosaic of globally significant biomes (nearly all those to be found in tropical America) from mangroves, semi-deserts, tropical dry and wet forests to montane forests and páramos (Cleef *et al*. 1984, Pérez-Preciado 1984, Hernández-Camacho & Sánchez 1992, Cardona & Ojeda 2010). The SNSM is also one of the last refuges where ancient pre-Columbian cultures still survive; it is considered an indigenous reserve and natural national park by the Colombian government, and was declared a Biosphere Reserve and a World Heritage site by UNESCO in 1979 (Cardona & Ojeda 2010). Because of its unique biological diversity, the SNSM massif has been considered a continental island (Adams 1973, Cleef *et al.* 1984). The SNSM National Park is also among the world's most irreplaceable protected areas for conservation of amphibian, bird, and mammal species (Le Saout *et al.* 2013). A significant number of reptile, amphibian, mammal, and lepidopteran species are endemic to the SNSM (Lynch & Ruiz-Carranza 1985, Montero-Abril & Ortiz-Pérez 2010, Carvajal-Cogollo *et al.* 2012, Muñoz-Saba & Hoyos-R. 2012, Solari *et al*. 2013), and new species of arachnids, crustaceans, coleopterans, lepidopterans, amphibians, reptiles, and birds have recently been described from the massif (e.g. Muller & Heimer 1988, Kaplan 1997, Leistikow 2001, Kury & Pérez 2002, Bernal & Roze 2005, Bálint & Wojtusiak 2006, Camero-R. 2010, Jiménez-Ferbans *et al.* 2012, Donegan *et al.* 2013). Because of its high number of endemic bird taxa (18 species and 55 subspecies), the SNSM represents the world's single-most important continental avian center of endemism. Also, the SNSM is a highly strategic stopover for neotropical migrant bird species travelling from the Caribbean to South America, with a total number of 673 bird species registered in 2004 (Strewe & Navarro 2004).

The flora of the SNSM also exhibits high levels of endemism (Wurdack 1976, Cleef *et al.* 1984, Ayers & Boufford 1988, Carbonó & Lozano-Contreras 1997, Hernández-Camacho *et al*. 1992a, 1992b, Alvear 2010, Alvear & Almeda 2014). Although the SNSM has been the focus of a number of botanical explorations and research efforts (Cleef & Rangel 1984, Cleef *et al.* 1984, Lozano-Contreras 1984, Rangel & Jaramillo-Mejía 1984, Carbonó & Lozano-Contreras 1997, Rangel & Garzón 1995) much of the massif still remains insufficiently explored (Forero 1988, Prance & Campbell 1988) and inadequately collected because of limited roads and challenging terrain. Despite these limitations, the discovery of new genera and species of flowering plants continues. New genera have recently been described in the Poaceae (*Agrostopoa*; Davidse *et al.* 2009) and the Cytinaceae (*Sanguisuga*; Fernández-Alonso & Cuadros-Villalobos 2012). In addition, numerous new species have been described either subsequent to the summary by Carbonó & Lozano-Contreras (1997) or were not included in that publication. For instance, 26 new species were described from the following families: Acanthaceae (Wasshausen 1985), Apocynaceae (Morales 2006), Asclepiadaceae (Morillo 1990), Asteraceae (Díaz-Piedrahíta & Bueno 1997; Robinson 2006), Caryophyllaceae (Sklenář 2008), Cytinaceae (Fernández-Alonso & Cuadros-Villalobos 2012), Geraniaceae (Aedo *et al.* 2003, Aedo 2009), Lamiaceae (Fernández-

Alonso 2003), Loasaceae (Weigend 1996, 1997, 2006), Malvaceae (Fernández-Alonso 2002), Melastomataceae (Alvear & Almeda 2014), Monimiaceae (Renner & Hausner 2000), Myrtaceae (Parra-O. 2001, 2012), Orchidaceae (Dalström 2012), Poaceae (Stančík 2003; Davidse *et al.* 2009), Rosaceae (Romoleroux 2009), Solanaceae (Sawyer 2007), Styracaceae (Wallnöfer 1997), and Valerianaceae (Bernal 2009). Most of these new species are still only known from the type collections.

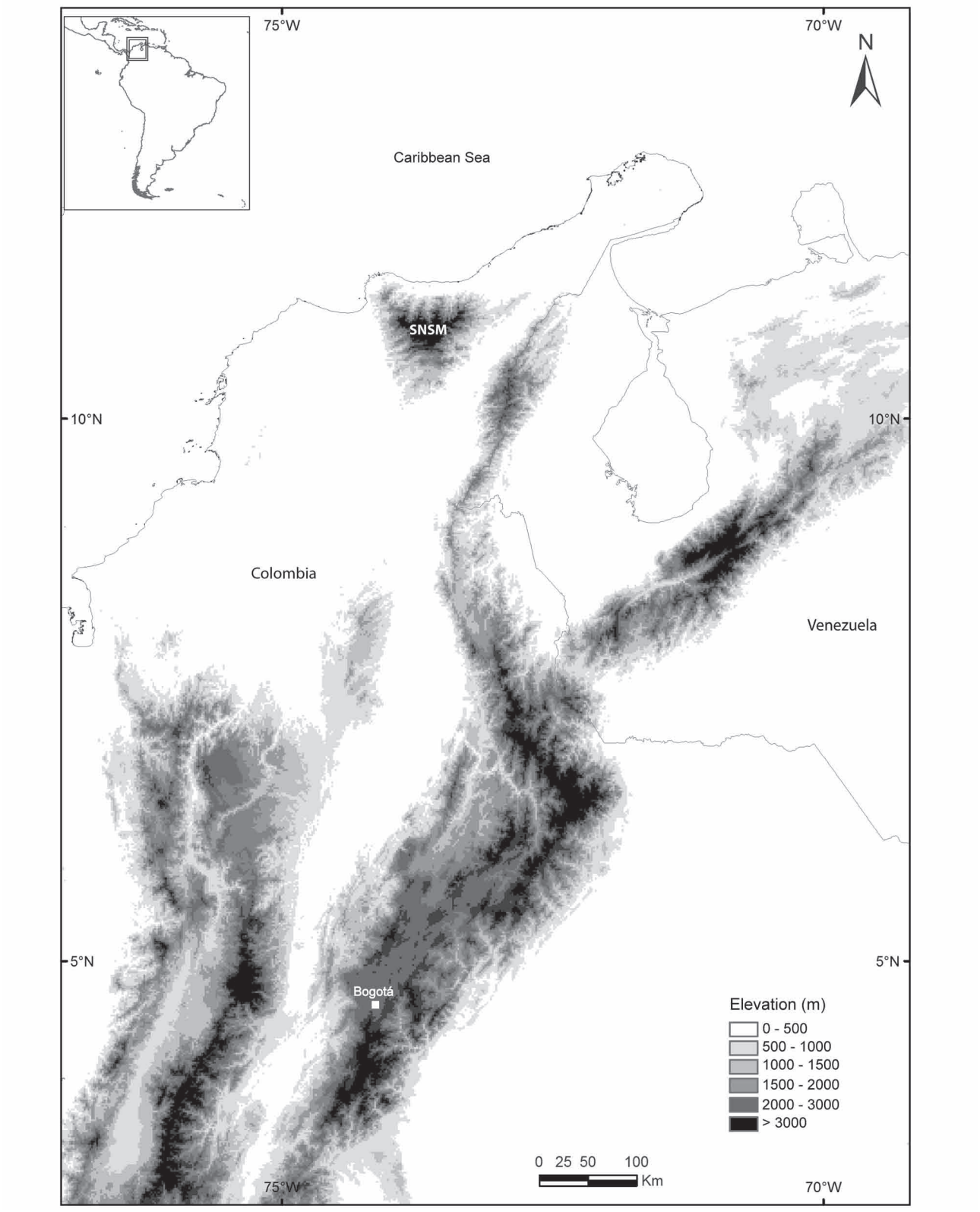

FIGURE 1. Location of the Sierra Nevada de Santa Marta (SNSM), Colombia.

The Melastomataceae, in particular, have an important number of species that are endemic to the SNSM (Wurdack 1976, Alvear 2010, Alvear & Almeda 2014) (Some examples in Figure 2). In this study we include all the currently known species of Melastomataceae that occur on this massif. Our investigation is based on the study of herbarium material, our own recent collections, publications, and online databases. For each species we include information about nomenclatural types and basionyms, habit or growth form, elevation, geographic distribution in Colombia and the neotropics generally, as well as a representative voucher. Using data from the forthcoming Catalogue of the Plants of Colombia (Bernal *et al.* 2014), our collections, and other published data, we performed similarity analyses to compare Melastomataceae diversity of the SNSM with the biogeographic regions of Colombia and with neotropical countries or regions (Brazil, Mesoamerica, the West Indies, Venezuela, Ecuador, Peru, Bolivia, and the Guianas). This study, which highlights one of the most diverse flowering plant families in the neotropics, intends to provide an additional source of data to support conservation efforts focused on the SNSM (Aide & Cavelier 1994, Carbonó & Lozano-Contreras 1997, Cavelier *et al.* 1998).

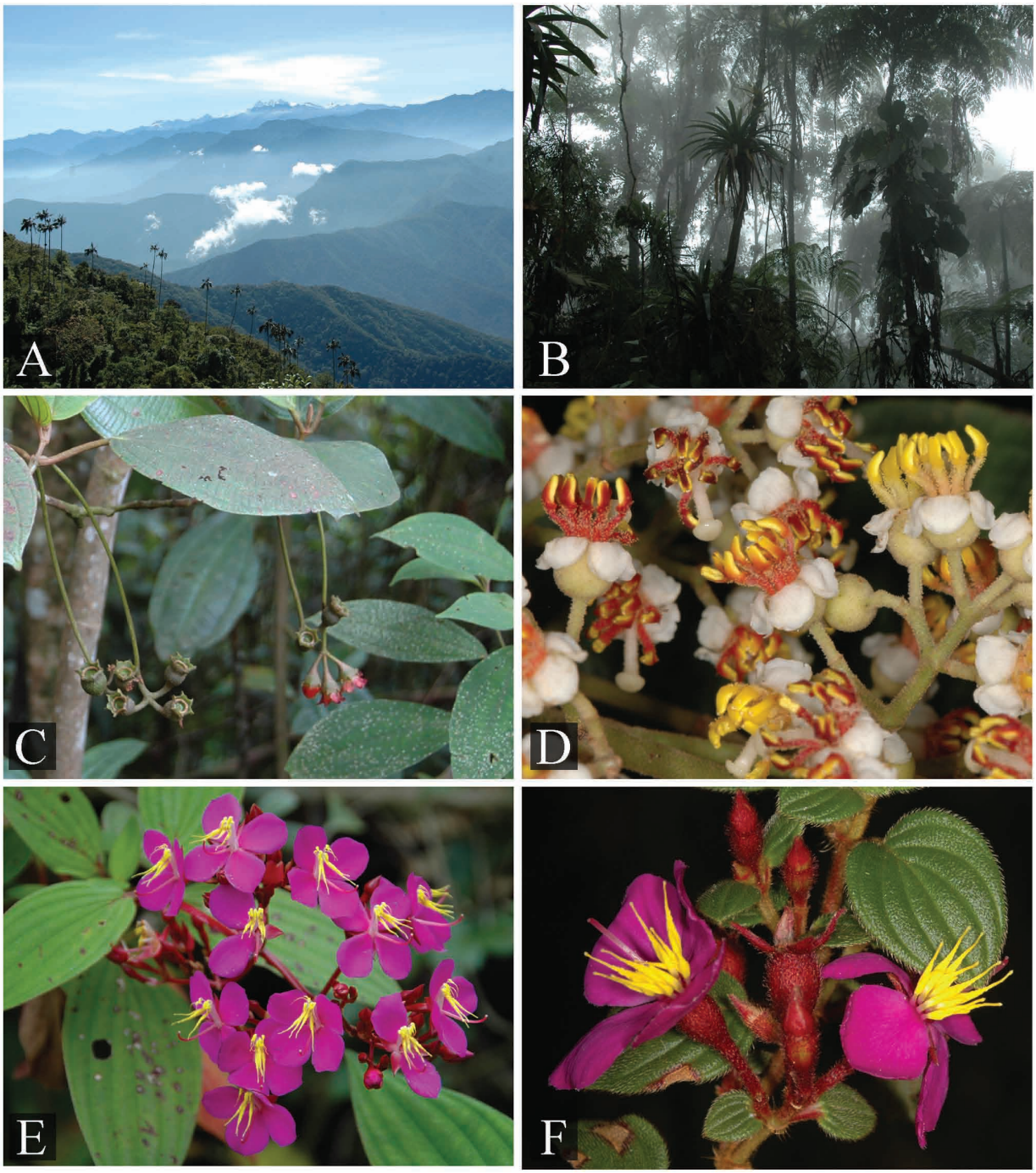

FIGURE 2. Representative species of Melastomataceae and habitats of the SNSM. A. View of the main massif peaks from Cerro Kennedy. B. Cloud forest. C. *Huilaea kirkbridei*. D. *Miconia floribunda*. E. *Monochaetum magdalenense*. F. *Monochaetum rotundifolium*. All photos by F. Almeda.

Methods

The checklist of the Melastomataceae of the SNSM was based on the study of herbarium collections [California Academy of Sciences Herbarium (CAS), Herbario Nacional Colombiano (COL), Herbario de la Universidad del Valle (CUVC), Herbario del Instituto Alexander von Humboldt (FMB), Herbario de la Universidad de Pamplona (HECASA), Herbario de la Universidad de Antioquia (HUA), US National Herbarium (US), Herbario de la Universidad del Magdalena (UTMC)], information from the TROPICOS database at the Missouri Botanical Garden Herbarium (MO), the results of collecting expeditions conducted by the authors, and an extensive literature search. Accepted species names were verified by using The International Plant Names Index (IPNI) 2013 and MELnames 2013 online databases.

The following information was included for each species occurring in the SNSM: basionym, country of origin for the type specimen and herbarium repository, habits documented for the species, whether the species is endemic to the SNSM or to Colombia, elevational range (for the species in Colombia), distribution within Colombia (by state and biogeographic region, see below) and/or distribution in the Americas (if applicable), and additional notes (e.g., species known only from the type or from few collections). All species occurrences are documented by a herbarium specimen collected in the SNSM.

The distribution of each species was determined following the biogeographic regions proposed in the Catalogue of the Plants of Colombia (Bernal *et al.* 2014). The ten considered biogeographic regions of Colombia are:

- *Amazonia*. The Amazon region east of the Andes, up to about 500 m and north to the Guaviare River, excluding the Guayana Shield formations.
- *Andes*. The Andean Cordillera, above 500 m on the Amazon and Pacific slopes, and above 1000 m in the Cauca and Magdalena River valleys. It includes rather isolated massifs, like the Serranía de San Lucas.
- *Guayana & Macarena*. Guayana Shield formations in the departments of Guainía, Vaupés, Guaviare, Caquetá, and the Serranía de La Macarena in the department of Meta. It extends south to Araracuara, on the Caquetá River.
- *Caribbean Islands*. The archipelago of San Andrés, Providencia, Santa Catalina and adjacent cays.
- *Caribbean lowlands* (Caribe). Lowlands in northern Colombia, up to about 500 m. It extends south to the lower Cauca River, near the northern end of Serranía de San Lucas to the westernmost hills of the Serranía de Abibe.
- *Eastern Plains* (Orinoquía). Savannas east of the Andes and north of the Guaviare River, and up to about 500 m on the Andean slopes.
- *Pacific lowlands* (Pacífico). Lowlands west of the Andes, up to about 500 m. Extends north to Urabá, Darién, and the upper Sinú River. Includes the Serranías del Darién and Baudó, which exceed 1,000 m, but are too poorly explored to separate them as different regions.
- *Sierra Nevada de Santa Marta* (SNSM). The whole massif above ca. 500 m.
- *Cauca River valley* (V Cauca). The basin of the Cauca River, up to ca. 1,000 m. It is a major intermountain river valley that extends north to the northern end of the Cordillera Central, near Tarazá.
- *Magdalena River valley* (V Magdalena). The basin of the Magdalena River, up to ca. 1000 m. It is a major intermountain river valley that extends north to the northern end of Serranía de San Lucas.

The abbreviations used for the departamentos (states) of Colombia are: AMA: Amazonas. ANT: Antioquia. ARA: Arauca. ATL: Atlántico. BOL: Bolívar. BOY: Boyacá. CAL: Caldas. CAQ: Caquetá. CAS: Casanare. CAU: Cauca. CES: Cesar. CHO: Chocó. CÓR: Córdoba. CUN: Cundinamarca. GUI: Guainía. GUV: Guaviare. HUI: Huila. MAG: Magdalena. MET: Meta. NAR: Nariño. NSA: Norte de Santander. PUT: Putumayo. QUI: Quindío. RIS: Risaralda. SAP: San Andrés y Providencia. SAN: Santander. SUC: Sucre. TOL: Tolima. VAL: Valle del Cauca. VAU: Vaupés. VIC: Vichada.

Infraspecific categories have been recognized for some species included in this catalogue (*Clidemia capitellata, C. ciliata, C. hirta, C. octona, Miconia albicans, M. dodecandra, M. ligustrina, M. prasina, M. spinulosa, M. theizans, M. tinifolia*, and *Tibouchina gracilis*). However, all of these taxa require further study to evaluate formally proposed infraspecific taxa. We here consider the above enumerated entities only at the specific level.

The resulting checklist of Melastomataceae was used to perform similarity analyses to compare the floristic composition of the SNSM to: a) the Colombian biogeographic regions and b) neotropical countries or regions. For the first comparison, the species and distribution data were taken from the Melastomataceae treatment for the Catalogue

of the Plants of Colombia (Almeda *et al.* in press). For the second one, the information was extracted from floras or catalogues of nine neotropical countries or regions: Colombia (Almeda *et al.* in press), Bolivia (Foster 1958, Renner (in press), Brazil (Baumgratz *et al.* 2013), Ecuador (Renner 1999, Ulloa Ulloa & Neill 2005, Neill & Ulloa Ulloa 2011), the Guianas (including Suriname, French Guiana and Guyana; Wurdack 1993, Wurdack *et al.* 1993, Almeda *et al.* 2007), Mesoamerica (including some southern Mexican states, Belize, Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, and Panama; Almeda 2009), Peru (Brako 1993, Ulloa Ulloa *et al.* 2004), Venezuela (Michelangeli & Cotton 2008), and the West Indies (including the Bahama Archipelago, the Greater Antilles, and the Lesser Antilles; Michelangeli & Bécquer-Granados 2012). A thorough synonymy check was done to avoid duplication of information. Because *Miconia* is the largest genus in the family, the nomenclator of Goldenberg *et al.* (2013) was used to corroborate valid species names and current distributions. The data matrices for similarity analyses used an absence (0) / presence (1) coding. In order to analyze the SNSM as an independent region, its endemic species (15) were coded as absent from Colombia.

Similarity analyses were performed using the Palaeontological Statistics (PAST) program, version 2.12 (Hammer *et al.* 2001). We calculated the Jaccard similarity index (Jaccard 1912) and the Dice similarity index (also called the Sørensen coefficient; Dice 1945, Sørensen 1948). Both indices use binary (absence-presence) data, give emphasis to shared taxa, and ignore absences in the samples to be compared; however, the Dice similarity index is less sensitive to differences in sample size (Shi 1993, Hammer & Harper 2006). Distance matrices were calculated using the aforementioned indices, and they were the data source used to perform cluster analyses using the unweighted pair-group average algorithm (UPGMA).

Results

The Melastomataceae from the SNSM include 20 genera and 86 species (9% of the Colombian Melastomataceae diversity). Almost 25% of these species are endemic to Colombia (21 species, 6.7% of the endemic Colombian Melastomataceae) of which 18% (15 species) are restricted to the SNSM massif (Appendix 1).

Comparisons among biogeographic regions in Colombia

Within the biogeographic regions of Colombia, the Andes stand out as the richest region in terms of Melastomataceae species (641 species; 37 %) and endemic taxa (252 species; 67%) (Figure 3). It is followed by Amazonia and the Pacific lowlands (ca. 13% of species diversity in both regions; 237 and 224 species respectively), but the latter has a higher number of endemics (50 species; 13%) than Amazonia (12 species; 3%). Although the SNSM is among the regions with the fewest species in Colombia, it is the third richest region for endemic species after the Andes and the Pacific Lowlands.

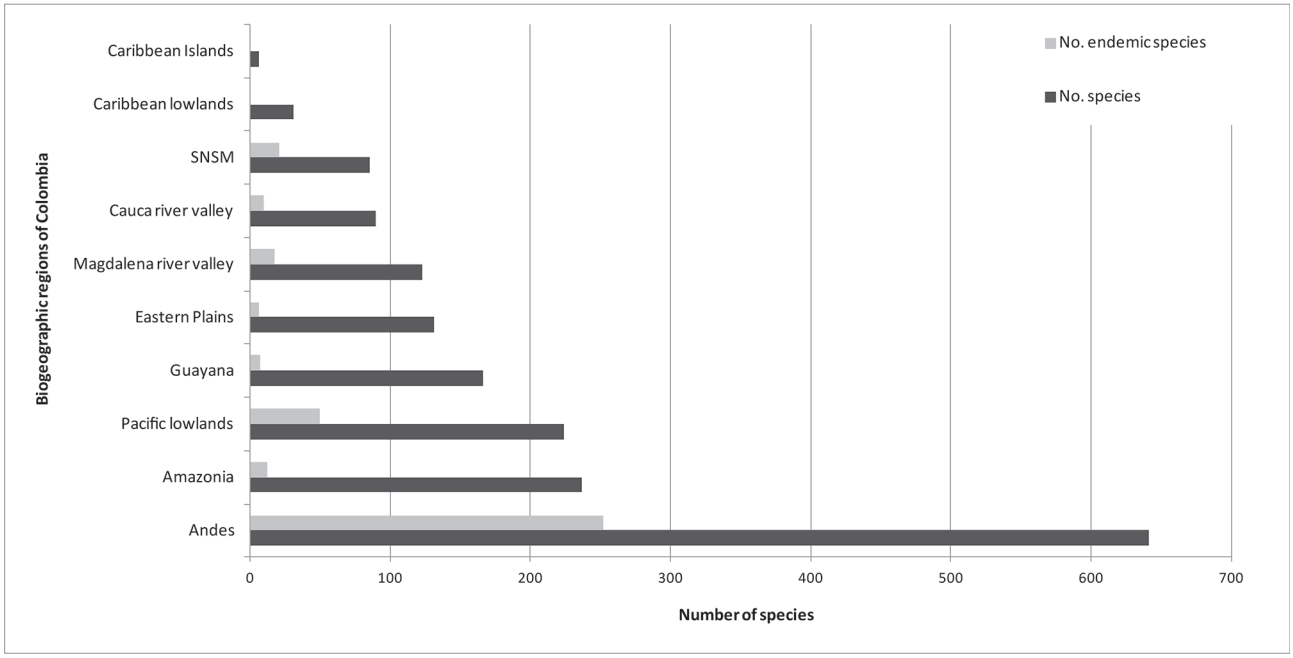

FIGURE 3. Number of species and endemic species of Melastomataceae by biogeographic regions in Colombia.

The similarity analyses comparing Melastomataceae species composition across the ten biogeographic regions of Colombia show that only the two inter-Andean major river valleys (V Cauca/V Magdalena) and the Magdalena Valley/Eastern Plains have similarity indices (both Dice and Jaccard) above 0.4 (Table 1).

TABLE 1. Similarity indices comparing the Melastomataceae present in the biogeographic regions of Colombia. Dice index values in the upper triangle, Jaccard index values in the lower triangle. Values above 0.4 are shown in bold.

Dice / Jaccard	Amazonia	Andes	Guayana	Carib. Islands	Carib. Lowlands	Eastern plains	Pacific	SNSM	V_Cauca	V_Magdalena
Amazonia	1	0.18	0.37	0.03	0.10	0.34	0.24	0.11	0.26	0.29
Andes	0.10	1	0.15	0.01	0.05	0.18	0.34	0.17	0.20	0.24
Guayana	0.22	0.08	1	0.01	0.08	0.36	0.19	0.15	0.23	0.28
Carib. Islands	0.02	0.01	0.01	1	0.27	0.09	0.03	0.02	0.08	0.06
Carib. Lowlands	0.06	0.03	0.04	0.16	1	0.23	0.13	0.22	0.23	0.23
Eastern plains	0.20	0.10	0.22	0.05	0.13	1	0.25	0.22	0.38	**0.43**
Pacific	0.14	0.21	0.10	0.01	0.07	0.15	1	0.16	0.38	0.38
SNSM	0.06	0.09	0.08	0.01	0.13	0.13	0.09	1	0.24	0.26
V_Cauca	0.15	0.11	0.13	0.04	0.13	0.23	0.23	0.14	1	**0.62**
V_Magdalena	0.17	0.14	0.17	0.03	0.13	0.28	0.23	0.15	0.45	1

Figure 4 shows the results of the cluster analyses using the Dice and Jaccard indices for the Melastomataceae in the biogeographic regions of Colombia. Two major groups emerge from both analyses: one cluster consists of the Caribbean Islands/Caribbean Lowlands regions and a second one groups all the remaining Colombian biogeographic regions. The SNSM is consistently positioned at the base of the second cluster in both analyses.

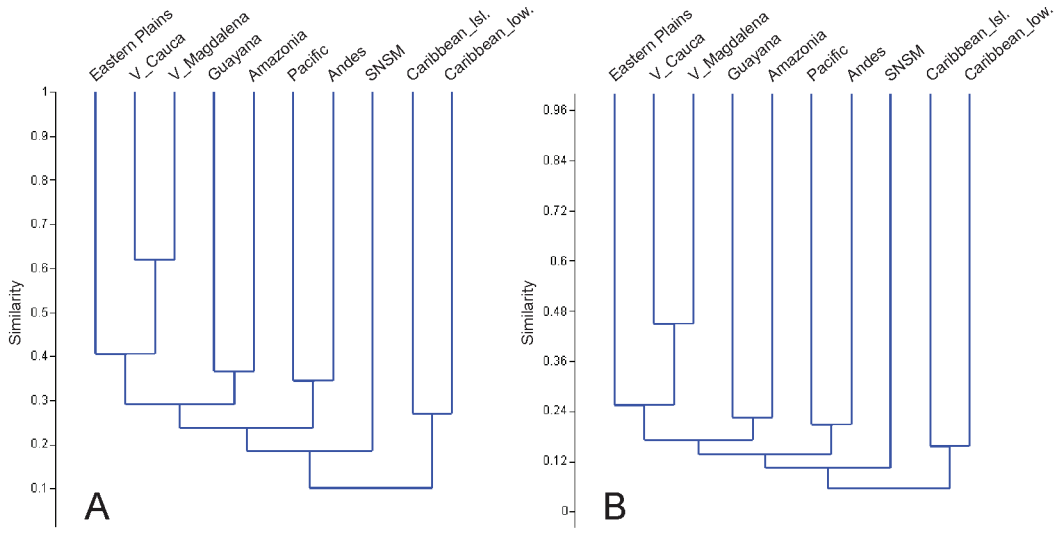

FIGURE 4. Cluster analyses for Melastomataceae diversity found in the ten biogeographic regions in Colombia. A) Cluster analysis using the Dice similarity index. B) Cluster analysis using the Jaccard similarity index. The analyses were done using the UPGMA algorithm.

Of the 71 species that are not endemic to the SNSM, 24 are found in both the SNSM and the Andes (34%). The remaining species are more widely distributed and are present in the SNSM and two or more areas, thus 43% of these species are found in four or more biogeographic regions (Table 2). All species found in four or more regions are present in the SNSM, the Andes, and a combination of two additional biogeographic regions.

TABLE 2. Number and percentage of SNSM non-endemic species distributed in one or more of the biogeographic regions in Colombia (the SNSN is always counted as an independent region). *= This region corresponds to the SNSM to account for two widely distributed species (*Clidemia monantha* and *Henriettea succosa*, primarily found in Mesoamerica) that in Colombia are only found there.

Number of biogeographic regions of Colombia where the species is found	Number of spp.	Percentage of spp.
2	26	37
3	13	19
6	9	13
4	6	9
8	5	7
5	4	6
9	4	6
1*	2	3
7	2	3

Comparisons among neotropical countries or regions

The number of genera and endemic genera per country or region within the neotropics is shown in Figure 5. Brazil stands out as the richest country for total number of genera (63) and endemic genera (17); the second richest countries are Colombia (58) and Venezuela (53), both with similar numbers for overall generic richness.

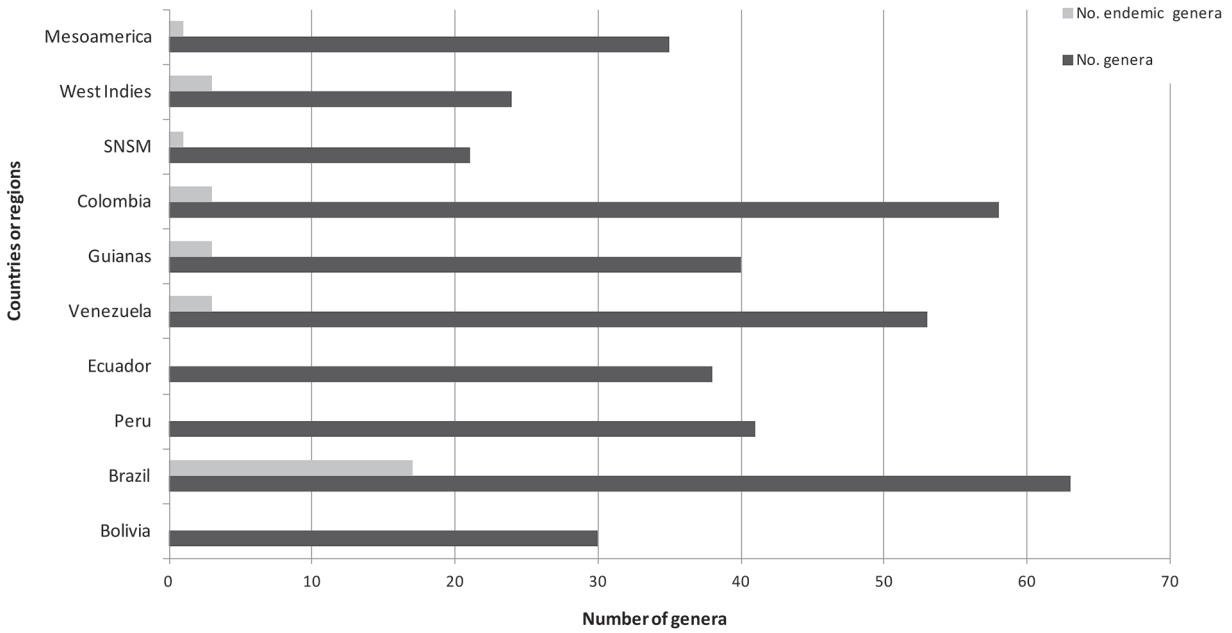

FIGURE 5. Number of genera and endemic genera of Melastomataceae by neotropical countries and regions.

The number of species and endemic species per country or region within the neotropics is presented in Figure 6. Again, Brazil stands out as the richest country for total number of species (1,336) and endemic species (846). Brazil is followed by Colombia, which has almost twice as many Melastomataceae species than Mesoamerica and three times more than the Guianas. Colombia has about 40% more Melastomataceae species than Ecuador and 35% more than Venezuela.

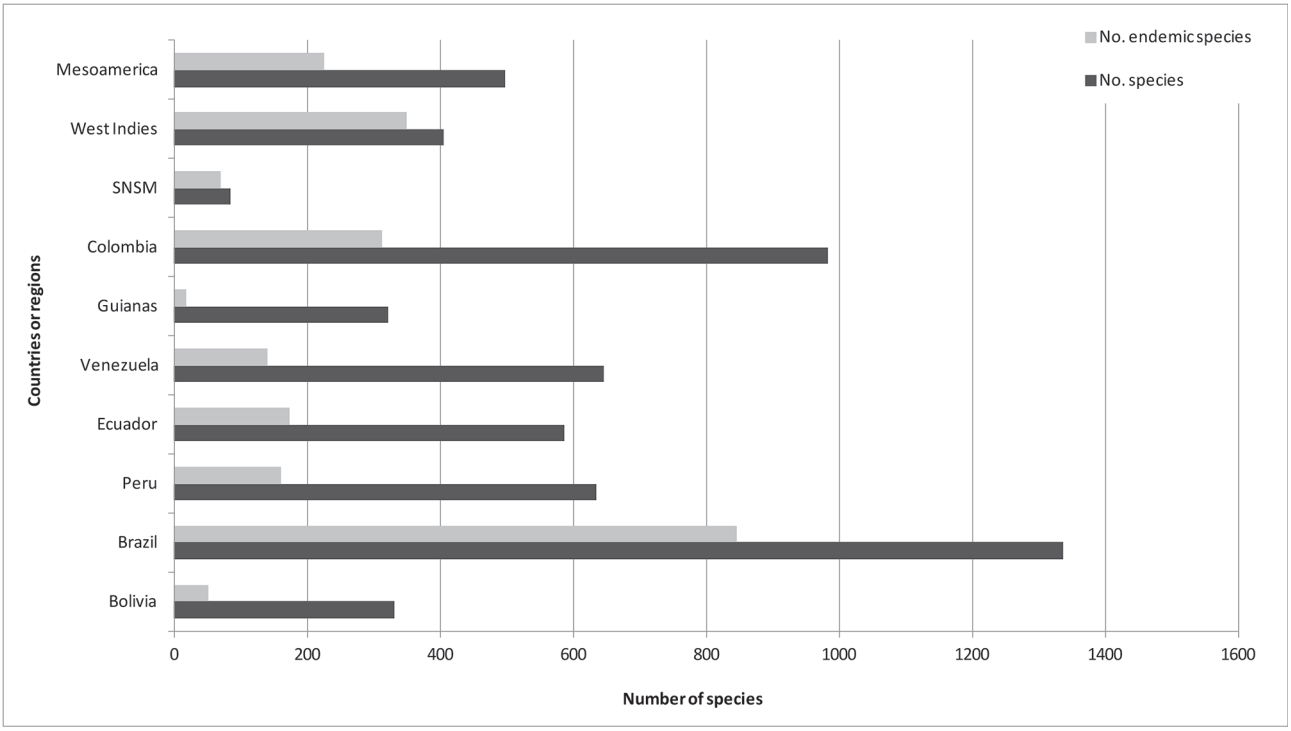

FIGURE 6. Number of species and endemic species of Melastomataceae by neotropical countries and regions.

When comparing the species of Melastomataceae present in the SNSM and the other countries or regions in the neotropics, the similarity indices (Table 3) indicate that none of the pairs of countries or regions have a similarity above 0.5.

TABLE 3. Similarity indices comparing the Melastomataceae present in neotropical countries or regions. Dice index values in the upper triangle, Jaccard index values in the lower triangle. Values above 0.4 are shown in bold.

Dice / Jaccard	Mesoamerica	Colombia	SNSM	Brazil	Venezuela	Guianas	Ecuador	Peru	Bolivia	West Indies
Mesoamerica	1	0.30	0.15	0.10	0.21	0.17	0.25	0.18	0.18	0.10
Colombia	0.17	1	0.13	0.25	**0.44**	0.25	**0.41**	0.34	0.23	0.07
SNSM	0.08	0.07	1	0.04	0.15	0.15	0.08	0.08	0.13	0.08
Brazil	0.05	0.14	0.02	1	0.31	0.28	0.15	0.23	0.21	0.05
Venezuela	0.12	0.28	0.08	0.18	1	**0.49**	0.21	0.26	0.26	0.09
Guianas	0.09	0.14	0.08	0.17	0.32	1	0.17	0.24	0.30	0.10
Ecuador	0.14	0.26	0.04	0.08	0.12	0.10	1	**0.43**	0.25	0.07
Peru	0.10	0.20	0.04	0.13	0.15	0.13	0.27	1	**0.41**	0.07
Bolivia	0.10	0.13	0.07	0.12	0.15	0.18	0.14	0.26	1	0.09
West Indies	0.05	0.03	0.04	0.02	0.05	0.05	0.04	0.03	0.05	1

Figure 7 shows the cluster analyses performed using the similarity indices for the Melastomataceae species present in neotropical countries or regions. A grade is formed toward the base of the dendogram and includes the West Indies, the SNSM, and Mesoamerica, followed by a cluster that includes all South American countries and regions. Within the South American countries two major groups are shown, one of the Andean countries (Colombia, Ecuador, Peru, and Bolivia) and the other with Venezuela, the Guianas, and Brazil.

From the 71 species of Melastomataceae in the SNSM that are not endemic, the majority of them (90%) are distributed in two or more additional regions or countries within the neotropics. Therefore, 26% of these 71 species are found in the SNSM, in other areas of Colombia, and in another region or country: Venezuela, Mesoamerica and/or Ecuador. 17% of those taxa are found in all the ten regions or countries compared, 14% are found in four regions or countries (Colombia and various combinations involving Venezuela, Mesoamerica, Ecuador, Guianas and the West

Indies), and 13% are found in nine of the regions or countries compared (Table 4). The SNSM has Melastomataceae species that are also present in all the other neotropical countries or regions. It is noteworthy that two widely distributed species of the Mesoamerican region (*Clidemia monantha* and *Henriettea succosa*), are known in Colombia only from the SNSM region.

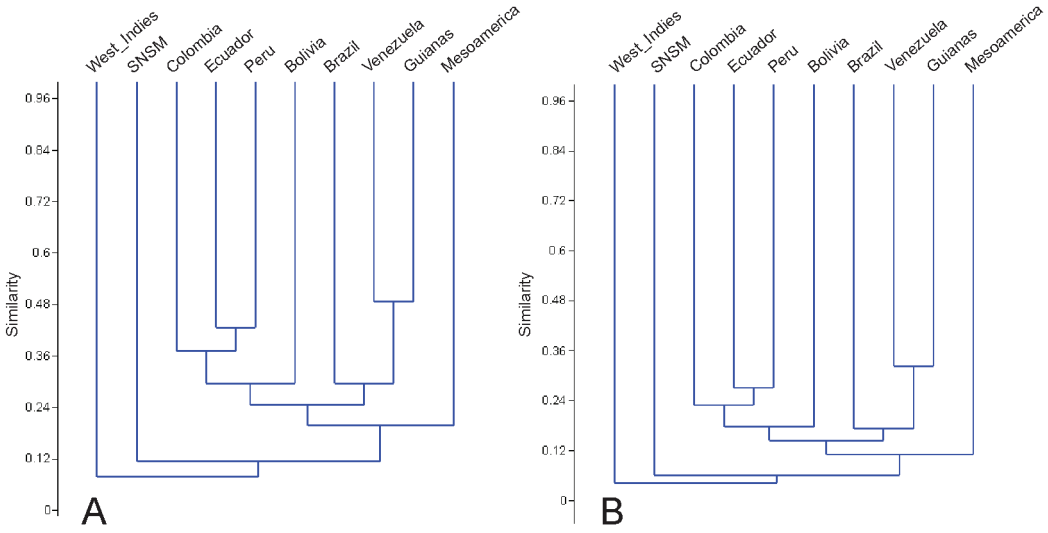

FIGURE 7. Cluster analyses for the Melastomataceae diversity found in neotropical countries or regions. A) Cluster analysis using the Dice similarity index. B) Cluster analysis using the Jaccard similarity index. The analyses were done using the UPGMA algorithm.

TABLE 4. Number and percentage of SNSM non-endemic species distributed in two or more of the ten neotropical regions or countries (the SNSM is always counted as an independent region).

Number of neotropical regions/countries where the species is found	Number of spp.	Percentage of spp.
3	18	26
10	12	17
4	10	14
9	9	13
2	7	10
6	5	7
7	4	6
5	3	4
8	2	3

Discussion

The results of this study highlight the richness of the Melastomataceae of the SNSM and in particular its high levels of endemism, with 18% of the species restricted to the SNSM massif. The overall richness and endemism of the Melastomataceae of the SNSM may be influenced by the massif's extensive topographic relief and microclimatic gradients (Cleef *et al*. 1984, Hernández-Camacho & Sánchez 1992, Hernández-Camacho *et al.* 1992a, 1992b, 1992c, Cardona & Ojeda 2010).

According to Carbonó & Lozano-Contreras (1997), around 97% of the endemic taxa of SNSM angiosperms are restricted to the high-altitude ecosystems of the massif, with 49% in the páramo (3200–4800 m), 23% in the Andean forest (2400–3200 m), and 25.5% in the Sub-Andean forests (1100–2400 m). For the Melastomataceae of the SNSM, Carbonó & Lozano-Contreras (1997) listed 16 endemic species. Our study shows a similar number of endemic species (15), although the list of endemic taxa has changed: two species reported by Carbonó & Lozano-Contreras (1997) are no longer endemic to the region (*Graffenrieda santamartensis* and *Monochaetum cinereum*) and a new endemic species was recently described for the massif (*Monochaetum carbonoi*; Alvear & Almeda 2014).

In addition, Carbonó & Lozano-Contreras (1997) noted that the majority of the Melastomataceae endemics of the SNSM are distributed at mid elevations and not in the páramo. We also found that most of the endemic species of Melastomataceae of the SNSM are in the highlands with 67% of the endemic species present above 2400 m. According to our data, 60% of the endemic species are found in Sub-Andean and Andean forests (33% in Sub-Andean forests and 27% in Andean and Sub-Andean forests), 20% are found in Andean forest and páramo, and 20% are restricted to the páramo.

Although the SNSM is among the regions with the fewest number of species in Colombia, the comparisons among the biogeographic regions in that country show that the SNSM is the third richest region for endemic species. This is probably a reflection of its isolation, topographic and environmental heterogeneity despite its comparatively small area (Cleef *et al*. 1984, Pérez-Preciado 1984, Hernández-Camacho & Sánchez 1992) when compared to richer biogeographic regions. In contrast, the higher number of endemic elements are found in the Andes and the Pacific lowlands, regions that have much larger areas (the Andes comprises three cordilleras that run through the country and the Pacific lowlands are located on the entire western side of Colombia from the border with Ecuador to the border with Panama) (Bernal *et al.* 2014). Our results show that the SNSM is consistently found toward the base of the dendogram. After analyzing the 71 species that are not endemic to the SNSM, it is clear that most of them represent widely distributed taxa (43% of these species are found in four or more biogeographic regions). On the other hand, the analyses confirm that the SNSM has affinities with the Andes (34% of species shared between those two regions), as is the case for the general flora of the massif (Hernández-Camacho *et al.* 1992b, 1992c).

Phytogeographical analyses for the SNSM flora have shown that although most of the elements originated in lowland humid and warm climates, subsequent speciation occurred in the highlands after orogenic uplift during the Cenozoic; many of its elements are of Andean origin, with relative ease of dispersion, and thus it is hypothesized that many of them came from the mountains of the Serranía de Perijá and the cordillera of Mérida (Hernández-Camacho *et al.* 1992b, 1992c). The orogenic irruption of new highlands created the new environments into which a diverse middle-elevation flora could radiate. This seems to be the general pattern of diversification for the highland flora in northern South America (Van der Hammen 1976).

The cluster analysis that includes the countries or regions in the neotropics shows that the SNSM is placed toward the base of the dendogram and next to two major groups of South American elements. Although the analysis does not indicate similarity with a particular country or region, 26% of the 71 species of the SNSM Melastomataceae that are not endemic to the massif are also found in other areas of Colombia, neighboring countries (Ecuador and Venezuela), and the Mesoamerican region. Because the land bridge connecting South America with the Mesoamerican region area is recent (Pliocene, ca. 5 mya) it seems plausible that the Melastomataceae of the SNSM was drawn from the Colombian Andes to the south and other adjacent areas of northern South America (Venezuela and Ecuador) (Hernández-Camacho *et al.* 1992c, Michelangeli *et al.* 2013). Therefore, the SNSM could have played a stepping stone role in the migration of Melastomataceae from the Andes to the Mesoamerican region, which is reflected in terms of species affinities.

Final remarks

For its size, Colombia is one of the world's richest regions for Melastomataceae with an impressive level of endemism for a continental country (Almeda *et al.* in press). Within Colombia the biogeographic region of the Sierra Nevada de Santa Marta has high levels of endemism in proportion to its area, but its geographic isolation, challenging terrain, and paucity of access roads have limited botanical exploration. As a result, many areas of the massif still remain unknown and even the north-western corner, an area that has received more attention, is in need of more intensive field studies. In terms of conservation, although many of the distribution ranges of species endemic to this massif are within the government-owned Parque Nacional Natural SNSM and some private reserves (e.g., Reserva Natural de la Aves El Dorado), there are still other threatened areas that currently have no official protected status (Carbonó & Lozano-Contreras 1997).

Dozens of undescribed species from the SNSM (and Colombia in general) await detailed study, so this checklist should be considered a progress report designed to serve as a foundation for continuing research and ongoing conservation efforts. In addition, a majority of Colombian genera of Melastomataceae are also in need of comprehensive study.

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Appendix 1. Catalogue of the Melastomataceae of the SNSM, Colombia
Totals: 20 genera, 86 species, 15 endemic species*

Aciotis, 1 species

***Aciotis purpurascens* (Aubl.) Triana**
Bas.: *Melastoma purpurascens* Aubl.
Type: French Guiana, *Aublet s.n.* (HT: BM).
Herb, Shrub. Amazonia, Andes, Guayana, Eastern Plains, Pacific lowlands, SNSM, V Cauca, V Magdalena. 0–2700 m.
Dept.: AMA, ANT, BOY, CAL, CAQ, CAS, CAU, CHO, CÓR, CUN, GUV, MAG, MET, NAR, NSA, PUT, SAN, TOL, VAL, VAU, VIC.
Distr.: Mesoamerica to Brazil and Bolivia; Granada and Trinidad.
Voucher: *Madriñán 428* (COL, MO).

Adelobotrys, 1 species

***Adelobotrys adscendens* (Sw.) Triana**
Bas.: *Melastoma adscendens* Sw.
Type: Jamaica, *Swartz s.n.* (HT: S).
Shrub, Climber, Liana, Epiphyte, Hemiepiphyte. Amazonia, Andes, Caribbean lowlands, Pacific lowlands, SNSM, V Cauca, V Magdalena. 0–1370 m.
Dept.: ANT, BOL, CAQ, CHO, CUN, MAG, NAR, NSA, PUT, RIS, SAN, VAL.
Distr.: Mexico to Ecuador, Peru, Brazil and Bolivia; Jamaica.
Voucher: *Carbonó 680* (COL, UTMC).

Arthrostemma, 1 species

***Arthrostemma ciliatum* Pav. ex D. Don**
Type: Peru, *Pavón s.n.* (HT: BM).
Herb, Shrub, Small tree, Climber. Amazonia, Andes, Caribbean lowlands, Eastern Plains, Pacific lowlands, SNSM, V Cauca, V Magdalena. 15–2260 m.
Dept.: ANT, BOY, CAL, CAQ, CAU, CHO, CUN, GUJ, MAG, MET, NAR, NSA, PUT, QUI, RIS, SAN, TOL, VAL.
Distr.: Mexico to Ecuador, Peru, Brazil and Bolivia; Greater Antilles, Trinidad; Hawaii.
Voucher: *Romero-Castañeda 10731* (COL, MO).

Axinaea,1 species

***Axinaea costaricensis* Cogn.**
Type: Costa Rica, *Pittier 2007* (HT: BR; IT: F, US).
Tree. Andes, SNSM. 2100–2450 m.
Dept.: MAG, NSA, RIS.
Distr.: Costa Rica, Panama, Colombia, Venezuela.
Voucher: *Almeda 10183* (CAS, COL, FMB, HECASA, HUA, NY, UTMC).

Bellucia, 2 species

***Bellucia pentamera* Naudin**
Type: Peru, *Gay 1269* (HT: P; F, frag.).
Shrub, Small tree, Tree. Amazonia, Andes, Guayana, Pacific lowlands, SNSM, V Cauca. 0–1600 m.
Dept.: AMA, ANT, BOY, CAL, CAQ, CAS, CAU, CHO, CUN, GUJ, GUV, MET, NAR, NSA, PUT, RIS, SAN, TOL, VAL.

Distr.: Mexico to Ecuador, Peru, Brazil and Bolivia; Guadeloupe.
Voucher: *Gentry 47562* (MO).

***Bellucia spruceana* (Benth. ex Triana) J.F. Macbr.**
Bas.: *Loreya spruceana* Benth. ex Triana
Type: Brazil, *Spruce 1249* (HT: K; IT: B,destroyed,BR, frag.,C,G,G-BOISS,GH,P).
Small tree, Tree. SNSM, V Magdalena. 330–800 m.
Dept.: ANT, GUJ.
Distr.: N South America.
Voucher: *Cuadros 2979* (MO, US).

Blakea, 2 species, 1 endemic species*

***Blakea granatensis* Naudin**
Type: Colombia, *Linden 822* (HT: P?; IT: BR-fragm., G, MPU; photos: MO, US).
Shrub, Tree, Liana, Epiphyte, Climber. Colombia Endemic. Andes, SNSM. 1100–2500 m.
Dept.: ANT, BOY, CAU, CUN, MAG, NAR, SAN.
Distr.: Colombia.
Voucher: *Almeda 10166* (CAS, COL, UTMC)

****Blakea schultzei* Markgr.**
Type: Colombia, *Schultze 1531* (HT: B, destroyed?).
Shrub, Tree, Small tree. SNSM Endemic. 1800–2200 m.
Dept.: CES, MAG.
Distr.: Colombia.
Voucher: *Forero 679* (COL, NY).

Chaetolepis, 4 species, 2 endemic species*

***Chaetolepis alpina* Naudin**
Type: Colombia, *Linden 724* (LT: P; ILT: BM, BR, F, G, K, MPU, NY).
Herb, Shrub. Andes, SNSM. 1700–4100 m.
Dept.: CES, GUJ, MAG, NSA, SAN.
Distr.: Colombia, Venezuela.
Voucher: *Cuatrecasas 24667* (COL, NY).

***Chaetolepis anisandra* Naudin**
Type: Venezuela, *Schomburgk 663* (HT: P: IT: BM, BR, G, K, P).
Shrub. Andes, SNSM. 1950–2800 m.
Dept.: CES, CUN, MAG.
Distr.: Colombia, Venezuela, Guyana.
Voucher: *Almeda 101678* (CAS, COL).

****Chaetolepis loricarella* Triana**
Type: Colombia, *Purdie s.n.* (HT: BM; IT: K).
Shrub. SNSM Endemic. 2900–3700 m.
Dept.: CES, MAG.
Distr.: Colombia.
Voucher: *Kernan 154* (COL, NY, US).

****Chaetolepis santamartensis* Wurdack**
Type: Colombia, *Cuatrecasas 24669* (HT: US; IT: COL).
Shrub. SNSM Endemic. 2500–3300 m.
Dept.: MAG.

Distr.: Colombia.
Voucher: *Rangel 908* (COL).

Clidemia, 8 species

***Clidemia capitellata* (Bonpl.) D. Don**
Bas.: *Melastoma capitellatum* Bonpl.
Type: Colombia, *Bonpland 1720* (HT: P; IT: BM).
Herb, Shrub, Tree. Amazonia, Andes, Guayana, Eastern Plains, Pacific lowlands, SNSM, V Cauca, V Magdalena. 0–2500 m.
Dept.: AMA, ANT, ARA, BOL, BOY, CAL, CAQ, CAS, CAU, CHO, CUN, GUI, GUV, HUI, MAG, MET, NAR, NSA, PUT, QUI, SAN, TOL, VAL, VAU, VIC.
Distr.: Mexico to Brazil and Bolivia; Antilles.
Voucher: *Winkler MC23* (COL).

***Clidemia ciliata* Pav. ex D. Don**
Type: Peru, *Pavón s.n.* (HT: BM; IT: MA).
Herb, Shrub, Small tree. Andes, Eastern Plains, SNSM, V Cauca, V Magdalena. 100–2260 m.
Dept.: AMA, ANT, BOY, CAL, CAQ, CAS, CAU, CES, CHO, CUN, MAG, MET, NAR, NSA, RIS, SAN, TOL, VAL.
Distr.: Mesoamerica to Venezuela, Colombia and Peru.
Voucher: *Cuatrecasas 24425* (COL, US).

***Clidemia dentata* Pav. ex D. Don**
Type: Peru, *Pavón s.n.* (HT: P; IT: MA).
Herb, Shrub, Tree. Andes, Guayana, Eastern Plains, Pacific lowlands, SNSM, V Magdalena. 0–1250 m.
Dept.: ANT, CAQ, CAU, CHO, CUN, GUJ, MAG, MET, NAR, NSA, PUT, RIS, SAN, VAL.
Distr.: Mexico to Brazil and Bolivia.
Voucher: *Madriñán 167* (COL, MO).

***Clidemia hirta* (L.) D. Don**
Bas.: *Melastoma hirtum* L.
Type: Central America, precise locality unknown, *Collector unknown s.n.* (HT: LINN, IDC microfiche).
Herb, Shrub, Tree. Amazonia, Andes, Guayana, Caribbean lowlands, Eastern Plains, Pacific lowlands, SNSM, V Cauca, V Magdalena. 0–2300 m.
Dept.: AMA, ANT, BOL, BOY, CAQ, CAS, CAU, CHO, CÓR, CUN, GUI, GUJ, GUV, HUI, MAG, MET, NAR, NSA, PUT, RIS, SAN, TOL, VAL, VAU.
Distr.: Mesoamerica to N and C South America; Greater Antilles; introduced in the Old World tropics.
Voucher: *Carbonó 1477* (UTMC).

***Clidemia monantha* L.O. Williams**
Type: Nicaragua, *Williams 23858* (HT: F; IT: EAP, F, US).
Shrub. SNSM. 1100–1500 m.
Dept.: MAG.
Distr.: Mesoamerica, Colombia, Venezuela.
Voucher: *Madriñán 314* (MO).

***Clidemia octona* (Bonpl.) L.O. Williams**
Bas.: *Melastoma octonum* Bonpl.
Type: Colombia, *Humboldt 1745* (HT: P).
Shrub, Tree. Amazonia, Andes, Guayana, Eastern Plains, Pacific lowlands, SNSM, V Cauca, V Magdalena. 30–2300 m.
Dept.: ANT, BOY, CAL, CAQ, CAS, CAU, CES, CHO, CÓR, CUN, GUV, MAG, MET, NAR, PUT, RIS, SAN, TOL, VAL, VAU.

Distr.: Mexico to N and C South America; Cuba, Jamaica.
Voucher: *Madriñán 495* (COL, MO).

***Clidemia pustulata* DC.**
Type: Brazil, *Martius s.n.* (HT: M: IT: G-DC, fragm.).
Shrub. Amazonia, Andes, Pacific lowlands, SNSM. 3–2400 m.
Dept.: ANT, CAL, CHO, MAG, PUT, TOL, VAU.
Distr.: N South America; Trinidad.
Voucher: *Smith 459* (COL, MO, US).
Note: very close to *Clidemia urceolata* DC. and maybe not distinct.

***Clidemia sericea* D. Don**
Type: Peru, *Pavón s.n.* (HT: BM; IT: P).
Herb, Shrub. Andes, Guayana, Eastern Plains, Pacific lowlands, SNSM, V Cauca, V Magdalena. 20–2500 m.
Dept.: AMA, ANT, CAL, CAQ, CAS, CAU, CHO, CUN, GUI, GUV, HUI, MAG, MET, NSA, SAN, TOL, VAL, VIC.
Distr.: Mexico to Brazil and Bolivia; Trinidad.
Voucher: *Carbonó 1476* (UTMC).

Conostegia, 4 species

***Conostegia cinnamomea* (Beurl.) Wurdack**
Bas.: *Miconia cinnamomea* Beurl.
Type: Panama, *Billberg 271* (HT: S; IT: S [2]).
Shrub, Small tree. Andes, Pacific lowlands, SNSM. 50–1500 m.
Dept.: ANT, BOY, CHO, MAG, NAR.
Distr.: Mesoamerica to Colombia and Venezuela.
Voucher: *Madriñán 486* (COL, MO).

***Conostegia icosandra* (Sw. ex Wikstr.) Urb.**
Bas.: *Melastoma icosandrum* Sw. ex Wikstr.
Type: Guadeloupe, *Forsström s.n.* (LT: S).
Shrub, Tree. Pacific lowlands, SNSM. 140–1450 m.
Dept.: ANT, GUJ, MAG.
Distr.: Mexico to Colombia, Venezuela and Brazil; Antilles.
Voucher: *Madriñán 155* (COL, MO).

***Conostegia montana* (Sw.) D. Don ex DC.**
Bas.: *Melastoma montana* Sw.
Type: Jamaica, *Swartz s.n.* (HT: S).
Shrub, Small tree, Tree. Andes, Pacific lowlands, SNSM. 0–2000 m.
Dept.: ANT, BOY, CHO, MAG, NAR, RIS, VAL.
Distr.: Mesoamerica to Venezuela and Ecuador; Antilles.
Voucher: *Torrijos 34* (UTMC).

***Conostegia xalapensis* (Bonpl.) D. Don ex DC.**
Bas.: *Melastoma xalapense* Bonpl.
Type: Mexico, *Humboldt & Bonpland s.n.* (HT: P).
Shrub, Small tree, Tree. Andes, SNSM. 0–1400 m.
Dept.: ANT, CAL, CES, CUN, MAG, TOL.
Distr.: Mexico to Colombia; Cuba.
Voucher: *Romero-Castañeda 807* (COL, US).

Graffenrieda, 1 species

***Graffenrieda santamartensis* Wurdack**
Type: Colombia, *Smith 1843* (HT: NY; IT: COL, F, NY, US).
Shrub, Tree. Andes, Guayana, SNSM. 1500–2200 m.
Dept.: ANT, MAG, MET, NSA, SAN.
Distr.: Mesoamerica (Honduras) and Colombia.
Voucher: *Kirkbride 1907* (COL, NY, US).

Henriettea, 4 species

***Henriettea fascicularis* (Sw.) M. Gómez**
Bas.: *Melastoma fasciculare* Sw.
Type: Jamaica, *Swartz s.n.* (HT: S; IT: LD).
Tree. Amazonia, Andes, Guayana, Eastern Plains, Pacific lowlands, SNSM, V Cauca, V Magdalena. 10–1400 m.
Dept.: AMA, ANT, BOY, CAQ, CUN, GUV, MAG, MET, PUT, VAL, VAU.
Distr.: Mesoamerica, Colombia, Ecuador, Peru, Brazil, Bolivia; Greater Antilles.
Voucher: *Dueñas 303* (COL).

***Henriettea succosa* (Aubl.) DC.**
Bas.: *Melastoma succosum* Aubl.
Type: French Guiana, *Aublet s.n.* (HT: BM).
Tree, Shrub. SNSM. 500–1000 m.
Dept.: GUJ.
Distr.: Mesoamerica, Colombia, Venezuela, Guayanas, Brazil, Trinidad, Tobago.
Voucher: *Gentry 47553* (MO, US).

***Henriettea tovarensis* (Cogn.) Penneys, F.A. Michelangeli, Judd & Almeda**
Bas.: *Henriettella tovarensis* Cogn.
Type: Venezuela, *Fendler 444* (HT: BR; IT: BR, CAS, G, GH, GOET, K, MO, NY, PH, S).
Small tree, Tree. Andes, SNSM. 1245–1800 m.
Dept.: ANT, CUN, MAG.
Distr.: Colombia, Venezuela.
Voucher: *Kirkbride 2121* (COL, MO).

***Henriettea trachyphylla* (Triana) Penneys, F.A. Michelangeli, Judd & Almeda**
Bas.: *Henriettella trachyphylla* Triana
Type: Colombia, *Triana s.n.* (HT: BM; IT: P).
Shrub, Small tree, Tree. Andes, Guayana, SNSM. 700–3026 m.
Dept.: ANT, CAQ, CUN, MAG, MET, NSA, QUI, VAL.
Distr.: Mesoamerica to Colombia.
Voucher: *Almeda 10165* (CAS, COL, UTMC).

Huilaea, 1 species, 1 endemic species*

****Huilaea kirkbridei* Wurdack**
Type: Colombia, *Kirkbride 2260* (HT: US; IT: COL, K, NY).
Tree. SNSM Endemic. 1650–1950 m.
Dept.: MAG.
Distr.: Colombia.
Voucher: *Morales-P. 1798* (COL)**.**
Note: known only from the type and one additional collection.

Kirkbridea, 2 species, 2 endemic species*

***Kirkbridea pentamera* Wurdack**
Type: Colombia, *Kirkbride 2259* (HT: US; IT: COL, K, NY).
Small tree, Tree. SNSM Endemic. 1650–1750 m.
Dept.: MAG.
Distr.: Colombia.
Voucher: *Carbonó 2805* (UTMC).
Note: known only from the type and one additional collection.

***Kirkbridea tetramera* Wurdack**
Type: Colombia, *Kirkbride 2243* (HT: US; IT: COL, K, NY).
Shrub, Small tree. SNSM Endemic. 1600–1800 m.
Dept.: MAG.
Distr.: Colombia.
Voucher: *Kirkbride 2004* (COL, NY, US).
Note: known only from the type and paratype.

Leandra, 2 species

***Leandra lindeniana* (Naudin) Cogn.**
Bas.: *Clidemia lutescens* var. *lindeniana* Naudin
Type: Venezuela, *Linden 67* (LT: P; ILT: BR, G, MPU).
Shrub. Andes, SNSM. 1500–2500 m.
Dept.: ANT, CAU, CUN, HUI, MAG, NSA, SAN, VAL.
Distr.: Venezuela, Colombia, Guyana.
Voucher: *Almeda 10168* (CAS, COL, UTMC).

***Leandra mexicana* (Naudin) Cogn.**
Bas.: *Clidemiastrum mexicanum* Naudin
Type: Mexico, *Linden 636* (ST: P; IST: G, K).
Herb, Shrub. Andes, SNSM, V Cauca, V Magdalena. 400–1320 m.
Dept.: ANT, MAG.
Distr.: Mexico to Colombia.
Voucher: *Torrijos 25* (UTMC).

Meriania, 4 species

***Meriania candollei* Cogn.**
Type: Colombia, *Schlim 253* (HT: B-destroyed; IT: BM, BR, F, fragm., FI, G-DC, K, MPU).
Tree. Colombia Endemic. Andes, SNSM. 1800–2350 m.
Dept.: MAG, NSA.
Distr.: Colombia.
Voucher: *Kernan 126* (US).
Note: probably a synonym of *Meriania speciosa* (Bonpl.) Naudin.

***Meriania grandidens* Triana**
Type: Colombia, *Schlim 666* (ST: BR, G-DC).
Shrub, Small tree, Tree. Andes, Eastern Plains, SNSM. 420–3048 m.
Dept.: CES, CUN, GUJ, MAG, NSA, SAN.
Distr.: Colombia, Venezuela.
Voucher: *Cuadros 2933* (MO).
Note: probably a synonym of *Meriania speciosa* (Bonpl.) Naudin.

***Meriania longifolia* (Naudin) Cogn.**
Bas.: *Chastenaea longifolia* Naudin
Type: Venezuela, *Linden 35* (HT: P?; IT: K).
Shrub, Small tree, Tree. Andes, Guayana, SNSM. 600–2700 m.
Dept.: ANT, BOY, CAL, CAQ, CAU, CES, CUN, GUJ, HUI, MAG, MET, NSA, QUI, SAN, TOL, VAL.
Distr.: Colombia, Venezuela.
Voucher: *Kirkbride 1916* (COL).

***Meriania macrophylla* (Benth.) Triana**
Bas.: *Davya macrophylla* Benth.
Type: Guatemala, *Hartweg s.n.* (HT: K).
Tree. Andes, SNSM. 1300–2500 m.
Dept.: ANT, CUN, HUI, MAG, NSA, RIS, SAN, VAL.
Distr.: Mesoamerica to Colombia and Venezuela.
Voucher: *Kirkbride 2390* (COL, US).

Miconia, 35 species, 4 endemic species*

***Miconia aeruginosa* Naudin**
Type: Colombia, *Bonpland s.n.* (HT: P; IT: P).
Shrub, Small tree, Tree. Andes, Caribbean lowlands, Eastern Plains, SNSM. 40–2600 m.
Dept.: ANT, BOL, BOY, CAL, CAQ, CAS, CAU, CES, CUN, GUJ, HUI, MAG, NAR, NSA, QUI, RIS, SAN, TOL, VAL.
Distr.: Mesoamerica to Guyana, Ecuador and Bolivia.
Voucher: *Madriñán 433* (COL).

***Miconia albicans* (Sw.) Triana**
Bas.: *Melastoma albicans* Sw.
Type: Jamaica, *Swartz s.n.* (LT: S; ILT: BM).
Herb, Shrub, Small tree. Andes, Caribbean lowlands, Eastern Plains, SNSM, V Cauca, V Magdalena. 25–2500 m.
Dept.: ANT, ARA, BOL, BOY, CAQ, CAS, CAU, CES, CÓR, CUN, GUV, HUI, MAG, MET, NAR, NSA, SAN, TOL, VAL, VIC.
Distr.: Mexico to C South America; Greater Antilles.
Voucher: *Smith 2074* (COL, NY).

***Miconia biappendiculata* (Naudin) L. Uribe**
Bas.: *Miconia granulosa* var. *biappendiculata* Naudin
Type: Colombia, *Bonpland s.n.* (HT: P).
Tree. Colombia Endemic. Andes, SNSM. 2500–3650 m.
Dept.: BOY, CAL, CAU, CUN, HUI, MAG, PUT, VAL.
Distr.: Colombia.
Voucher: *Almeda 10179* (CAS, COL, UTMC).
Note: records of this species in Bolivia are based on misidentifications (Wurdack, com. pers.).

***Miconia caudata* (Bonpl.) DC.**
Bas.: *Melastoma caudatum* Bonpl.
Type: Colombia, *Humboldt & Bonpland s.n.* (HT: P).
Shrub, Small tree, Tree. Andes, Pacific lowlands, SNSM, V Cauca, V Magdalena. 150–3200 m.
Dept.: ANT, BOY, CAL, CAU, CES, CHO, CUN, HUI, MAG, NAR, QUI, RIS, SAN, TOL, VAL.
Distr.: Mesoamerica to Colombia.
Voucher: *Torrijos M-7* (UTMC).

***Miconia dodecandra* (Desr.) Cogn.**
Bas.: *Melastoma dodecandrum* Desr.
Type: Brazil, *Blanchet 3620* (LT: BR-520725; ILT: BR-520964, M?).
Small tree, Tree. Amazonia, Andes, Guayana, SNSM. 775–1950 m.
Dept.: AMA, ANT, BOL, BOY, CAQ, CAU, CES, CHO, CUN, HUI, MAG, MET, NSA, PUT, SAN, VAL.
Distr.: Mexico to C South America; Trinidad, Antilles.
Voucher: *Romero-Castañeda 760* (COL).

***Miconia dolichopoda* Naudin**
Type: Venezuela, *Funck 93* (HT: P; IT: BM, BR, G, P).
Shrub, Small tree, Tree. Andes, SNSM. 1600–2900 m.
Dept.: BOY, CAL, CUN, MAG, NSA, SAN, VAL.
Distr.: Mesoamerica to Colombia and Venezuela.
Voucher: *Kirkbride 1998* (COL, US).

***Miconia floribunda* (Bonpl.) DC.**
Bas.: *Melastoma floribundum* Bonpl.
Type: Peru, *Bonpland s.n.* (HT: P).
Shrub, Small tree, Tree. Andes, SNSM. 1200–3300 m.
Dept.: ANT, BOY, CAQ, CAU, CHO, CUN, HUI, MAG, NSA, PUT, RIS, SAN, VAL.
Distr.: Colombia, Venezuela, Ecuador, Peru.
Voucher: *Almeda 10145* (CAS, COL, UTMC).

***Miconia ibaguensis* (Bonpl.) Triana**
Bas.: *Melastoma ibaguense* Bonpl.
Type: Colombia, *Humboldt & Bonpland 371* (HT: P).
Herb, Shrub. Andes, Eastern Plains, SNSM, V Magdalena. 240–2740 m.
Dept.: ANT, BOL, CAL, CAS, CAU, CES, CUN, MAG, MET, NAR, NSA, RIS, SAN, TOL.
Distr.: Mexico to C South America; Trinidad, Greater Antilles.
Voucher: *Schwabe s.n.* (COL).

****Miconia insueta* Wurdack**
Type: Colombia, *Barclay 6790* (HT: US; IT: COL).
Shrub. SNSM Endemic. 2670–3300 m.
Dept.: MAG.
Distr.: Colombia.
Voucher: *Jaramillo 5443* (COL).

***Miconia ligustrina* (Sm.) Triana**
Bas.: *Melastoma ligustrinum* Sm.
Type: Colombia, *Mutis s.n.* (HT: LINN 559.15).
Shrub, Small tree, Tree. Andes, SNSM. 2050–3800 m.
Dept.: ANT, BOY, CAU, CUN, HUI, MAG, MET, NAR, NSA, PUT, RIS, SAN, VAL.
Distr.: Colombia, Ecuador.
Voucher: *Almeda 10174* (CAS, COL)

***Miconia lonchophylla* Naudin**
Type: Venezuela, *Funck 94* (HT: P; IT: BR, G, P).
Shrub, Tree. Andes, Pacific lowlands, SNSM. 50–2670 m.
Dept.: ANT, CHO, CUN, MAG, NAR, SAN, VAL.
Distr.: Mexico to Colombia and Venezuela.
Voucher: *Jaramillo 5261-A* (COL, US).

***Miconia matthaei* Naudin**
Type: Peru, *Mathews 1299* (HT: P; IT: BR, E, K).
Shrub, Tree. Andes, Guayana, SNSM, V Cauca, V Magdalena. 340–1150 m.
Dept.: ANT, GUJ, MET, RIS.
Distr.: Mexico to C South America; Trinidad, Greater Antilles.
Voucher: *Carbonó 369* (COL, UTMC).

***Miconia multispicata* Naudin**
Type: Jamaica, *Purdie s.n.* (HT: P; IT: K).
Small tree. Amazonia, Andes, Guayana, Eastern Plains, SNSM, V Magdalena. 210–1500 m.
Dept.: ANT, BOY, CAQ, CAS, CUN, GUV, MAG, MET, NSA, PUT.
Distr.: Mesoamerica to C South America; Jamaica.
Voucher: *Romero-Castañeda 822* (COL, US).

***Miconia neomicrantha* Judd & Skean**
Bas.: *Melastoma micranthum* Sw.
Type: Jamaica, *Swartz s.n.* (HT: BM).
Shrub, Small tree, Tree. Amazonia, Andes, Caribbean lowlands, Pacific lowlands, SNSM, V Magdalena. 0–2420 m.
Dept.: ANT, CAL, CAQ, CAU, CHO, CUN, HUI, MAG, NAR, NSA, PUT, QUI, RIS, TOL, VAL.
Distr.: Mexico to Venezuela and Peru; La Española, Jamaica.
Voucher: *Madriñán 230* (COL, MO).

****Miconia oreogena* Wurdack**
Type: Colombia, *Barclay 6684* (HT: US; IT: COL, MO).
Shrub. SNSM Endemic. 3200–3510 m.
Dept.: GUJ, MAG.
Distr.: Colombia.
Voucher: *Kirkbride 1769* (COL, US).

***Miconia prasina* (Sw.) DC.**
Bas.: *Melastoma prasinum* Sw.
Type: Jamaica, *Swartz s.n.* (LT: S).
Shrub, Small tree, Tree. Amazonia, Andes, Caribbean Islands, Caribbean lowlands, Eastern Plains, Pacific lowlands, SNSM, V Cauca, V Magdalena. 40–2700 m.
Dept.: AMA, ANT, ARA, BOY, CAL, CAQ, CAU, CHO, CÓR, CUN, GUV, HUI, MAG, MET, NAR, NSA, PUT, QUI, RIS, SAP, SAN, TOL, VAL, VIC.
Distr.: Mexico to C South America; Trinidad, Antilles.
Voucher: *Winkler MC25* (COL).

***Miconia pulvinata* Gleason**
Type: Colombia, *Smith 1841* (HT; NY; IT: CM, F, GH, K, US).
Shrub. Andes, Eastern Plains, SNSM. 420–1600 m.
Dept.: ANT, BOY, CAQ, CUN, MAG, MET, NSA, SAN.
Distr.: Colombia, Venezuela.
Voucher: *Smith 1841* (NY, US).

***Miconia punctata* (Desr.) D. Don ex DC.**
Bas.: *Melastoma punctatum* Desr.
Type: Dominican Republic. *Herb. Delétang 59* (HT: P-JU).
Shrub, Small tree, Tree. Amazonia, Andes, Guayana, Eastern Plains, Pacific lowlands, SNSM. 0–1700 m.
Dept.: AMA, CAQ, CAU, CHO, CUN, GUI, GUV, MAG, MET, NSA, PUT, SAN, VAL, VIC.
Distr.: Mexico to N and C South America; Trinidad, Greater Antilles.
Voucher: *Gentry 76203* (MO).

***Miconia quinquenervia* (Mill.) Gamba & Almeda**
Bas.: *Melastoma quinquenervium* Mill.
Type: Exact locality not legible, *Miller s.n.* (HT: BM).
Herb, Shrub. Pacific lowlands, SNSM, V Magdalena. 0–1200 m.
Dept.: ANT, BOL, CAL, CHO, CUN, MAG, TOL.
Distr.: Mesoamerica to Venezuela and Ecuador.
Voucher: *Madriñán 497* (COL, MO).

***Miconia rubiginosa* (Bonpl.) DC.**
Bas.: *Melastoma rubiginosum* Bonpl.
Type: Colombia, *Humboldt & Bonpland 372* (HT: P).
Shrub, Small tree, Tree. Andes, Guayana, Eastern Plains, SNSM, V Magdalena. 80–3250 m.
Dept.: ANT, BOY, CAS, CAU, CES, CUN, GUJ, GUV, HUI, MET, NSA, SAN, TOL, VAL, VIC.
Distr.: Mesoamerica to N and C South America; Trinidad, Greater Antilles.
Voucher: *Cuadros 2881* (COL, MO).

***Miconia rufescens* (Aubl.) DC.**
Bas.: *Melastoma rufescens* Aubl.
Type: French Guiana, *Aublet s.n.* (HT: BM).
Shrub, Tree. Andes, Caribbean lowlands, Eastern Plains, SNSM, V Cauca, V Magdalena. 100–1850 m.
Dept.: AMA, ANT, ARA, CAQ, CAS, CAU, CUN, GUJ, GUV, HUI, MAG, MET, NSA, SAN, TOL, VAL, VIC.
Distr.: N and C South America.
Voucher: *Carbonó 577* (COL, UTMC).

***Miconia schlimii* Triana**
Type: Colombia, *Schlim 903* (ST: BM; IST: BR, K, MPU).
Tree. Caribbean lowlands, Pacific lowlands, SNSM. 0–500 m.
Dept.: CHO, MAG.
Distr.: Mesoamerica to Colombia and Venezuela.
Voucher: *Smith 13* (US).

***Miconia serrulata* (DC.) Naudin**
Bas.: *Diplochita serrulata* DC.
Type: Brazil, *Martius s.n.* (HT: M).
Herb, Shrub, Small tree, Tree. Amazonia, Andes, Guayana, Caribbean lowlands, Eastern Plains, Pacific lowlands, SNSM, V Cauca, V Magdalena. 5–2640 m.
Dept.: AMA, ANT, BOL, BOY, CAL, CAQ, CAS, CAU, CES, CHO, CUN, GUV, MAG, MET, NAR, NSA, PUT, SAN, VAU.
Distr.: Mexico to N and C South America; Trinidad, Greater Antilles.
Voucher: *Carbonó 2847* (UTMC).

***Miconia shattuckii* Standl.**
Type: Panama, *Shattuck 335* (HT: F; IT: F, MO).
Shrub, Small tree. Caribbean lowlands, Pacific lowlands, SNSM. 200–820 m.
Dept.: ANT, CHO, MAG.
Distr.: Mesoamerica to Colombia.
Voucher: *Lozano 3799* (COL).

****Miconia smithii* Cogn. ex Gleason**
Type: Colombia, *Smith 1846* (HT: NY; IT: BR, CM, E, F, GH, K, MICH, PH, US).
Shrub, Tree. SNSM Endemic. 1700–2700 m.
Dept.: MAG.
Distr.: Colombia.
Voucher: *Kirkbride 1952* (COL, US).

***Miconia spicellata* Bonpl. ex Naudin**
Type: Colombia, *Bonpland s.n.* (HT: P; IT: G, P, US).
Shrub, Small tree, Tree. Andes, SNSM, V Cauca, V Magdalena. 250–1850 m.
Dept.: ANT, CAL, CUN, HUI, MAG, RIS, SAN, TOL, VAL.
Distr.: Colombia, Venezuela.
Voucher: *Schwabe s.n.* (COL).
Note: the type locality is Colombia not Brazil (Wurdack 1978).

***Miconia spinulosa* Naudin**
Type: Venezuela, *Funck 96* (HT: P; IT: BM, BR, P).
Shrub, Small tree. Andes, SNSM. 1000–2400 m.
Dept.: CUN, MAG, NSA, SAN.
Distr.: Colombia, Venezuela.
Voucher: *Kirkbride 2019* (COL, US).

***Miconia stenostachya* DC.**
Type: Brazil, *Martius s.n.* (HT: M).
Shrub, Small tree, Tree. Amazonia, Andes, Eastern Plains, SNSM, V Cauca, V Magdalena. 100–2700 m.
Dept.: AMA, ANT, ARA, BOY, CAS, CES, CÓR, CUN, GUV, HUI, MAG, MET, NAR, NSA, SAN, TOL, VAL, VIC.
Distr.: Mexico to N and C South America; Trinidad.
Voucher: *Carbonó 3319* (UTMC).

***Miconia summa* Cuatrecasas**
Type: Colombia, *Cuatrecasas 2510* (HT: MA; IT: F-fragm.).
Shrub, Small tree, Tree. Colombia Endemic. Andes, SNSM. 1900–3890 m.
Dept.: BOY, CUN, MAG, NSA, SAN.
Distr.: Colombia.
Voucher: *Carbonó 2509* (UTMC).

***Miconia theizans* (Bonpl.) Cogn.**
Bas.: *Melastoma theaezans* Bonpl.
Type: Colombia, *Humboldt & Bonpland 2026* (HT: P).
Shrub, Small tree, Tree. Andes, Guayana, Pacific lowlands, SNSM, V Cauca, V Magdalena. 230–3900 m.
Dept.: ANT, BOY, CAL, CAQ, CAU, CES, CHO, CUN, GUJ, HUI, MAG, MET, NAR, NSA, PUT, QUI, RIS, SAN, TOL, VAL.
Distr.: Mesoamerica, Colombia, Venezuela, Ecuador, Peru, Bolivia, Brazil, Paraguay; Greater Antilles.
Voucher: *Kirkbride 1929* (COL).

***Miconia tinifolia* Naudin**
Type: Venezuela, *Linden 438* (HT: P; IT: F, FI, G, K, MPU, NY, P, TCD).
Shrub, Small tree, Tree. Andes, SNSM. 2000–3850 m.
Dept.: ANT, BOY, CAQ, CAU, MAG, QUI, RIS, SAN, VAL.
Distr.: Colombia, Venezuela, Ecuador, Guyana.
Voucher: *Kirkbride 1887* (COL).

***Miconia tovarensis* Cogn.**
Type: Venezuela, *Fendler 419* (HT: BR; IT: GH, K, MO, NY, PH, TCD).
Shrub, Small tree, Tree. Andes, SNSM. 2200–3750 m.
Dept.: CES, HUI, MAG, NSA.
Distr.: Colombia, Venezuela.
Voucher: *Almeda 10146* (CAS, COL, UTMC).

***Miconia tricaudata* Wurdack**
Type: Colombia, *Barclay 6579* (HT: US; IT: COL, MO).
Shrub. SNSM Endemic. 3250–3530 m.
Dept.: MAG.
Distr.: Colombia.
Voucher: *Rangel 953* (COL, US).

***Miconia tuberculata* (Naudin) Triana**
Bas.: *Octomeris tuberculata* Naudin
Type: Venezuela, *Linden 293* (HT: P; IT: P).
Herb, Shrub, Small tree. Andes, SNSM. 700–2100 m.
Dept.: ANT, CAU, CES, CUN, HUI, MAG, NSA.
Distr.: Colombia, Venezuela.
Voucher: *Cuatrecasas 24331* (COL).

***Miconia velutina* Triana**
Type: Colombia, *Schlim 545* (HT: BM; IT: BR, K, MPU, US).
Shrub, Tree. Andes, SNSM. 1700–3900 m.
Dept.: ANT, CES, HUI, MAG, NSA, RIS, SAN.
Distr.: Colombia, Venezuela.
Voucher: *Jaramillo 5282-A* (COL).

Monochaetum, 9 species, 5 endemic species*

***Monochaetum brachyurum* Naudin**
Type: Colombia, *Funck 1314* (HT: P; IT: BR-fragm., F-fragm.G, MPU).
Shrub. Andes, SNSM. 800–3750 m.
Dept.: BOY, CES, CUN, MAG, NSA, SAN.
Distr.: Colombia, Venezuela.
Voucher: *Carbonó 5205* (UTMC).

***Monochaetum carbonoi* Alvear & Almeda**
Type: Colombia, *Carbonó 5094* (HT: UTMC; IT: COL).
Shrub. SNSM Endemic. 3300 m.
Dept.: MAG.
Distr.: Colombia.
Voucher: *Carbonó 5094* (COL, UTMC).
Note: known only from the type.
Conservation status: Endangered (EN).

***Monochaetum cinereum* Gleason**
Type: Colombia, *Smith 762* (HT: NY; IT: BR-fragm., CM, F, G, GH, MICH, NY, US, W).
Shrub. Colombia Endemic. Andes, SNSM. 1370–2000 m.
Dept.: CES, MAG.
Distr.: Colombia.
Voucher: *van der Hammen 1079* (COL).

***Monochaetum laxifolium* Gleason**
Type: Colombia, *Smith 774* (HT: NY; IT: BR-fragm., A, CM, F, G, GH, M, MICH, NY, US, W).
Shrub. SNSM Endemic. 1370–2100 m.
Dept.: MAG.
Distr.: Colombia.
Voucher: *Kirkbride 2423* (COL, F, NY, US).
Note: known from less than five collections.

***Monochaetum longicaudatum* Alvear & Almeda**
Type: Colombia, *Hanbury-Tracy 342* (HT: US; IT: K).
Shrub. Colombia Endemic. Andes, SNSM. 2000–4250 m.
Dept.: CAL, CES, GUJ, MAG.
Distr.: Colombia.
Voucher: *Romero-Castañeda 848* (COL, US, UTMC)
Note: known from less than five collections.
Conservation status: Endangered (EN).

****Monochaetum magdalenense* Wurdack**
Type: Colombia, *Díaz-Piedrahita 165* (HT: US; IT: COL).
Shrub. SNSM Endemic. 2100–2475 m.
Dept.: MAG.
Distr.: Colombia.
Voucher: *Lozano 997* (COL, US).

****Monochaetum rotundifolium* Cogn. ex Gleason**
Type: Colombia, *Smith 1851* (HT: NY; IT: BR, F, GH, MO, NY, US).
Shrub. SNSM Endemic. 1800–2600 m.
Dept.: MAG.
Distr.: Colombia.
Voucher: *Kirkbride 1845* (COL, F, US).

***Monochaetum stellulatum* Naudin**
Type: Colombia, *Linden 736* (HT: P; IT: BR-fragm., F-fragm.,G).
Shrub. Andes, SNSM. 2000–3100 m.
Dept.: GUJ, MAG, NSA, SAN.
Distr.: Colombia, Venezuela.
Voucher: *Cuadros 2771* (COL, MO, US).

****Monochaetum uberrimum* Sandwith**
Type: Colombia, *Hanbury-Tracy 316* (HT: K; IT: K).
Shrub. SNSM Endemic. 2000–2750 m.
Dept.: CES, MAG.
Distr.: Colombia.
Voucher: *Cuatrecasas 24706* (COL, F, US).

Pilocosta, 1 species

***Pilocosta nana* (Standl.) Almeda & Whiffin**
Bas.: *Chaetolepis nana* Standl.
Type: Panama, *Cooper 233* (HT: F).
Herb, Liana. SNSM. 700–1000 m.
Dept.: GUJ, MAG, NAR.
Distr.: Mesoamerica to Colombia and Ecuador.
Voucher: *Romero-Castañeda 772* (COL).

Pterolepis, 1 species

***Pterolepis trichotoma* (Rottb.) Cogn.**
Bas.: *Rhexia trichotoma* Rottb.
Type: Suriname, *Rolander s.n.* (HT: SBT).
Herb. Caribbean lowlands, Eastern Plains, SNSM. 175–1150 m.

Dept.: ANT, ARA, CAS, CES, CUN, GUJ, GUV, MAG, MET, TOL, VAL, VIC.
Distr.: Mexico to N and C South America; Trinidad.
Voucher: *Carbonó 1225* (UTMC).

Tibouchina, 2 species

***Tibouchina gracilis* (Bonpl.) Cogn.**
Bas.: *Rhexia gracilis* Bonpl.
Type: Brazil, *Langsdorff s.n.* (HT: LE? or P?).
Herb, Shrub. Andes, Eastern Plains, SNSM. 100–2569 m.
Dept.: ANT, CAU, CES, CUN, GUJ, HUI, MAG, MET, SAN, VAL, VIC.
Distr.: Colombia and Venezuela to Argentina.
Voucher: *Carbonó 562* (COL, UTMC).

***Tibouchina longifolia* (Vahl) Baill.**
Bas.: *Rhexia longifolia* Vahl
Type: America meridional, *von Rohr 15* (HT: C).
Herb, Shrub. Amazonia, Andes, Guayana, Caribbean lowlands, Eastern Plains, Pacific lowlands, SNSM, V Cauca, V Magdalena. 0–3000 m.
Dept.: ANT, BOL, BOY, CAL, CAQ, CAS, CAU, CHO, CUN, GUV, HUI, MAG, MET, NAR, NSA, PUT, QUI, RIS, SAN, TOL, VAL.
Distr.: Mexico to C South America; Cuba, La Española, St. Kitts, San Vicente, Trinidad.
Voucher: *Cuatrecasas 24428* (COL).