Miconia canoi (Melastomataceae, Miconieae), a new species from southern Ecuador and northern Peru.

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Abstract. **Miconia canoi**, a new species of Melastomataceae from northern Peru and southern Ecuador is described. *Miconia canoi* is similar to other scrambling or small shrubs of *Miconia* found in the páramos and jalcas, but can be easily identified by the combination of glabrous, ovate leaf blades without obvious secondary venation in the adaxial surface, four-merous flowers with persistent bracteoles, glandular pubescent filaments and style, and a capitate to galeate stigma. Based on anther morphology and its mode of dehiscence, *M. canoi* would be assigned to *M.* sect. *Chaenopleura* in the traditional sectional system for this genus. The new species is illustrated and compared to putative relatives.

Keywords: Anther dehiscence, *Miconia* section *Chaenopleura*, *Miconia* section *Cremanium*, Páramo.

Resumen. Se describe **Miconia canoi**, una nueva especie de Melastomataceae del norte del Perú y sur del Ecuador. *Miconia canoi* es similar a otras especies postradas o rastreras de *Miconia* de las jalcas y páramos, pero es facilmente identificable por la combinación de hojas ovadas y glabras sin una venación secundaria obvia en la superficie abaxial, flores tetrameras con bracteolas persistentes, filamentos y estilos glandular pubescentes y el estigma capitado a galeado. Basados en la morfología de la antera y su modo de dehiscencia, *M. canoi* sería asignada a *M.* sec. *Chaenopleura* en la división seccional tradicional del género. Se ilustra la nueva especie y se compara con especies putativamente relacionadas.

Miconia Ruiz & Pav. (Melastomataceae: Miconieae), with close to 1100 species is the largest exclusively Neotropical genus (Goldenberg et al., 2013), and this number would be 1800–1900 if circumscribed to encompass all species currently placed within tribe Miconieae (see Ionta et al., 2012; Michelangeli et al., 2016). Traditionally, the genus has been divided into 11 sections based mostly on calyx and anther morphology (Bentham and Hooker, 1867; Triana, 1871; Cogniaux, 1891). While most sections (as well as the remaining genera in the Miconieae) are not monophyletic, molecular phylogenetic analyses have started to shed light on the relationships within this large group and the extent to which anther morphology is phylogenetically informative, and thus taxonomically useful (Michelangeli et al., 2004; Goldenberg et al., 2008; Martin et al., 2008; Michelangeli et al., 2008). Although the sections are not monophyletic, they remain a useful tool to identify and group species.

Within *Miconia*, *M.* sect. *Cremanium* (D.Don) Triana ex Hook.f. and *M.* sect. *Chaenopleura* (Rich. ex DC.) Triana ex Hook.f. have always been closely associated due to their short, obovate, white anthers, which open by broad pores in *M.* sect. *Cremanium* and by slits in *M.* sect. *Chaenopleura* (Goldenberg et al., 2008). While neither section is monophyletic, all species of *M.* sect. *Chaenopleura* sampled to date in molecular analyses have been recovered within a larger clade that contains almost all species of *M.* sect. *Cremanium*, as well as many species of *M.* sect. *Amblyarrhena* (Naudin) Triana ex Hook.f. and a few members of other groups (Michelangeli et al., 2004; Goldenberg et al., 2008; Martin et al., 2008;

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Michelangeli et al., 2008). Moreover, all species of *M.* sect. *Chaenopleura* from the Greater Antilles form a clade (sometimes with a couple of species of *M.* sect. *Cremanium*), while Andean members of *M.* section *Chaenopleura* are neither monophyletic, nor sister to the Greater Antilles member of the section (Michelangeli et al., 2004; Goldenberg et al., 2008; Martin et al., 2008; Michelangeli et al., 2008). This is actually not surprising given that the morphology of the anther slits in the Andean and Antillean species of *M.* sect. *Chaenopleura* is obviously different, providing evidence they have evolved independently. Antillean species have two slits that extend the entire length of the anther, one on each theca (Judd, 2007). However, in the Andean species there is a single anther slit positioned between the thecae and it often runs 1/2 to 1/3 of the length of the fertile portion of the anthers (Macbride, 1941; Wurdack, 1973, 1980). Interestingly, most species of *M.* sect. C*haenopleura* are found at high elevation, regardless of whether they belong to the Antillean clade or to one of the Andean groups, suggesting that the opening by slits may be an adaptation to pollination in higher and colder environments. Moreover, *M.* section *Chaenanthera* (Naudin) Cogn. is also characterized by anthers opening by slits, but in this case the species are primarily found at medium and high elevations in the mountains of Eastern Brazil (Goldenberg, 2000), and indeed the evolution of anthers opening by slits has evolved at the same time that species have shifted to more generalized pollination syndromes that include non-buzzing bees, flies, wasps and other insects (Brito et al., 2016).

During field work in northern Peru we found a species of *Miconia* with anthers opening by slits that did not correspond to any species described to date. Further examination of herbarium specimens from southern Ecuador revealed the existence of an additional collection, obviously conspecific with the one collected in Peru. We describe here this new species and compare it to putative relatives and phenetically similar species.

Materials and methods

Measurements and other characteristics from the new species were taken from herbarium specimens, alcohol preserved flowers and buds, and from images taken in the field. Flower measurements were made from alcohol-preserved material, while all other measurements were taken from herbarium specimens. Measurements and characters from putative relatives were obtained from herbarium specimens consulted in person (BM, F, K, MO, MOL, NY, USM; acronyms according to Thiers, 2017) or from types available online through the Global Plants project (http://plants.jstor.org) and websites of individual herbaria. Species distributions were obtained from specimens deposited at the aforementioned herbaria and from data in the published literature (Macbride, 1941; Wurdack, 1973, 1980; Jørgensen and León-Yánez, 1999; León, 2006; Almeda et al., 2016).

Miconia canoi Michelang. & Paredes, **sp. nov.** Type: Peru. Piura: Huancabamba, Dist. El Carmen de La Frontera, Laguna Shimbe, laderas en el SE de la laguna, 3275 m, 5.05011°S, 79.460103°W, 11 March 2016 (fl, fr), *F. A. Michelangeli 2650 with D. F. Paredes & M. Gavrutenko* (holotype: USM; isotypes: CPUN, MO, NY). (Figs. 1,2)

Diagnosis: A species of *Miconia* sect. *Chaenopleura* with flowers similar to those of *Miconia rotundifolia* and *M. chionophila* in having persistent bracteoles and glandular filaments and style, but differing by the mostly erect habit, narrowly ovate, adaxially glabrous leaves with the secondary venation not evident on the adaxial surface, and flowers nodding at anthesis.

Herb to subshrub, rhizomatous, the rhizomes up to 2.5 cm diam, the aerial branches up to 40 cm long. Young stems obscurely quadrangular to flattened, reddish to crimson, later becoming terete, greenish, with roughened trichomes 0.5–1 mm long, sparse in the internodes and denser in the nodes and immediately below the petioles. Leaves opposite, more or less distichous, isomorphic; petioles 3.5–5 mm long, flattened and more or less caniculate, crimson, with sparse trichomes as on the stems; leaf blades ovate to narrowly ovate, 1.1–2 × 0.5–1 cm, the abaxial surface reddish, later becoming pale green to yellowish, with sparse dot-like sessile glands; the adaxial surface lustrous, green, glabrous; the base attenuate, the apex acute but the tip rounded and mucronate, the margin obscurely to obviously revolute, dentate and sparsely ciliate, the trichomes 0.25 mm long; venation acrodromous with one pair of secondary veins, the primary raised on the abaxial surface and slightly sunken on the adaxial

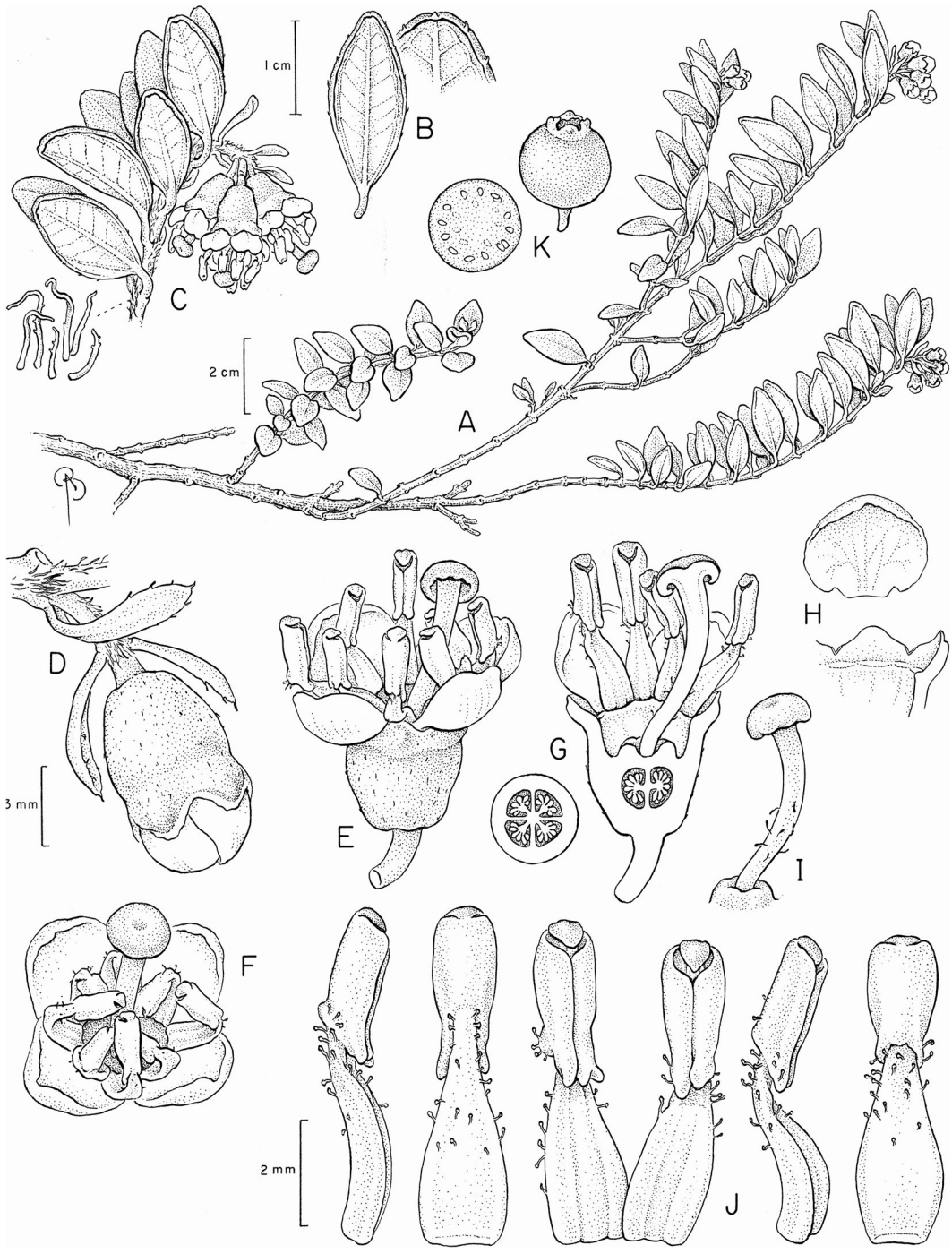

Fig. 1. *Miconia canoi*. **A.** Habit. **B.** Leaf abaxial surface and detail of leaf apex. **C.** Apex of flowering branch and inflorescence. **D.** Flower bud and bracteoles. **E.** Flower at anthesis, lateral view. **F.** Flower at anthesis, top view. **G.** Flower at anthesis, longitudinal section. **H.** Petal and top of hypanthium and calyx on adaxial view. **I.** Style and longitudinal section of stigma. **J.** Stamens (from left to right) antesepalous stamens in dorsal, lateral and ventral view, antepetalous stamens in dorsal, lateral and ventral view. **K.** Fruit (a berry) and cross section. (All from the NY isotype).

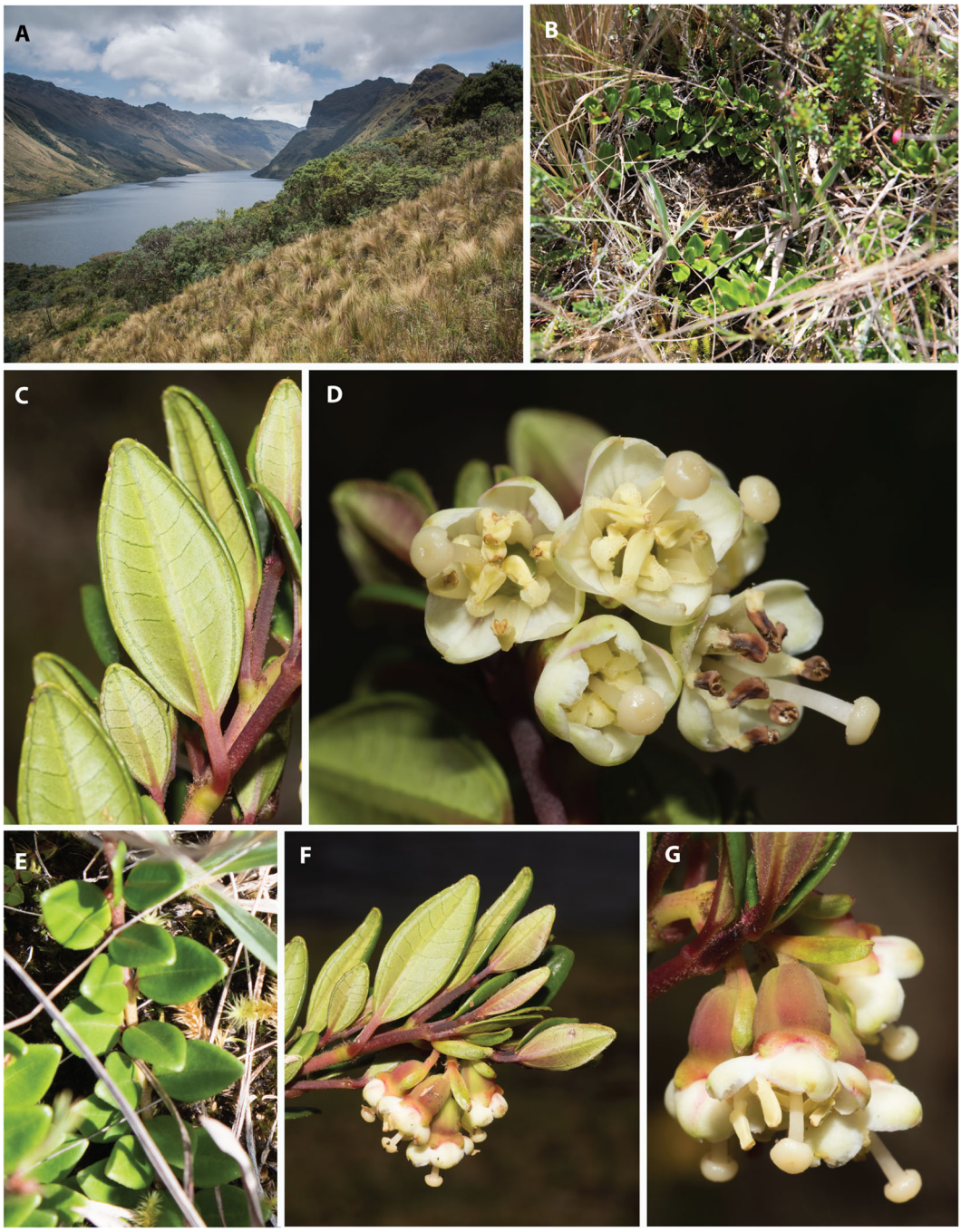

Fig. 2. *Miconia canoi* and habitat. **A.** Habitat of *M. canoi* in Piura, northern Peru. **B.** Habit of *M. canoi*, growing among grasses. **C.** Leaves, abaxial surface. **D.** Inflorescence, bottom view. **E.** Leaves, adaxial surface. **F.** Flowering branch and inflorescence, lateral view. **G**. Detail of flower, lateral view. (B-G, from *Michelangeli 2650*; photos by F. A. Michelangeli).

surface, the secondary veins arising at the base of the leaf, running close to the margin, slightly raised on the abaxial surface, not evident on the adaxial surface, tertiary veins percurrent, spaced 1.5–1.8 mm, flat on the abaxial surface, not evident on the adaxial surface. Inflorescence

terminal, a short cyme up to 2.5 cm long, the peduncles obscurely quadrangular with sparse trichomes 0.7–1 mm long, these denser on the nodes; bracteoles persistent, 5–6(−8) × 1.1–1.6 mm, narrowly obovate, ciliolate in the distal 1/3; pedicel 2.8–3.1 mm long. Flowers 4-merous, nodding at anthesis, the hypanthium 4 × 4–4.2 mm, widely campanulate to globose, reddish, the outer surface sparsely pubescent, the trichomes ca. 0.2 mm, the inner surface glabrous, the torus glabrous and without a fringe; calyx 1.6–1.9 mm long, fused 1/2 way up, the free lobes broadly deltoid, the outer teeth not projecting beyond the inner lobes and conspicuous in live material, but drying flat and incospicuous; petals sub-orbicular, 3.2–4 × 4.1–4.9 mm, the surface pruinous, white to cream; stamens 8, sub-isomorphic, the antesepalous set ca.10–15% larger than the antepetalous set, white to cream (turning dark brown after anthesis); filaments 2.6–3.1 × 1.2–1.7 mm, flat at the base and narrowing towards the apex, sparsely glandular puberulous, thecae, 2-celled, obovate, 2–2.5 mm long, the base of each cell projecting ventrally as an appendage ca. 0.6 mm long, dorsally sparsely glandular; opening initially by a ventrally inclined broad pore, but then becoming rimose as the apex of the anther continues to split; ovary inferior, 4-locular, with a collar around the insertion of the style; style 5.5–6 mm long, sparsely glandular, widening towards the apex, the stigma capitate to galeate, 1.6–2 mm diam. Fruit a berry, 7 × 6 mm, purplish black at maturity. Seeds 0.8–0.95 mm long, ovoid to lacrimiform.

Distribution.—*Miconia canoi* is only known from two collections, the type locality in the páramos of northern Peru, close to but north of the Huancabamba depression, and the páramo of the Parque Nacional Podocarpus in Loja, Ecuador (Fig. 3). These two localities both harbor páramo vegetation dominated by grasses above the tree line; they are ca. 85 km apart. The Peruvian locality, Laguna Shimbe in Piura, is moderately degraded, mainly due to cattle grazing and tourism, mostly in pursuit of magical-healing ceremonies ("chamanismo").

Conservation status.—Given its restricted distribution with only one of the two populations within a protected area (Podocarpus National Park in Ecuador), *Miconia canoi* should probably be listed as critically endangered. However, because it is only known from two collections in poorly sampled areas (especially on the Peruvian side of the distribution), we propose that at this time be considered as data deficient (DD; IUCN, 2012; IUCN Standards and Petitions Subcommittee, 2017).

Etymology.—This species is named after Peruvian botanist Asunción Cano Echevarría, in homage to his vast collections of the Andean flora of Peru, his role as mentor of numerous Peruvian and international botanists working in Peru, and his valuable support of our work.

Additional specimen examined: ECUADOR. Loja: Parque Nacional Podocarpus, road Yangana–Cerro Toledo, at entrance to crest, 4°23'S 79°06'W, 3100 m, 26 Feb 1985 (fr), *B. Øllgaard et al. 58,226* (AAU [n.v.], MO, NY, QCA [n.v.], QCNE, US).

Miconia canoi is morphologically similar to several other species of *Miconia* sect. *Cremanium* and *M.* sect. *Chaenopleura*, most notably *M. cauingia* J. F. Macbr., *M. chionophila* Naudin, *M. fruticulosa* Cogn., *M. pernettifolia* Triana, *M. rotundifolia* (D. Don) Naudin, and *M. vaccinioides* (Bonpl.) Naudin, all of them distributed in the jalcas and páramos of the Andes between Ecuador and Peru (with the exception of *M. chionophila* with a wider occurrence). It shares with all these species four-merous flowers (although *M. pernettifolia* can be five-merous), with white to cream, obovate anthers that open by broad pores or slits. Additionally, like all of the mentioned species with the exception of *M. pernettifolia*, it has a broadly peltate to capitate or galeate stigma. It also shares with *M. chionophila*, *M. pernettifolia*, *M. rotundifolia* and *M. vaccinioides* persistent bracteoles. However, *M. canoi* is easily distinguishable from all of these species except *M. vaccinioides* by having the secondary venation not apparent on the adaxial surface of the leaves. *Miconia vaccinioides* also has very obscure secondary venation on the adaxial leaf surface, but its leaves are considerably smaller (5–6.2 × 3.8–4 mm). Additionally, *M. vaccinioides* has glabrous stamen filaments and a glabrous style. For additional diagnostic characters and geographical distributions of the species of this group, see Table 1.

It should be noted that the paratype (*Øllgaard 58,226*) was initially determined as *M. vaccinioides*. However, this collection, although in fruit, clearly belongs to *M. canoi.* Additionally, *M. vaccinioides* has been reported from Ecuador based on two additional specimens: *Øllgaard 74,468* (AAU, MO) and *Keating 195* (QCNE) (Jørgensen & Ulloa Ulloa, 1994; Keating, 1994; Jørgensen & León-Yánez, 1999; Keating, 2008). The Keating

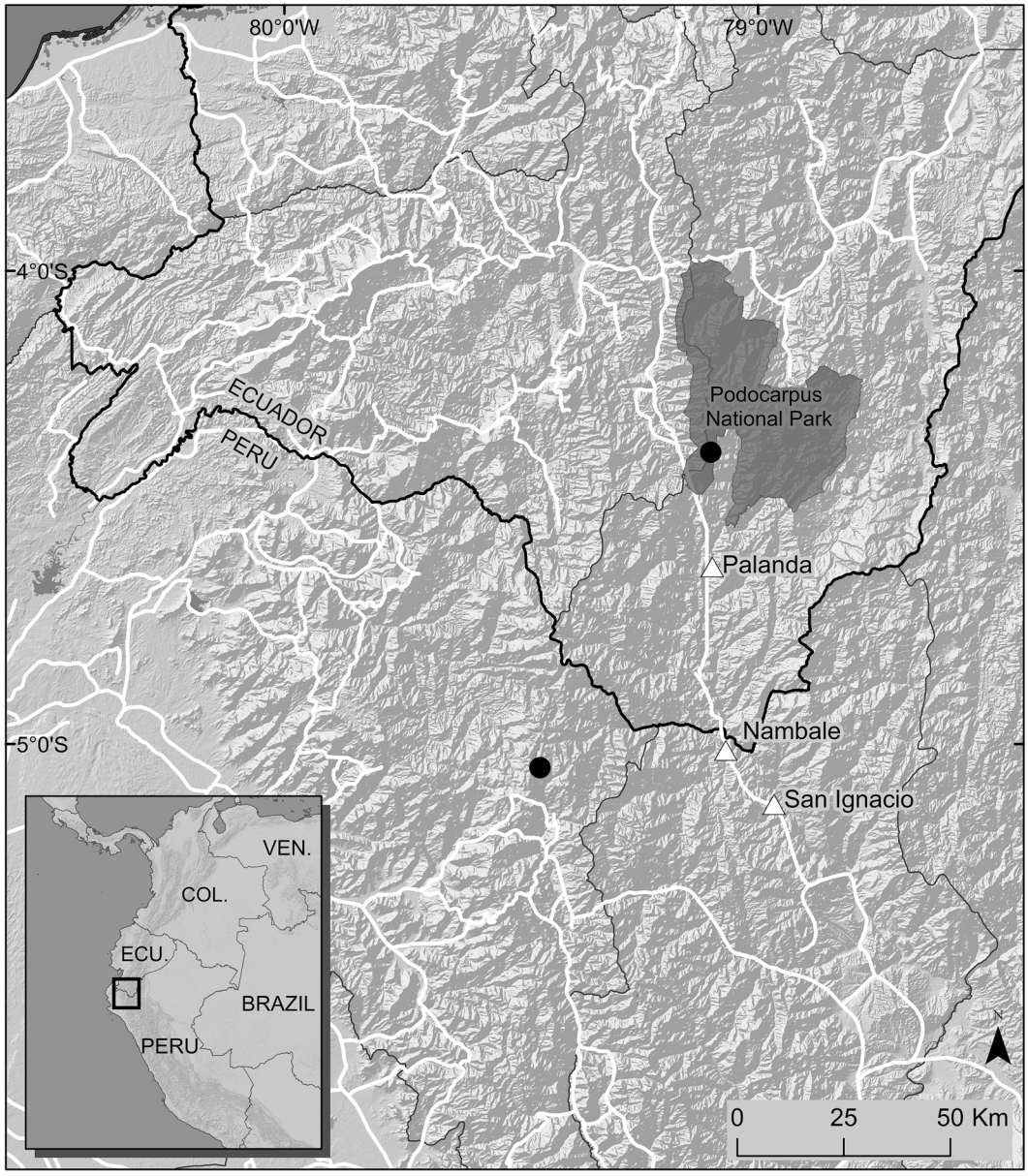

Fig. 3. Distribution of *Miconia canoi* in southern Ecuador and northern Peru.

specimen is clearly not *M. vaccinioides*, and it is perhaps *M. castillensis* Wurdack., while the Ø-llgaard collection is *M. paludigena* Wurdack. This means that to our knowledge *M. vaccinioides* has not yet been positively recorded from Ecuador, and it remains as a species endemic to Peru.

At Laguna Shimbe in Peru, *Miconia canoi* grows sympatrically with *M. rotundifolia*. In fact, we found *M. canoi* while searching for *M. rotundifolia* within the grassy vegetation on the mountain slope around Laguna Shimbe. Although we also found *M. rotundifolia* in the same general area, we did not find them co-occurring within 100 m of each other. It seems that *M. canoi* prefers steeper and better-drained soil, while *M. rotundifolia* was usually in flatter and moister areas.

In spite of the limited amount of material available, it is possible to see how the anthers of

TABLE 1. COMPARISON OF MORPHOLOGICAL CHARACTERS AND DISTRIBUTION OF *MICONIA CANOI* AND PUTATIVE RELATIVES

	M. cauingia	*M. chionophila*	*M. pernettifolia*	*M. rotundifolia*	*M. vaccinioides*	*M. canoi*
Habit	Shrub, 0.2–0.4 m tall	Low creeping shrub or perennial herb to 0.1 m tall	Prostrate shrub, to 0.5 m tall	Low creeping shrub or perennial herb	Small shrub, erect, to 1.2 m tall	Prostrate subshrub, to 0.4 m tall
Blade shape	Ovate to ovate-elliptic	Narrowly ovate to subrotund	Elliptic to obovate-elliptic	Orbicular to sub-orbicular	Narrowly ovate-elliptic	Ovate to narrowly ovate
Venation	Shortly-plinerved	Basinerved, ciliate, not revolute	Basinerved, ciliate, not revolute	Basinerved, ciliolate to ciliate, not revolute	Basinerved, slightly dentate, revolute	Basinerved, dentate and sparsely ciliate, obscurely to clearly revolute
Blade margin	Slightly callose-crenulate, not revolute					
Abaxial leaf surface	Slightly rugose, with dot-like glands	Flat, setulose to glabrate	Flat, glabrous	Flat, setulose to glabrate	Flat, glabrous	Flat, glabrous with glandular dots
Domatia on abaxial vein axils	A tuft of hairs	Absent	Absent	Absent	Absent	Absent
Bracteole persistence	No	Yes	Yes	Yes	Yes	Yes
Petal number	4	4	4–5	4	4	4
External calyx lobes	Rounded, not projecting above inner lobes	Acute, not projecting above inner lobes	Subulate, projecting above inner lobes	Acute, not projecting above inner lobes	Triangular, not projecting above inner lobes	Triangular, not projecting above inner lobes
Glands on filaments	No	Yes	No	Yes	No	Yes
Anther dehiscence	Two broad slits	Two broad slits	Two broad pores	Two broad slits	Two broad pores to cleft	Two broad pores to cleft
Connective	Prolonged below thecae, not lobed	Very shortly prolonged below thecae, not lobed or very shortly bilobed on ventral side, with a dorsal emarginated tooth	Very shortly prolonged below thecae, shortly bilobed on ventral side, with a dorsal emarginated tooth	Very shortly prolonged towards dorsal side.	Very shortly prolonged below thecae, shortly bilobed on ventral side, with a dorsal emarginated tooth	Very shortly prolonged below thecae, shortly bilobed on ventral side, with a dorsal emarginated tooth
Glands on style	No	Yes	No	No	No	Yes
Stigma shape	Peltate	Peltate	Punctiform to slightly expanded	Capitate	Capitate to galeate	Capitate to galeate
Distribution	Northern Peru	Throughout the Andes and Costa Rica	Southern Ecuador	Ecuador, Peru	Ecuador, Peru	Southern Ecuador and northern Peru

Miconia canoi serve as a perfect example of how the limits between *Miconia* sect. *Cremanium* and *M.* sect. *Chaenopleura* are poorly defined. In *M. canoi* the anthers start opening by two broad pores, separated by a slightly protruding septum. However, very quickly the lower edges of the pores tear downwards uniting to form a single slit that extends 1/5–1/4 of the length of the anther, with the connective septum protruding at its apex. Therefore, even though these anthers are obviously cleft, as in *M.* sect. *Chaenopleura*, because the slit does not extend downwards very far, the superficial appearance is that of a broad pore, as exhibited by *M.* sect. *Cremanium*. A similar situation has been observed in *M.* sect. *Chaenanthera*, in which closely related species differ in the amount by which the slits extend downwards from the apex of the anthers, resulting in different morphological types in spite of similar opening mechanisms (Goldenberg et al., 2003).

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