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Three new species of *Markea* (Solanaceae, Juanulloeae) from Colombia

ANDRÉS OREJUELA[1], CLARA INÉS OROZCO[1] & GLORIA BARBOZA[2]
[1] *Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Apartado 7495, Bogotá, Colombia.*
E–mail: ciorozcop@unal.edu.co, aaorejuelar@unal.edu.co, gbarboza@imbiv.unc.edu.ar
[2] *Instituto Multidisciplinario de Biología Vegetal (IMBIV–CONICET). Facultad de Ciencias Químicas, Universidad Nacional de Córdoba, Haya de la Torre y Medina Allende, CC 495, CP 5000. Córdoba, Argentina.*

Abstract

Three new species of *Markea* from Colombia are described and their morphological affinities and conservation status are discussed. *Markea hunzikeri* is different from other species of *Markea* because it presents a 3-lobed calyx and 3-lobed stigma. *Markea huilensis* shows affinity with *Markea lopezii* and *Markea epifita,* from which it differs by its exerted anthers, tubular-campanulate corolla and fruit with leathery, black, non-translucent exocarp when dry. *Markea purpurea* is clearly differentiated from other species in this genus by its very reduced, extra-axillary, short-pedunculate inflorescence, generally bearing one short-pedicellate or sessile flower with corolla dark purple or black inside. For new species illustrations, photographs of live plants and distribution maps are presented. As a tool for species identification of *Markea*, this paper is accompanied by a key to all species currently recognized in the genus. Additionally, photographs of live plants for most of the species of the genus are included.

Key words: Colombia, *Hawkesiophyton,* Juanulloeae, *Markea,* Solanaceae, taxonomy

Resumen

Se describen tres especies nuevas de *Markea* para Colombia y se discuten sus afinidades morfológicas y estado de conservación. *Markea hunzikeri* se distingue fácilmente de otras especies de *Markea* por su cáliz y estigma 3-lobulados. *Markea huilensis* es semejante a *Markea lopezii* y *Markea epifita*, de las que se diferencia por sus anteras exertas, corola tubular-campanulada y fruto con exocarpo coriáceo, negro y no translúcido en material de herbario. *Markea purpurea* se diferencia fácilmente de otras especies del género por su inflorescencia muy reducida, corto pedunculada, de posición extra-axilar, generalmente con una flor cortamente pedicelada o sésil, de corola púrpura en su interior. Para las nuevas especies se presentan ilustraciones, fotografías en vivo y mapas de distribución. Como herramienta para la identificación de las especies de *Markea*, este artículo va acompañado de una clave para todas las especies reconocidas actualmente en el género. Adicionalmente, se incluyen fotos en vivo para muchas de las especies del género.

Palabras clave: Colombia, *Hawkesiophyton,* Juanulloeae, *Markea,* Solanaceae

Introduction

Markea Richard (1792: 107) (Solanaceae) is a neotropical genus of the subfamily Solanoideae and belongs to the tribe Juanulloeae Hunz. (Hunziker 1977, 1979, 1997; Knapp *et al*. 1997; Knapp 1998). The species of *Markea* are epiphytic or hemi-epiphytic vines or shrubs, distributed from Panama to Bolivia and Southern Brazil (Hunziker 1997, 2001; Knapp *et al.* 1997). Most of its species grow in primary forests from sea level to 3000 m. The highest diversity is found in the Colombian and Ecuadorian Andes (Hunziker 1997, 2001) while the highest concentration of species is present in Colombia with 13 of the 20 species currently recognized in the genus, including the three new species described in this paper.

In a most recent phylogenetic study for Solanaceae, Olmstead *et al*. (2008) recognize tribe Juanulloeae as a natural group. However, the circumscription of this tribe has been historically controversial, specifically regarding the inclusion of the genus *Solandra* Swartz (1787: 300), and more recently, *Schultesianthus* Hunziker (1977: 35) (Knapp *et al*. 1997; Hunziker 2001; Olmstead *et al*. 2008). Additionally, different concepts have been formulated on the status

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of *Ectozoma* Miers (1849: 191), *Hawkesiophyton* Hunziker (1977: 39), and *Rahowardiana* D'Arcy (1974: 670) as independent genera or synonyms of other genera in Juanulloeae (Knapp *et al*. 1997; Hunziker 2001). In the case of *Markea*, the morphology and the molecular data corroborate its inclusion in Juanulloeae (Knapp *et al*. 1997; Hunziker 2001; Olmstead *et al.* 2008; Särkinen *et al*. 2013; Orejuela *et al.* in prep.). However, there is no clear agreement on its circumscription. Knapp *et al*. (1997) included *Hawkesiophyton* in *Markea,* while Hunziker (2001) considered both genera to be independent.

Markea has been traditionally delimited on the basis of a combination of characters which include solitary flowers or flowers arranged in few-flowered pendant cymes, deeply split calyx lobes, corolla aestivation overlapping, corolla funnelform or infundibuliform and basifixed anthers (Knapp *et al*. 1997; Hunziker 2001). However, some of these characters might be somewhat variable among the species of the genus (Knapp 1998) or found in other genera within Juanulloeae (Orejuela pers. obs.). As stated by Knapp *et al*. (1997), the fruit in *Markea* with thin and chartaceous pericarp dries translucent, and the seeds pale to tan or orange with elongate, rectangular testal cells could be useful in the recognition of the genus; nevertheless, the fruits of several species are not known or can rarely be assessed due to the scarcity of fruiting specimens. Consequently, the real taxonomic importance of these characters in the definition of *Markea* requires further study. In this context, *Markea* remains poorly defined and, as mentioned by Knapp (1998) and recently by Stehmann & Giacomin (2012), it is clear that the genus requires a monograph based on field observations and new collections.

The three new species here described were discovered on the basis of an intense herbarium revision and fieldwork, conducted within a comprehensive study aimed at clearing the taxonomical and systematic problems of tribe Juanulloeae (Orejuela *et al*. in prep.). Taking into account our recent advances in the knowledge of the tribe, and in spite of the fact that the generic limits of *Markea* are still unclear, we decided to describe these species under *Markea*. These plants are a morphological match with the genus *Markea*.

Additionally, the new species could not be described in *Dyssochroma* Miers (1849: 250) or *Merinthopodium* Donnell Smith (1897: 11*)* due to the absence of green-campanulate corollas and valvar aestivation. Neither the new species could be described in *Juanulloa* Ruiz & Pavon (1794: 27) because the narrow tubular corolla and dorsifixed anthers are not present; or in *Schultesianthus* because the leaves are not coriaceous and lack the minute peltate glandular trichomes, and the zygomorphic flowers typical of this genus are absent. Lastly, these new species could not be described in *Trianaea* Planchon & Linden (1853: 4) because the ventrifixed anthers, the 4 to 5-carpellate, and 8 to l0-loculate ovary are not present, and consequently the 5-lobed stigma are also absent.

Materials and Methods

Material of the three species in question was collected in the field. Part of this material was prepared for herbarium collection, while some fruit and flower samples were preserved in 70% alcohol to facilitate description. Additionally, the collections of 20 Colombian herbaria were studied (CAUP, COAH, COL, CUVC, FMB, HECASA, HUA, HUAZ, HUQ, JAUM, JBB, JBGP, LLANOS, MEDEL, PSO, TOLI, UDBC, UIS, UTMC and VALLE), together with those of other herbaria (CORD, F, MO, QCA and QCNE). Online herbaria and databases, protologues and types and/or photographs were additionally consulted. The key for *Markea* species is based on herbarium material, field observations, descriptions of the species and photographs. Additionally, photographs for most of the species of the genus are included.

Taxonomy

Markea hunzikeri A. Orejuela & C. I. Orozco *spec. nov.* (Fig. 1, 2, 3).

Type:—COLOMBIA. Antioquia: Municipio de Urrao, Corregimiento de Encarnación, Parque Nacional Natural "Las Orquídeas", Sector Calles, camino hacia "La Virgen", aproximadamente 1800 m. 14 April 2011 (fl, fr), *J. Betancur, P. Pedraza, A. Orejuela, J. M. Vélez-Puerta & A. Duque 15234* (holotype: COL!; isotypes: COL!, CORD!, HUA!, MEDEL!;MO!, NY!, US!).

Markea hunzikeri differs from other species in this genus by its 3-lobed calyx and 3-lobed stigma.

FIGURE 1. *Markea hunzikeri.* A. Floriferous branch. B. Inflorescence. C. Flower bud. D. Flower at anthesis. E. Corolla. F. Corolla aestivation. G. Open corolla. H. Stamen. I. Gynoecium. J. Fruit. K, L. Fruit in cross section. M. Seed. N. Embryo. (Based on *J. Betancur et al. 15234*, type collection). Drawing by Marcela Morales.

Epiphytic shrub or subshrub adhered through adventitious roots. Stem terete at the basal branching in fresh material, angular when dry, with conspicuous lenticels, glabrous, the branches slender, internodes clearly differentiated in young

and adult branches, the bark brown, somewhat papyraceous and slightly bright in young branches. Leaves alternate, petiolate; petiole green to violaceous when fresh, 2-10 mm long, articulate, glabrous; blade elliptic to lanceolate or oblong, 5.6–13.6×1–6.2 cm, symmetrical to slightly asymmetrical, chartaceous, minutely glandular trichomes, soon glabrescent, adaxially dark green and abaxially lighter green when fresh, in dry material dark brown adaxially, olive green abaxially, the base usually symmetrical, cuneate, the apex acuminate, 5-10 mm long, the margin entire, slightly revolute, the secondary veins 3 to 5 pairs, slightly raised on the abaxial surface, reticulum inconspicuous. Inflorescence in monochasial cymes, simple, axillary, (2.4–) 3.1–6 cm long, pendunculate, generally with one flower in anthesis and several scars indicating 4 to 7 flowers formed in different development periods of the inflorescence, bracteate, glabrous; peduncle (0.3–) 1–3.3 (–4) cm long; bracts two, unciform, ca. 0.5 mm long, the buds broadly ovoid; calyx 3-winged, totally covering the corolla before anthesis, calyx and corolla aestivation valvate and quincuncial respectively. Flowers pedicellate; pedicel 3-8 mm long, distally thickened. Calyx 3-lobed, 1.9–3.2×1.4–1.9 cm, green with purplish tinges when fresh, the base slightly cordate, indument with glandular trichomes, slightly scattered on surface, the tube 3-5 mm long, 3-ribbed, the lobes broadly ovate, 1.6–2.4×1.1–1.8 cm, fused by their edges along 2/3 of their length, forming three wings or ribs, the apex acute and mucronate, reticulate venation inconspicuous, each lobe with a main vein reaching the apex and 2 to 4 secondary veins departing from the base of each lobe. Corolla 5-lobed, rarely 6-lobed, tubular-campanulate, 2.2–3.8×1.1–1.7 cm, glabrous, yellowish green, purple at the inner base of the tube, the tube 1.4–1.8 cm long, differentiated into a narrow base, 3.5–4.5×3–4.7 mm and a campanulate portion 1.1–1.3×1–1.7 cm, the lobes ovate, revolute with apex obtuse, slightly reflexed during anthesis, 9–10×7.5–9.8 mm. Stamens 5 (6), 6.5–7.4 mm long, the filaments 1.2–1.4 mm long, adnate at ca. 3.2 mm from the base of the corolla, purple in fresh, brown when dry, scarcely pubescent at the insertion point, with trichomes simple, uniseriate, with 4 to 6 cells, the anthers 6–6.2 mm long, ellipsoid, basifixed, connivent. Ovary conic, ca. 3.1×2 mm, 2 to 3 carpels, 2 to 3 locules, glabrous, the disc nectariferous 5 lobed and well developed; style 7.2–9 mm long, cream, with purplish tinges in fresh material; stigma 3-lobed, light green in fresh material, ca. 1.3 ×1.4 mm. Fruit a berry ellipsoid, 1.1–1.4×0.7–1 cm, light green when unripe, translucent exocarp when dry, the persistent calyx totally covering the fruit, slightly accrescent, 2.2–2.9×2.1 cm, the calyx lobes on the fruit ca. 2.9×2.2–2.3 cm. Seeds numerous, sub-reniform, 2.3–2.5×1.2–1.4 mm, pale brown when dry, the testa reticulate; embryo slightly curved, ca. 2.1×0.5 mm, the cotyledons ellipsoid, as wide but shorter than the rest of the embryo, with relatively abundant endosperm.

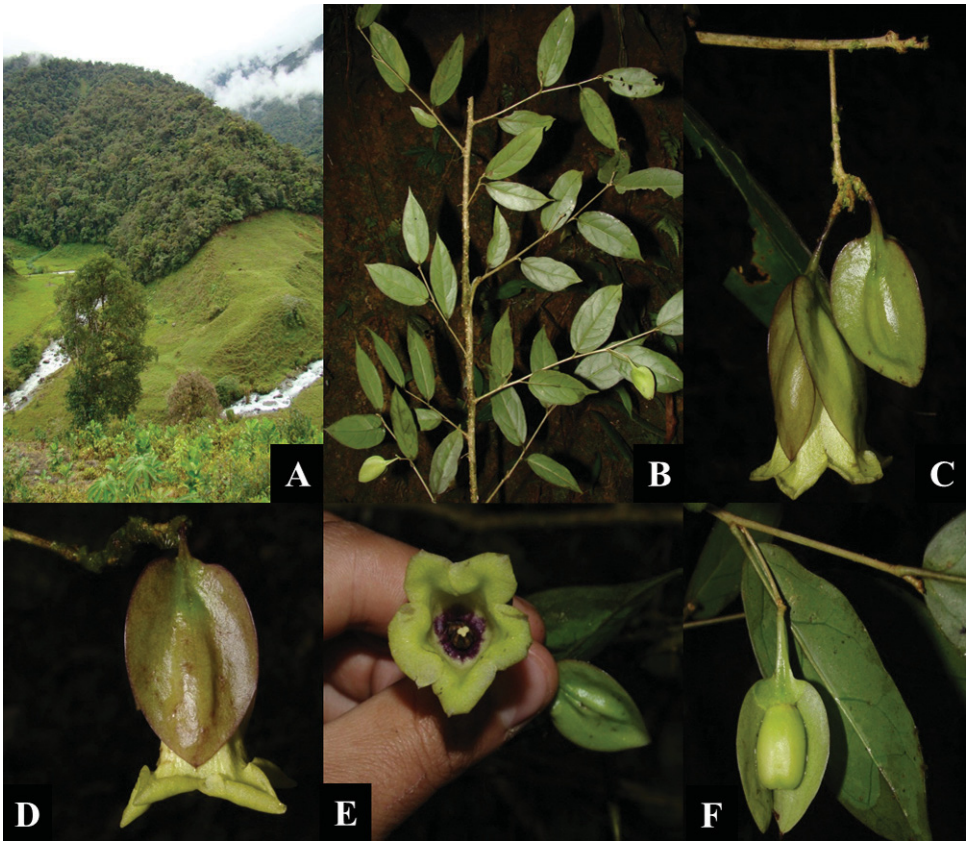

FIGURE 2. *Markea hunzikeri.* A. Type locality ("Las Orquídeas" National Natural Park). B. Branch. C. Inflorescence. D. Flower at anthesis. E. Front view of the corolla. F. Immature fruit (holotype *Betancur et al. 15234*, photograph by Andrés Orejuela).

Etymology:—The specific name is dedicated to Prof. Armando Hunziker (1919-2001) for his numerous contributions to the knowledge of tribe Juanulloeae and for being the first one to recognize, in his unpublished notes, this taxon as a probable new species of *Hawkesiophyton*, a genus which has been synonymized under *Markea* by Knapp *et al*. (1997). A complete list of Hunziker´s contributions can be found in Anton & Barboza (2007).

Distribution and Habitat:—*Markea hunzikeri* is distributed in Colombia's Andean region in the departments of Antioquia, Tolima and Valle, growing in preserved forest and relicts from 800–2500 m.

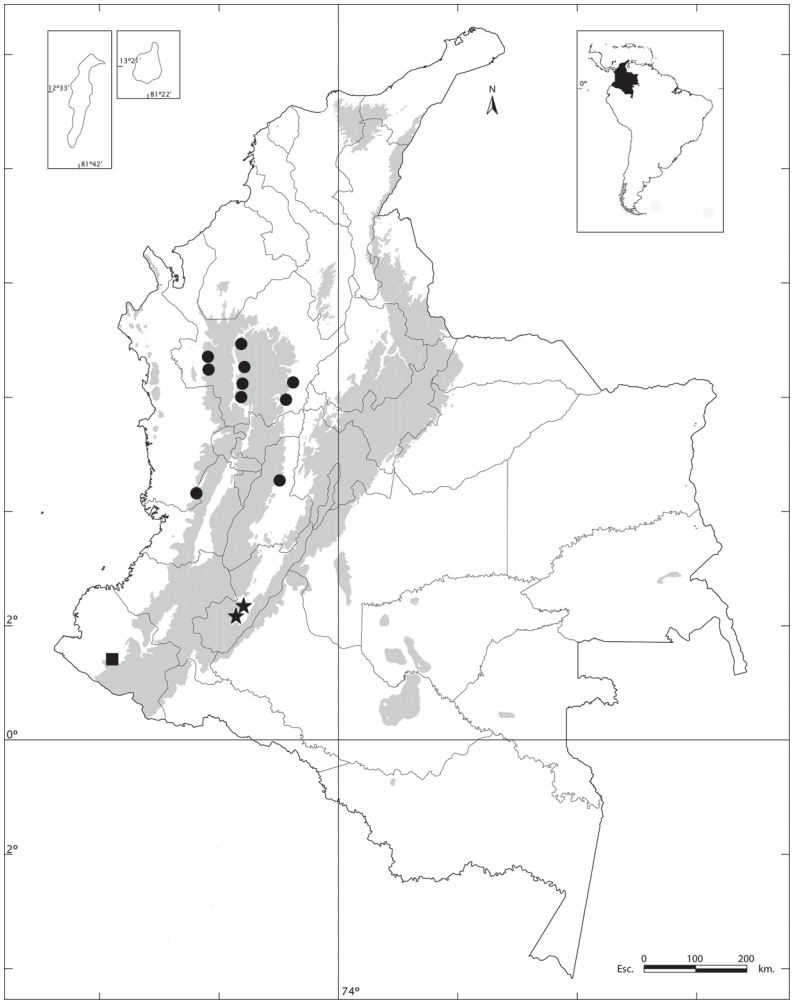

FIGURE 3. Distribution map for *Markea hunzikeri* (circles), *Markea huilensis* (stars) and *Markea purpurea* (squares). Cordilleras in Colombia (gray color).

Phenology:—Flowering and fruiting take place all year long.

Conservation status:—*Markea hunzikeri* is endemic to Colombia. Most of the samples come from localities not included in the Colombian National System of Protected Areas (Sistema Nacional de Áreas Protegidas de Colombia), except for those collected from "Las Orquídeas" National Natural Park and from private reserves, including the Ecological Park "Piedras Blancas", "Montevivo" Natural Reserve, and the Wild Life Refuge of "Alto de San Miguel", in Antioquia. *Markea hunzikeri* is proposed as a vulnerable species (VU) because the area in which it is present (17,000 km^2, as calculated by the minimum convex polygon method) is below 20,000 km^2, which is the lower limit stated by criterion B 1ab [i, iii] of the IUCN (2012). Additionally, most of the known collections of *M. hunzikeri* come from forest relicts in highly fragmented areas around the city of Medellín.

Additional specimens examined:—COLOMBIA. Antioquia: Arví, vereda El Roble, finca La Forzosa, alto El Surtido, 1750 m, 2 June 2004, *Ariza & Toro 670* (UDBC); municipio Caldas, reserva "Alto de San Miguel", cuenca alta del río Medellín, 1800–2000 m, 75°38´ W, 6°05´ N, 23 November 1996, *Roldán & Velásquez 2482* (HUA); municipio Envigado, vereda "El Escobero" finca "La Morena", 2100 m, 6°10´19" N, 75°39´09" W, 2 November 1996, *Correa et al. 1508* (JAUM); municipio de Frontino, corregimiento Nutibara, región de Murrí, margen de carretera, 1780 m, 11 July 1986, *Acevedo et al. 1283* (HUA); Alto de Cuevas, 10 km al oriente de La Blanquita, 12 km al occidente de Nutibara, 1680 m, 6°40' N, 76°30' W, 2 March 1992, *Gentry et al. 76033* (MO); Corregimiento de Nutibara, cuenca

alta del río Cuevas, 1720 m, 12 July 1986, *Sánchez et al. 347* (COL); 8 km al Sur de Angostura sobre la vía a la represa Miraflores, 2000 m, 6° 50′ N, 75°18′ W, 8 February 1986, *Stein & Cogollo 3397* (COL); entre los municipios de Frontino y Urrao, Parque Nacional Natural "Las Orquídeas", sector Calles, margen derecha del rio Calles, 1250 m, 6°32′ N, 76°19′ W, 30 May 1988, *Cogollo & Ramírez 3068* (COL); margen izquierda del río Calles, 1 km arriba de la confluencia de los ríos Polo y Calles, 1460 m, 6°32′ N, 76°19′ W, 11 February 1989, *Cogollo et al. 3894* (COL); municipio de Medellín, San Antonio del Prado, al sur de Medellín, vereda La Cabaña, finca Loma Linda, al oeste del pueblo, 2200 m, 6 November 1986, *Albert de Escobar et al. 8765* (HUA); near Medellín, February 1931, *Archer 1597* (US); corregimiento de Altavista, monte El Encanto, quebrada El Barcino, 2350–2380 m, 6°13′44" N, 75°39′33" W, 16 June 1997, *Giraldo et al. 1630* (HUA, JAUM); corregimiento Santa Helena, Reserva Natural Montevivo, sector Casapalo, 2500 m, 06°12′48" N 75° 29′32.2" W, 20 October 2002, *David & Idarraga 376* (HUA); corregimiento de Altavista, vereda Aguas frías, cabecera de la quebrada "Las Picachas", 2250–2300 m, 6°13′57" N, 75°39′45" W, 19 May 1997, *Rodríguez et al. 811* (JAUM); vereda Aguas Frias (parte alta), alto El Cedro, 2450 m, 06°13′55" N, 75°39′25" W, 08 February 2008, *Rodríguez et al. 6403* (HUA); entre el municipio Medellín y Guarne, parque ecológico Piedras Blancas, sector Lajas, 2350 m, 6°18′ N,75°29′ W, 10 December 1994, *Fonnegra et al. 5331* (COL, HUA, MO); municipio Rionegro, corregimiento Santa Helena, vereda Yarumales, 23 km al SE de Medellín por la vía a Santa Helena, 2400 m, 6°16′ N, 75°32′ W, 11 January 1994, *Callejas & Bornstein 11091* (HUA); municipio San Francisco, corregimiento de Aquitania, rio Venado, 1200–1350 m, 2 April 1992, *Fonnegra et al. 4052* (COL, HUA); tierra fría, 1150–1250 m, 5 April 1992, *Fonnegra et al. 4319* (HUA, MO); municipio Yarumal, vereda "El Cedro" sobre la vía Alto de Ventanas-El Cedro, 127 Km al NE de Medellín, 1600–1800 m, 7°06′ N, 75°32′ W, 7 March 1993, *Callejas & Gómez 10809* (HUA). **Tolima**: entre Murillo, 15 km. de Líbano, 2000 m, 8 April 1984, *Albert de Escobar et al. 4211* (HUA). **Valle del Cauca**: Cordillera Occidental, vertiente occidental, Hoya del río San Quininí, lado izquierdo, La Laguna, bosques, 1250–1400 m, 10–20 December 1943, *Cuatrecasas 15485* (VALLE).

Discussion:—*Markea hunzikeri* can be easily recognized from any other species of the genus because of its consistently 3-lobed calyx and stigma. This species is sympatric with *Markea antioquensis* S. Knapp (1998: 153) and *Markea pilosa* S. Knapp (1998:157) but these species are morphologically very different (Fig. 2A, G). Besides of the 5-lobed calyx and 2-lobed stigma, among others characters, in *M. antioquensis* and *M. pilosa* the size of the corollas are longer than 4 cm (see the key). In spite of the noticeable 3-lobed calyx and stigma, *M. hunzikeri* has been confused in herbaria with *Markea sturmii* Cuatrec. (1959: 271). Both species are epiphytic small shrubs, profusely branched with slender stems and small leaves of comparable size and color. These similarities may have led to the inclusion of *M. hunzikeri* as *M. sturmii* in the catalogue of Solanaceae for the Flora of Antioquia (Nee 2011).

On the other hand, both species are part of the group of *Markea* bearing small flowers, less than 3 cm long; however, in *M. hunzikeri* the calyx is 3-lobed, with lobes broadly ovate and base cordate, while in *M. sturmii* the calyx is 5-lobed, exhibiting elliptical lobes with cuneate base (Fig. 1, 2, 5B). In *M. hunzikeri*, the base of the filaments has sparsely simple uniseriate trichomes, while in *M. sturmii* the filaments are glabrous. Additionally, in *M. hunzikeri* the bracts are small and unciform while in *M. sturmii* are conspicuous and foliose. Finally, the stigma in *M. hunzikeri* is 3-lobed vs. the 2-lobed stigma of *M. sturmii.*

Markea huilensis A. Orejuela & J. M. Vélez, *spec. nov.* (Fig. 3, 6, 7).

Type:—COLOMBIA. Huila: Municipio de La Plata, vereda La María, Finca Meremberg, sitio Agua Bonita, 2287 m, 02°12'13.1" N, 76°06'33.8" W, 5 August 2010, *A. Orejuela & J. M. Vélez-Puerta 112* (holotype COL!; isotypes COL!, MO!).

Markea huilensis is similar to *Markea lopezii* Hunz. from which it differs by its tubular-campanulate yellowish-green corolla with conspicuous purple veins, anthers completely exerted, 2-locular fruit with leathery exocarp, not translucent and black when dry.

Epiphytic or hemi-epiphytic vine adhering to the trees by adventitious roots. Stem terete in fresh material, irregularly angulate when dry, the indument of simple trichomes, 0.2-1.8 mm long, uniseriate, (2) 4 to 7 (11) cells, hyaline, ochre to brown, with deciduous apex and a multicellular usually persistent base conferring the surface a tuberculate appearance, the internodes in young branches (1.5–) 2.1–4.5 (–5.2) cm long, densely hirsute, the adult branches are congested with apparent whorled leaf arrangements, becoming glabrescent as they age, and bearing broad circular foliar scars left by the petiole insertion and by the dryness of the branches, the bark pale brown. Leaves sub-opposed or alternate on young branches, apparently whorled on adult branches and crowded towards the tip; petiole pale green when fresh, 0.4–3.8 cm long, conspicuously articulate, densely hirsute; blade elliptic to broadly elliptic, 9.0–16.7×4.6–11.7 cm, rarely asymmetric, membranaceous, sparsely pubescent both abaxially and adaxially, with

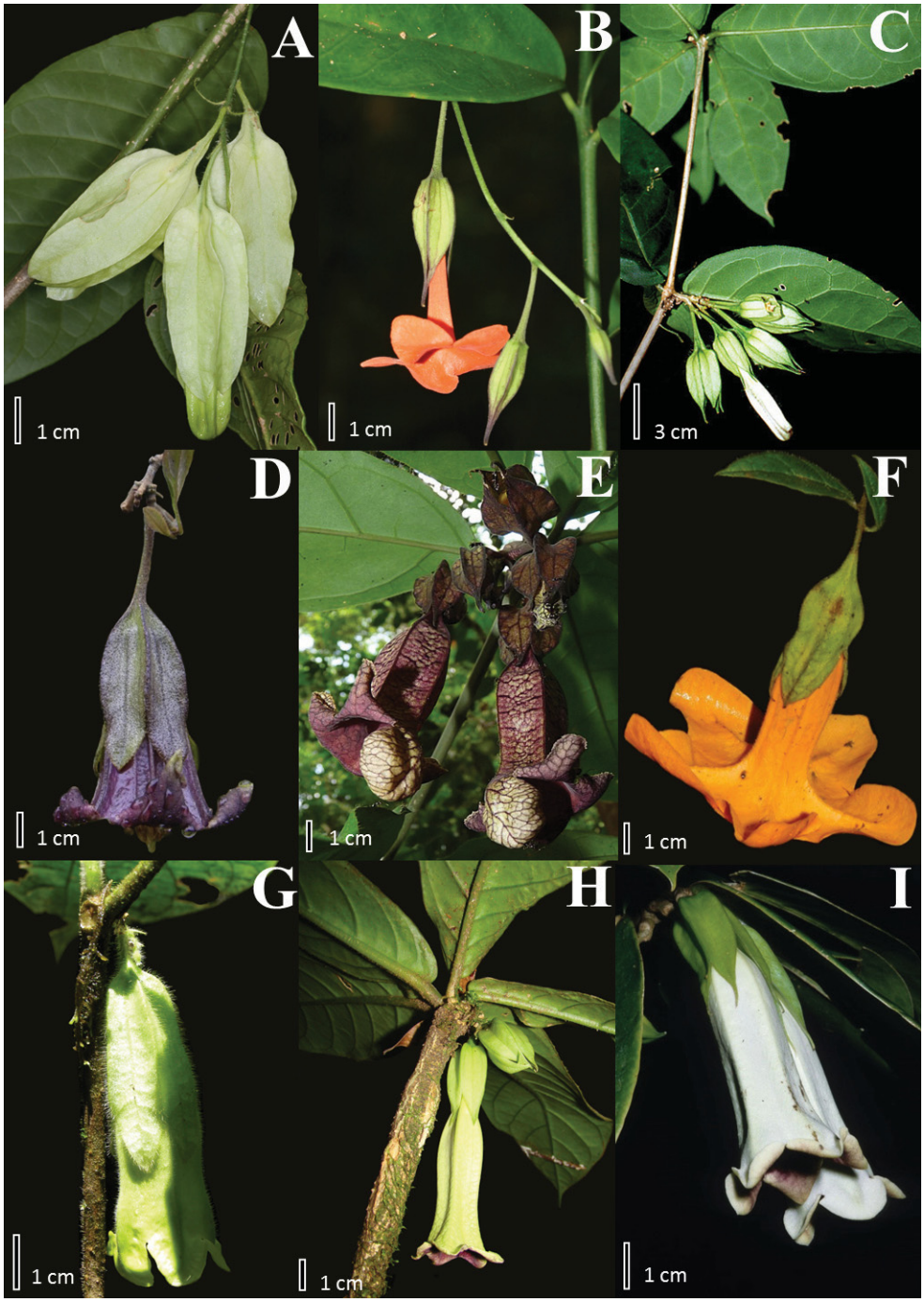

FIGURE 4. *Markea* species with corollas longer than 4 cm. A. *M. antioquensis*. B. *M. coccinea*. C. *M. formicarum*. D. *M. fosbergii*. E. *M. longiflora*. F. *M. lopezii*. G. *M. pilosa*. H. *M. plowmanii*. I. *M. sessiliflora*. (Photographs A by Julio Betancur; B, C by Robin Foster; D by Rocío Deanna; E by Hervé Galliffet; F by Eduardo Calderón; G by Andrés Orejuela; H by Antonio Peña; I by Günter Gerlach).

simple trichomes, 0.3–2 mm long, uniseriate, with 4 to 9 cells, hyaline in fresh, brown to dark olive when dry, the base asymmetric, cuneate or obtuse, the apex usually acuminate, 7–9 mm long, mucronate, the margin entire, undulate, the secondary veins 4 to 6 pairs, slightly raised abaxially, reticulum inconspicuous both adaxially and abaxially. Inflorescence in monochasial cymes, simple, sometimes branched, at sub-axillary position, 24–53 cm long, long-pedunculate, pendulous, 2 to 7 flowers, bracteate, the surface tuberculate and densely hirsute with trichomes as on the stems; peduncle 8.5–19 cm long; bracts foliaceous and linear ca. 5.6×1.5 cm, the floral buds ellipsoid, ca. 10.5×2.5 cm, calyx and corolla aestivation valvate and cochlear respectively. Flowers pedicellate; pedicel 1.5–2 mm long, conic, 5-ribbed, distally thickened. Calyx 5-lobed, ca. 3.3×1.5 cm, dark green with purple margins in fresh material, adaxially reticulate, abaxially pubescent, the trichomes simple multicellular, uniseriate, 4 to 7 cells, hyaline to brown, the tube 5–7 mm long, the lobes lanceolate, 2.7–5.2×1.3–1.5 cm, the apex largely acuminate, acumen 6–9 mm long.

Corolla 5-lobed, tubular-campanulate, 8.5–10×ca. 4.8 cm, yellowish green, strongly reticulate both abaxially and adaxially, exhibiting violaceous veins in fresh material, scarcely pubescent, trichomes similar to those of the calyx, the tube 6.2–6.7 cm long, differentiated into a narrow base ca. 20×8–10 mm and a wide distal portion 4.2–4.6 x ca. 5 cm, the lobes oblong, revolute, with the apex obtuse, reflexed during anthesis, 2.3–3.3×1.6–1.7 cm. Stamens 5, exerted, 6.1–6.9 cm, the filaments 4.7–5 cm long, adnate at ca. 2 cm from the base of the corolla, with hyaline dense indument of simple, uniseriate trichomes at the insertion point, the anthers basifixed 14–19×1.3–1.5 mm, not connivent. Ovary conic, 7×3.5 mm, light yellow, 2-carpelar, 2-locular, glabrous, the disc nectariferous well developed and lobed, light green in fresh material. Style 7.3–8 cm long, cream, glabrous. Stigma 2-lobed, clavate, glabrous. Fruit a berry, ovoid, 4.2 ×2.5 cm, dark green when fresh, exocarp 2–2.8 mm, thick when fresh, coriaceous, black when dry, the persistent calyx partially covering the fruit, 4–5×2.3 cm. Seeds numerous, subreniform, 2.6–3.0×1.2–1.4 mm, ochre in fresh material, dark brown when dry, the testa reticulate; embryo slightly curved, 2.5×0.5 mm, cotyledons shorter than, and as wide as the rest of the embryo, with a slight constriction at the junction point, endosperm abundant.

Etymology:—The specific name refers to the department of Huila, where the known collected samples of this new species come from.

Habitat and distribution:—*Markea huilensis* is known only in the department of Huila, southwestern Colombia. This species is found in preserved or partially altered forest at 2200–2300 m.

Phenology:—Flowering and fruiting take place from July to August and December to January.

Conservation status:—*Markea huilensis* is known from four collections of two localities in the department of Huila, Colombia, with an approximate distance of 80 km in between. *Markea huilensis* is proposed here as an endangered species (EN), conforming to criterion B1ab [i, iii] of the IUCN (2012), as the area where it is found is approximately 300 km^2, and also because of the highly fragmented conditions of the forest relicts surrounding this area. Apart from this, the places where it has been collected are not under any governmental protection program.

Additional material examined:—COLOMBIA. Huila: municipio La Plata, vereda Agua Bonita, Finca Meremberg, 1200–1300 m (the real altitude of this locality is 2200–2300 m; the discrepancy is probably due to a typing mistake on the label of this specimen), 21 July 1975, *Díaz-Piedrahita et al. 793* (COL); Carretera Popayán-La Plata, km 100, Reserva forestal de Fauna y Flora Merenberg, 2300 m, 12 December 1982, *Murcia 09* (COL); Municipio San Agustín, vereda La Castellana, reserva privada Los Yalcones, interfluvio quebrada El Palmar-río Balseros, sitio El Palmar, 2400–2600 m, 1°47′44” N, 76°21′5” W, 15–20 August 2005, *Mendoza & Robles 16548* (FMB).

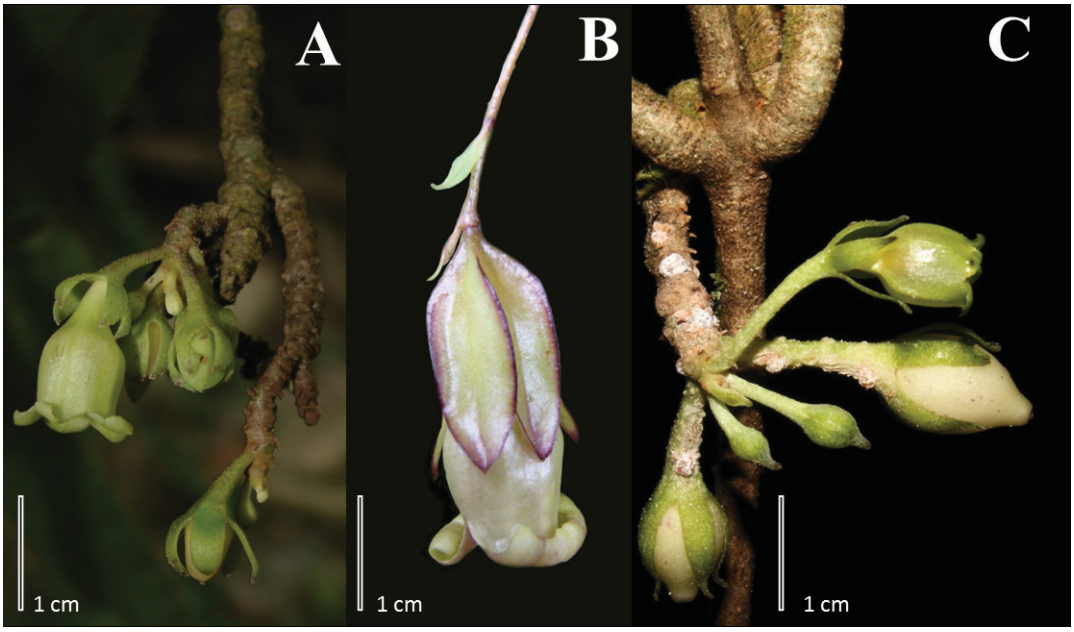

FIGURE 5. *Markea* species with corollas up to 3 cm long. A. *M. panamensis*. B. *M. sturmii*. C. *M. ulei*. (Photographs. A, B by Andrés Orejuela; C. by María Fernanda González).

Discussion:—*Markea huilensis* is sympatric with *M. sturmii*, but, they are morphologically very different (Fig. 5B, 6,7), the size of the corolla in *M. huilensis* is longer than 4 cm (see the key), whereas in *M. sturmii* is up to 3 cm long. *Markea huilensis* is morphologically and phylogenetically (Orejuela *et al*. in prep.) related to *Markea epifita* S. Knapp (1998: 155) and *Markea lopezii* Hunz. (1985: 9). These taxa form a group of species with elongated and

pendulous inflorescence with nodose and tuberculate axes, bearing few flowers, with showy corollas (9-12 cm long). These species also share the apparently verticillate arrangement of the adult leaves, the membranaceus leaf blade, with simple and uniseriate trichomes persistent on both surfaces. The pedicels are distally winged and the calyx has membranaceous and well developed lobes with largely acuminate apexes (Fig. 4F, 6, 7).

Markea huilensis is differentiated from *M. epifita* and *M. lopezii* because it is a more robust and densely hairy plant. The corolla in *M. huilensis* is tubular-campanulate while in *M. lopezii* and *M. epifita* is tubular funnelform (Fig.4F, 6, 7). In *M. huilensis* the corolla is yellowish green, with purple veins both abaxially and adaxially, instead in *M. lopezii* the corolla is orange with purple tinges at the base of the corolla adaxially, while in *M. epifita* the corolla is cream or green with purple lines or tinges in the throat and in the lobes.

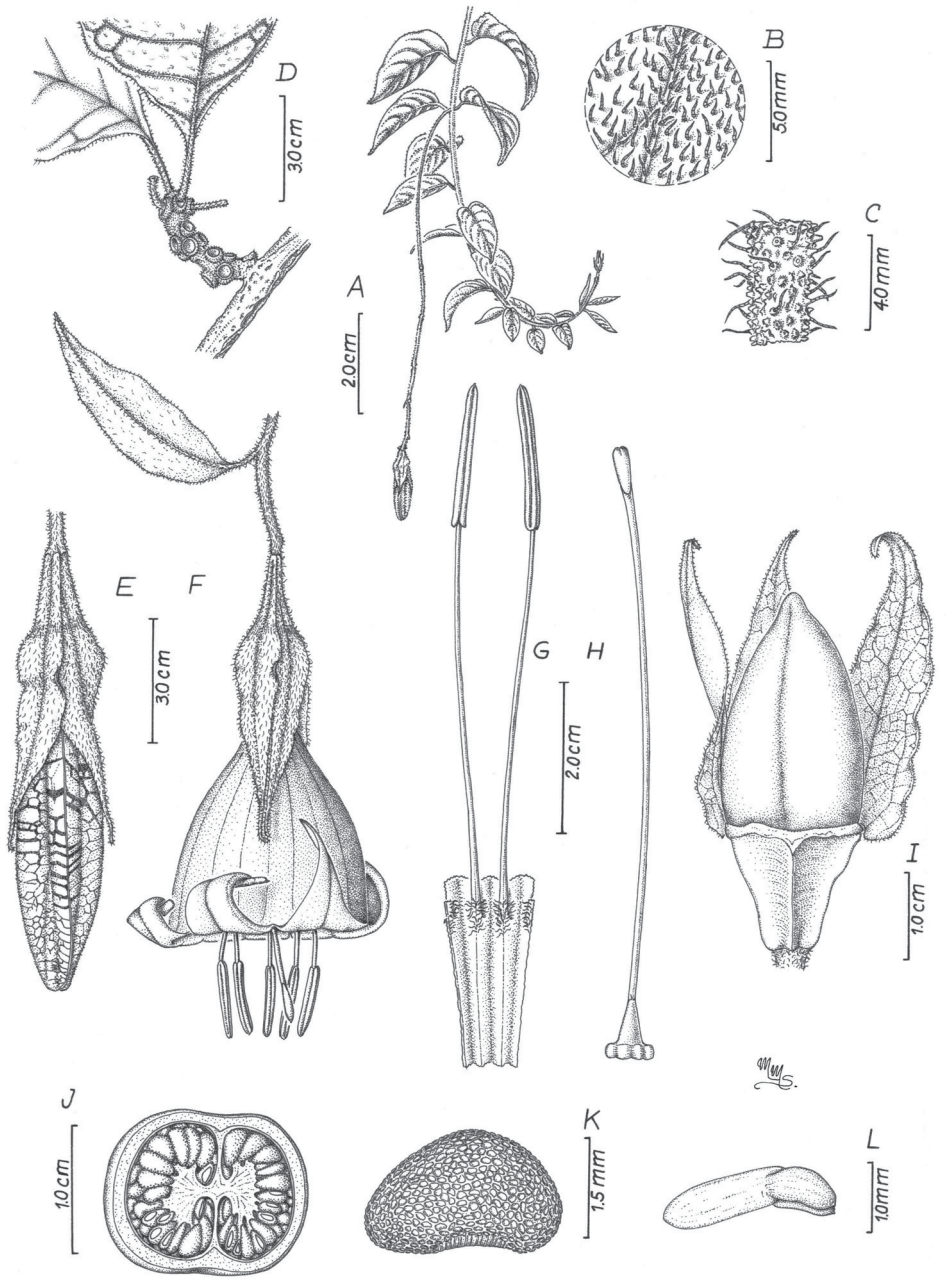

FIGURE 6. *Markea huilensis.* A. Floriferous branch. B. Indument on the leaf blade. C. Indument on young stems. D. Leaves arrangement. E. Flower bud. F. Flower in anthesis. G. Stamens. H. Gynoecium. I. Fruit with sepals removed. J. Fruit in cross section. K. Seed. L. Embryo. Based on *A. Orejuela & J. M. Vélez-Puerta 112,* type collection (COL); *Murcia 9* (COL); *Diaz-Piedrahita et al.793* (COL). Drawing by Marcela Morales.

The anthers in *M. huilensis* are completely exerted while in *M. lopezii* they are partially included and in *M. epifita* completely included. The fruit in *M. huilensis* with leathery exocarp, not translucent and black when dry, is 2-locular, while in *M. lopezii* the fruit with membranaceous exocarp, light yellow and translucent when dry is visually 4-locular even though it comes from a 2-locular ovary, probably due to secondary formation of placental septa during fruit development. The fruit in *M. epifita* is not yet known. Finally, light microscope analysis of the pollen grains of *M. huilensis* indicates that this new species lacks spinal supratectal process observed by Persson *et al.* (1994) in *M. lopezii*.

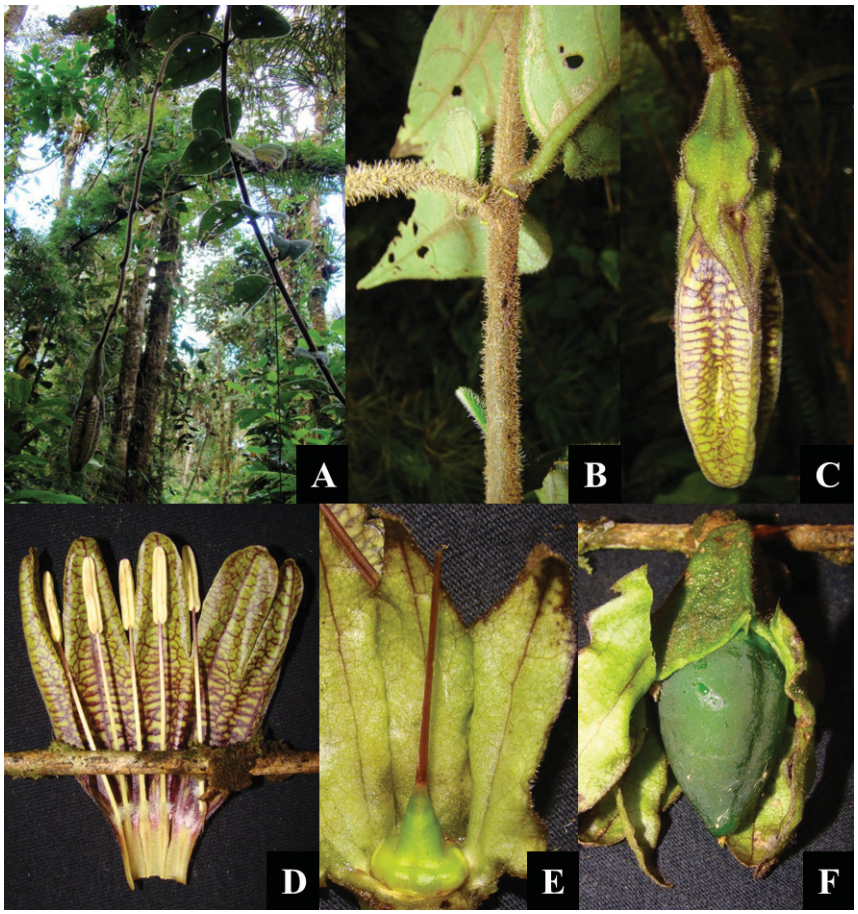

FIGURE 7. *Markea huilensis.* A. Floriferous branch. B. Detail of the indument C. Flower bud. D. Open corolla. E. Immature fruit. F. Developed fruit (holotype *A. Orejuela & J. M. Vélez-Puerta 112*. Photograph by Andrés Orejuela).

Markea purpurea A. Orejuela & C. I. Orozco *spec. nov.* (Fig. 3, 8, 9).

Type:—COLOMBIA. Nariño: Municipio de Barbacoas, corregimiento de Altaquer, vereda El Barro, Reserva Natural Rio Ñambi, 1200–1400 m, 1°17′ N, 78°04′ W, 16 April 2004, *Salinas et al. 470* (holotype COL!; isotype PSO!).

Markea purpurea is easily differentiated from other *Markea* species by the short- pedunculate, extra-axillary inflorescence, which usually bears one sub-sessile flower, the purple calyx with a green and verrucose base abaxially, and the pale green corolla with violet longitudinal lines abaxially and purple to black at mouth of the corolla tube adaxially.

Epiphytic or hemi-epiphytic shrubs adhered through adventitious roots. Stem terete in fresh material, slightly angular when dry, longitudinally furrowed, glabrous, the young branches unknown, the bark light yellow. Leaves apparently whorled, up to six per node; petiole green to brownish in fresh material, yellow when dry, articulate, 2.1–3.2 cm long, thickened when fresh, canaliculate and somewhat furrowed when dry; blade elliptic to obovate, 21–33 ×9.5–17.8 cm, symmetric to slightly asymmetric, membranaceous when fresh, papyraceous when dry, glabrous adaxially, with scarce, minute, simple glandular trichomes abaxially, disperse on the secondary and minor veins, light green adaxially and greyish green abaxially, when fresh, yellowish green on both surfaces when dry, the base slightly asymmetric, cuneate, the apex acuminate, 8–11 mm long, the margin entire, the secondary veins 6 to 12 pairs, abaxially raised, impressed

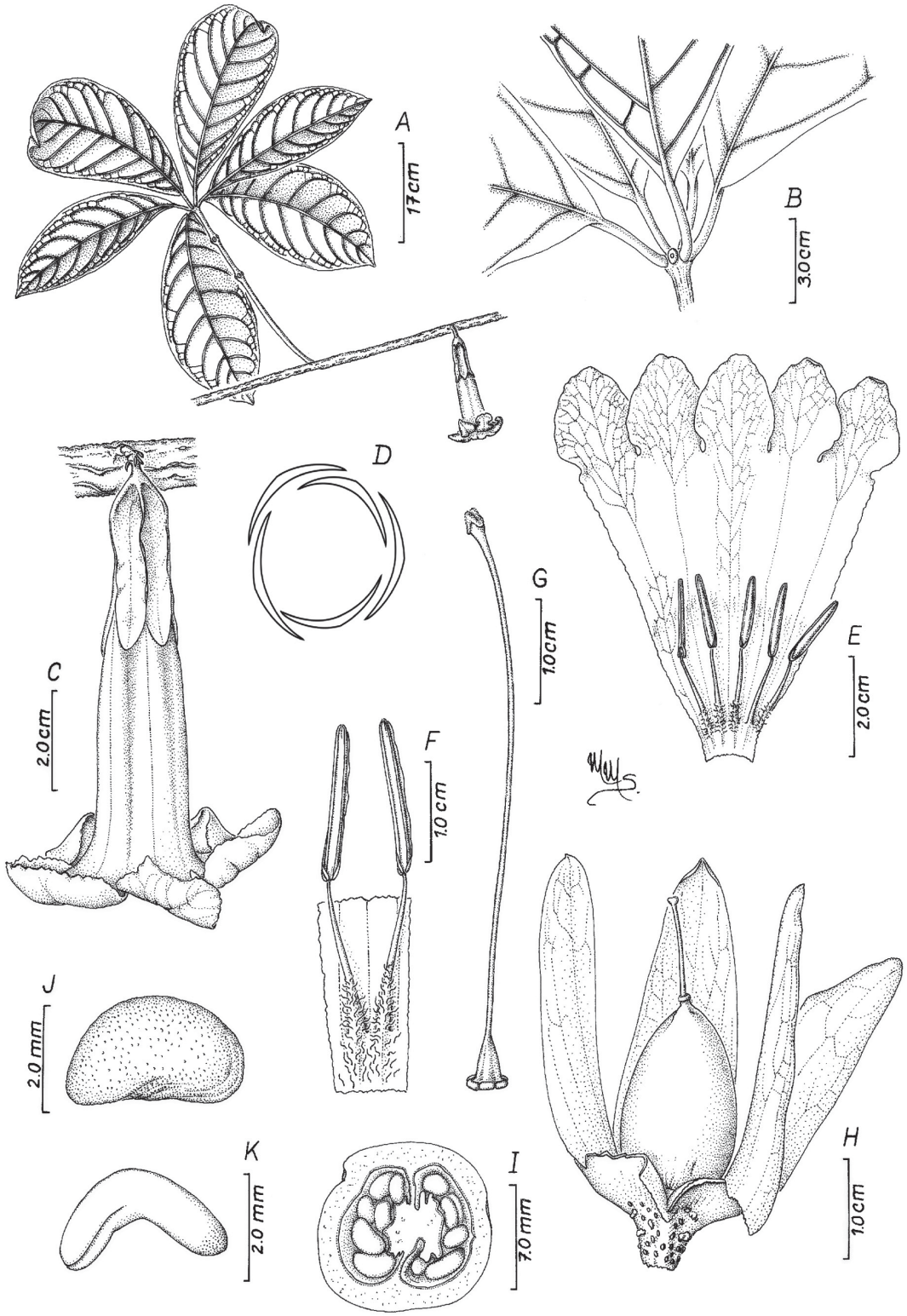

FIGURE 8. *Markea purpurea* A. Floriferous branch. B. Leaves arrangement. C. Flower at anthesis. D. Corolla aestivation. E. Open corolla. F. Stamens. G. Gynoecium. H. Fruit. I. Fruit in cross section. J. Seed. K. Embryo. Based on *Salinas et al. 470* (COL) and *A. Orejuela & Castillo-García 564* (COL). Drawing by Marcela Morales.

adaxially, conferring the surface a bullate appearance, forming a dense reticulum with the minor veins. Inflorescence in condensed cymes, simple, extra-axillary, 7.3–8 cm long, apparently sessile or short-pedunculate, generally one flower and various scars indicating 3 to 4 flowers, bracteate, scarcely pubescent with trichomes similar to those of the leaves; peduncle up to 3.5 mm long; bracts elliptic, triangular, the largest ones 2.6×1.3 cm, the smallest ones 0.7×0.6

mm, the floral buds ovoid, aestivation of calyx and corolla valvate and quincuncial respectively. Flowers sessile or short-pedicellate; pedicel up to 6 mm long, progressively thickening as it reaches the base of the calyx. Calyx 5-lobed, 2.6–3.2×1.3 cm, abaxially violaceous with verrucous, green base, apparently glabrous, with minute, simple glandular trichomes on both the adaxial and abaxial surfaces, the tube 5-ribbed, 6–8×11.5–12.5 mm, the lobes elliptic, 20–24×8–9 mm, apparently fused all along their length, the apex obtuse, each lobe with a main vein reaching the apex and two secondary veins departing from the base of each lobe, parallel to the main vein, reticulum inconspicuous. Corolla 5-lobed, abaxially light green with purple lines, pedicel up to 6 mm, adaxially purple to black, 8–9.5 2.5–3 cm, tubular-infundibuliform, the tube 6.5–7.5 cm long, differentiated into a narrow proximal portion 16–17 mm×4–5 mm and a widened gradually distal portion 5.3–5.7×2.1–2.2 cm, with indument of simple uniseriate trichomes with 4 to 7 cells restricted to the most proximal portion of the tube on the adaxial surface, the lobes reflexed during anthesis, 1.7–2.1×1.5–1.7 cm, ovate, revolute, glabrous with the apex obtuse. Stamens 5, 2.7–3.2 cm long, inserted, the filaments 1.5–1.6 cm long, purple in fresh, pale yellow when dry, adnate at 1.3–1.5 cm from the base of the corolla tube, indument, with simple uniseriate trichomes, 4 to 7 cells, purple in fresh material, at the basal quarter of the filament in the insertion point and minute simple glandular trichomes, densely distributed along the filament, the anthers ellipsoid, basifixed, cream in fresh material, 13–15 mm long, not connivent. Ovary conic, 3.5×3.5 mm, glabrous, cream in fresh material, 2-carpelar, 2-locular, nectariferous disc 5-lobed. Style filiform, 4.5 mm long, white, inserted. Stigma 2-lobed, white in fresh material, clavate. Fruit an ovoid berry 1.5×1.2 cm of unknown color, with a persistent, slightly accrescent calyx, the calyx tube 7 ×16 mm, the lobes 2.6–2.7×1–1.1 cm, opening up to the base. Seeds numerous, reniform to subreniform, 3.5–3.8×1.6–1.8 mm, testa reticulate, cells elongated and irregularly shaped; embryo curved, 2.5×0.6 mm, cotyledons just as wide as, and shorter than the rest of the embryo, endosperm abundant.

Etymology:—The specific name derives from the Latin *purpura*, referring to the color of the corolla.

Habitat and distribution:—*Markea purpurea* is known from the Pacific flanks of the Andes in the department of Nariño, southwestern Colombia, in the Natural Reserve "Rio Ñambi", between 1200–1400 m.

Phenology:—Floral buds in July, flowers in April and May, and fruits in May.

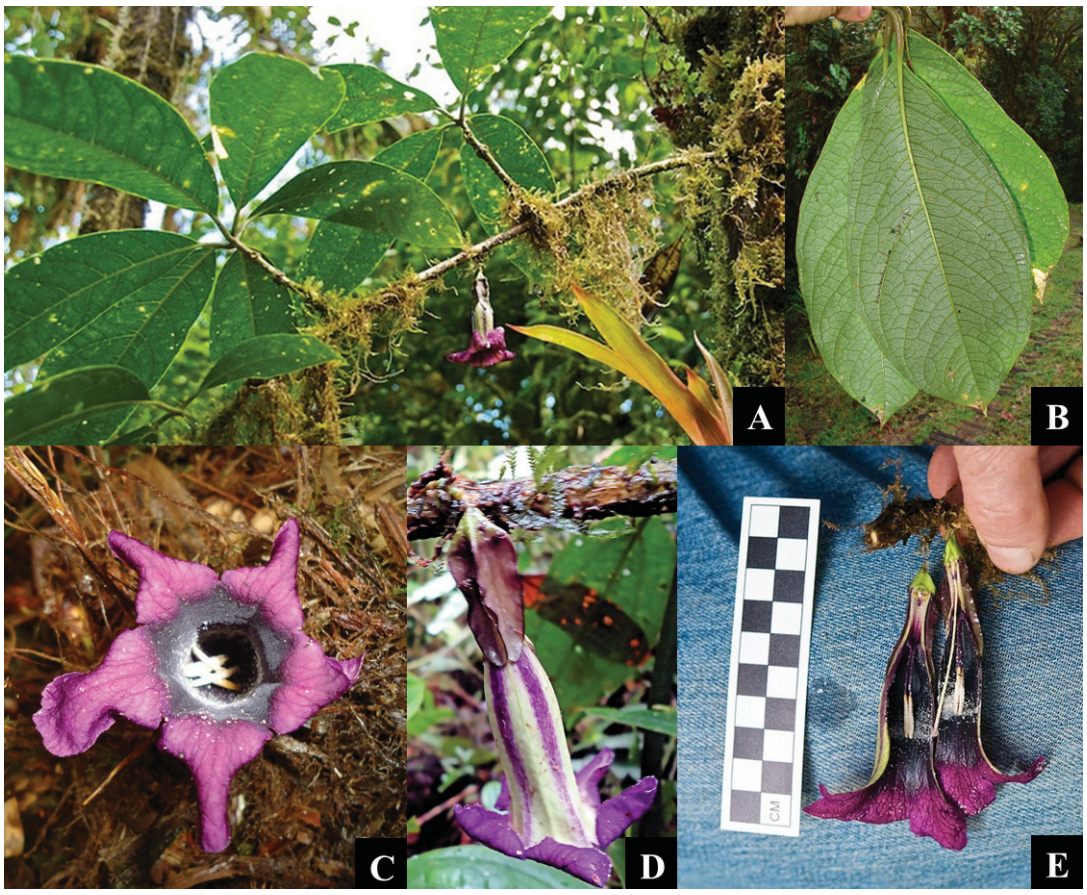

FIGURE 9. *Markea purpurea.* A. Floriferous branch. B. Leaf abaxial surface. C. Flower, front view. D. Flower, lateral view. E. Flower in longitudinal cut (Photographs A and E by T. Andres; B by J. M. Vélez; and C and D by J. Castillo-García).

Additional material examined:—COLOMBIA. **Nariño**: Municipio de Barbacoas, corregimiento de Altaquer, vereda El Barro, Reserva Natural "Rio Ñambi", 1200–1400 m, 7 May 2013, *Orejuela & Castillo-García 564* (COL!, PSO!).

Discussion:—*Markea purpurea* is sympatric with *M. antioquensis* and *M. pilosa*. These three species share the same leaf arrangement in apparent whorls of 3 to 6 leaves, clustered towards the branch tips; their flowers are usually white-greenish to purple or violaceous and exhibit infundibuliform corollas with similar size, which varies between 7–10 cm long, and the stamens are completely included in the corolla tube (Fig. 4 A,G, 8, 9). However, *M. antioquensis* and *M. pilosa* can easily be distinguished from *M. purpurea* by the axillary position of the many flowered inflorescence, with peduncles more than 1 cm long vs. the extra-axillary inflorescence, generally one-flowered, with a few scars, apparently sessile or short-pedunculate (peduncle up to 3.5 mm) of *Markea purpurea*. Additionally, the stems, leaves and inflorescences of *M. antioquensis* and *M. pilosa* have simple, uniseriate and multicellular trichomes, which are absent in *M. purpurea* (see the key).

Markea purpurea shows no morphological affinities with any other species of the genus. However, due to its short inflorescence bearing one single flower, which is apparently sessile, it might be confused with *Markea sessiliflora* Ducke (1915: 56). These two species differ because the leaves of *M. sessiliflora* are somewhat succulent in fresh material, with inconspicuous third order venation, coriaceous and dark brown when dry, the inflorescences have an axillary position, the peduncle is thick and often ramified, the green calyx has lobes largely cuspidate, the corolla is white, occasionally tinged with violet adaxially, with short lobes 5-10 mm long (Fig. 4I).

The characters mentioned above, contrast with those observed in *M. purpurea*, whose leaves are membranaceous when fresh, papyraceous and yellowish green when dry, with a dense and marked third order venation, the inflorescences are extra-axillary, the peduncle when present is thin and simple, the violaceous calyx has elliptic lobes, and the corolla is abaxially light green with purple lines, adaxially purple to black, with lobes 17–21 mm long (Fig. 8, 9).

Key to *Markea*

We present an updated key that includes all the currently recognized species in *Markea* and the changes documented since the last revision of the genus done by Hunziker (1997); these changes include the alternative circumscription published by Knapp *et al.* (1997) and the new species described since then (Knapp 1998; Rodríguez 2006; Stehmann & Giacomin, 2012). The key is based on original descriptions, herbaria specimens, and field observations. Most of the species of the genus are represented by live photographs (Fig. 4, 5).

1. Corolla up to 3 cm long. Filaments always shorter than the anthers, anthers connivent, thecae confluent at apex.....2
- Corolla longer than 4 cm. Filaments longer or as long as the anthers, non connivent, thecae not confluent at apex.....6
2. Calyx and stigma 3-lobed. Central Colombia (Western and Central Cordilleras). ..... *M. hunzikeri* (Fig. 1, 2)
- Calyx and stigma 5-lobed.....3
3. Plants conspicuously pubescent with bifurcate or trifurcate trichomes. Corolla hypocrateriform. Northern Peru (Amazon region) . ..... *M. vasquezii*
- Plants apparently glabrous or glabrescent, indument when present only of simple trichomes. Corolla tubular-campanulate 4
4. Inflorescence medium pedunculate, peduncle 6–10 cm long, axis thin, poorly lignified, nodes absent, deciduous at fruiting. Inflorescence few flowered (no more than four), distributed along the axis; bracts linear, foliose, up to 3 cm long. Southern and central Colombia (Western and Central Cordilleras) ..... *M. sturmii* (Fig. 5B)
- Inflorescence sessile, with short pedunculate, less than 5 cm long, axis thick, woody, conspicuously nodose and tuberculate, with perennial elongation. Inflorescence multiflowered (with more than four flowers at the apex); bracts triangular, non foliose, ca. 1 mm long.....5
5. Filament glabrous at the base. Northern Colombia and Panama.....*M. panamensis* (Fig. 5A)
- Filament with abundant, simple and uniseriate trichomes at the base. Bolivia, Brazil, Colombia, Guyana, Peru, Suriname, Venezuela (Amazon basin). .....*M. ulei* (Fig. 5C)
6. Inflorescence length more than 20 cm long 7
- Inflorescence length lesser than 12 cm.....10
7. Leaves glabrous, chartaceous. Corolla hypocrateriform, red-orange, 4–7 cm long. Bolivia, Brazil, Colombia, French Guiana, Peru, Suriname (Guiana Shield and Amazon basin)..... *M. coccinea* (Fig. 4B)
- Leaves pubescent, membranaceous. Corolla infundibuliform or tubular-campanulate, orange, cream or yellowish green with purple tinges, 9–12 cm long.....8
8. Anthers included. Central Ecuador (Eastern Cordillera).....*M.epifita*
- Anthers partially to completely exerted 9
9. Corolla tubular-campanulate, yellowish green with conspicuous reticulum of both adaxially and abaxially. Anthers completely exerted. Fruit 2-locular. Colombia (Central Cordillera).....*M. huilensis* (Fig. 6, 7)
- Corolla infundibuliform, orange, with reticulum of purple veins adaxially at the base of the corolla tube. Anthers partially included. Fruit visually 4-locular. Colombia (Western and Central Cordilleras)..... *M. lopezii* (Fig. 4F)
10. Calyx length usually exceeding the midpoint of the corolla length in flower anthesis. Apex of the calyx lobes usually acute or obtuse 11

- Calyx length usually less than the midpoint of the corolla length in flower anthesis. Apex of the calyx lobes acuminate to largely acuminate 14
11. Leaf blades coriaceous, margin revolute. Indument with abundant branched trichomes. Ovary 4-locular. Southern Ecuador ..... *M. fosbergii* (Fig. 4D)
- Leaf blades membranaceous, margin flat. Indument with simple trichomes. Ovary 2- locular 12
12. Inflorescence glabrous, usually 1-flowered, the bracts absent. Ecuador (Western Cordillera) ..... *M. spruceana*
- Inflorescence hairy, usually 4 or more flowered, the bracts stipule-like and conspicuous. 13
13. Indument densely pilose on the whole plant. Southwestern Colombia and northwestern Ecuador. ..... *M. pilosa* (Fig. 4G)
- Indument sparsely present to glabrescent. Colombia (Western Cordillera) ..... *M. antioquensis* (Fig. 4A)
14. Flowers sessile or sub-sessile 15
- Flowers pedicellate 16
15. Leaf blades coriaceous, dark brown when dry in herbarium material, margin revolute. Axillary inflorescence. Brazil, Guyana, Surinam, Venezuela ..... *M. sessiliflora* (Fig. 4I)
- Leaf blades membranaceous, light brown when dry in herbarium material, margin flat. Extra-axillary inflorescence. Southwestern Colombia (Western Cordillera) ..... *M. purpurea* (Fig. 8, 9)
16. Inflorescence with 1 to 5 flowers 17
- Inflorescence with 8 to 20 flowers 19
17. Corolla campanulate. Filaments adnate at ca. 10 mm from the base of the corolla tube. Eastern Brazil ..... *M. atlantica*
- Corolla infundibuliform. Filaments adnate at 25–40 mm from the base of the corolla tube 18
18. Indument with simple trichomes; margin of leaf blade ciliate. Apexes of the corolla lobes obtuse or rounded. Colombia, Brazil, Peru (Amazon basin) ..... *M. formicarum* (Fig. 4C)
- Indument with branched trichomes; margin of leaf blade non-ciliate. Apexes of the corolla lobes acute. Eastern and Southeastern Colombia (Eastern Cordillera, low slopes and Amazon low lands) ..... *M. plowmanii* (Fig. 4H)
19. Calyx lobes shortly acuminate. Narrow part of the corolla tube protruding from the calyx in flower anthesis. Bracts absent or inconspicuous. Lesser Antilles, Northern Brazil, French Guiana, Guyana and Venezuela ..... *M. longiflora* (4E)
- Calyx lobes largely acuminate. Narrow part of the corolla tube included in the calyx in flower anthesis. Bracts linear and conspicuous. Southern Colombia and Northern Ecuador (low slopes and Amazon low lands) ..... *M. harlingiana*

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