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Taxonomic revision of the genus Pentacalia (Compositae, Senecioneae) in Ecuador

Joel CALVO

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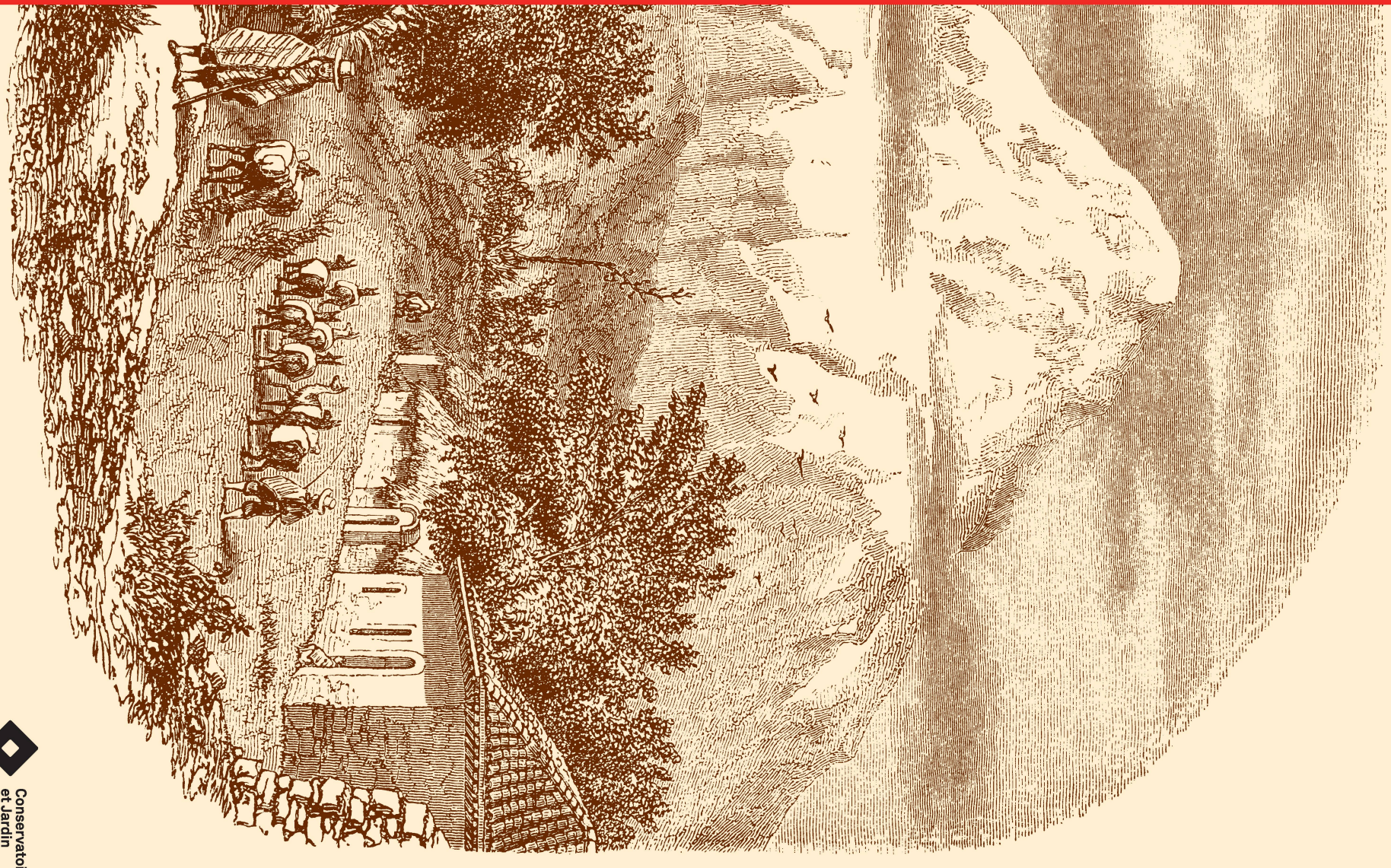

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Taxonomic revision of the genus Pentacalia (Compositae, Senecioneae) in Ecuador

Joel Calvo

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Abstract

Pentacalia Cass. (*Compositae*, *Senecioneae*) is a neotropical plant genus distributed from southern Mexico to northwestern Argentina, plus two disjunct species occurring in eastern Brazil. The Andes of Colombia, Ecuador, and Peru are the center of diversity of the genus, with most species thriving in montane forests. As currently circumscribed, it includes c. 162 species. These are scandent woody plants with alternate (very rarely opposite), simple leaves, usually corymbiform, thyrsoid-paniculiform or racemiform synflorescences, involucres with supplementary bracts at the base (calycle), radiate, disciform, or discoid capitula with yellow or white corollas, stamens with balustriform filament collar and caudate anther bases, styles with truncate to obtuse branches that usually have a crown of sweeping trichomes, and glabrous or pubescent achenes with a capillary pappus composed of barbellate bristles. The first comprehensive revision of this genus in Ecuador recognizing 27 species is presented here. *Pentacalia campii* (Cuatrec.) Cuatrec. is synonymized with *P. corazonensis* (Hieron.) Cuatrec., as well as *P. carchiensis* (Cuatrec.) Cuatrec. with *P. aschersoniana* (Hieron.) Cuatrec., *P. carmelana* H. Rob. & Cuatrec. with *P. huilensis* (Cuatrec.) Cuatrec., *P. cazaletii* H. Rob. & Cuatrec. with *P. zakii* H. Rob. & Cuatrec., *P. chachapoyensis* (Greenm.) Cuatrec. with *P. theifolia* (Benth.) Cuatrec., *P. gibbiflora* (Cuatrec.) Cuatrec. with *P. oronocensis* (DC.) Cuatrec., and both *P. mikanioides* J. Calvo and *P. zamorana* H. Rob. & Cuatrec. with *P. millei* (Greenm.) Cuatrec. The names *Senecio disciformis* Hieron. and *Pentacalia floribunda* Cuatrec. are lectotypified, and an epitype is designated for *Senecio disciformis*. Four new taxa are described, i.e., *Pentacalia celicana* J. Calvo & G. Benítez, *P. nordenstamii* J. Calvo, *P. oellgaardii* J. Calvo, and *P. luteynorum* subsp. *lutea* J. Calvo. Descriptions and distribution maps are provided for all accepted species, in addition to an identification key. Pictures of living plants are provided for 19 species. Fifteen (15) species are illustrated, 13 of them for the first time.

Resumen

Pentacalia Cass. (*Compositae*, *Senecioneae*) es un género de plantas neotropical que se distribuye desde el sur de México hasta el noroeste de Argentina, además de dos especies disjuntas que se encuentran en el este de Brasil. Los Andes de Colombia, Ecuador y Perú son el centro de diversidad del género, donde la mayoría de las especies prosperan en los bosques montanos. De acuerdo con la circunscripción actual del género, este incluye c. 162 especies. Son plantas leñosas escandentes con hojas alternas (muy raramente opuestas), simples, sinflorescencias generalmente corimbiformes, tirsoideo-paniculiformes o racemiformes, involucros con brácteas suplementarias en la base (calículo), capítulos radiados, disciformes o discoideos con corolas amarillas o blancas, estambres con el collar del filamento balaustriforme y base de las anteras caudadas, estilos con ramas truncadas a obtusas que suelen tener una corona de cortos tricomas simples, y aquenios glabros o pubescentes con un vilano capilar compuesto de tricomas mínimamente barbados. Se presenta la primera revisión exhaustiva de este género en Ecuador, en la que se reconocen 27 especies. *Pentacalia campii* (Cuatrec.) Cuatrec. se sinonimiza a *P. corazonensis* (Hieron.) Cuatrec., así como *P. carchiensis* (Cuatrec.) Cuatrec. a *P. aschersoniana* (Hieron.) Cuatrec., *P. carmelana* H. Rob. & Cuatrec. a *P. huilensis* (Cuatrec.) Cuatrec., *P. cazaletii* H. Rob. & Cuatrec. a *P. zakii* H. Rob. & Cuatrec., *P. chachapoyensis* (Greenm.) Cuatrec. a *P. theifolia* (Benth.) Cuatrec., *P. gibbiflora* (Cuatrec.) Cuatrec. a *P. oronocensis* (DC.) Cuatrec., y *P. mikanioides* J. Calvo y *P. zamorana* H. Rob. & Cuatrec. a *P. millei* (Greenm.) Cuatrec. Se lectotipifican los nombres *Senecio disciformis* Hieron. y *Pentacalia floribunda* Cuatrec., y además se designa un epítipo para *Senecio disciformis*. Se describen cuatro nuevos táxones, i.e., *Pentacalia celicana* J. Calvo & G. Benítez, *P. nordenstamii* J. Calvo, *P. oellgaardii* J. Calvo y *P. luteynorum* subsp. *lutea* J. Calvo. Se proporcionan descripciones y mapas de distribución para todas las especies aceptadas, además de una clave de identificación. Se incluyen fotografías de 19 especies en su hábitat. Se ilustran, además, 15 especies, 13 de ellas por primera vez.

Keywords

ASTERACEAE – *Pentacalia* – Andes – Ecuador – *Senecioneae* – Taxonomy

Introduction

The neotropical genus *Pentacalia* Cass. (*Compositae*, *Senecioneae*) comprises c. 162 species distributed from southern Mexico to northwestern Argentina, plus two disjunct species occurring in the Brazilian Atlantic Forest. The northern Andes are considered the center of diversity of the genus, Colombia having the foremost number of species, followed by Peru and Ecuador (Calvo & Buira, 2018).

Species belonging to genus *Pentacalia* are scandent woody plants with alternate (very rarely opposite), simple leaves, usually corymbiform, thyrsoid-paniculiform or racemiform synflorescences, involucres with supplementary bracts at the base (calycle), radiate, disciform, or discoid capitula with yellow or white corollas, stamens with balustriform filament collar and caudate anther bases, styles with truncate to obtuse branches that usually have a crown of sweeping trichomes (sometimes with a tuft of longer trichomes, but not strictly penicillate), and glabrous or pubescent achenes with a capillary pappus composed of barbellate bristles.

Pentacalia was established by Cassini (1827) to exclude the Colombian species *Cacalia arborea* Kunth from the genuine *Cacalia* L., based on its 5-ribbed achenes. However, Cassini's genus was not recognized by Candolle (1838) or later botanists who worked on the neotropical *Senecioneae* (e.g. Bentham & Hooker, 1839; Hieronymus, 1900, 1901; Greenman, 1923, 1938). *Pentacalia* was finally retrieved by Robinson & Cuatrecasas (1978) when revising the species of *Senecio* sect. *Streptothamni* Greenm. from Central America. Its recognition as a genus distinct from *Senecio* L. was supported by the following morphological characters: fruticose to scandent habit with woody stems, distinctly petiolate usually non-stipitate leaves, minutely fistulose or non-fistulose receptacles, tails on the anthers, and the rather stout 5-ribbed achenes. Such circumscription was later broadened by Cuatrecasas (1981) to also embrace the rather erect species with shrubby habit originally treated in *Microchaete* Benth. These species were accordingly placed in *Pentacalia* subg. *Microchaete* (Benth.) Cuatrec., and the lianoid ones retained to the typical subgenus. Jeffrey (1992) did not adopt Cuatrecasas (1981)'s broad sense of *Pentacalia* and elevated to generic rank the subgenus *Microchaete* (under the replacement name *Monticalia* C. Jeffrey) and restricted *Pentacalia* to the lianoid species recovering the narrow concept of the genus established by Robinson & Cuatrecasas (1978). Afterward, this criterion has been adopted by most taxonomists working on these groups (Nordenstam, 1999; Pelser et al., 2007; Beck & Ibáñez, 2014; Pruski, 2018a, b; Calvo, 2021).

Historical overview in Ecuador

Georg H.E.W. Hieronymus (1846–1921) can be considered the first botanist to contribute to the taxonomy of the group in Ecuador, describing four species currently accepted under the genus *Senecio*. Hieronymus received at Berlin material sent by Jesuit Father Luis [Luigi] Sodiro (1836–1909), Italian botanist established in Quito who intensively collected in the province of Pichincha (Jørgensen, 1999). In 1938, the American synanterologist Jesse M. Greenman (1867–1951) described three new species as part of a broad study of the South American *Senecio*. However, it was in the mid-20th century when the number of species belonging to this group notably increased, due to the collections made by Wendell H. Camp (1905–1963), American botanist at the New York Botanical Garden. Camp collected in Ecuador between May 1944 and September 1945 for the United States *Cinchona* missions searching species of that genus with high quinine content (Rickett, 1963; Balslev & Joyal, 1980). Although the mission was focused on the species of *Cinchona*, Camp and his assistants made general collections of c. 5,800 numbers (c. 26,000 sheets including numerous duplicates). Most of these collections were made in southern Ecuador, in the provinces of Azuay, Morona-Santiago, and Loja. They are of a very high quality and from areas that were barely explored at that time, hence, many of them served as type material (Balslev & Joyal, 1980). The *Compositae* were later studied by Catalan Josep [José] Cuatrecasas (1903–1996) when he worked at the Field Museum before moving to Washington D.C. in 1955 (Robinson et al., 1996; López Sánchez, 2022). He described several new species, five of them treated herein (Cuatrecasas, 1954). Cuatrecasas devoted part of his career to the study of the tribe *Senecioneae* in the Northern Andes (Colombia, Ecuador) becoming the foremost specialist of this group in the region (Calvo & Beltrán, 2022). At the U.S. National Herbarium, Cuatrecasas collaborated with synanterologist Harold E. Robinson (1932–2020) and together they published 12 new species from Ecuador (one currently accepted as a member of *Dendrophorbium* (Cuatrec.) C. Jeffrey) and provided the first identification key for the Ecuadorian *Pentacalia*. After them, Swedish botanist Bertil Nordenstam prepared the genus *Pentacalia* for the *Catalogue of the vascular plants of Ecuador* [hereafter *Catalogue*] accepting 33 species, 24 of them endemic (Nordenstam, 1999); see Table 1. Since Nordenstam, two new species have been described (Calvo & Buira, 2018; Calvo & Pérez, 2023) and two names synonymized (Calvo et al., 2019). The work presented in the following contribution represents the first comprehensive treatment of this genus for Ecuador. Twenty-seven (27) species are recognized (Table 1), eight names are newly synonymized, two names are lectotypified, four new taxa are described, and 15 species are illustrated.

Discussion of characters

Habit – *Pentacalia* species are scandent, woody plants with long dangling branches. While most species are strictly lianoid, *Pentacalia arborea* (Kunth) Cass. and *P. theifolia* (Benth.) Cuatrec. sometimes display a suberect habit leaning over adjacent vegetation.

Table 1. – Accepted species of *Pentacalia* Cass. from Ecuador according to the main treatments.

Robinson & Cuatrecasas (1993) [29 spp.]	Nordenstam (1999) [33 spp.]	Current treatment (2024) [27 spp.]
Pentacalia andrei	*Pentacalia andrei*	*Pentacalia andrei*
Pentacalia arborea	*Pentacalia arborea*	*Pentacalia arborea*
--	--	*Pentacalia atrovinosa* [publ. 2023]
Pentacalia campii	*Pentacalia campii*	= *Pentacalia corazonensis*
Pentacalia carchiensis	*Pentacalia carchiensis*	= *Pentacalia aschersoniana*
Pentacalia carmelana	*Pentacalia carmelana*	= *Pentacalia huilensis*
Pentacalia cazaletii	*Pentacalia cazaletii*	= *Pentacalia zakii*
--	--	*Pentacalia celicana* [sp. nov.]
Pentacalia corazonensis	*Pentacalia corazonensis*	*Pentacalia corazonensis*
Pentacalia disciformis	*Pentacalia disciformis*	*Pentacalia disciformis*
Pentacalia dorrii	*Pentacalia dorrii*	*Pentacalia dorrii*
Pentacalia floribunda	*Pentacalia floribunda*	*Pentacalia floribunda*
Pentacalia gibbiflora	*Pentacalia gibbiflora*	= *Pentacalia oronocensis*
Pentacalia hillii	*Pentacalia hillii*	*Pentacalia hillii*
Pentacalia hitchcockii	*Pentacalia hitchcockii*	= *Pentacalia theifolia*
Pentacalia huilensis	*Pentacalia huilensis*	*Pentacalia huilensis*
Pentacalia hurtadoi	*Pentacalia hurtadoi*	*Pentacalia hurtadoi*
Pentacalia lanceolifolia	*Pentacalia lanceolifolia*	= *Pentacalia andrei*
--	*Pentacalia loretensis*	[not present in Ecuador]
Pentacalia luteynorum	*Pentacalia luteynorum*	*Pentacalia luteynorum* subsp. *luteynorum*
--	--	*Pentacalia luteynorum* subsp. *lutea* [subsp. nov.]
Pentacalia millei	*Pentacalia millei*	*Pentacalia millei*
Pentacalia moronensis	*Pentacalia moronensis*	*Pentacalia moronensis*
Pentacalia napoensis	*Pentacalia napoensis*	*Pentacalia napoensis*
--	--	*Pentacalia nordenstamii* [sp. nov.]
--	--	*Pentacalia oellgaardii* [sp. nov.]
Pentacalia oronocensis	*Pentacalia oronocensis*	*Pentacalia oronocensis*
Pentacalia pailasensis	*Pentacalia pailasensis*	[doubtful name]
Pentacalia palaciosii	*Pentacalia palaciosii*	*Pentacalia palaciosii*
--	*Pentacalia popayanensis*	*Pentacalia popayanensis*
Pentacalia riotintis	*Pentacalia riotintis*	*Pentacalia riotintis*
Pentacalia ruficaulis	*Pentacalia ruficaulis*	*Pentacalia ruficaulis*
Pentacalia sevillana	*Pentacalia sevillana*	*Pentacalia sevillana*
--	*Pentacalia sylvicola*	[not present in Ecuador]
Pentacalia theifolia	*Pentacalia theifolia*	*Pentacalia theifolia*
--	--	*Pentacalia todziae* [new record publ. 2019]
--	*Pentacalia weinmannifolia*	[not present in Ecuador]
Pentacalia zakii	*Pentacalia zakii*	*Pentacalia zakii*
Pentacalia zamorana	*Pentacalia zamorana*	= *Pentacalia millei*

Leaves – Foliar characters such as size, shape, and indumentum are useful for species distinguishing purposes. The degree of prominence of the venation is also taxonomically informative: secondary and tertiary veins are conspicuous on both surfaces in *Pentacalia floribunda* Cuatrec., whereas in *P. luteynorum* H. Rob. & Cuatrec. only the secondary veins are barely conspicuous.

Synflorescences – Two groups of taxa can be easily differentiated according to the position of the synflorescences: (1) species with mostly terminal synflorescences (Fig. 1A → p. 33); (2) species with mostly lateral, axillary synflorescences, where the apical meristem indeterminately elongates (Fig. 1B) (Calvo, 2021). It should be noted that Robinson & Cuatrecasas (1993) gave great importance to this character and placed it early in the identification key. Although it certainly has a worthy taxonomic value, it is sometimes difficult to discern on those herbarium specimens not properly or deficiently collected. *Pentacalia carmelana* H. Rob. & Cuatrec., here treated as a synonym of *P. huilensis* (Cuatrec.) Cuatrec., was originally described as a species with mostly lateral, axillary synflorescences and placed accordingly in Robinson and Cuatrecasas's key. Additional material showed that this species actually displays mostly terminal synflorescences, which is in line with both the description of *P. huilensis* and the key provided in the treatment of the Colombian species (Díaz-Piedrahita & Cuatrecasas, 1999). Herein, the author tried to place this character as late as possible in the key.

Three main types of synflorescences are found in *Pentacalia*: (1) corymbiform as in *P. dorrii* H. Rob. & Cuatrec. (Fig. 1C); (2) thyrsoid-paniculiform as in *P. millei* (Greenm.) Cuatrec. (Fig. 1D); (3) racemiform as in *P. hurtadoi* H. Rob. & Cuatrec. (Fig. 1E).

Capitula – The type of capitula is very useful for differentiating species: (1) radiate capitula are heterogamous, with peripheral florets pistillate developing a limb (ligule, lamina) and disc florets hermaphroditic and tubular; the peripheral florets can be well-developed and patent (Fig. 1F) or reduced and curved downward (Fig. 1G); (2) disciform capitula are heterogamous, with peripheral florets pistillate and tubular, and disc florets hermaphroditic and tubular; the peripheral florets usually are shorter than the disc florets and (2–)4–5-lobed (Fig. 1H), sometimes with the lobes somewhat atrophied. Such florets are generally thought to be derived by reduction from ray florets, as well as plants with disciform capitula are generally thought to come from ancestors with radiate capitula (Barkley et al., 2006); (3) discoid capitula are homogamous, with all florets hermaphroditic and tubular (Fig. 1I).

Except for *Pentacalia celicana* J. Calvo & G. Benítez (described below) and *P. luteynorum* subsp. *luteynorum* that have white ray florets, all species with radiate capita exhibit yellow ray florets, becoming red burgundy as florets mature in a few species. *Pentacalia carchiensis* (Cuatrec.) Cuatrec., here synonymized with *P. aschersoniana* (Hieron.) Cuatrec., was originally described as having "flores radii feminei circa 4 subtubulosi, corolla angusta 5 mm longa apice lamina subligulari profunde 3-dentata". Since the peripheral florets sometimes display a vestigial limb or this is absent, it has been described herein as a subradiate capitula although its identification in the key can be achieved both by subradiate capitula or disciform capitula (step 22). The same occurs for *P. disciformis* (Hieron.) Cuatrec., a disciform species with tubular peripheral florets that sometimes develop a very small limb.

Involucres – The number and length of involucral bracts are usually regular in each species, and therefore, helpful for separating species. In *Pentacalia palaciosii* H. Rob. & Cuatrec., *P. ruficaulis* (Greenm. & Cuatrec.) Cuatrec., and *P. sevillana* (Cuatrec.) Cuatrec. the number of involucral bracts slightly varies. Characters of the supplementary bracts (calycle) such as the number, length, and shape are also useful.

Floral microcharacters – The filament collar is balustriform, which agrees with the placement of the genus *Pentacalia* within the subtribe *Senecioninae* (Nordenstam et al., 2009). The anther bases are caudate, sometimes very shortly. In all species examined the style branch apices are truncate with a crown of sweeping hairs. Floral microcharacters are not taxonomically informative at specific rank.

Achenes – The achenes of the Ecuadorian *Pentacalia* are homomorphic, cylindrical, ribbed, and glabrous (papillose in a single collection of *P. oronocensis* (DC.) Cuatrec.). The pappus is ordinarily 1-seriate, capillary and composed of barbellate, whitish bristles. Although the genus *Pentacalia* was coined after the 5-ribbed achenes of the type species, *P. arborea*, the number of ribs varies from five to seven (ten) in the species examined. When the achenes are not completely developed, the number of ribs is difficult to determine. Achene's characters have not been used in this work for species identification purposes.

Phylogenetic relationships

A phylogenetic analysis of the genus *Pentacalia* has not been conducted, however, some insights can be drawn out from the ITS phylogeny of the tribe *Senecioneae* by Pelser et al. (2007). The tree accessions of *Pentacalia* included in the study are nested in the weakly supported *Faujasia-Oldfeltia* clade: (1) *Pentacalia antioquensis* (Cuatrec.) Cuatrec. based on *van der Werff & Giraldo 9736*, which corresponds to *P. trianae* (Klatt) Cuatrec. (Díaz-Piedrahita & Cuatrecasas, 1999); (2) *Pentacalia arborea* based on *Øllgaard & Balslev 8298*, identified as *P. theifolia* both here and by Robinson in sched. (AAU); (3) *Pentacalia desiderabilis* (Vell.) Cuatrec. based on *Hatschbach & Oliveira 43028*. They appear in various parts of the clade

although the support is generally low too. *Pentacalia trianae* from Colombia and *P. arborea* from Colombia and Ecuador are strongly related to each other, and found in a subclade along with species of *Monticalia* and *Scrobicaria* Cass. This latter genus contains three species restricted to Colombia and Venezuela and mainly differs from *Pentacalia* in having opposite leaves. The accession of *P. desiderabilis*, a species endemic to Brazil, is nested among species of *Dendrophorbium* and *Graphistylis* B. Nord. also from Brazil. These results, though weakly supported, suggest that *Pentacalia* as currently circumscribed is not monophyletic. Additional studies based on an exhaustive sampling including species of *Pentacalia* that represent the entire distribution area of the genus, as well as species of the aforementioned allied genera, are essential for drawing the evolutionary relationships of these plant groups and, if needed, make the taxonomic adjustments accordingly.

Material and methods

The present contribution is the result of an exhaustive review of the published bibliography, fieldwork in Ecuador carried out in 2017, 2018, and 2023, and the examination of 369 herbarium specimens (duplicates excluded) kept at the following herbaria: AAU, G, HA, HUTPL, LOJA, MA, P, Q, QAP, QCA, QCNE, QPLS, US, and USM. Additionally, digital images of specimens from B, COL, E, F, GH, HAL, K, LD, LP, MO, MT, NY, P, PR, PRC, S, UC, US, VALLE, and VEN were studied. The loans of specimens received from AAU, MA, P, and US were essential to achieve this revision.

The types of all accepted names and synonyms were studied, except for *Pentacalia pailasensis* H. Rob. & Cuatrec., the holotype of which appears to be lost after having been loaned by F to another institution (K. Hansen, pers. comm.). It is therefore treated as doubtful. The qualitative characters provided in the descriptions were studied, when needed, with the aid of the stereo microscope Leica M60, whereas quantitative characters were recorded using a Mitutoyo digital caliper, CD-15DC. The maps were generated using QGIS 3.16 Hannover. Information concerning the habitat, elevation, and flowering period of each species was obtained from the herbarium specimen labels and the information compiled in the field. Nineteen (19) out of the 27 accepted species were observed in Ecuador during the field trips.

Accepted species are presented in alphabetical order and are listed in Appendix 1. All studied exsiccatae can be found in Appendix 2. An index to all scientific names is provided at the end of this publication. The list of specimens examined given for each species includes only the Ecuadorian material, except for the species that citing the collections from the neighboring countries is relevant for completeness sake. If herbarium specimens from a province were not studied but the presence of the species is expected there, the name of that province is included in the distribution and followed by a question mark. The leaf descriptions and measurements provided in this treatment correspond to the leaf lamina. General botanical terms largely follow Beentje (2012), whereas specific terms concerning the family *Compositae* are in line with those used by Robinson & Cuatrecasas (1993).

Taxonomic treatment

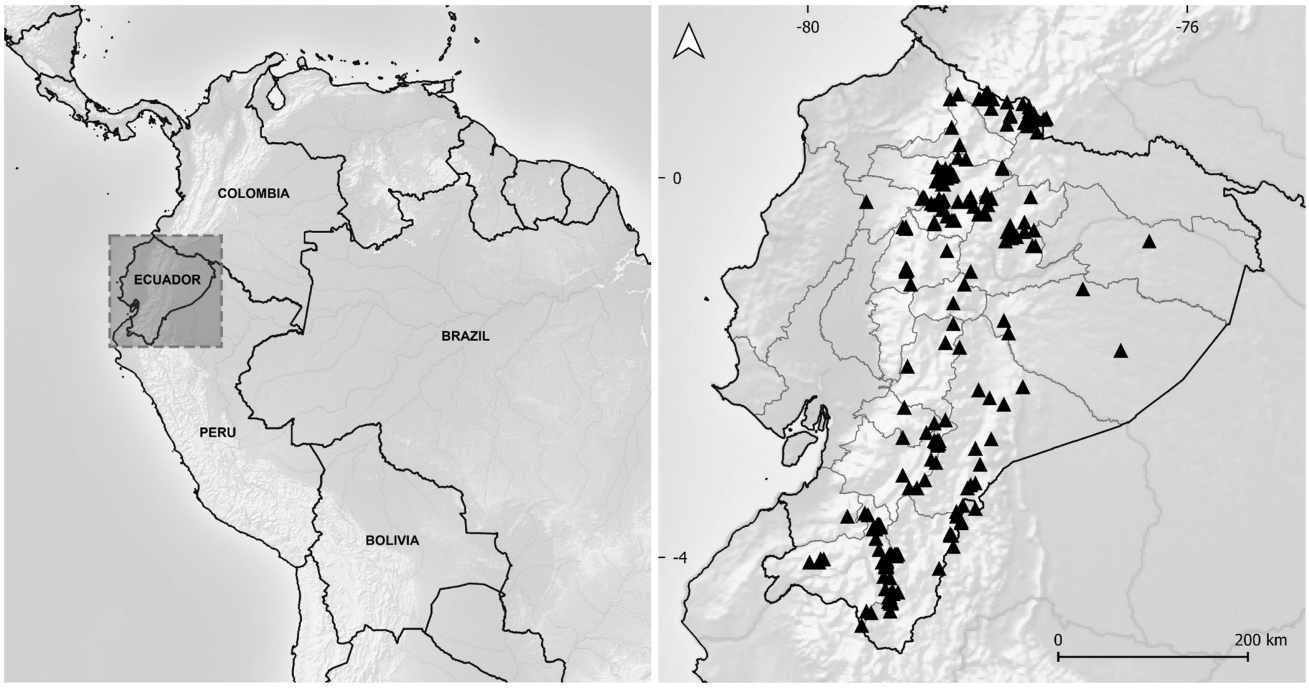
Pentacalia Cass. in Cuvier F., Dict. Sci. Nat., ed. 2, 48: 461. 1827.

Typus: *Cacalia arborea* Kunth [≡ *Pentacalia arborea* (Kunth) Cass.].

≡ *Senecio* sect. *Triana* Cuatrec. in Fieldiana, Bot. 27(2): 71. 1951. ≡ *Pentacalia* Cass. subg. *Pentacalia*.

= *Senecio* sect. *Streptothamni* Greenm. in Bot. Jahrb. Syst. 32: 19. 1902. **Typus:** *Senecio streptothamnus* Greenm. [≡ *Pentacalia streptothamna* (Greenm.) H. Rob. & Cuatrec.].

Plants scandent, woody, with long dangling branches, sometimes rather suberect with branches leaning over adjacent vegetation; stems terete, often furrowed, glabrous or with indumentum, solid or fistulous. *Leaves* alternate (opposite in 3 Peruvian species), simple, petiolate; laminas lanceolate, oblanceolate, elliptic, ovate, or obovate, apex rounded to acuminate, base attenuate to cordate, margin entire to dentate (usually remotely mucronate-denticulate), glabrous to covered by different types of indumentum (trichomes usually simple, multicellular, eglandular, rarely T-shaped in few non-Ecuadorian species), chartaceous, coriaceous, or fleshy, concolorous or slightly discolorous, secondary and tertiary veins conspicuous or inconspicuous. *Synflorescences* terminal or lateral (axillary), corymbiform, thyrsoid-paniculiform, or racemiform. *Capitula* radiate, disciform, or discoid, sessile to pedunculate; involucres cylindrical to campanulate, glabrous or covered by indumentum; receptacles epaleaceous, rather flat, smooth or somewhat irregularly alveolate; involucral bracts 1-seriate, usually 8–13, linear-oblong; supplementary bracts (calycle) (1–)3–5(–7), linear-subulate to ovate. *Ray florets* pistillate; corollas with reduced or well-developed limbs, patent or curved downward, subentire to 3-toothed at apex, yellow or white (becoming red burgundy as florets mature in few species). *Peripheral florets* of disciform capitula pistillate; corollas tubular, usually shorter than disc florets, deeply (2–)4–5-lobed, yellow or whitish. *Disc florets* hermaphroditic; corollas tubular, 5-lobed, yellow or whitish (becoming red burgundy as florets mature in few species); filament collars balustriform; anther bases caudate (sometimes only very shortly caudate), anther appendages 2–3 times longer than wide; style branches truncate with crown of sweeping trichomes. *Achenes* cylindrical, 5–10-ribbed, usually glabrous (pubescent in few non-Ecuadorian species); pappus usually 1-seriate, bristles capillary, barbellate, whitish.



Map 1. – Distribution of the genus *Pentacalia* Cass. in Ecuador.

Chromosome number: *n* = 17 or 20 (Robinson et al., 1997; based on *Pentacalia phanerandra* (Cufod.) H. Rob. & Cuatrec. from Costa Rica); *n* = 20 (Powell & Cuatrecasas, 1970; based on *P. silvascandens* (Cuatrec.) Cuatrec. from Colombia; *n* = 45–50 (Jeffrey et al., 1977; based on *P. desiderabilis* from Brazil); *n* = 50 (Turner et al., 1967; based on *P. jalcana* (Cuatrec.) Cuatrec. from N Peru).

Etymology. – The name *Pentacalia* refers to the 5-ribbed achenes of the type of the genus.

Distribution and ecology. – *Pentacalia* occurs from southern Mexico to northwestern Argentina, plus two disjunct species in the Atlantic Forest of Brazil. Most species thrive in the montane forest within an elevational gradient of 2000–3000 m, but some species reach higher elevations and are found in the paramo ecosystem while others occur at sea level. In Ecuador, all the species are found at elevations of (230–)1000–3800 m (Map 1).

Notes. – The publication of *Pentacalia* subg. *Microchaete* by Cuatrecasas (1981) automatically established the autonym *Pentacalia* Cass. subg. *Pentacalia* (Turland et al., 2018: ICN Art. 22.1). The citation of *Pentacalia* subg. *Pentacalia* Cuatrec. by Cuatrecasas (1981), Díaz-Piedrahita & Cuatrecasas (1999), and Calvo (2021) is an error. For details on the original description of *Pentacalia* by Cassini see Calvo (2021).

Key to the species of Pentacalia in Ecuador

[modified and updated from Robinson & Cuatrecasas (1993)]

1. Capitula radiate 2
1a. Capitula discoid or disciform (rarely subradiate) 16

2. Leaves glabrous 3
2a. Leaves with indumentum 11

3. Involucral bracts 10–10.5 mm long ..... **4. *P. atrovinosa***
3a. Involucral bracts 4.2–8.4 mm long 4

4. Ray florets white 5
4a. Ray florets yellow 6

5. Leaves oblong-elliptic, 12–16.5 × 3.8–5.9 cm, margin denticulate to serrulate, secondary and tertiary veins conspicuous; ray floret limbs curved downward .... **5. *P. celicana***
5a. Leaves lanceolate to narrowly elliptic, 5.3–8 × 2.1–3.5 cm, margin entire, secondary veins barely conspicuous, tertiary veins inconspicuous; ray floret limbs patent .... **13a. *P. luteynorum*** subsp. ***luyteynorum***

6. Synflorescences mostly lateral, axillary 7
6a. Synflorescences mostly terminal 8

7. Leaves 5–10.5 × 3–6 cm; involucral bracts 7–8 .... **22. *P. riotintis***
7a. Leaves 11.5–16.2 × 6.3–10.2 cm; involucral bracts 11–13 ..... **26. *P. todziae***

8. Leaves obovate to oblanceolate (rarely ovate), apex obtuse ..... **8. *P. dorrii***

8a. Leaves lanceolate to ovate or narrowly elliptic, apex acute to acuminate 9

9. Peduncles 8–30 mm long; secondary leaf veins arising from the base or nearly so; synflorescences lax ..... **1. *P. andrei***

9a. Peduncles 2–10 mm long; secondary leaf veins pinnate; synflorescences rather condensed 10

10. Leaves 8.5–18 × 4.5–10 cm, elliptic to ovate, coriaceous, secondary veins conspicuous, arched ..... **11. *P. huilensis***

10a. Leaves 5.3–8 × 2.1–3.5 cm, lanceolate to narrowly elliptic, somewhat fleshy, secondary veins barely conspicuous, not or barely arched ..... **13b. *P. luteynorum*** subsp. ***lutea***

11. Leaves lanate on abaxial surface 12

11a. Leaves pilose to tomentose on abaxial surface 13

12. Ray floret limbs well-developed, 6–8 × 2.1–2.2 mm, patent; leaf indumentum usually whitish ..... **18. *P. oellgaardii***

12a. Ray floret limbs reduced, 2–4.6 × 0.7–1.2 mm, curved downward; leaf indumentum ochraceous ..... **21. *P. popayanensis***

13. Leaves 2.5–5.2 × 1.1–3.2 cm; stem indumentum hirsute-tomentose, rusty ..... **23. *P. ruficaulis***

13a. Leaves 6.5–18 × 3.9–10 cm; stem indumentum absent or glabrescent to tomentose, whitish to brownish 14

14. Leaves coriaceous, secondary veins strongly arched; involucres glabrous ..... **11. *P. huilensis***

14a. Leaves chartaceous, secondary veins not or barely arched; involucres sparsely pilose to tomentulose 15

15. Ray floret limbs well-developed, 8.3–10.5 × 1.8–2.3 mm, patent; peduncles 8–23 mm long ..... **6. *P. corazonensis***

15a. Ray floret limbs reduced, (1.6–)4.4–7 × 0.8–1.5 mm, curved downward; peduncles 3–12 mm long ..... **17. *P. nordenstamii***

16. Capitula discoid 17

16a. Capitula disciform (rarely subradiate) 22

17. Synflorescences mostly lateral, axillary, racemiform or racemose-paniculiform; involucral bracts 6.9–10 mm long; leaf margin entire 18

17a. Synflorescences mostly terminal, thyrsoid-paniculiform; involucral bracts 3.2–5.9 mm long; leaf margin remotely mucronate-denticulate, crenate, or finely dentate (rarely entire) 20

18. Secondary leaf veins barely conspicuous; synflorescences racemose-paniculiform; peduncles 6–10 mm long ..... **15. *P. moronensis***

18a. Secondary leaf veins conspicuous; synflorescences racemiform; peduncles 3–7 mm long 19

19. Tertiary leaf veins usually inconspicuous; florets 15–23; involucral bracts 6.9–7.2 × 2–2.2 mm ..... **12. *P. hurtadoi***

19a. Tertiary leaf veins conspicuous; florets 12–14; involucral bracts 7.7–10 × 1.1–1.7 mm ..... **16. *P. napoensis***

20. Leaves lanate on abaxial surface ..... **19. *P. oronocensis***

20a. Leaves glabrous on both surfaces 21

21. Leaves ovate to oblong-ovate, obtuse to rounded at base (sometimes cuneate), coriaceous, margin crenate to roughly denticulate; branchlet indumentum usually crisped-tomentose ..... **2. *P. arborea***

21a. Leaves lanceolate to narrowly elliptic, attenuate to cuneate at base, rather chartaceous, margin entire to finely dentate; branchlet indumentum absent or glabrescent, rarely tomentulose ..... **25. *P. theifolia***

22. Capitula subradiate (peripheral florets with a vestigial limb) 23

22a. Capitula disciform 24

23. Leaves rather concolorous, glabrescent on abaxial surface; peduncles 0.5–3 mm long ..... **3. *P. aschersoniana***

23a. Leaves discolorous, lanate on abaxial surface; peduncles 2–10 mm long ..... **7. *P. disciformis***

24. Leaves lanate on abaxial surface 25

24a. Leaves glabrous, tomentulose, or sparsely arachnoid-floccose on abaxial surface 27

25. Leaves lanceolate to narrowly elliptic, base cuneate to obtuse, margin usually remotely mucronate-denticulate (sometimes entire); disc florets 11–15; plant indumentum usually ochraceous ..... **19. *P. oronocensis***

25a. Leaves lanceolate to ovate, base obtuse to cordate, margin entire; disc florets 15–45; plant indumentum usually whitish 26

26. Involucral bracts 8; supplementary bracts 2.2–3.1 × 1.8–2.1 mm; disc florets 15–22; peduncles 2–10 mm long ..... **7. *P. disciformis***

26a. Involucral bracts 10(–11); supplementary bracts 4.5–5.5 × 2.3–3.2 mm; disc florets 40–45; peduncles 5–16 mm long ..... **10. *P. hillii***

27. Involucres floccose-lanate ..... **3. *P. aschersoniana***

27a. Involucres glabrous or somewhat arachnoid-tomentulose near base 28

28. Synflorescences mostly lateral, axillary; leaf margin entire 29

28a. Synflorescences mostly terminal; leaf margin remotely mucronate-denticulate to denticulate (rarely entire) 31

29. Synflorescences racemiform (rarely racemose-paniculiform); capitula on peduncles 5–14 mm long ..... **20. *P. palaciosii***

29a. Synflorescences thyrsoid-paniculiform; capitula subsessile or shortly pedunculate (0.5–3 mm long) 30

30. Supplementary bracts (2.5–)4.1–6.1 × 1–1.8 mm, extending to ½ or almost equaling the length of involucral

bracts; disc florets 15–20; secondary and tertiary leaf veins conspicuous ..... **24. *P. sevillana***

30a. Supplementary bracts 1.2–1.5 × 0.5–0.7 mm, extending to < ¼ the length of involucral bracts; disc florets 7–10; secondary leaf veins usually barely conspicuous, tertiary veins inconspicuous ..... **27. *P. zakii***

31. Capitula pedunculate, peduncles 10–30 mm long; supplementary bracts 3–5 mm long, extending to ¾ or equaling the length of involucral bracts; disc florets 18–20 ..... **9. *P. floribunda***

31a. Capitula sessile or very shortly pedunculate, peduncles 0.5–2 mm long; supplementary bracts 0.7–1.6 mm long, extending to ¼–⅓ the length of involucral bracts; disc florets 8–11 ..... **14. *P. millei***

Clave de identificación de las especies de Pentacalia en el Ecuador

[modificada y actualizada de Robinson & Cuatrecasas (1993)]

1. Capítulos radiados 2
1a. Capítulos discoides o disciformes (raramente subradiados) 16
2. Hojas glabras 3
2a. Hojas con indumento 11
3. Brácteas involucrales (filarias) 10–10,5 mm de largo ..... **4. *P. atrovinosa***
3a. Brácteas involucrales 4,2–8,4 mm de largo 4
4. Flores liguladas blancas 5
4a. Flores liguladas amarillas 6
5. Hojas oblongo-elípticas, 12–16,5 × 3,8–5,9 cm, margen de denticulado a serrulado, nervios secundarios y terciarios conspicuos; lígulas curvadas hacia abajo .... **5. *P. celicana***
5a. Hojas de lanceoladas a estrechamente elípticas, 5,3–8 × 2,1–3,5 cm, margen entero, nervios secundarios apenas conspicuos y terciarios inconspicuos; lígulas patentes ..... **13a. *P. luteynorum*** subsp. ***luyteynorum***
6. Sinflorescencias en su mayoría laterales, axilares 7
6a. Sinflorescencias en su mayoría terminales 8
7. Hojas 5–10,5 × 3–6 cm; brácteas involucrales 7–8 ..... **22. *P. riotintis***
7a. Hojas 11,5–16,2 × 6,3–10,2 cm; brácteas involucrales 11–13 ..... **26. *P. todziae***
8. Hojas de obovadas a oblanceoladas (raramente ovadas), ápice obtuso ..... **8. *P. dorrii***
8a. Hojas de lanceoladas a ovadas o estrechamente elípticas, ápice de agudo a acuminado 9
9. Pedúnculos 8–30 mm de largo; nervios secundarios de la hoja nacen de la base de la lámina o casi; sinflorescencias laxas ..... **1. *P. andrei***
9a. Pedúnculos 2–10 mm de largo; nervios secundarios de la hoja pinnados; sinflorescencias densas 10
10. Hojas 8,5–18 × 4,5–10 cm, de elípticas a ovadas, coriáceas, nervios secundarios conspicuos, arqueados ..... **11. *P. huilensis***
10a. Hojas 5,3–8 × 2,1–3,5 cm, de lanceoladas a estrechamente elípticas, algo carnosas, nervios secundarios apenas conspicuos, no arqueados o poco ..... **13b. *P. luteynorum*** subsp. ***lutea***
11. Hojas lanosas en el envés 12
11a. Hojas de pelosas a tomentosas en el envés 13
12. Lígulas bien desarrolladas, 6–8 × 2,1–2,2 mm, patentes; indumento de las hojas generalmente blanquecino ..... **18. *P. oellgaardii***
12a. Lígulas reducidas, 2–4,6 × 0,7–1,2 mm, curvadas hacia abajo; indumento de las hojas ocráceo ..... **21. *P. popayanensis***
13. Hojas 2,5–5,2 × 1,1–3,2 cm; indumento de los tallos hirsuto-tomentoso, rojo herrumbroso ..... **23. *P. ruficaulis***
13a. Hojas 6,5–18 × 3,9–10 cm; indumento de los tallos ausente o de glabrescente a tomentoso, de blanquecino a parduzco 14
14. Hojas coriáceas, nervios secundarios fuertemente arqueados; involucros glabros ..... **11. *P. huilensis***
14a. Hojas cartáceas, nervios secundarios no arqueados o poco; involucros de dispersamente pelosos a tomentulosos ... 15
15. Lígulas bien desarrolladas, 8,3–10.5 × 1,8–2,3 mm, patentes; pedúnculos 8–23 mm de largo ..... **6. *P. corazonensis***
15a. Lígulas reducidas, (1,6–)4,4–7 × 0,8–1,5 mm, curvadas hacia abajo; pedúnculos 3–12 mm de largo ..... **17. *P. nordenstamii***
16. Capítulos discoides 17
16a. Capítulos disciformes (raramente subradiados) 22
17. Sinflorescencias en su mayoría laterales, axilares, racemiformes o racemoso-paniculiformes; brácteas involucrales 6,9–10 mm de largo; margen de las hojas entero 18
17a. Sinflorescencias en su mayoría terminales, tirsoideo-paniculiformes; brácteas involucrales 3,2–5,9 mm de largo; margen de las hojas distantemente mucronado-denticulado, crenado o finamente dentado (raramente entero) 20
18. Nervios secundarios de la hoja apenas conspicuos; sinflorescencias racemoso-paniculiformes; pedúnculos 6–10 mm de largo ..... **15. *P. moronensis***
18a. Nervios secundarios de la hoja conspicuos; sinflorescencias racemiformes; pedúnculos 3–7 mm de largo 19
19. Nervios terciarios de la hoja generalmente inconspicuos; flósculos 15–23; brácteas involucrales 6,9–7,2 × 2–2,2 mm ..... **12. *P. hurtadoi***

19a. Nervios terciarios de la hoja conspicuos; flósculos 12–14; brácteas involucrales 7,7–10 × 1,1–1,7 mm ..... **16. *P. napoensis***

20. Hojas lanosas en el envés ..... **19. *P. oronocensis***
20a. Hojas glabras en ambas superficies 21

21. Hojas de ovadas a oblongo-ovadas, de obtusas a redondeadas en la base (a veces cuneadas), coriáceas, margen de crenado a toscamente denticulado; indumento de las ramillas generalmente crespo-tomentoso ..... **2. *P. arborea***
21a. Hojas de lanceoladas a estrechamente elípticas, de atenuadas a cuneadas en la base, más bien cartáceas, margen de entero a finamente dentado; indumento de las ramillas ausente o glabrescente, raramente tomentuloso ..... **25. *P. theifolia***

22. Capítulos subradiados (flores de la periferia con lígula vestigial) 23
22a. Capítulos disciformes 24

23. Hojas más bien concoloras, glabrescentes en el envés; pedúnculos 0.5–3 mm de largo ..... **3. *P. aschersoniana***
23a. Hojas discoloras, lanosas en el envés; pedúnculos 2–10 mm de largo ..... **7. *P. disciformis***

24. Hojas lanosas en el envés 25
24a. Hojas glabras, tomentulosas o dispersamente aracnoideo-flocosas en el envés 27

25. Hojas de lanceoladas a estrechamente elípticas, de cuneadas a obtusas en la base, margen por lo general distantemente mucronado-denticulado (a veces entero); flósculos 11–15; indumento de la planta generalmente ocráceo ..... **19. *P. oronocensis***
25a. Hojas de lanceoladas a ovadas, de obtusas a cordadas en la base, margen entero; flósculos 15–45; indumento de la planta generalmente blanquecino 26

26. Brácteas involucrales 8; brácteas suplementarias (caliculares) 2,2–3,1 × 1,8–2,1 mm; flósculos 15–22; pedúnculos 2–10 mm de largo ..... **7. *P. disciformis***
26a. Brácteas involucrales 10(–11); brácteas suplementarias 4,5–5,5 × 2,3–3,2 mm; flósculos 40–45; pedúnculos 5–16 mm de largo ..... **10. *P. billii***

27. Involucros flocoso-lanosos ..... **3. *P. aschersoniana***
27a. Involucros glabros o ligeramente aracnoideo-tomentulosos cerca de la base 28

28. Sinflorescencias en su mayoría laterales, axilares; margen de las hojas entero 29
28a. Sinflorescencias en su mayoría terminales; margen de las hojas de distantemente mucronado-denticulado a denticulado (raramente entero) 31

29. Sinflorescencias racemiformes (raramente racemoso-paniculiformes); capítulos con pedúnculos 5–14 mm de largo ..... **20. *P. palaciosii***
29a. Sinflorescencias tirsoideo-paniculiformes; capítulos subsésiles o cortamente pedunculados (0,5–3 mm de largo) 30

30. Brácteas suplementarias (2,5–)4,1–6,1 × 1–1,8 mm, alcanzando la mitad o casi igualando la longitud de las brácteas involucrales; flósculos 15–20; nervios secundarios y terciarios de las hojas conspicuos ..... **24. *P. sevillana***
30a. Brácteas suplementarias 1,2–1,5 × 0,5–0,7 mm, alcanzando < ¼ la longitud de las brácteas involucrales; flósculos 7–10; nervios secundarios de las hojas generalmente apenas conspicuos, terciarios inconspicuos ..... **27. *P. zakii***

31. Capítulos pedunculados, pedúnculos 10–30 mm de largo; brácteas suplementarias 3–5 mm de largo, alcanzando ¾ o igualando la longitud de las brácteas involucrales; flósculos 18–20 ..... **9. *P. floribunda***
31a. Capítulos sésiles o muy cortamente pedunculados, pedúnculos 0.5–2 mm de largo; brácteas suplementarias 0,7–1,6 mm de largo, alcanzando ¼–⅓ la longitud de las brácteas involucrales; flósculos 8–11 ..... **14. *P. millei***

1. ***Pentacalia andrei*** (Greenm.) Cuatrec. in Phytologia 49: 243. 1981 (Fig. 2, 3 → p. 34, 35).

   ≡ *Senecio andrei* Greenm. in Ann. Missouri Bot. Gard. 25: 797. 1938. **Holotypus: Ecuador. Loja/Zamora-Chinchipe:** Loja-Zamora, c. 3000 m, 1.XII.1876, *André 4520* (GH [GH00012076] image!; iso-: K [K000497636] image!).

   = *Pentacalia lanceolifolia* (Cuatrec.) Cuatrec. in Phytologia 49: 247. 1981. ≡ *Senecio lanceolifolius* Cuatrec. in Brittonia 8: 43. 1954. **Holotypus: Ecuador. Morona-Santiago:** cordillera Cutucú, ridge south and west of río Itzintza, 2°40'S 78°W, 17.XI–5.XII.1944, *Camp E-1389* (F [F0076929F] image!; iso-: NY [NY00259211] image!).

Plants scandent; stems terete, finely furrowed, glabrous, solid. *Leaves* alternate, simple, petiolate; petioles 1–1.2 cm long; laminas 4–6 × 2.4–2.8 cm, lanceolate to ovate, apex attenuate to acuminate, base obtuse to rounded, margin entire or remotely mucronate-denticulate, glabrous on both surfaces, somewhat coriaceous, concolorous or slightly discolorous, secondary veins barely conspicuous on adaxial surface, conspicuous on abaxial surface. *Synflorescences* mostly terminal, corymbiform, with bracts foliose; synflorescence branches glabrous or very sparsely pilose. *Capitula* heterogamous, radiate, pedunculate; peduncles 8–30 mm long, glabrous or almost so, with 3–4 linear-oblong bracteoles; involucres cylindrical, glabrous; involucral bracts 8–9, 4.2–5.2 × 1.1–1.8 mm, linear-oblong; supplementary bracts 1–3, 1.2–1.3 × 0.5–0.6 mm, linear-subulate, extending to < ¼ the length of involucral bracts. *Ray florets* 7–8, pistillate; corollas 11.2–16.1 mm long, limbs 8.2–12.2 × 2.1–2.7 mm, patent,

subentire to 3-toothed, yellow. *Disc florets* 11–12, hermaphroditic; corollas 5.1–6 mm long, tubular, 5-lobed, yellow; anthers yellowish, anther bases caudate, ½ as long as filament collar, appendages c. 0.4 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 2.9–3.5 × c. 0.8 mm, cylindrical, c. 7-ribbed, glabrous; pappus 4.9–5.7 mm long, bristles capillary, barbellate, whitish.

Additional iconography. – Calvo et al. (2019a: 284, fig. 1).

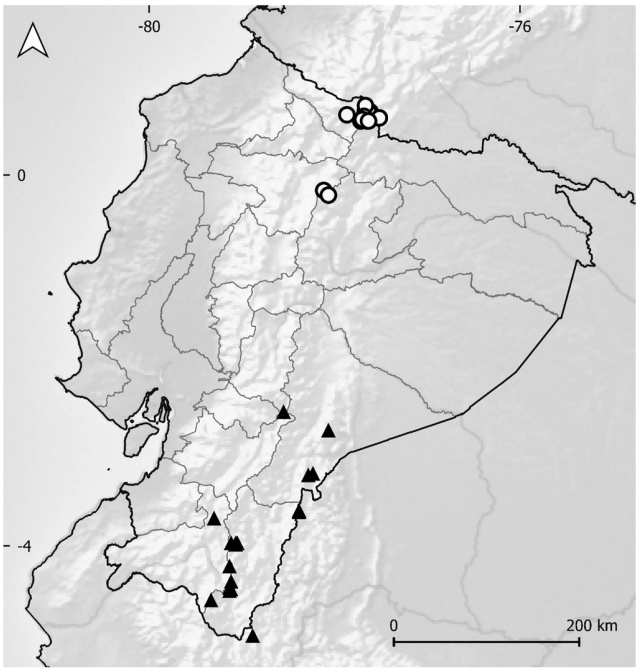
Etymology. – The species honors the French horticulturist and botanical explorer Édouard F. André (1840–1911), who collected the type material in 1876 in southern Ecuador.

Distribution, ecology and phenology. – Ecuador (Azuay, Loja, Morona-Santiago, Zamora-Chinchipe) and N Peru. This species occurs in montane forests, at elevations of (1500–)1800–3400 m. Specimens in flower have mostly been collected between September and December (Map 2).

Notes. – *Pentacalia andrei* groups in the ensemble of species with mostly terminal synflorescences, radiate capitula, and glabrous leaves. It is similar to *P. dorrii* but differs in having lanceolate to ovate leaves with attenuate to acuminate apex (vs. obovate to oblanceolate (rarely ovate) with obtuse apex), laxer synflorescences, longer peduncles (8–30 mm vs. 7–18 mm), and secondary veins arising from the base or nearly so (vs. clearly pinnately veined).

The collection *Cazalet & Pennington 5466*, from Imbabura, was wrongly identified and cited as *Pentacalia andrei* by Nordenstam (1999). The specimen is here identified as *P. nordenstamii* J. Calvo (described below). The distribution of *P. andrei* is therefore restricted to southern Ecuador and northern Peru (Calvo et al., 2019a).

Additional specimens examined. – **Ecuador. Azuay:** Sevilla de Oro, Amaluza, represa Molino, campamento Arenales, 2°33'S 78°33'W, 2142 m, 22.XI.2018, *Minga et al. 3916* (HA). **Loja:** Podocarpus N.P., Cajanuma entrance, on upper slopes, 2890 m, 23.XI.2016, *Homeier & Peña 5796* (HUTPL); Saraguro–Loja, km 12.4, turnoff towards Fierro Urco, km 3.8–7.1, 3°42'S 79°18'W, 3120–3390 m, 7.XII.1994, *Jørgensen et al. 1295* (LOJA, QCA, QCNE, US); P.N. Podocarpus, cerro Toledo, 4°23'S 79°7'W, 2500–3400 m, 30.X.1989, *Madsen 86250* (AAU, LOJA, QCA, QCNE, US); sendero lagunas Banderillas, 4°13'S 79°8'W, 2600 m, 23.V.2002, *Merino, Delgado & Chimbo E-1518* (LOJA); muletrack Amaluza–Palanda, W slope, near the pass (W of laguna Chuquiragua), 4°35'S 79°20'W, 3100–3400 m, 22.IX.1976, *Øllgaard & Balslev 9626* (AAU). **Morona-Santiago:** cantón Limón–Indanza, cordillera del Cóndor (c. 15–20 km S/SE of the comunidad Warints, 3°14'S 78°17'W, 1900–2200 m, 15.XII.2002, *Clark & Jost 6998* (LOJA, QCNE, US); Limón Indanza, región de la Cordillera del Cóndor, cuenca del río Coangos, centro Shuar Warints, laderas y cumbre del cerro Chakiniats, 3°13'S 78°14'W, 1490 m, 13.X.2002, *Toasa et al. 8995* (QCNE). **Zamora-Chinchipe:** camino cercano a la estación eléctrica San Ramón, 3°58'S 79°3'W, 29.X.2018, *Arnelas, Calvo & Armijos 1092* (HUTPL); desde la pista Yangana–Valladolid, enfrente de un refugio con la inscripción "Entrada a Quebrada Honda" sale un camino de herradura, 4°28'S 79°7'W, 2450 m, 8.X.1995, *Garmedia & Paredes 561* (LOJA, MA, QCNE); road Valladolid–Nudo de Sabanilla, horse trail to quebrada Honda, [4°27'S 79°8'W], 2650 m, 17.X.1988, *Harling 25292* (QCA); Estación San Francisco, 3°59'S 79°4'W, 2400 m, 22.I.2002, *Lozano et al. E-375* (LOJA); limit of P.N. Podocarpus, around pass on road Loja–Zamora, 3°58'S 79°7'W, 2750–2950 m, 25.XII.1988, *Madsen & Ellemann 75982* (AAU); area of ECSF (Estación Científica San Francisco) Research Station approx. 30 km away from the city of Loja on the highway towards Zamora, 3°58'S 79°4'W, 2150 m, 7.XII.1999, *Matezki 114* (HUTPL); ibid., 2090 m, 17.X.1999, *Matezki 50* (HUTPL); ibid., 2200 m, 13.XI.1999, *Matezki 84* (US); El Pangui, Cordillera del Cóndor, 2 km N of Cóndor Mirador military post, 3°37'S 78°23'W, 1975 m, 6.IX.2003, *Neill et al. 14426* (QCNE); Palanda, Tapichalaca Reserve, S of Podocarpus N.P., E of road between Yangana and Valladolid, 4°29'S 79°8'W, 2550 m, 25.IX.2007, *Neill, Davidson & Christoph 15990* (LOJA); in the vicinity of the mining camp at the río Tundaime, along trail from military base El Cóndor to the look-out point, 3°38'S 78°23'W, 1800–2000 m, 28.X.2004, *van der Werff et al. 18955* (LOJA, QCNE). **Peru. Cajamarca:** San Ignacio, San José de Lourdes, cerro Picorana, 4°58'S 78°53'W, 2830 m, 17.VIII.1998, *Campos, L. Campos & Zurita 5542* (US, USM).



Map 2. – Distribution of *Pentacalia andrei* (Greenm.) Cuatrec. (triangle) and *P. arborea* (Kunth) Cass. (open circle).

2. ***Pentacalia arborea*** (Kunth) Cass. in Cuvier F., Dict. Sci. Nat., ed. 2, 48: 461. 1827.

   ≡ *Cacalia arborea* Kunth, Nov. Gen. Sp. 4: 128 [ed. folio]. 1818. ≡ *Psacalium arboreum* (Kunth) DC., Prodr. 6: 335. 1838. ≡ *Senecio arboreus* (Kunth) Greenm. in Ann. Missouri Bot. Gard. 10: 77. 1923. **Holotypus: Colombia. Cauca:** páramo de Almaguer, s.d., *Bonpland & Humboldt 2070* (P-Bonpl. [P00320224]!; iso-: B-W [B-W 15046-01 0] image!, F [F0077031F fragm.] image!, HAL [HAL0113446] image!).

   – *Pentacalia arborea* (Kunth) H. Rob. & Cuatrec. in Phytologia 40: 39. 1978 [isonym].

Plants scandent or suberect leaning over adjacent vegetation; stems terete, slightly furrowed, crisped-tomentose, solid. *Leaves* alternate, simple, petiolate; petioles 0.8–1.2 cm long; laminas 3.8–5.5 × 2.3–3 cm, ovate or oblong-ovate to broadly lanceolate or narrowly elliptic, apex obtuse (sometimes rather acute), base obtuse to rounded (sometimes cuneate), margin subentire to crenate or roughly denticulate, glabrous on both surfaces, coriaceous, concolorous or slightly discolorous, secondary and tertiary veins conspicuous on both surfaces, protruding on abaxial surface. *Synflorescences* mostly terminal, thyrsoid-paniculiform, with bracts linear-subulate; synflorescence branches crisped-tomentose (rarely glabrous or glabrescent). *Capitula* homogamous, discoid, shortly pedunculate; peduncles 2–4 mm long, tomentulose to crisped-tomentose, with 1–3 linear-subulate bracteoles; involucres cylindrical, glabrous; involucral bracts 8, 4.2–4.8 × 0.8–1.2 mm, linear-oblong; supplementary bracts 4–6, 1.2–2.3 × 0.4–0.5 mm, linear, extending to ⅓ the length of involucral bracts. *Disc florets* 8–11, hermaphroditic; corollas 4.1–4.4 mm long, tubular, 5-lobed, whitish; anther bases very shortly caudate, ¼ as long as filament collar, appendages c. 0.3 × 0.15 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 1.7–2.1 × 0.5–0.6 mm, cylindrical, 5–7-ribbed, glabrous; pappus 3.5–3.7 mm long, bristles capillary, barbellate, whitish.

Iconography. – Kunth (1818: tab. 359, sub *Cacalia arborea*); Díaz-Piedrahita & Cuatrecasas (1999: 122, fig. 41).

Etymology. – The epithet *arborea* means tree-like, tending to be of tree-like dimensions. Kunth named the plant as such based on the original annotations made by Bonpland in the field ("Journal Botanique"), where he described the plant as "Arbor 3 orgyalis". This corresponds to c. 5.4 m, since *orgyalis* is a fathom-long, i.e., a unit of length equal to six feet. This species is not a tree and the name probably responds to the fact that the species develop long scandent stems that dangle or lean over other plants.

Distribution, ecology and phenology. – Colombia and Ecuador (Carchi, Napo, Sucumbíos). This species occurs at the edge of montane forests and in scrubs near the limit with the paramo ecosystem, at elevations of 2800–3700 m. Flowering nearly all year round (Map 2).

Notes. – The combination of *Cacalia arborea* in *Pentacalia* has widely been attributed to Robinson and Cuatrecasas (Díaz-Piedrahita & Cuatrecasas, 1999; Nordenstam, 1999; Calvo, 2021). Considering that *Pentacalia* was originally described by Cassini (1827) in order to exclude from *Cacalia* L. the Andean species *C. arborea* Kunth, the combination should be attributed to Cassini as Candolle already did (Candolle, 1838). Robinson and Cuatrecasas' combination is here considered as a later isonym.

Pentacalia arborea was described from a material collected by Bonpland and Humboldt in páramo de Almaguer (Cauca, Colombia). This species has mostly terminal, thyrsoid-paniculiform synflorescences composed of shortly pedunculate, discoid capitula. The leaves usually are ovate or oblong-ovate, obtuse to rounded at base, coriaceous, with margin crenate to roughly denticulate and tertiary veins conspicuous (in dried specimens). The synflorescences branches usually have a crisped-tomentose indumentum. Nonetheless, this species exhibits a considerable variability concerning the leaf shape and branchlet indumentum are quite variable. According to this variability, Díaz-Piedrahita & Cuatrecasas (1999) recognized in Colombia several species very similar to *P. arborea*, i.e., *P. chaquiroensis* (Greenm.) Cuatrec. from Antioquia, *P. diamantensis* (Cuatrec.) Cuatrec. from Valle del Cauca, *P. sonsonensis* (Cuatrec.) Cuatrec. from Antioquia, and *P. weinmannifolia* (Cuatrec.) Cuatrec. from Nariño/Putumayo. *Pentacalia sonsonensis* is well-characterized by its involucre composed of five involucral bracts, but the other species are hardly distinguishable one from another and they lack a defined distribution pattern. In my opinion this ensemble of taxa should be treated as a unique variable species but this taxonomic decision goes behind the scope of this revision.

In Ecuador, the species were cited from Carchi, Imbabura, Napo, and Sucumbíos (Nordenstam, 1999). According to the herbarium specimens, several collections have interchangeably been identified as *P. arborea* or *P. theifolia*. In the key provided by Robinson & Cuatrecasas (1993), these species are separated by the shape of the axis of the synflorescence (mostly straight in *P. arborea* vs. somewhat zigzagged in *P. theifolia*) and the arrangement of the secondary veins of the leaves (spreading at nearly 90° in *P. arborea* vs. spreading at 70–80° in *P. theifolia*). Based on the studied material, those characters do not seem useful to differentiate both species. Herein, the characters proposed for discriminating them concern the leaf morphology (ovate to oblong-ovate, obtuse to rounded at base, coriaceous, crenate to roughly denticulate, with conspicuous venation in *P. arborea* vs. lanceolate to narrowly elliptic, attenuate to cuneate at base, rather chartaceous, entire to finely dentate, with less marked venation in *P. theifolia*) and the branchlet indumentum (crisped-tomentose in *P. arborea* vs. glabrous or glabrescent, rarely tomentulose in *P. theifolia*). However, and as commented above, these characters vary and several specimens are difficult to assign to one or another species; this is the case of *Palacios & Clark 12499* (QCNE, US) and *Palacios & Clark 12444* (QCNE), both from cerro Golondrinas in Carchi, that were identified by H. Robinson as *P. arborea* (in sched., 1998) and *P. theifolia* (in sched., 2000) respectively. Because of their mostly attenuate to cuneate leaves, with subentire margin and secondary and tertiary veins not very conspicuous, these collections are identified as *P. theifolia*. The leaf characters seem

more useful than the branchlet indumentum for differentiating *P. arborea* from *P. theifolia* (see additional comments under this latter species). Among the specimens identified as *P. arborea* from northern Ecuador, one finds specimens with stems and branchlets glabrous or glabrescent (*Dodson & Gentry 12074*, Q, US), crisped-tomentose (*Holm-Nielsen et al. 29921*, AAU, US), or with tomentose indumentum only on the young branchlets (*King et al. 10136*, US). On the other hand, the collection *Ståhl 1565* (AAU, QCA, QCNE) shows atypical short involucres (3.5–3.7 vs. 5.2–5.7 mm). Since the remaining characters match those of *P. arborea,* it is accordingly identified as such.

Pentacalia arborea is distributed through the Andes of Colombia and northern Ecuador, whereas *P. theifolia* extends from western Venezuela to central Peru. In Ecuador, their distribution areas overlap in the region of eastern Carchi and western Sucumbíos. From this area, I identified several specimens with hesitation. Molecular studies would help to understand the relationships between these species and if hybridization events occur.

Pentacalia weinmannifolia (Cuatrec.) Cuatrec. was cited by Nordenstam (1999) on the basis of the collection *Løjtnant et al. 12073* (AAU, QCA), which is here identified as *P. arborea*. The former species is therefore excluded from the Ecuadorian flora.

Additional specimens examined. – **Carchi:** 4.8 km W of Carmelo, along road from Tulcán to Alegría vía Carmelo and Santa Bárbara, [0°41'N 77°37'W], 2900 m, 5.II.1982, *Dodson & Gentry 12074* (Q, US); carretera El Carmelo–El Frailejón–Unión Panamericana Norte, [0°42'N 77°40'W], 1.I.1981, *Jaramillo & Coello 4024* (AAU); above La Esperanza, 5 km W of El Carmelo on road to Tulcán, 0°41'N 77°38'W, 3200–3450 m, 9.IV.1979, *Løjtnant, Molau & Madison 12073* (AAU, QCA); Tulcán–El Carmelo road, 27 km of Panamerican hwy., 0°45'N 77°40'W, 3300 m, 10.I.1985, *Luteyn & Cotton 10952* (QCNE); Tulcán, Estación Biológica Guandera, 0°35'N 77°43'W, 3200 m, 16–17.VII.1998, *Mora et al. 140* (QCNE); Montúfar, San Gabriel–Las Delicias, límite entre el bosque andino y el páramo de la Reserva Ecológica El Ángel, 0°39'N 77°52'W, 3400 m, 7.XI.1993, *Palacios 11798* (QCNE); al E de la colonia Huaqueña en el sector Bretaña o loma Corazón, 0°38'N 77°41'W, 3000–3200 m, 18.II.1989, *Palacios & van der Werff 3920* (AAU, QCNE, US); El Mirador, a 15 km al S de San Francisco, 0°37'N 77°31'W, 3300 m, 2.VIII.1990, *Palacios & Rubio 5265* (QCNE); Tulcán, Reserva Guandera, c. 6 km E of Fernández Salvador, 0°36'N 77°42'W, 3350–3400 m, 2.VII.1996, *Webster et al. 32064* (US). **Napo:** Oyacachi, 0°10'S 78°7'W, 3000–3200 m, 7.IX.1998, *Moreno 208* (QCA); environs of Oyacachi and along trail to old village, 0°13'S 78°4'W, 2800–3200 m, 4–7.IX.1995, *Ståhl 1565* (AAU, QCA, QCNE). **Sucumbíos:** Playón de San Francisco, El Mirador, [0°37'N 77°31'W], 16.VIII.1978, *Boeke & Jaramillo 2746* (AAU, QCA); SE of El Playón de San Francisco on the slopes of cerro Mirador, 0°35'N 77°38'W, 3300–3700 m, 28.XII.1980, *Holm-Nielsen, Jaramillo & Coello 29743* (AAU); S of El Playón de San Francisco on the slopes of cerro Mirador, 0°35'N 77°39'W, 3300–3600 m, 29.XII.1980, *Holm-Nielsen, Jaramillo & Coello 29921* (AAU, US); Sucumbíos–camino al cerro El Mirador, 16.VIII.1978, *Jaramillo & Boeke 605* (QCNE); 11 km W of El Playón de San Francisco on road to Julio Andrade 5 km up the río Chingual, [0°38'N 77°39'W], 3200 m, 15.V.1990, *King, Peterson & Judziewicz 10136* (G, QCA, US).

3. ***Pentacalia aschersoniana*** (Hieron.) Cuatrec. in Phytologia 49: 243. 1981 (Fig. 4A–C → p. 36).

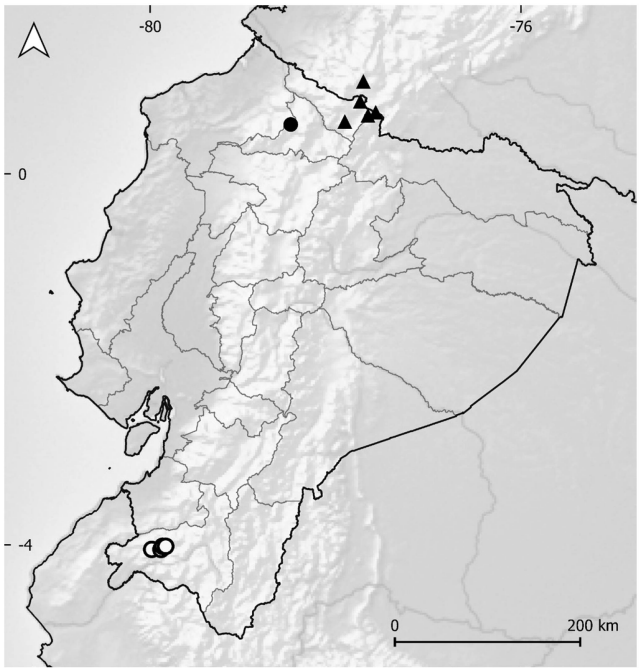
   ≡ *Senecio aschersonianus* Hieron. in Bot. Jahrb. Syst. 28: 642. 1901. **Lectotypus** (designated by Cuatrecasas, 1981: 243). **Colombia. Caldas:** Manizales, 2200 m, 1851–1857, *Triana 1485* (P [P02296693]!; isolecto-: E [E00414369] image!, MO-1013804 fragm. image!, P [P02296694]!). Holotypus: B†. Excluded syntypus: ibid., *Triana 2811.26* (COL [COL000005372] image!).

   = *Senecio carchiensis* Cuatrec. in Feddes Repert. Spec. Nov. Regni Veg. 55: 135. 1953. ≡ *Pentacalia carchiensis* (Cuatrec.) Cuatrec. in Phytologia 49: 244. 1981, **syn. nov. Holotypus: Ecuador. Carchi:** La Rinconada, between Ibarra and Tulcán, 10–11.VIII.1923, *Hitchcock 20946* (GH [GH00012098] image!; iso-: NY [NY00259141] image!; US [US00588526] image!).

Plants scandent; stems terete, furrowed, floccose to lanate, becoming glabrescent, solid. *Leaves* alternate, simple, petiolate; petioles 1.6–2.4 cm long; laminas 8.4–9.5 × 5–6.8 cm, ovate, apex acute to obtuse, base obtuse to rounded, margin entire, glabrescent on adaxial surface, faintly arachnoid (becoming quickly glabrescent) on abaxial surface, coriaceous, rather concolorous, secondary veins barely conspicuous on adaxial surface, conspicuous and protruding on abaxial surface. *Synflorescences* mostly terminal, thyrsoid-paniculiform, with bracts linear-oblong; synflorescence branches whitish floccose-lanate. *Capitula* heterogamous, subradiate, subsessile or shortly pedunculate; peduncles 0.5–3 mm long, whitish floccose-lanate, with 1 linear-subulate bracteole or absent; involucres cylindrical, whitish floccose-lanate; involucral bracts 8, 3.8–4.8 × 1–2.1 mm, linear-oblong to lanceolate; supplementary bracts 3–4, 2.1–3.5 × 1.6–2.2 mm, lanceolate to ovate, extending to ½ the length of involucral bracts. *Peripheral florets* 5–6, pistillate; corollas 4.8–4.9 mm long, developing minute limbs 0.5–0.9 × c. 0.5 mm (sometimes missing or inconspicuous), subentire to 3-toothed, yellow. *Disc florets* 15–23, hermaphroditic; corollas 5.7–6.2 mm long, tubular, 5-lobed, light yellow; anther bases caudate, almost as long as filament collar, appendages c. 0.4 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* c. 1 × 0.5 mm (immature), cylindrical, glabrous; pappus 4.8–5.1 mm long, bristles capillary, barbellate, whitish.

Etymology. – The epithet *aschersoniana* honors the German botanist Paul F.A. Ascherson (1834–1913), curator at B who was mainly known as a leading authority on the Central European flora.

Distribution, ecology and phenology. – Colombia and Ecuador (Carchi, Sucumbíos?). This species occurs in montane forests,



Map 3. – Distribution of *Pentacalia aschersoniana* (Hieron.) Cuatrec. (triangle), *P. atrovinosa* J. Calvo & Á.J. Pérez (closed circle), and *P. celicana* J. Calvo & G. Benítez (open circle).

at elevations of 3000–3460 m. Specimens in flower have been collected in August (Map 3).

Notes. – *Pentacalia aschersoniana* was described from Manizales (Caldas, Colombia) and it is characterized by having glabrescent leaves, subradiate capitula with peripheral florets tubular or with a vestigial limb, peduncles up to c. 3 mm long, lanate involucres, and ovate supplementary bracts. Díaz-Piedrahita & Cuatrecasas (1999) synonymized it with *P. magnusii* (Hieron.) Cuatrec., a species with sessile or very shortly pedunculate capitula, tomentose indumentum restricted to the involucre base, and linear-subulate supplementary bracts. The character concerning the shape of the supplementary bracts is very useful for separating one species from another. Greenman (according to herbarium identifications) and Cuatrecasas (1981) accepted them as distinct species. The collections *García-Barriga & Hawkes 13065* from Nariño and *Killip 6737* (US) and *Pennell & Killip 6509* (US) from Cauca (southern Colombia) were cited by Díaz-Piedrahita & Cuatrecasas (1999) as *P. magnusii*, but it is interesting to note that they were identified in sched. as *S. aschersonianus* by Cuatrecasas (US01844400) and Greenman (US01844386 and US01844387). These species are here treated as distinct, *P. aschersoniana* being distributed through the Colombian Cordillera Central from the departments of Caldas southward to Nariño and the bordering area of Ecuador, whereas *P. magnusii* is restricted to the central and northern part of the Colombian Andes. See additional comments under *P. nordenstamii*.

Hieronymus described this species based on the duplicate he received in B, which should be considered as the holotype and that was destroyed during the WWII. Before its lost, a minimal fragment was taken and kept at MO along with a black and white picture of the holotype. This was most probably done by Jesse M. Greenman (1867–1951) (J. Solomon, pers. comm.), authority on neotropical *Senecio* who did his Ph.D. in the University of Berlin and became curator at MO in 1913 (Woodson, 1951). These fragments, which are barely taxonomically informative, are here considered as isotypes (see also under *P. corazonensis* (Hieron.) Cuatrec., *P. disciformis* (Hieron.) Cuatrec., and *P. popayanensis* (Hieron.) Cuatrec.). Following ICN Art. 9.11, when the holotype has been lost or destroyed, a lectotype as a substitute for it may be designated, and this chosen among the isotypes if these exist (ICN Art. 9.12). Cuatrecasas (1981) cited the holotype at P, which is an error because this specimen corresponds to an isotype. Cuatrecasas's indication of the holotype is then corrected to lectotype according to ICN Art. 9.10 and accepted as such. Triana's specimen at COL numbered "2811.26" (COL000005372) should correspond to a duplicate of Triana's European numbering "1485", however, it does not. It is here identified as *Pentacalia sylvicola* (Greenm.) Cuatrec., a radiate species with well-developed ray limbs and supplementary bracts linear-subulate (notice the resemblance to US01844612). This species is common in the central part of the Cordillera Central of Colombia (Díaz-Piedrahita & Cuatrecasas, 1999). The specimen COL000005372 is therefore excluded from the original material of *Senecio aschersonianus*.

Pentacalia carchiensis was treated as an accepted species endemic to Ecuador (known only from Carchi) by Nordenstam (1999). It was described as having abaxial leaf surfaces lanuginous initially and later becoming glabrous, with protruding secondary veins; capitula heterogamous, subdiscoid, on peduncles 3–8 mm long; involucres composed of 8 involucral bracts, 4.5–5 mm long, dorsally lanate and supplementary bracts ovate, c. 3 × 2.5 mm, dorsally lanate; ray florets c. 4, subtubulose, with a subligulate limb and disc florets 16–19; achenes glabrous. Since all these characters fit well with the original description of *P. aschersoniana* and no characters were found to separate them, these species are here synonymized. The historical treatment of the original material of *P. carchiensis* also supports this decision. The isotype at US was firstly identified by Greenman (in sched., 17.V.1949) as *Senecio aschersonianus* Hieron. and a few years later as *S. aschersonianus* f. *vestitus* by Cuatrecasas (in sched., V.1952, see US00588526), who finally described it as a new species under the name *S. carchiensis*. In the protologue, it was compared with *S. breviligulatus* Hieron. but *S. aschersonianus* was oddly not mentioned. In terms of geographical distribution, the few

known collections of *Pentacalia carchiensis* represent a clear continuity of the populations of *P. aschersoniana* from Nariño, southern Colombia. The collection *Mexia 7629* comes from the valley of the río Pun, on the border between Colombia and Ecuador. Díaz-Piedrahita & Cuatrecasas (1999) identified it as *P. breviligulata* (Hieron.) Cuatrec., but Cuatrecasas (in sched.) previously annotated the specimen at F with the nomen nudum *Senecio carchiensis* var. *punis* Cuatrec. This specimen appears to have been lost (K. Hansen, pers. comm.). The duplicates at UC and US show plants having involucres and synflorescence branches with floccose-lanate indumentum and ovate supplementary bracts; they are here identified as *Pentacalia aschersoniana*.

Pentacalia aschersoniana is very similar to *P. disciformis*, but the leaves are glabrescent beneath (vs. lanate) and the peripheral florets usually develop a tiny limb (vs. tubular, rarely with a vestigial limb). The involucre is also slightly smaller and the peduncles somewhat shorter. The young leaves are sparsely arachnoid and become glabrous or almost so as times passes. The synflorescences are also more compacted. It is interesting to note that the peripheral pistillate florets have a minute limb but sometimes this is missing or inconspicuous, making difficult to describe the capitula as subradiate or disciform. Because of the vestigial limbs, it also can be confused with *P. breviligulata* from Colombia, a rather disciform species with tubular peripheral florets. It further differs in having peduncles 4–10 mm long, somewhat flexuous, involucral bracts glabrous or with very sparse indumentum, and supplementary bracts linear-lanceolate, not lanceolate-ovate as in *P. aschersoniana*.

Additional specimens examined. – **Colombia. Cauca:** Cordillera Central, "Canaan", Mt. Puracé, [2°21'N 76°27'W], 3100–3300 m, 11/16.VI.1922, *Killip 6737* (US); Cordillera Central, "Canaan", Mt. Puracé, [2°21'N 76°27'W], 3100–3300 m, 11–13.VI.1922, *Pennell & Killip 6509* (US). **Nariño:** carretera a Ipiales, de Túquerres a Ipiales, [1°0'N 77°42'W], 2950–3100 m, 28.VII.1948, *García-Barriga & Hawkes 13065* (COL, US); near Pun, valley of río Pun, [0°40'N 77°34'W], 2849 m, 15.VIII.1935, *Mexia 7629* (F†, UC, US). **Ecuador. Carchi:** El Ángel–Tulcán main road, km 1, turn off towards W, app. 8 km, 0°34'N 77°54'W, 3460 m, 8.VIII.1990, *Jørgensen et al. 92277* (AAU, L, QCA, QCNE, US); road Julio Andrade–Playón de San Francisco, [0°38'N 77°39'W], 3300 m, 9.VIII.1989, *van der Werff & Gudiño 11059* (AAU, QCNE, US).

4. ***Pentacalia atrovinosa*** J. Calvo & Á.J. Pérez in Brittonia 75: 225. 2023.

   Holotypus: Ecuador. Imbabura: Reserva Ecológica Cotacachi-Cayapas, comunidad de Piñán, cordillera de Cayapas, sendero de Eloy Alfaro, entrando por el páramo Cayapa-Chupa, 0°32'28"N 78°29'11"W, 3095–3150 m, 9.IX.2017, *Pérez et al. 11145* (QCA [QCA244951]!; iso-: G [G00398277]!).

Plants scandent; stems terete, rather smooth, glabrous, solid. *Leaves* alternate, simple, petiolate; petioles 0.5–1.5 cm long; laminas 2.8–5.5 × 1.6–2.6 cm, oblong-elliptic to obovate, apex rounded, mucronulate, base cuneate to obtuse, margin entire, glabrous on both surfaces, fleshy, strongly discolorous (in living plants), secondary veins inconspicuous on adaxial surface, barely conspicuous on abaxial surface (in dried specimens). *Synflorescences* mostly terminal, rather corymbiform (or corymbose-paniculiform), lax, with bracts linear, reduced; synflorescence branches tomentulose. *Capitula* heterogamous, radiate, pedunculate; peduncles 15–23 mm long, tomentulose, with 5–7 linear-subulate bracteoles; involucres cylindrical, glabrous; involucral bracts c. 8, 10–10.5 × 0.9–1.4 mm, linear-oblong, burgundy as capitulum ages; supplementary bracts 1–3, c. 2 × 0.5–0.6 mm, linear-subulate, extending to < ¼ the length of involucral bracts. *Ray florets* 5–7, pistillate; corollas c. 13.5 mm long, limbs c. 7.3 × 0.4–0.5 mm, curved downward and slightly involute, apex subentire to 2-toothed, pale yellow initially, becoming burgundy. *Disc florets* c. 8, hermaphroditic; corollas 9.6–10.2 mm long, tubular, 5-lobed, pale yellow initially, becoming burgundy; anthers brownish initially, becoming burgundy, bases caudate, ⅔ as long as filament collar, appendages c. 0.5 × 0.2 mm; style branches truncate with crown of sweeping trichomes, yellow. *Achenes* c. 2.2 × 0.4 mm (immature), cylindrical, glabrous; pappus 8–8.5 mm long, bristles capillary, barbellate, whitish.

Iconography. – Calvo & Pérez (2023: 226, 227, fig. 1, 2).

Etymology. – The epithet *atrovinosa* refers to the characteristic burgundy-colored involucral bracts of this species (Calvo & Pérez, 2023).

Distribution, ecology and phenology. – Endemic to Ecuador (Imbabura–Esmeraldas limit). *Pentacalia atrovinosa* is known only from a single collection from the Cordillera de Cayapas in the Cotacachi-Cayapas Reserve. It occurs in a hyper-humid and cloudy forest area, at elevations of 3000–3200 m. Collected in flower in September (Map 3).

Notes. – Species readily distinguishable by its leaves fleshy, discolorous, involucral bracts c. 8, 10–10.5 mm long, and the radiate capitula with ray floret limbs curved downward and slightly involute. In living plants, the involucres become burgundy-colored as capitulum ages. See additional comments in Calvo & Pérez (2023).

5. ***Pentacalia celicana*** J. Calvo & G. Benítez, **sp. nov.** (Fig. 5 → p. 37).

   Holotypus: Ecuador. Loja: Paltas, Guachanamá, vía principal Guachanamá–barrio Las Rosas, zona baja del cerro Guachahurco, 4°01'47"S 79°52'02"W, 2654 m, 22.VII.2023, *Espinosa-Ortega, Calvo & Benítez 1043* (LOJA-19571!; iso-: HUTPL-15121!, QCA [QCA249769]!, [+ 4 duplicates to be distributed]).

Pentacalia celicana belongs to the species group with terminal, thyrsoid-paniculiform synflorescences composed of radiate capitula with reduced limbs. These are white, which makes it very distinctive among its congeners. It differs from P. luteynorum H. Rob. & Cuatrec. subsp. luteynorum, also with white limbs, by the larger leaves (12–16.5 × 3.8–5.9 cm vs. 5.3–8 × 2.1–3.5 cm), the denticulate to serrulate leaf margin (vs. entire), and, among other characters, the proportionally shorter petioles.

Plants scandent; stems terete, furrowed, glabrous, solid. *Leaves* alternate, simple, petiolate; petioles 0.4–0.9 cm long; laminas 12–16.5 × 3.8–5.9 cm, oblong-elliptic, apex attenuate, base cuneate to subcordate, margin denticulate to serrulate, glabrous on both surfaces, rather chartaceous, concolorous, secondary and tertiary veins conspicuous on both surfaces. *Synflorescences* mostly terminal, thyrsoid-paniculiform, with bracts foliose; synflorescence branches glabrous or glabrescent (axis somewhat zigzagged). *Capitula* heterogamous, radiate, pedunculate; peduncles (3.5–)7–15 mm long, glabrous or sparsely pilose distally, with 2–4 linear bracteoles; involucres cylindrical, glabrous or with some scattered trichomes near base; involucral bracts 8, 4.7–5 × 1–2 mm, linear-oblong; supplementary bracts 2–3, 2.3–2.8 × 0.2–0.3 mm, linear-subulate, extending to ½ the length of involucral bracts. *Ray florets* 5–7, pistillate; corollas 5.3–6.4 mm long, limbs 2.1–3.5 × 0.8–1.2 mm, curved downward (rolled) and slightly involute, subentire to 2(–3)-toothed, white. *Disc florets* 10–13, hermaphroditic; corollas 5.1–6.4 mm long, tubular, 5-lobed, white; anther bases caudate, ½ as long as filament collar, appendages c. 0.5 × 0.3 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 2.4–2.8 × 0.7–0.8 mm, cylindrical, c. 5-ribbed, glabrous; pappus 4.7–5.2 mm long, bristles capillary, barbellate, whitish.

Etymology. – The epithet *celicana* refers to the village of Celica, in the vicinity of which the species seems restricted. The name Celica derives from the Latin *coelica*, meaning "celestial", because this village is generally above the sea of clouds arriving from the Pacific Ocean.

Distribution, ecology and phenology. – Endemic to Ecuador (Loja). This species is known only from the vicinity of the Cerro Guachanamá and Cerro Guachahurco. These are among the highest elevations in western Loja, a region where the lowlands are mostly dominated by dry forests. It grows in remnants of montane forests in rather wet ravines, at elevations of 2540–2890 m. Some species observed in the same habitat are: *Ageratina* sp., *Baccharis* sp. (*Compositae*), *Calceolaria perfoliata* L. f. (*Scrophulariaceae*), *Dendrophorbium scytophyllum* (Kunth) C. Jeffrey, *Gynoxys laurifolia* (Kunth) Cass. ex DC., *Liabum* sp. (*Compositae*), *Oreocallis grandiflora* (Lam.) R. Br. (*Proteaceae*), *Oreopanax* sp. (*Araliaceae*), *Rubus* sp. (*Rosaceae*), *Streptosolen jamesonii* Miers (*Solanaceae*), *Tibouchina* sp. (*Melastomataceae*). Collected in flower in July (Map 3).

Notes. – *Pentacalia celicana* is easily recognizable by its oblong-elliptic, glabrous, short petiolate leaves, the diffuse synflorescence with the axis in zigzag, and the long pedunculate, radiate capitula with white ray florets having short limbs curved downward. Because the limbs are often barely conspicuous, one may mistakenly interpret the species as having non-radiate capitula. This species and *P. luteynorum* subsp. *luteynorum* are the only members of the genus in Ecuador with white ray limbs. They can be differentiated by the leaves (12–16.5 × 3.8–5.9 cm, denticulate to serrulate, with secondary and tertiary veins conspicuous in *P. celicana* vs. 5.3–8 × 2.1–3.5 cm, entire, with secondary veins barely conspicuous and tertiary veins inconspicuous in *P. luteynorum* subsp. *luteynorum*) and the limbs of ray florets (curved downward in *P. celicana* vs. patent in *P. luteynorum* subsp. *luteynorum*).

Pentacalia celicana displays a combination of characters that makes it quite unique within the genus in Ecuador, and therefore, any confusion seems unlikely. Moreover, no other species has been recorded in the area where it thrives.

Additional specimens examined. – **Loja:** vía principal Guachanamá–barrio Las Rosas, 5 km NE de Guachanamá, 1 km SO de Las Rosas, 4°1'S 79°50'W, 2537 m, 22.VII.2023, *Espinosa-Ortega, Calvo & Benítez 1048* (QCA); carretera Célica, Guachanamá–Limón, entre Sasanamá–Guachanamá y desvío de carretero a Limón, c. 6 km de la Y a antenas, 4°3'S 79°59'W, 2888 m, 27.VII.2009, *Jaramillo, J.A. Jaramillo & Venalcázar 29697* (QCA); cerro de Celica, Célica–Guachanamá, km 14–18, 4°3'S 79°53'W, 2700 m, 13.IV.1994, *Jørgensen et al. 168* (LOJA, QCA, QCNE).

6. ***Pentacalia corazonensis*** (Hieron.) Cuatrec. in Phytologia 49: 245. 1981 (Fig. 6, 7A, B → p. 38, 39).

   ≡ *Senecio corazonensis* Hieron. in Bot. Jahrb. Syst. 29: 73. 1900. **Lectotypus** (designated by Cuatrecasas, 1981: 245). **Ecuador. Pichincha:** forêts du Corazón, s.d., [*Sodiro 59/3*] (P [P03782379]!; isolecto-: LP [LP002368] image!, MO-1013809 fragm. image!). Holotypus: B†.

   = *Pentacalia campii* (Cuatrec.) Cuatrec. in Phytologia 49: 244. 1981. ≡ *Senecio campii* Cuatrec. in Brittonia 8: 41. 1954, **syn. nov. Holotypus. Ecuador. Cañar:** Chimborazo-Cañar border, near Tipococha, 2985–3170 m, 7.VII.1945, *Camp E-4070* (F [F0076871F] image!; iso-: K [K000497634] image!, MO-1649963 image!, P [P01816873]!, NY [NY00259138] image!, UC [UC986394] image!, US [US00123268] image!).

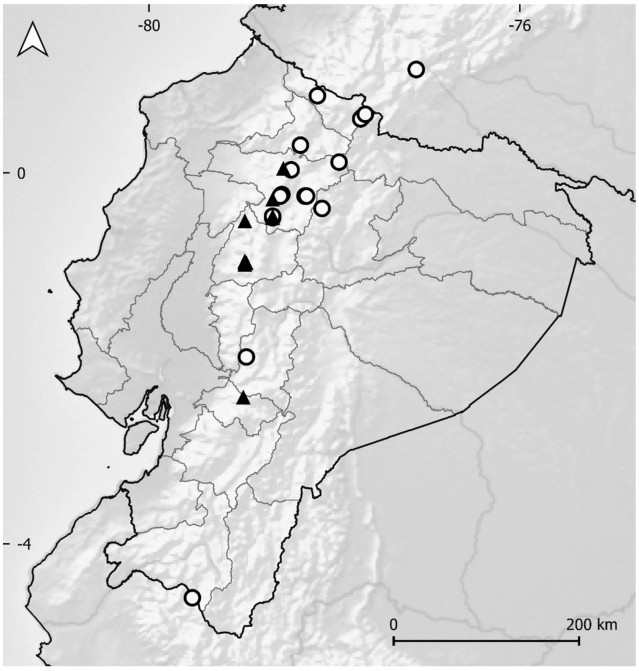
Plants scandent; stems terete, furrowed, glabrescent to tomentose, solid. *Leaves* alternate, simple, petiolate; petioles 1.1–2.4 cm long; laminas 7–13 × 3.9–8 cm, elliptic to ovate, apex acute or rounded and mucronate, base obtuse to subcordate, margin entire to remotely mucronate-denticulate,

glabrous except for some arachnoid trichomes on the midrib on adaxial surface, glabrescent to tomentose on abaxial surface, rather chartaceous, concolorous, secondary and tertiary veins conspicuous on both surfaces, protruding on abaxial surface. *Synflorescences* mostly terminal, corymbiform, usually with proximal bracts foliose and distal ones linear, reduced; synflorescence branches tomentulose to tomentose. *Capitula* heterogamous, radiate, pedunculate; peduncles 8–23 mm long, tomentulose to tomentose, with 2–5 linear-subulate bracteoles; involucres cylindrical, with some scattered trichomes to sparsely tomentulose; involucral bracts 8, 5.1–6 × 1.2–1.4 mm, linear-oblong; supplementary bracts 2–3, 2.1–2.4 × 0.3–0.7 mm, linear-subulate, extending to ¼ the length of involucral bracts. *Ray florets* c. 8, pistillate; corollas 12.4–15.9 mm long, limbs 8.3–10.5 × 1.8–2.3 mm, patent, subentire to 3-toothed, yellow. *Disc florets* 11–20, hermaphroditic; corollas 7.4–8.2 mm long, tubular, 5-lobed, yellow; anther bases caudate, ¾ as long as filament collar, appendages c. 0.5 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 2.4–3.7 × 0.6–0.7 mm, cylindrical, 5–7-ribbed, glabrous; pappus 6.4–7.9 mm long, bristles capillary, barbellate, whitish.

Etymology. – The epithet *corazonensis* refers to the Corazón Volcano in southern Pichincha. The type material of this species comes from the montane forests of the foothills of this volcano.

Distribution, ecology and phenology. – Endemic to Ecuador (Cañar, Cotopaxi, Pichincha). It occurs in montane forests and in the transition to the paramo, at elevations of 2770–3540 m. In the locus classicus the species was found growing along with some interesting species: *Aequatorium repandiforme* B. Nord., *Dendrophorbium tipocochense* (Domke) B. Nord., *Gynoxys corazonensis* Hieron., *Mikania multinervia* Turcz., *M. sylvatica* Klatt, and *Mutisia hieronymi* Sodiro ex Cabrera (*Compositae*). Specimens in flower have mostly been collected between July and September (Map 4).

Notes. – The holotype of the name *Senecio corazonensis*, destroyed at B, was labeled with the following information: "Num. 59/3 […] Senecio corazonensis Hieron. […] n. sp. […] Frut. alte scandens panic. ampliss. […] Crescit in silv. m. Corazón 2000–2800 m" […] A. Sodiro". Cuatrecasas (1981) lectotypified the name on the specimen P03782379, which bears a label with minimal transcribed data: "Forêts du Corazon, septembre". Although the collector is not indicated, several other Sodiro's specimens kept at P are labeled in the same way. Then, I accept Cuatrecasas' designation being aware that it is hard to know if this specimen corresponds for sure to a duplicate of the collection studied by Hieronymus. In contrast, the isolectotype at LP has an original label with almost the same information than the holotype but unnumbered and without the elevation range. The abbreviation "Dom." on the label indicates that this specimen was addressed to the Argentinian pharmacologist Juan A. Domínguez (1876–1946), who founded the Museo de Farmacobotánica in 1900 (which harbors herbarium BAL). At QPLS, there is a Sodiro specimen identified as "Senecio corazonensis Hieron." collected in "m. Corazón" in July 1882 and numbered "59/3" but the plant corresponds to *Gynoxys corazonensis* Hieron. (see QPLS211176); this is clearly a mislabeling case.



Map 4. – Distribution of *Pentacalia corazonensis* (Hieron.) Cuatrec. (triangle) and *P. disciformis* (Hieron.) Cuatrec. (open circle).

This species is well characterized by its long-radiate and long-pedunculate capitula arranged in mostly terminal, corymbiform synflorecences. The leaves are large, entire or almost so (rarely remotely mucronate-denticulate), with conspicuous secondary and tertiary veins and disperse tomentum on the abaxial surface (sometimes only on the secondary veins and midrib). The type material of *Senecio campii* has the leaf indumentum slightly denser than that of *S. corazonensis*, but otherwise no differences were found and their synonymy is proposed here.

Pentacalia corazonensis has been confused by *P. dorrii* (*Øllgaard & Christensen 74999*; see Nordenstam, 1999), but the latter has smaller, obovate, cuneate at base, completely glabrous, sub-fleshy leaves. Their distribution areas do not overlap. Because of the synflorescence and the capitulum morphology, this species may be also confused with *P. ruficaulis* from Azuay and Morona-Santiago. However, this latter species has elliptic to ovate, significatively smaller leaves (2.5–5.2 × 1.1–3.2 cm) and hirsute-tomentose, rusty stem indumentum.

This species may also be confused with *Pentacalia nordenstamii* (see additional comments under this species).

Additional specimens examined. – **Cotopaxi:** Pilaló–Latacunga road, at timberline on the W slopes of Andes, 0°57'S 78°58'W, 3400 m, 6.VII.1968, *Holm-Nielsen & Jeppesen 1386* (AAU); Latacunga–Quevedo road, above Pilaló, km 74 from Pujilí, 0°58'S 78°57'W, 3500 m, 26.IV.1979, *Løjtnant, A. Molau & Molau 13731* (AAU, QCA); Quevedo-Latacunga road, páramos de Zumbagua, 19 km E of Pilaló and 78 km W of Latacunga, [0°59'S 78°58'W], 3536 m, 25.XII.1978, *Luteyn & Lebrón-Luteyn 6510* (AAU, US); about 84 km E of Quevedo, en route to Quito, [0°58'S 78°58'W], 19.IX.1959, *Maguire & C.K. Maguire 44255* (US); Sigchos, Triunfo Grande, bosque al N de carretera, c. 2 horas de casa de Galo Roballo, loma La Delicia, 0°31'S 78°58'W, 5.VIII.2003, *Ramos et al. 6979* (QCNE, US). **Pichincha:** Aloag, Pongo, vertiente N del volcán Corazón, 0°29'S 78°40'W, 3355 m, 13.VII.2023, *Calvo & Benítez 8458* (QCA); Calacalí, pista de Yunguilla a Montecristi, pr. Cebadal, 0°3'N 78°33'W, 2815 m, 14.VII.2023, *Calvo & Benítez 8464* (QCA); Lloa, Chiriboga, vía Chiriboga–Quito, c. 2 km pasada la estación de bombeo, 0°17'S 78°40'W, 2770 m, 16.VII.2023, *Calvo & Benítez 8483* (QCA); forêts du Corazon, [0°29'S 78°40'W], s.d., s.c. [Sodiro?] (P); Machachi, Reserva Ecológica Los Ilinizas, cañada que baja de cerro Corazón, hacienda Buenos Aires, 0°28'S 78°40'W, 3378 m, 19.VIII.2003, *Ramos, Contreras & L. Ramos 7426* (QCNE, US); in silvis subandinis vulcano Corazón, [0°29'S 78°40'W], s.d., *Sodiro s.n.* (LP).

7. ***Pentacalia disciformis*** (Hieron.) Cuatrec. in Phytologia 49: 245. 1981 (Fig. 4D–F, 8 → p. 36, 40).

   ≡ *Senecio disciformis* Hieron. in Bot. Jahrb. Syst. 29: 72. 1900. **Lectotypus** (designated here): **Ecuador. Pichincha:** in silvis subandinis regionis occidentalis, s.d., *Sodiro s.n.* (MO-1013812 fragm. image!). **Epitypus** (designated here): **Ecuador. Pichincha:** pentes Est du Pichincha, 29.VI.1930, *Benoist 2676* (P [P03749420]!). Holotypus: B†.

Plants scandent; stems terete, scarcely furrowed, floccose to lanate, becoming glabrescent, partially fistulous. *Leaves* alternate, simple, petiolate; petioles 1.2–1.6(–3.4) cm long; laminas 7.4–14 × 4.4–8.7 cm, ovate, apex acute to obtuse, base rounded to cordate, margin entire, glabrescent on adaxial surface, whitish lanate (sometimes ochraceous in dried specimens) on abaxial surface, coriaceous, discolorous, secondary veins conspicuous on adaxial surface, covered by indumentum on abaxial surface but usually protruding. *Synflorescences* mostly terminal, thyrsoid-paniculiform, with bracts linear-oblong; synflorescence branches floccose-lanate. *Capitula* heterogamous, disciform (rarely subradiate), pedunculate; peduncles 2–10 mm long, floccose-lanate, with 1–2 linear-subulate bracteoles or absent; involucres cylindrical, floccose to lanate; involucral bracts 8, 4.8–7.1 × (1–)1.6–2.4 mm, linear-oblong to lanceolate; supplementary bracts 3–4, 2.2–3.1 × 1.8–2.1 mm, lanceolate to ovate, extending to ⅓ the length of involucral bracts. *Peripheral florets* 5–8, pistillate; corollas 4.9–6.2 mm long, tubular (rarely developing minute limbs), 3–5-lobed, light yellow. *Disc florets* 15–22, hermaphroditic; corollas 5.9–8.4 mm long, tubular, 5-lobed, light yellow; anthers orange, anther bases caudate, as long as filament collar, appendages c. 0.4 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* c. 1.6 × 0.4 mm (immature), cylindrical, c. 7-ribbed, glabrous; pappus 5–5.8 mm long, bristles capillary, barbellate, whitish.

Etymology. – The epithet *disciformis* refers to the type of capitula of this species, where the peripheral florets are pistillate, tubular, and usually much shorter than the disc florets.

Distribution, ecology and phenology. – S Colombia, Ecuador (Carchi, Chimborazo, Imbabura, Napo, Pichincha, Sucumbíos), and N Peru. This species occurs in montane forests and disturbed patches in pastured or cultivated areas, at elevations of (2400–)2800–3400 m. Specimens in flower have mostly been collected between July and December (Map 4).

Notes. – Hieronymus (1900: 72) provided the following indication in the protologue: "crescit in silvis subandinis regionis occidentalis (S. sine numero). Flores ex schedula cl. Sodiroi haud ingrate olent". A picture of the holotype, which was destroyed at B, shows a label that perfectly matches the protologue information and the provisional Sodiro's identification "Senecio nitidus? DC.". This picture is mounted on a sheet along with a small fragment of the holotype (MO-1013812) (see comments under *Pentacalia aschersoniana*).

As pointed out by Morton (1972), Luis [Luigi] Sodiro (1836–1909) had the habit of revisiting the locus classicus of the new species he found and collecting additional material. This, in addition to the fact that he did not number the specimens consecutively but used sometimes a sort of species identification number, makes difficult to know if two specimens belong to the same collection or not. In the case concerned here, I found two specimens that were initially identified as *Senecio nitidus* (Kunth) DC.: one comes from Lloa and was collected in August 1872 and the second one from Corazón Volcano in July 1882. Both localities correspond to the western region of Quito (Pichincha Province) but an unequivocal clue associating them with the holotype lacks. Similarly, there is an unnumbered Sodiro's specimen at G originating from Candolle's Herbarium that reads: "crescit in silv. subband. utriusq. catenae" and "frut. altissime scandens, caulibus ramisq. sterilib. foliisq. glaberr.". We know that the holotype was incorporated at B on January 29, 1897 (stamped on the label) and that the G specimen arrived at Candolle Herbarium on January 29, 1909 (shipment of 688 specimens including 200 *Compositae*; Candolle et al., 1794–1921). Such difference in time makes improbable that these specimens belonged to the same collection. Furthermore, the specimen at G was already identified as "Senecio disciformis Hier." and lacks the initial determination. Failing to locate other original material, this name is lectotypified on the fragment of the holotype (treated

as an isotype) kept at MO (Fig. 9 → p. 41). As it is scarcely informative regarding the synflorescence type, an epitype is designated. The selected specimen is a Benoist collection from the eastern foothills of Pichincha Volcano.

This species typically presents disciform capitula with tubular peripheral florets usually much shorter than the disc florets. However, I have studied three collections where the peripheral florets show a very small, vestigial limb (*Cerón & Reyes 62562*, *Cuamacás et al. 568*, *Peñafiel et al. 323*).

Pentacalia disciformis may be confused with *P. aschersoniana* and *P. hillii* (Greenm.) Cuatrec. (for distinguishing one from another see comments under these species). It is interesting to note that some specimens provide information about the presence of pendulous branches with sterile, glabrous leaves, which contrasts with the typical leaves with lanate indumentum on the abaxial surface. Luis [Louis] Mille (Belgian Sodiro's pupil; 1873–1953) explicitly annotated the following observation on the label of the specimen *Mille 724*: "emittens ramos pendulos steriles cum foliis crassis carnosis glaberrimis". Likewise, one specimen at G (*Sodiro s.n.*) contains a fragment of a branch with such morphology. I did also observe these sterile, pendulous branches in the field (Fig. 8C → p. 40, leaf on the left), confirming that this species can present a striking foliar dimorphism in early stages.

The presence of *Pentacalia disciformis* in the province of Chimborazo is based on a Sodiro collection from Pallatanga made in October 1886 (Q-001139). The species has not been collected in this region since then. This species was not cited in Peru by Dillon & Hensold (1993) and Benítez & Calvo (2020) indicated it from this country with doubt. After studying the specimen *Gentry et al. 74971* (US01844804) from Piura (N Peru), I did not find any significant difference to recognize more than a single taxon.

Additional specimens examined. – **Colombia. Nariño:** Pasto, corregimiento de El Encano, antigua Reserva Herederos, camino ecológico hacia Santa Teresita, 2800 m, [1°7'N 77°7'W], 29.I.2011, *González, Ramírez & Urbano 2947* (CAUP). **Ecuador. Carchi:** road Julio Andrade–Palestina, 0°38'N 77°40'W, 3300 m, 27.XII.1980, *Holm-Nielsen & Jaramillo & Coello 29720* (AAU); Tulcán, Estación Biológica Guandera, 0°35'N 77°43'W, 3200 m, 16–17.VII.1998, *Mora et al. 132* (QCNE); Montúfar, al este de Mariscal Sucre, 0°36'N 77°42'W, 3200 m, 3.I.1994, *Palacios 11978* (QCNE, US); Mira, El Carmen, cerro Golondrinas, 0°50'N 78°11'W, 2000–2400 m, 18–25.VIII.1994, *Tirado et al. 1211* (QCNE, US). **Chimborazo:** in prov. Riob. [Riobamba], Pallatanga, [1°59'S 78°57'W], X.1886, *Sodiro s.n.* (P, Q). **Imbabura:** Cotacachi, Reserva Ecológica Cotacachi-Cayapas, laguna de Cuicocha, islote Teodoro Wolff, 0°18'N 78°22'W, 3100–3300 m, 30.VIII.1991, *Peñafiel et al. 323* (MO, QCNE). **Napo:** Papallacta, carretera entre la laguna y el pueblo de Papallacta, 0°23'S 78°8'W, 3150 m, 13.XII.2009, *Cerón 66161* (Q). **Pichincha:** Lloa, below the village, [0°15'S 78°35'W], 2900 m, 8.VII.1955, *Asplund 17237* (US); au dessus de Paluguillo, [0°15'S 78°18'W], 19.II.1931, *Benoist 3883* (P); Aloag, Pongo, vertiente N del volcán Corazón, 0°28'S 78°40'W, 3320 m, 13.VII.2023, *Calvo & Benítez 8459* (QCA); Quito, parroquia Calacalí, Reserva Geobotánica del Pululahua, entre el sector el Hospital y el cerro Sincholagua, 0°2'N 78°28'W, 2850–3200 m, 5.VII.2008, *Cerón & Reyes 62562* (QAP); Cayambe, laguna San Marcos, zona de amortiguamiento de la reserva Cayambe-Coca, 0°7'N 77°57'W, 3200–3400 m, 2.I.2000, *Cuamacás, Gudiño & D. Gudiño 568* (QCNE); Pifi [Pifo], [0°15'S 78°19'W], 2800 m, VII.1898, *Mille 264* (QPLS); prope Pifo et in monte Pichincha, 3000 m, VII.1898, *Mille 724* (QPLS, US); Pifi [Pifo], [0°15'S 78°19'W], 2800 m, IX.1896, *Mille s.n.* (QPLS); m. Corazón, [0°29'S 78°40'W], VII.1882, *Sodiro 59/88* (QPLS); in silvis subandinis utriusque catenae, s.d., *Sodiro s.n.* (G, LP, MT); Lloa, [0°14'S 78°34'W], VIII.1872, *Sodiro s.n.* (QPLS). **Sucumbíos:** Cocha Seca, [0°38'N 77°40'W], 3250 m, 30.XII.1986, *Jaramillo 9359* (AAU, QCA). **Peru. Piura:** cerro Aypate, 49 km E of Ayabaca, 4°35'S 79°32'W, 2750 m, *Gentry, Díaz & Ortiz 74971* (US).

8. ***Pentacalia dorrii*** H. Rob. & Cuatrec. in Novon 3: 286. 1993 (Fig. 7C, D, 10 → p. 39, 42).

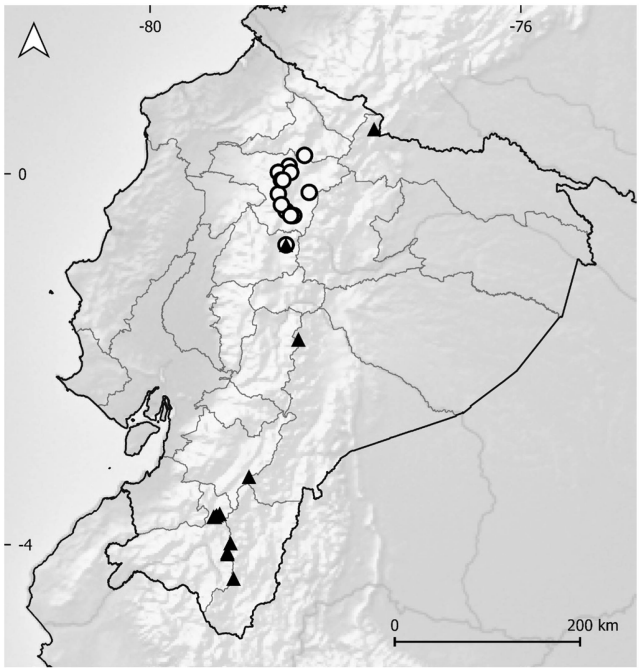
   Holotypus: Ecuador. Loja: road to Fierro Acru, N of Pichig, 03°40'S 79°15'W, 3015–3385 m, 15.VII.1989, *Dorr & Valdespino 6654* (US [US00406382] image!; iso-: F [F0076814F] image!, NY, S-R-7478 image!).

   Plants scandent; stems terete, barely furrowed, glabrous, partially fistulous. *Leaves* alternate, simple, petiolate; petioles 1–2 cm long; laminas 5.5–8.5 × 2.2–3.7(–5.4) cm, obovate to oblanceolate (rarely ovate), apex obtuse, usually mucronate, base cuneate, margin entire (sometimes with 2–3 mucrones on each side), slightly hyaline, glabrous on both surfaces, coriaceous (somewhat fleshy in living plants), concolorous, secondary and tertiary veins conspicuous on both surfaces, not protruding. *Synflorescences* mostly terminal, corymbiform, with bracts linear, reduced; synflorescence branches tomentulose to glabrescent. *Capitula* heterogamous, radiate, pedunculate; peduncles 7–18 mm long, pilose, with 3–5 linear-subulate bracteoles; involucres cylindrical, glabrous or almost so; involucral bracts (7–)8, (5.1–)6.7–8.3 × 0.9–2 mm, linear-oblong; supplementary bracts 3–4, 1.3–2.4 × c. 0.9 mm, linear-subulate, extending to ¼ the length of involucral bracts. *Ray florets* 5–8, pistillate; corollas (12–)15.6–17.2 mm long, limbs 9.7–10.9 × 1.9–2.7 mm, patent, subentire to 3-toothed, yellow. *Disc florets* 8–13, hermaphroditic; corollas 7.5–10 mm long, tubular, 5-lobed, yellow; anther bases caudate, as long as to slightly longer than filament collar, appendages c. 0.5 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 4–4.7 × c. 0.8 mm, cylindrical, 7-ribbed, glabrous; pappus 6.8–9.2 mm long, bristles capillary, barbellate, whitish.

   Additional iconography. – Calvo & Pérez (2023: 228, fig. 3B).

   Etymology. – The epithet *dorrii* honors the American botanist Laurence J. Dorr, who develops his career in the Smithsonian Institution.

   Distribution, ecology and phenology. – Putative endemic to Ecuador (Azuay, Cotopaxi, Loja, Morona-Santiago, Sucumbíos, Zamora-Chinchipe). It thrives in montane cloud forests and elfin humid forests in the transition to the paramo,



Map 5. – Distribution of *Pentacalia dorrii* H. Rob. & Cuatrec. (triangle) and *P. floribunda* Cuatrec. (open circle).

at elevations of 2600–3600. In the Podocarpus National Park (Loja), this species was observed growing along with *Bomarea* sp. (*Alstroemeriaceae*), *Cestrum* sp. (*Solanaceae*), *Clethra* sp. (*Clethraceae*), *Clusia elliptica* Kunth (*Clusiaceae*), *Cyathea* sp. (*Cyatheaceae*), *Dendrophorbium dodsonii* (H. Rob. & Cuatrec.) B. Nord., *Mikania* sp. (*Compositae*), *Palicourea* sp. (*Rubiaceae*), *Pentacalia oronocensis*, *Schefflera* sp. (*Araliaceae*), and *Weinmannia* sp. (*Cunoniaceae*). Specimens in flower have mostly been collected between July and December (Map 5).

Notes. – *Pentacalia dorrii* belongs to the species group with terminal, corymbiform synflorescences composed of radiate capitula with well-developed, patent limbs. It can be differentiated by its obovate or oblanceolate, glabrous, coriaceous leaves. In living plants, the leaves are somewhat fleshy and the veins are characteristically translucid. This species has been confused with *P. corazonensis* (see additional comments under the latter species).

There is a Bonpland and Humboldt specimen kept at B-W (B-W 15071-01 0) that was identified under the nomen nudum in sched. *Cacalia saligna* by Willdenow and *Senecio willdenowii* by Schultz Bipontinus. A duplicate was also kept at the general herbarium of Berlin but destroyed during the WWII. A photograph of this specimen (F0BN015793) indicated that it originated from herb. Kunth and previously from herb. Bonpland. According to the label information, the specimen was collected in Mulaló (Cotopaxi). The type material of *Pentacalia dorrii* was initially identified as "Senecio willdenowii Sch.-Bip., ined." by Pruski (in sched., 1989), and Robinson & Cuatrecasas (1993) commented their similarity. This specimen is here ascribed to *P. dorrii*. The collection *Reyes et al. 4370* from Sucumbíos represents the northernmost distribution of the species. The leaves of the specimen examined do not show the typical conspicuous venation of this species; otherwise, the remaining characters fall well in the variability of *P. dorrii*. Additional specimens from this area would be useful for confirming the identification.

Nordenstam (1999) cited *Pentacalia sylvicola* in the *Catalogue* based on the collection *Øllgaard et al. 38366* (AAU, QCA), which is here identified as *P. dorrii*. *Pentacalia sylvicola*, described from Tolima and mainly distributed through the Cordillera Central (Colombia), has rather chartaceous, discolorous leaves, and synflorescence branches more densely crisped-tomentose.

Additional specimens examined. – **Azuay:** Jima–San Miguel de Cuyes, km 17.2, páramos de Palcurco, 3°16'S 78°56'W, 3140 m, 4.XII.1990, *Jørgensen, Ulloa & Luteyn 92855* (AAU, QCNE, US). **Cotopaxi:** Mulaló, [0°46'S 78°32'W], s.d., *Bonpland & Humboldt s.n.* (B-W). **Loja:** Cajanuma, Podocarpus, sendero de los Miradores, bajando al refugio, 4°6'S 79°10'W, 2960 m, 13.XII.2017, *Calvo & Arnelas 7685* (HUTPL); road to Zamora from Loja, km 12–14, near top of pass, [3°59'S 79°8'W], 2800 m, 28.IX.1961, *Dodson & Thien 779* (US); carretero Yangana–Toledo, [4°22'S 79°6'W], 3150 m, 1.VIII.1986, *Freire 211* (QCA); Saraguro–Loja, km 12.4, turnoff towards Fierro Urco, km 2.5–2.7, 3°41'S 79°17'W, 3150–3300 m, 7.XII.1994, *Jørgensen et al. 1271* (LOJA, QCA, QCNE); Loja to Saraguro, just N of San Lucas, track to Fierro Urco, km 7 along track, 3°42'S 79°19'W, 3250 m, 16.IX.1997, *Lewis & Bruneau 3557* (AAU, LOJA, QCNE, US); P.N. Podocarpus, above Nudo de Cajanuma, around "centro de información", 4°5'S 79°10'W, 2800–3000 m, 6.IX.1988, *Madsen & Ellemann 75248* (AAU, LOJA); P.N. Podocarpus, E of Nudo de Cajanuma, just N of "centro de información", 4°5'S 79°10'W, 2900 m, 21.IX.1988, *Madsen 75435* (AAU, LOJA); P.N. Podocarpus, E of Nudo de Cajanuma, just N of "centro de información", 4°5'S 79°10'W, 2900 m, 26.VI.1988, *Øllgaard & Christensen 74999* (AAU, QCA); c. km 5 on road leading to Fierro Urcu from Pichig, SSW of Saraguro, 3°42'S 79°18'W, 3100–3200 m, 12.II.1989, *Øllgaard & Madsen 90479* (AAU); Parque Nacional Podocarpus, entrada Nudo de Cajanuma, sendero Guardianía–Mirador, 4°6'S 79°10'W, 2875 m, 2.V.2015, *Ulloa et al. 2289* (HA). **Morona-Santiago:** trail Alao–Huamboya, around La Magdalena, 1°47'S 78°24'W, 3450–3600 m, 8.V.1982, *Øllgaard et al. 38366* (AAU, QCA). **Sucumbíos:** parroquia La Bonita, 0°29'N 77°35'W, 2600–3000 m, 26–28.X.2008, *Reyes et al. 4370* (QCNE). **Zamora-Chinchipe:** Zamora, El Tambo, carretero viejo a Zamora desde El Tiro, 3°59'S 79°8'W, 2780 m, 19.VII.2023, *Calvo, Benítez & Espinosa-Ortega 8491* (HUTPL).

9. ***Pentacalia floribunda*** Cuatrec. in Phytologia 49: 254. 1981 (Fig. 11, 12 → p. 43, 44).

Lectotypus (designated here): **Ecuador. Pichincha:** in silvis subandinis prop. Nono, 2800 m, VIII.1887, *Sodiro 720* (NY [NY00259173] image!; isolecto-: G [G00398270]!, QPLS!; probable isolecto-: Q-1163!). Holotypus: *Sodiro 59/19* (B†).

Plants scandent; stems terete, furrowed, puberulous to glabrescent, solid. *Leaves* alternate, simple, petiolate; petioles 2.2–4.4 cm long; laminas 13–17 × 6.1–10.4 cm, ovate to broadly

elliptic, apex acute to shortly acuminate (rarely obtuse), base rounded to subcordate, margin denticulate, glabrous on adaxial surface, arachnoid initially, becoming glabrescent on abaxial surface, rather coriaceous, concolorous, secondary and tertiary veins conspicuous on both surfaces, protruding on abaxial surface. *Synflorescences* mostly terminal, thyrsoid-paniculiform, with bracts linear-subulate; synflorescence branches arachnoid initially, becoming glabrescent. *Capitula* heterogamous, disciform, pedunculate; peduncles 10–30 mm long, sparsely arachnoid, with 2–5 linear-subulate bracteoles; involucres campanulate, somewhat arachnoid near base; involucral bracts 8, 4.7–5.1 × 2.2–3.1 mm, broadly linear-oblong; supplementary bracts 4–5, 3–5 × 0.7–0.9 mm, linear-subulate, extending to ¾ or equaling the length of involucral bracts. *Peripheral florets* c. 5, pistillate; corollas 4.5–5 mm long, tubular, 4(–5)-lobed, aqua green (according to labels). *Disc florets* 18–20, hermaphroditic; corollas 6–7 mm long, tubular, 5-lobed, aqua green (according to labels); anther bases caudate, slightly longer than filament collar, appendages c. 0.5 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 2.8–3.8 × 0.8–1 mm, cylindrical, 6–7-ribbed, glabrous; pappus 6–7 mm long, bristles capillary, barbellate, whitish.

Etymology. – The epithet *floribunda* refers to the large thyrsoid-paniculiform synflorescence of this species.

Distribution, ecology and phenology. – Endemic to Ecuador (Cotopaxi, Imbabura, Pichincha). This species occurs at the edge of montane forests, at elevations of 2550–3500 m. In the area of Calacalí (Pichincha), this species was found at the edge of a disturbed montane forest next to the road and growing, among others, with *Dasyphyllum popayanense* (Hieron.) Cabrera and *Mutisia sodiroi* Hieron. (*Compositae*). Specimens in flower have mostly been collected between May and September (Map 5).

Notes. – Hieronymus (1900: 69) published the new combination *Senecio floribundus* (Kunth) Sch. Bip. ex Hieron. based on the name *Vernonia floribunda* Kunth. He stated that Kunth's species was wrongly described and ascribed to *Vernonia*, and accordingly, provided a new description. However, this was a misinterpretation because Kunth's name is positively a Vernonieae [= *Critoniopsis floribunda* (Kunth) H. Rob.]. The origin of such confusion is a Bonpland & Humboldt specimen kept at B-W that Schultz Bipontinus (and later Hieronymus) believed to correspond to the original material of *V. floribunda*, which is not (see B-W 15073-01 0). In the nomenclatural sense, Hieronymus' combination is an unfortunate name linked to *V. floribunda*, and therefore, excluded from this work.

The issue was resolved by Cuatrecasas (1981; see also Cuatrecasas, 1951) when validly published the name *Pentacalia floribunda* providing the reference to the previously and effectively published description by Hieronymus (ICN Art. 38.1). The author indicated as type the collection *Sodiro 59/19* from "montis Corazón", which most probably he did not study since the depositary herbarium is not indicated as in the paratypes. This collection was certainly studied by Hieronymus (1900: 70) but destroyed during the WWII. No duplicates of this collection were located either in QPLS, the herbarium in Quito that holds the main set of Sodiro's collections, or Q or any other herbaria. This indicates that Sodiro did might send unicates to Berlin, as it probably was also the case for the type of *Senecio disciformis* (= *Pentacalia disciformis*, see explanation above). Whatsoever was Sodiro's policy of donations and sells of his specimens, either the holotype or isotypes seem to be no longer extant. On this basis, a lectotype has been chosen among the paratypes indicated by Cuatrecasas. The specimen to serve as lectotype of the name *P. floribunda* is *Sodiro 720* at NY, with duplicates at G and QPLS. It is interesting to note that Sodiro indicated on the label the addressee of each duplicate, i.e., "Britt." for Nathaniel Lord Britton (1859–1934) at NY and "C. DC." for the duplicate sent to Casimir de Candolle (1836–1918) at Geneva. The specimen at QPLS bears "Bac.", which suggests that the specimen might have initially been addressed to Pasquale Baccarini (1858–1919) at Firenze but for some unknown reason the shipment was not done. The other paratypes cited by Cuatrecasas in the protologue are: *Benoist 2541* (P [P03749411]!), *Bonpland & Humboldt s.n.* (B-W [B-W 15073-01 0] image!), and *Mille 720* (GH, K). With regard to *Mille 720*, it is important to note that I found several specimens with this number coming from different localities, and therefore, belonging to different gatherings, i.e., from Pifi (VII.1899), Tambillo (VII.1917), and Atacazo (VII.1919). See notes under *P. disciformis* for details on Sodiro's collection method, which is also applicable to his pupil Luis Mille.

This species has a distinctive capitulum architecture with wide involucral bracts and supplementary bracts extending to ¾ or equaling the length of involucral ones, which resemble those of the Colombian species *Pentacalia urbanii* (Hieron.) Cuatrec. However, this latter species has laxer synflorescences with capitula twice the size of those of *P. floribunda* and entire or remotely mucronate-denticulate leaf margin. With regard to the leaf morphology, *P. floribunda* bears similarity with *P. kleinioides* (Kunth) Cuatrec., a species also restricted to Colombia. They can be readily distinguished by the synflorescences (laxer with longer pedunculate capitula in *P. floribunda*) and the capitulum type (disciform in *P. floribunda* vs. shortly radiate in *P. kleinioides*).

Finally, it is interesting to note that *Pentacalia kleinioides* was cited by Nordenstam (1999) from Imbabura and Pichincha under the homotypic synonym *Dendrophorbium kleinioides* (Kunth) B. Nord. The specimen supporting its presence in Ecuador, *Jaramillo & Proaño 1927* (AAU, QCA), it is here

identified as *Pentacalia floribunda*. The species *P. kleinioides* is therefore excluded from the Ecuadorian flora.

Additional specimens examined. – **Cotopaxi:** Mulaló, [0°46'S 78°32'W], s.d., *Bonpland & Humboldt s.n.* (B-W, P). **Imbabura:** carretera San José de Minas–Otavalo, hacia antenas de televisión de Canal 4, NE de Peñas Blancas, [0°12'N 78°20'W], 19.I.1980, *Jaramillo & Proaño 1927* (AAU, QCA). **Pichincha:** Nono, below the village, [0°4'S 78°34'W], 2600 m, 1.VII.1939, *Asplund 7457* (AAU); pentes E. du Pichincha, 18.V.1930, *Benoist 2541* (P); Calacalí, camino a la comunidad de Yunguilla, 0°0'N 78°32'W, 2650 m, 14.VII.2023, *Calvo & Benítez 8461* (QCA); Quito, parroquia Calacalí, Reserva Geobotánica del Pululahua, camino a Lulumbamba, 0°5'N 78°30'W, 2830 m, 2.V.1992, *Cerón & Reina 18821* (QCNE); Mejía, Tambillo, loma Canalajorumiladera, sector Pasochoa, margen derecha río arriba de quebrada Sambache, 0°27'S 78°29'W, 3439 m, 3.II.2013, *Cerón, Vega & Bravo 267* (HUTPL); Reserva Geobotánica del Pululahua, sector Moras Pungo–Papa Tena, 0°5'N 78°30'W, 2900–3100 m, 17.VIII.1988, *Cerón & M. Cerón 4476* (US); Rumiñahui, parroquia Amaguaña, Bosque Protector Pasochoa, 0°27'S 78°28'W, 3500–4300 m, 10.IX.1988, *Cerón & Alarcón 4842* (QCNE, US); Quito, parroquia Calacalí, Reserva Geobotánica del Pululahua, tanques de captación del agua–cerro Moraspungo, 0°1'N 78°29'W, 2550 m, 24.VI.2007, *Cerón & Reyes 59394* (Q, QAP); Andes of Quito, 2740 m, 1850, *Jameson s.n.* (G, US); Bosque Protector Pasochoa, 0°27'S 78°27'W, 2800–3200 m, 20.I.1989, *Jørgensen 65928* (AAU); in Coturco, [0°12'S 78°17'W], 3000 m, VII.1896, *Mille s.n.* (QPLS); Pifi [Pifo], [0°15'S 78°19'W], 2800 m, VII.1899, *Mille s.n. [720]* (QPLS); in montis Atacazo, [0°20'S 78°35'W], 2800 m, VII.1919, *Mille s.n. [720]* (US); prope Tambillo, [0°24'S 78°32'W], 2800 m, VII.1917, *Mille s.n. [720]* (QPLS, US); Calacalí, Reserva Geobotánica Pululahua, 0°5'N 78°30'W, 3000–3300 m, 27.V.1996, *Quelal, Terán & Toasa 16* (QAP); in silvis v. Lloa pr. Palmira, [0°13'S 78°37'W], 26.VIII.1872, *Sodiro s.n.* (QPLS); in silvis subandinis prope Nono, [0°4'S 78°35'W], VIII.1887, *Sodiro s.n.* (Q, QPLS); carretera Calacalí–Yunguilla, [0°1'N 78°37'W], 2800–3000 m, 14.III.1987, *Zak 1822* (AAU, L, US).

10. ***Pentacalia hillii*** (Greenm.) Cuatrec. in Phytologia 49: 246. 1981 (Fig. 13 → p. 45).

    ≡ *Senecio hillii* Greenm. in Ann. Missouri Bot. Gard. 25: 804. 1938. **Holotypus: Ecuador. Chimborazo:** in monte Titaicún, c. 3350 m, XI.1858, *Spruce 5587* (K [K000200583] image!; iso-: G [G00398265, G00398266]!, GH [GH00012139] image!, K [K000200582] image!, LD [LD1212367] image!, MO-1130241 fragm. image!, NY [NY00259200] image!, P [P01816927]!, S10-39330 image!).

Plants scandent; stems terete, scarcely furrowed, floccose to lanate, becoming glabrescent, rather solid. *Leaves* alternate, simple, petiolate; petioles 0.5–1.3 cm long; laminas 8–11.5 × 3.3–4.8 cm, lanceolate, apex acute, base obtuse, margin entire, glabrescent on adaxial surface, lanate on abaxial surface, coriaceous, discolorous, secondary veins barely conspicuous on adaxial surface, covered by indumentum on abaxial surface but protruding. *Synflorescences* mostly terminal, thyrsoid-paniculiform, with bracts linear-oblong; synflorescence branches floccose-lanate. *Capitula* heterogamous, disciform (rarely developing a very small limb), pedunculate; peduncles 5–16 mm long, lanate, without bracteoles or 1 at base; involucres campanulate, lanate; involucral bracts 10(–11), c. 7 × 2–3.8 mm, linear-oblong to lanceolate; supplementary bracts 4–5, 4.5–5.5 × 2.3–3.2 mm, ovate, extending to ¾ the length of involucral bracts. *Peripheral florets* 8–10(–12), pistillate; corollas 6.2–6.6 mm long, tubular, 4(–5)-lobed, light yellow. *Disc florets* 40–45, hermaphroditic; corollas 6.7–7.4 mm long, tubular, 5-lobed, light yellow; anthers orange (from label), anther bases caudate, ¾ as long as filament collar, appendages c. 0.5 × 0.16 mm; style branches truncate with crown of sweeping trichomes. *Achenes* c. 2.2 × 0.7 mm (immature), cylindrical, c. 8-ribbed, glabrous; pappus 6.5–6.8 mm long, bristles capillary, barbellate, whitish.

Etymology. – Greenman (1938) dedicated this species to Arthur W. Hill (1875–1941), director of the Royal Botanic Gardens, Kew, from 1922 until his death.

Distribution, ecology and phenology. – Endemic to Ecuador (Chimborazo). This species is known only from the type. According to the label information, it grows at elevations of c. 3350 m. Collected in flower in November (Map 6).

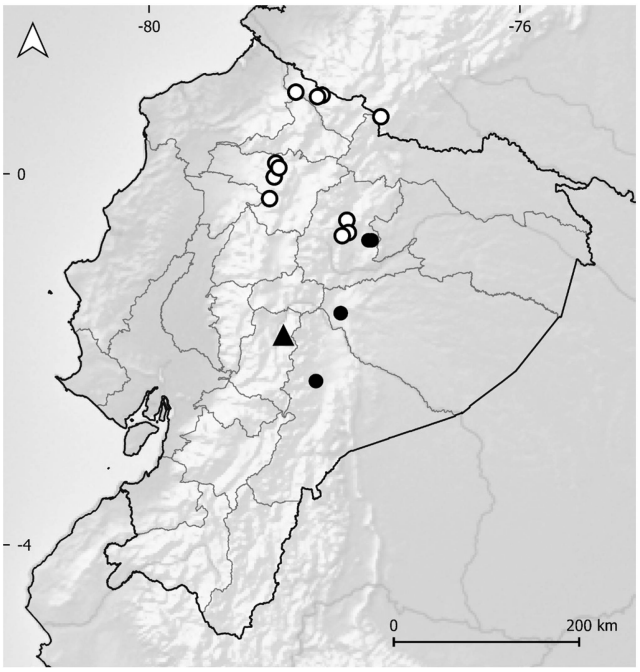
Notes. – As commented by Greenman (1938), this species is evidently closely related to *Pentacalia disciformis* because of their similarity in outline appearance. However, *P. hillii* differs in having larger and fewer capitula on longer peduncles (5–16 mm vs. 2–10 mm in *P. disciformis*), higher number of involucral bracts (10(–11) vs. 8 in *P. disciformis*), wider supplementary bracts (2.3–3.2 mm vs. 1.8–2.1 mm in *P. disciformis*), and higher number of disc florets (40–45 vs. 15–22 in *P. disciformis*).

As revealed by the picture of the holotype kept at MO [MO-1130241], the holotype (K000200583) was initially annotated by Greenman as *Senecio disciformis* var. *titaicensis* Greenm., a name never published. This label was removed from the specimen and replaced by another one with the published name *S. hillii*.

11. ***Pentacalia huilensis*** (Cuatrec.) Cuatrec. in Phytologia 49: 247. 1981 (Fig. 7E, F, 14 → p. 39, 46).

    ≡ *Senecio huilensis* Cuatrec. in Notas Fl. Colombia 6: 26. 1944. **Holotypus: Colombia. Huila:** comisaría del Caquetá, Cordillera Oriental sobre el filo divisorio, en Gabinete, 2300–2450 m, 22.III.1940, *Cuatrecasas 8485* (COL [COL000005410] image!; iso-: F [F0076907F, F0076908F] image!, P [P01816920] image!, US [US00123309] image!).

    = *Pentacalia carmelana* H. Rob. & Cuatrec. in Novon 3: 285. 1993, **syn. nov. Holotypus: Ecuador. Napo [Sucumbíos]:** Cartagena, km 25 from El Carmelo on road towards La Bonita, 0°37'N 77°30'W, 2800 m, 13.IV.1979, *Løjtnant, Molau & Madison 12335* (AAU!; iso-: QCA [QCA18596]!, US [US01844444] image!).



Map 6. – Distribution of *Pentacalia hillii* (Greenm.) Cuatrec. (triangle), *P. huilensis* (Cuatrec.) Cuatrec. (open circle), and *P. hurtadoi* H. Rob. & Cuatrec. (closed circle).

Plants scandent; stems terete, furrowed, glabrous (rarely tomentulose), partially fistulous. *Leaves* alternate, simple, petiolate; petioles 1–1.6 cm long; laminas 8.5–18 × 4.5–10 cm, elliptic to ovate, apex acute, usually shortly acuminate, base obtuse to rounded, margin entire, glabrous on adaxial surface, glabrous to crisped-pilose on abaxial surface, coriaceous, concolorous, secondary and tertiary veins conspicuous on both surfaces, protruding on abaxial surface. *Synflorescences* mostly terminal, corymbiform, with bracts linear, reduced (the proximal ones can be foliose); synflorescence branches tomentulose to tomentose. *Capitula* heterogamous, radiate, pedunculate; peduncles 3–7 mm long, tomentulose to tomentose, with 1–3 linear-subulate bracteoles; involucres cylindrical, glabrous or with some scattered trichomes; involucral bracts 8, 5.3–6.9 × 0.8–1.5 mm, linear-oblong; supplementary bracts 4–6, 1.2–2.6 × 0.6–0.7 mm, linear-subulate to lanceolate, extending to < ¼ the length of involucral bracts. *Ray florets* (3–)5–6, pistillate; corollas 6.4–8.8 mm long, limbs 2.6–4.6 × 0.6–1.7 mm, patent, subentire to 3-toothed, yellow. *Disc florets* 8–17, hermaphroditic; corollas 5.3–6.2 mm long, tubular, 5-lobed, yellow; anther bases caudate, as long as to slightly longer than filament collar, appendages c. 0.3 × 0.1 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 1.4–1.6 × 0.4–0.6 mm, cylindrical, c. 6-ribbed, glabrous; pappus 5.3–7.2 mm long, bristles capillary, barbellate, whitish.

Additional iconography. – Díaz-Piedrahita & Cuatrecasas (1999: 160, fig. 57).

Etymology. – The epithet *huilensis* refers to the Colombian department of Huila.

Distribution, ecology and phenology. – Colombia and Ecuador (Carchi, Napo, Pichincha, Sucumbíos). This species occurs in montane forests, at elevations of (1250–)1800–3000 m. In Pichincha, the species was found in an area where *Pentacalia corazonensis*, *P. floribunda*, and *P. luteynorum* subsp. *lutea* J. Calvo (described below) also grow. Specimens in flower have been collected nearly all year round (Map 6).

Notes. – *Pentacalia carmelana* was described on the basis of a single collection coming from the border between NW Sucumbíos (Ecuador) and SE Nariño (Colombia). In the protologue, the new species was compared with *P. huilensis* and *P. riotintis* (Cuatrec.) Cuatrec. The latter species can certainly be easily separated by its completely glabrous, fleshy leaves and by having mostly lateral, axillary synflorescences. *Pentacalia carmelana* and *P. huilensis* were also described as having mostly lateral, axillary synflorescences (Robinson & Cuatrecasas, 1993) but this was misinterpreted. In accordance with Díaz-Piedrahita & Cuatrecasas (1999), *P. huilensis* has mostly terminal synflorescences. The proximal synflorescences bracts can be foliose but the distal ones are linear, reduced. The leaf indumentum varies from glabrous to sparsely pilose (e.g. *Álvarez et al. 405*, *Davidse et al. 5611*, *Tirado et al. 1273*). The type material of *P. carmelana* certainly shows denser indumentum on the stems, synflorescence branches, and abaxial leaf surfaces but otherwise it displays the diagnostic characters of *P. huilensis*: broadly elliptic to ovate, coriaceous leaves with conspicuous, arched secondary veins; arched, corymbiform synflorescence branches; capitula with 8 involucral bracts, 4–6, short supplementary bracts, and 5–6 ray florets with proportionally small limbs (corolla c. 8.5 mm long with limb c. 4 × 1.4 mm). Because of any distinctive character lacks, taxonomic recognition of *P. carmelana* is not recommended.

The collection *Ramírez 4834* (COL, PSO) was identified as *Pentacalia huilensis* by Díaz-Piedrahita & Cuatrecasas (1999). It comes from La Victoria (SE Nariño, Colombia), a locality very close (c. 5 km away) to the type locality of *P. carmelana*. Then, the proposed synonymy also results in a geographically cohesive distributional area of *P. huilensis*.

Additional specimens examined. – **Carchi:** Espejo, El Gualtal, cresta del cerro Golondrinas Hembra, 0°51'N 78°8'W, 3000 m, 21.VIII.1994, *Palacios & Clark 12524* (QCNE); Tulcán, parroquia Tobar Donoso, reserva indígena Awá, centro El Baboso, 0°53'N 78°25'W, 1800 m, 17–27.VIII.1992, *Tipaz et al. 1786* (QCNE, US); Mira, El Carmen, cerro Golondrinas, 0°50'N 78°11'W, 2000–2400 m, 18–25.VIII.1994, *Tirado et al. 1273* (QCNE, US). **Napo:** Quijos, Sierra Azul (Agrícola Industrial Río Aragón), sendero de la cascada, 0°40'S 77°55'W, 2300 m, 2.V.1992, *Álvarez et al. 405* (QCNE, US); Quijos, 4 km S of Cosanga on road to Tena, 0°30'S 77°52'W, 2140 m, 15.II.1978, *Kirkbride & Chamba 4084* (Q, US); Quijos, Reserva Ecológica Antisana, cordillera de los Guacamayos, creuce del oleoducto de la compañía ARCO, El Mirador,

0°38'S 77°51'W, 2400 m, 6–10.I.1999, *Vargas & Narváez 3414* (QCNE, US). **Pichincha:** Lloa, Chiriboga, vía Chiriboga–Quito, antes de la estación de bombeo, 0°16'S 78°42'W, 2340 m, 16.VII.2023, *Calvo & Benítez 8480* (QCA); Quito, loma La Bola–cerro El Campanario, sendero entre la cima de La Bola y colinas justo antes del cerro El Campanario, 0°2'S 78°39'W, 2560–2712 m, 12.IX.2001, *Freire, Morales & Mites 3266* (QCNE); Quito, parroquia Nanegal, montañas de Maquipucuna, cerro Sosa and ridge adjacent to cerro Montecristi, 0°4'N 78°36'W, 2200–2250 m, 9.VII.1991, *Webster & Castro 28943* (US); in front of lodge at Hacienda El Carmen, 0°7'N 78°38'W, 1250 m, 18.XI.1998, *Webster 32903* (QCNE).

12. ***Pentacalia hurtadoi*** H. Rob. & Cuatrec. in Novon 3: 287. 1993 (Fig. 15 → p. 47).

Holotypus: Ecuador. Napo: 3 km este del caserío de Huamaní, al norte de la carretera Hollín–Loreto, 0°43'S 77°36'W, 1200 m, 17.IX.1988, *Hurtado & Alvarado 302* (US [US00406381] image!; iso-: AAU!, MO-3825930 image!, QCNE [QCNE55]!).

Plants scandent; stems terete, furrowed, glabrous, solid. *Leaves* alternate, simple, petiolate; petioles 0.9–1.5 cm long; laminas 9.5–12 × 3.5–3.7 cm, narrowly elliptic, apex acute to attenuate, base cuneate to obtuse, margin entire, glabrous on both surfaces, somewhat fleshy (drying coriaceous), concolorous, secondary veins conspicuous on abaxial surface, tertiary veins usually inconspicuous. *Synflorescences* mostly lateral, axillary, racemiform, similar in length than leaves, with bracts linear-subulate; synflorescence branches tomentulose. *Capitula* homogamous, discoid, pedunculate; peduncles 3–7 mm long, tomentulose, with 1–2 linear-subulate bracteoles; involucres cylindrical, glabrous; involucral bracts 8, 6.9–7.2 × 2–2.2 mm, linear-oblong; supplementary bracts 3–4, 1.9–2.6 × c. 0.5 mm, linear-subulate, extending to ¼ the length of involucral bracts. *Disc florets* 15–23, hermaphroditic; corollas 7.2–8.3 mm long, tubular, 5-lobed, pale greenish-yellow; anther bases caudate, slightly longer than filament collar, appendages c. 0.4 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 1.9–2.1 × 0.6–0.7 mm, cylindrical, 8–10-ribbed, glabrous; pappus c. 7.2 mm long, bristles capillary, barbellate, whitish.

Etymology. – This species is named after the collector of the type material, the Ecuadorian Fernando Hurtado. He did botanical inventories in the foothills of the Sumaco Volcano during 1988–1989 in the frame of the project DINAF-Missouri.

Distribution, ecology and phenology. – Endemic to Ecuador (Morona-Santiago, Napo, Pastaza). This species grows in premontane rainforests, at elevations of 950–1560 m. Collected in flower between June and September (Map 6).

Notes. – *Pentacalia hurtadoi* can be differentiated by its lateral, axillary synflorescences, which are racemiform and composed of discoid capitula, and the leaves with secondary veins conspicuous and tertiary veins inconspicuous or barely visible. In the key by Robinson & Cuatrecasas (1993), venation's characters were mainly used for differentiating *P. hurtadoi* from *P. napoensis* H. Rob. & Cuatrec. After studying the respective type materials, *P. napoensis* certainly shows the veinlets very conspicuous. Their capitula also appear to be slightly different. *Pentacalia hurtadoi* has capitula with 15–23 florets (vs. 12–14 in *P. napoensis*) and the involucral bracts slightly shorter and wider (6.9–7.2 × 2–2.2 mm vs. 7.7–10 × 1.1–1.7 mm in *P. napoensis*). Both species have scarcely been collected, which hinders the study of their variability. Moreover, it is interesting to note that the species are sympatric. Their respective types come indeed from the same locality and were collected the same day. Additional collections may suggest treating these taxa as a single species, but for the time being I prefer keeping them separated following Robinson & Cuatrecasas (1993).

The capitula resemble those of *Pentacalia moronensis* H. Rob. & Cuatrec., but this latter species has fleshy leaves with barely conspicuous secondary veins, laxer and more diffuse synflorescences, and longer capitulum peduncles. Another species with mostly lateral, axillary, racemiform synflorescences and discoid capitula is *P. uribei* Cuatrec. from Colombia. They differ, among other characters, in leaf indumentum (glabrous in *P. hurtadoi* vs. arachnoid on abaxial surface in *P. uribei*) and involucral bract length (6.9–7.2 mm in *P. hurtadoi* vs. 4–6.5 mm in *P. uribei*). *Pentacalia palaciosii* is also a similar species concerning the overall appearance but easily distinguishable by the disciform capitula.

The collection *García 675* (COL, MA) from San Andrés (Putumayo, Colombia) seems very close to *Pentacalia hurtadoi*. However, it has thinner and smaller laminas, with proportionally longer petioles (c. 2.5 cm long), the synflorescences are branched (vs. capitula usually solitary arising directly from the main axis), and the involucral bracts are slightly shorter (c. 6 mm long). From the Colombian species *Pentacalia retroflexa* S. Díaz, *García 675* differs in having synflorescences as long as the subtending leaves (vs. remarkably longer) and c. 8 involucral bracts (vs. 11). Additional collections are needed to clarify the taxonomic position of this collection.

Additional specimens examined. – **Morona-Santiago:** carretera Macas–Riobamba, tramo Proaño–9 de Octubre, filo del carretero, 2°14'S 78°12'W, 1562 m, 22.VIII.2002, *Caranqui, Toapanta & Croat 758* (QCNE). **Napo:** carretera Hollín-Loreto, 5 km al W de Guamaní, faldas del Volcán Sumaco, 0°43'S 77°38'W, 1200 m, 6–7.IX.1988, *Neill, Hurtado & Alvarado 8558* (QCNE, US). **Pastaza:** Veracruz, [1°30'S 77°56'W], [c. 950 m], 24.VI.1968, *Lugo 11* (AAU).

13. ***Pentacalia luteynorum*** H. Rob. & Cuatrec. in Novon 3: 287. 1993.

Holotypus: Ecuador. Napo: Baeza–Tena road, Cosanga to 5 km S of Cosanga, 1975–2225 m, 9.I.1979, *Luteyn & Lebrón-Luteyn 6733* (US [US00406380] image!; iso-: F [F0076815F] image!, NY [NY00039269] image!, QCA [QCA149509]!, US [US01106169] image!).

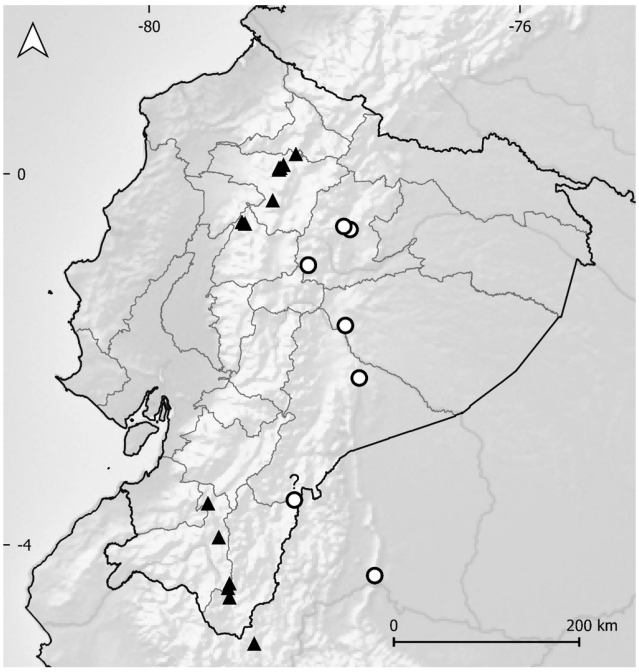
Plants scandent; stems terete, furrowed, glabrous, partially fistulous. *Leaves* alternate, simple, petiolate; petioles 0.7–1 cm long; laminas 5.3–8 × 2.1–3.5 cm, lanceolate to narrowly elliptic, apex acute to attenuate, base attenuate to cuneate, margin entire, glabrous on both surfaces, somewhat fleshy (drying subcoriaceous), concolorous, secondary veins barely conspicuous on abaxial surface. *Synflorescences* mostly terminal, thyrsoid-paniculiform, with bracts foliose; synflorescence branches sparsely pilose to somewhat arachnoid. *Capitula* heterogamous, radiate, pedunculate; peduncles 2–10 mm long, sparsely pilose to somewhat arachnoid, with 1–2 linear-oblong bracteoles; involucres cylindrical, glabrous or with some scattered trichomes near base; involucral bracts 8(–13), 4.7–7.5 × 0.9–1.9 mm, linear-oblong; supplementary bracts 4(–7), 1.4–1.8 × 0.5–0.6 mm, linear-subulate, extending to ¼ the length of involucral bracts. *Ray florets* 5, pistillate; corollas (3.8–)6.1–7.8 mm long, limbs (1–)2.5–3 × 0.9–1.2 mm, patent, subentire to 3-toothed, white or yellow. *Disc florets* 16–22, hermaphroditic; corollas 4.3–7.7 mm long, tubular, 5-lobed, pale greenish-yellow or yellow; anther bases caudate, as long as filament collar, appendages c. 0.4 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 1.8–1.9 × 0.5–0.6 mm, cylindrical, c. 5-ribbed, glabrous; pappus 5–7.8 mm long, bristles capillary, barbellate, whitish.

Etymology. – The species is named after the collectors of the type material, i.e., James L. Luteyn and María L. Lebrón-Luteyn.

Notes. – Species having mostly terminal synflorescences with foliose bracts. When producing lateral flowering shoots, the synflorescence is also terminal with foliose bracts. The leaves are somewhat fleshy, drying subcoriaceous. The capitula are radiate with white or yellow ray florets. Because of the fleshy leaves with barely conspicuous secondary veins, it resembles to *Pentacalia riotintis*, however, *P. luteynorum* has lanceolate to narrowly elliptic leaves and terminal synflorescences. In *P. riotintis* the ray florets are always yellow and have larger limbs. *Pentacalia luteynorum* usually has the stem somewhat inflated near the base of the synflorescence, but this characer has been observed in other species too (e.g. *P. dorrii*).

Both leaf and capitulum morphology resemble those of *Pentacalia ullucosana* (Hieron.) S. Díaz & Cuatrec., described from nearby Popayán and known only from the type collection. The color of the ray florets remains undescribed (Hieronymus, 1901; Díaz-Piedrahita & Cuatrecasas, 1999). These taxa may be conspecific but additional collections of the Colombian species are needed to reach a decision.

The species has been collected in the isolated Cordillera del Cóndor (eastern Zamora-Chinchipe; *Montenegro et al. 27*), but the specimen bears immature capitula with no mention of the ray floret color. This specimen is therefore tentatively placed under the typical subspecies (and showed on the map with a question mark, see Map 7).



Map 7. – Distribution of *Pentacalia luteynorum* H. Rob. & Cuatrec. subsp. *luteynorum* (open circle) and *P. luteynorum* subsp. *lutea* J. Calvo (triangle).

13a. ***Pentacalia luteynorum*** subsp. ***luteynorum*** (Fig. 16, 17F → p. 48, 65).

Ray florets white. *Disc florets* pale greenish-yellow.

Distribution, ecology and phenology. – Ecuador (Morona-Santiago, Napo, Pastaza, Zamora-Chinchipe) and N Peru. This species grows in premontane rainforests and montane forests, at elevations of 700–2000(–2900) m. Specimens in flower have mostly been collected between November and February (Map 7).

Additional specimens examined. – Ecuador. **Morona-Santiago:** Mutintz and vicinity, SW of Makuma, 2°12'S 77°44'W, 700 m, 4.XI.1996, *Ståhl et al. 3532* (AAU, QCA). **Napo:** Salcedo (San Miguel) to Salcedo–Napo road km 60, [0°59'S 78°17'W], 2900 m, 5.II.1977, *Boeke 925* (US); Quijos, along camino from Cosanga to río Aliso, c. 5 km W of Cosanga, [0°34'S 77°54'W], 2000 m, 20.II.1978, *Kirkbride & Chamba 4255* (US). **Pastaza:** parroquia Simón Bolívar, Los Vencedores, 1°38'S 77°53'W, 1040 m, 31.VII.1995, *Soejarto et al. 9229* (QCA); ibid., 1.VIII.1995, *Soejarto et al. 9274* (QCA). **Zamora-Chinchipe:** El Pangui, cordillera del Cóndor, valle del río Quimi, 3°31'S 78°26'W, 920 m, 11.XII.2000, *Montenegro et al. 27* (QCNE, US). Peru. **Loreto:** Alto Amazonas, cerros Campanquiz, 22 km NW of La Vista, [4°20'S 77°34'W], 850 m, 12.II.1978, *Wasshausen & Encarnación 896* (US).



Fig. 1. – Diagram of informative characters in *Pentacalia* Cass. **A.** Synflorescences mostly terminal (*P. ruficaulis*); **B.** Synflorescences mostly lateral, axillary (*P. sevillana*); **C.** Synflorescence corymbiform (*P. dorrii*); **D.** Synflorescence thyrsoid-paniculiform (*P. millei*); **E.** Synflorescence racemiform (*P. hurtadoi*); **F.** Capitula radiate with well-developed and patent ray florets (*P. corazonensis*); **G.** Capitula radiate with reduced and curved ray florets (*P. celicana*; black arrow shows a reduced ray floret); **H.** Capitula disciform (*P. floribunda*; black arrow shows a peripheral floret pistillate and tubular); **I.** Capitula discoid (*P. moronensis*).
[**A:** *Minga et al. 4163*, HA; **B:** *Calvo & Arnelas 7693*, HUTPL; **C:** *Calvo & Arnelas 7685*, HUTPL; **D:** *Calvo & Arnelas 7698*, HUTPL; **E:** *Hurtado & Alvarado 302*, MO; **F:** *Calvo & Benítez 8458*, QCA; **G:** *Espinosa-Ortega et al. 1043*, LOJA; **H:** *Calvo & Benítez 8461*, QCA; **I:** Ecuador, Pastaza, finca Heimatlos Eco Lodge, 6.VIII.2023] [Photos: **A–D, F–H:** J. Calvo; **E:** © Missouri Botanical Garden; **I:** E. Schulz]

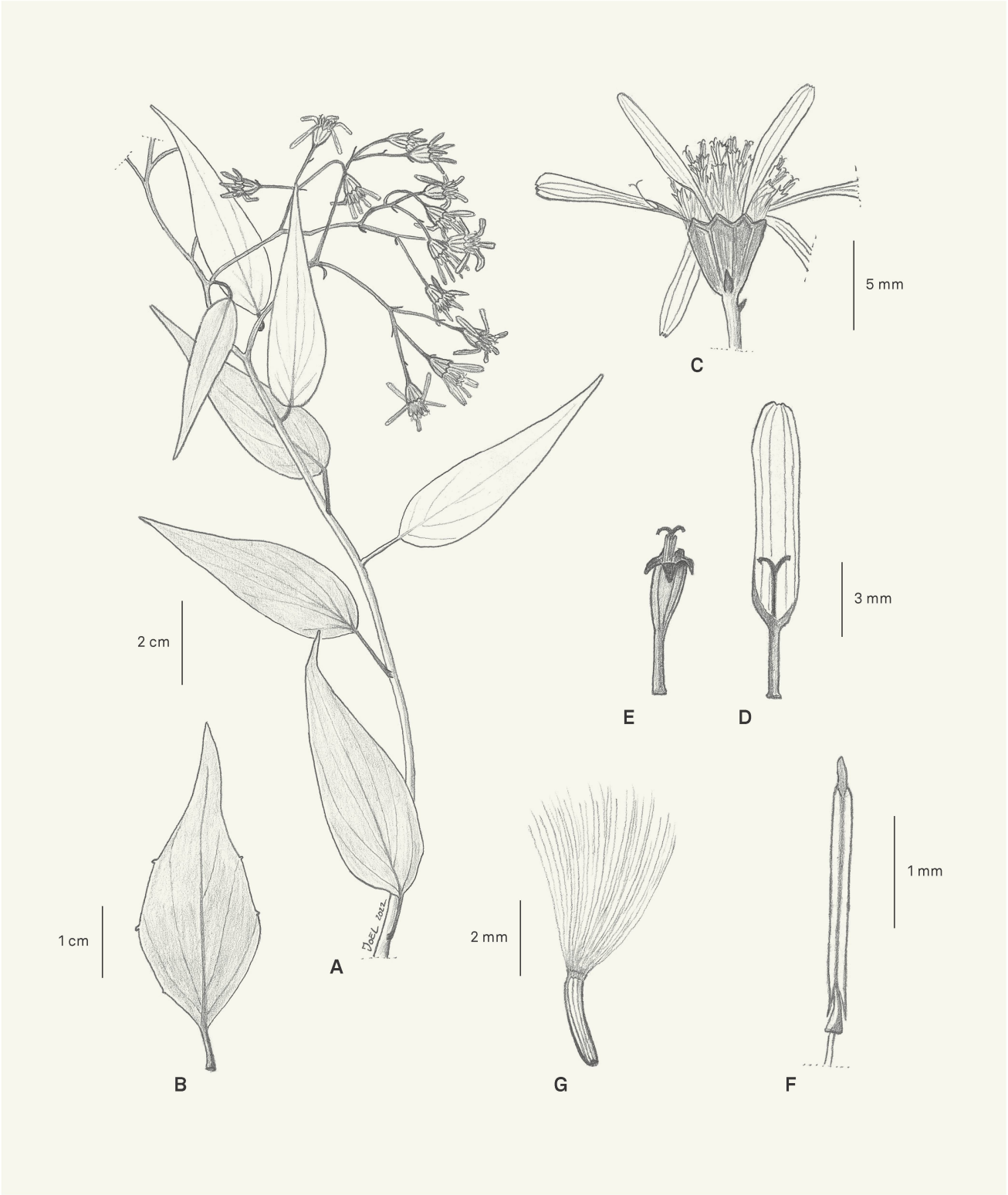


Fig. 2. – *Pentacalia andrei* (Greenm.) Cuatrec. **A.** Flowering branch; **B.** Leaf; **C.** Capitulum; **D.** Ray floret (achene and pappus removed); **E.** Disc floret (achene and pappus removed); **F.** Anther; **G.** Achene.
[**A:** *Matezki 84*, US; **B:** *Campos et al. 5542* from N Peru, US; **C–G:** *Madsen 86250*, US] [Drawing: J. Calvo]



Fig. 3. – *Pentacalia andrei* (Greenm.) Cuatrec. **A.** Habit; **B.** Synflorescence; **C.** Leaves. [*Arnelas et al. 1092*] [Photos: J. Calvo]

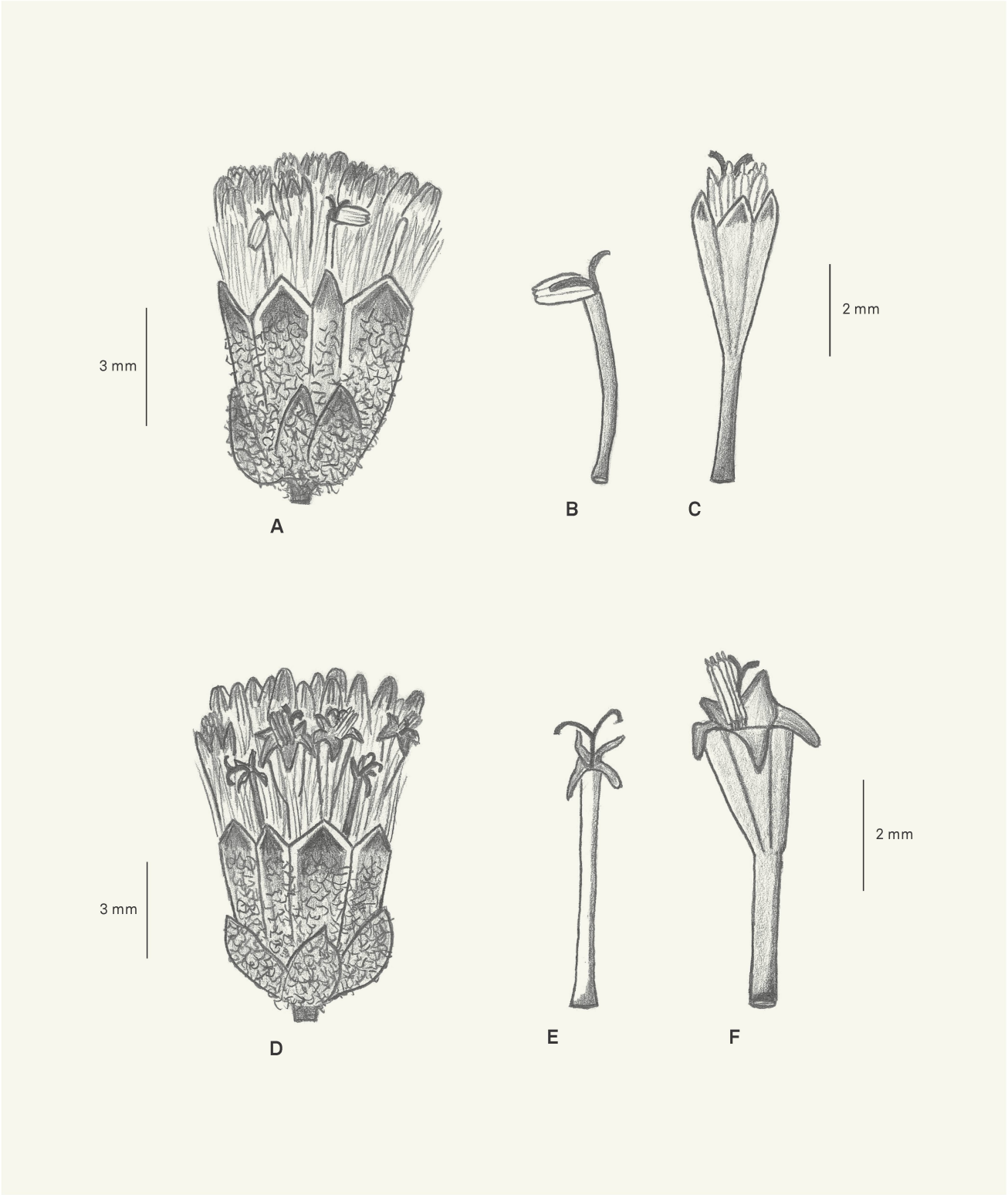


Fig. 4. – *Pentacalia aschersoniana* (Hieron.) Cuatrec. **A.** Capitulum; **B.** Peripheral floret (achene and pappus removed); **C.** Disc floret (achene and pappus removed). *Pentacalia disciformis* (Hieron.) Cuatrec. **D.** Capitulum; **E.** Peripheral floret (achene and pappus removed); **F.** Disc floret (achene and pappus removed). [**A–C:** *Jørgensen et al. 92277*, US; **D–F:** *Asplund 17237*, US] [Drawing: J. Calvo]

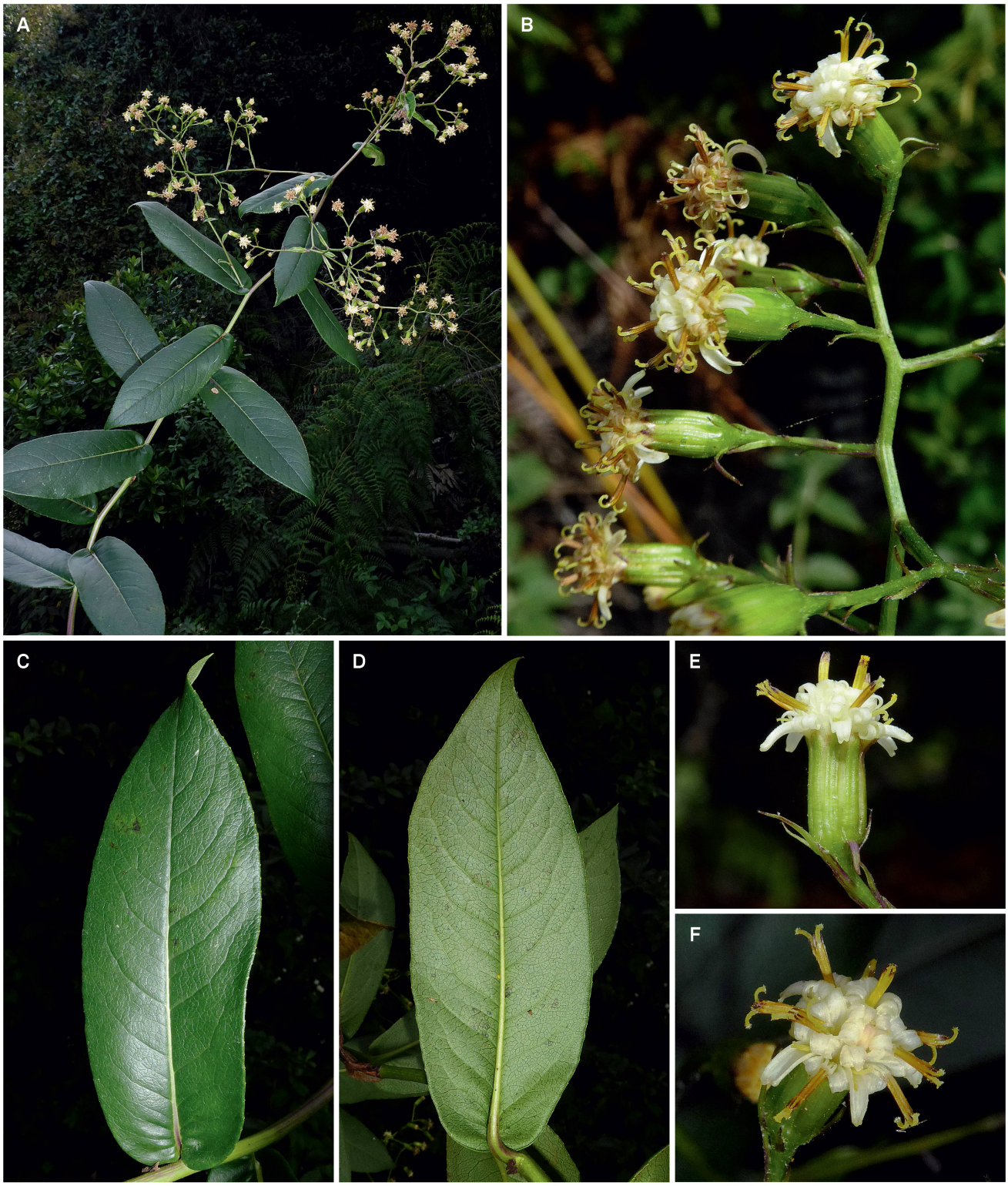


Fig. 5. – *Pentacalia celicana* J. Calvo & G. Benítez. **A.** Flowering branch; **B.** Zoom in of the synflorescence; **C.** Adaxial leaf surface; **D.** Abaxial leaf surface; **E.** Capitulum (side view); **F.** Capitulum (top view).
[*Espinosa-Ortega et al. 1043*] [Photos: J. Calvo]

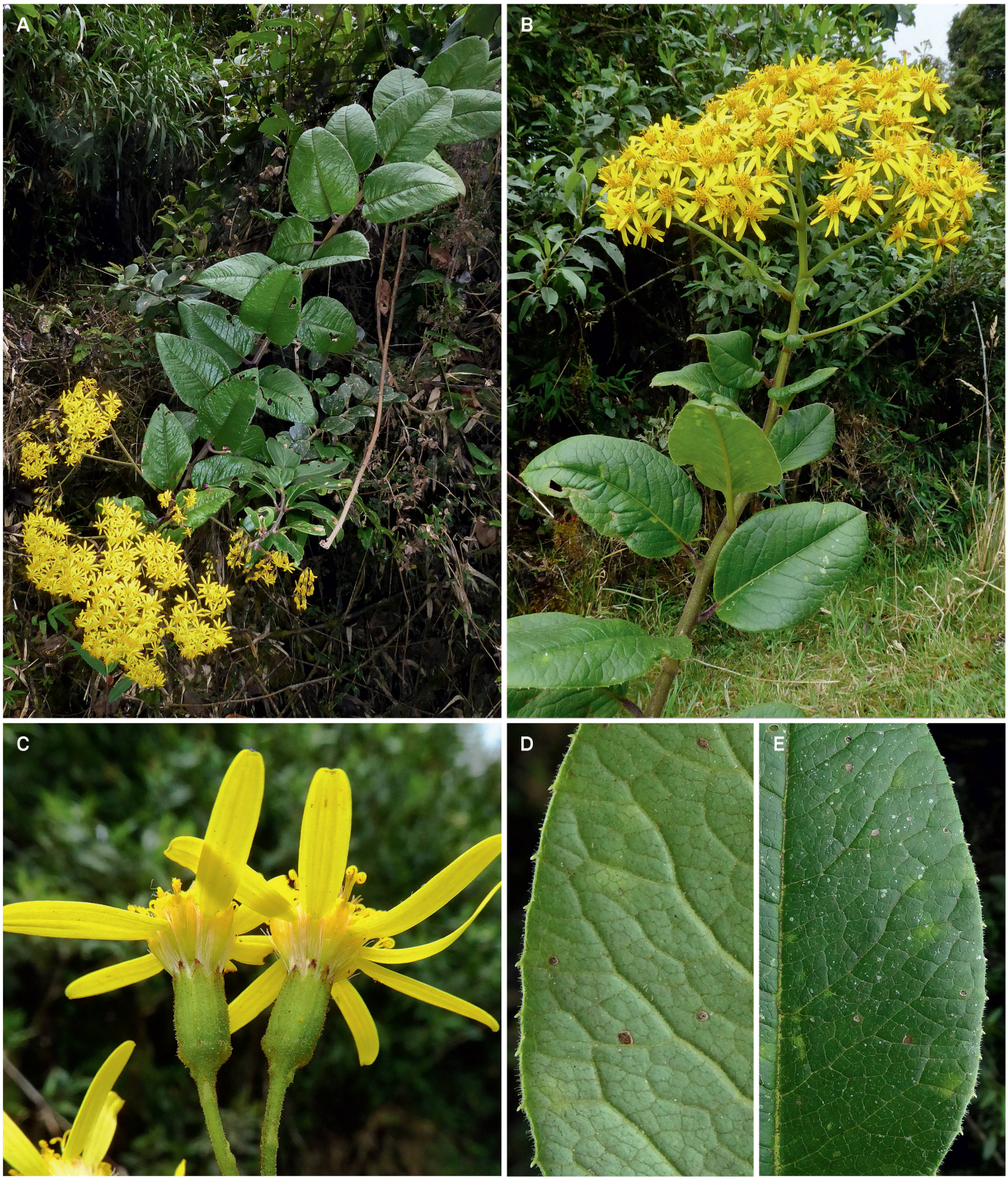


Fig. 6. – *Pentacalia corazonensis* (Hieron.) Cuatrec. **A.** Habit; **B.** Flowering branch (notice the terminal synflorescence); **C.** Capitula; **D.** Zoom in of abaxial leaf surface; **E.** Zoom in of adaxial leaf surface.
[*Calvo & Benítez 8458*] [Photos: J. Calvo]

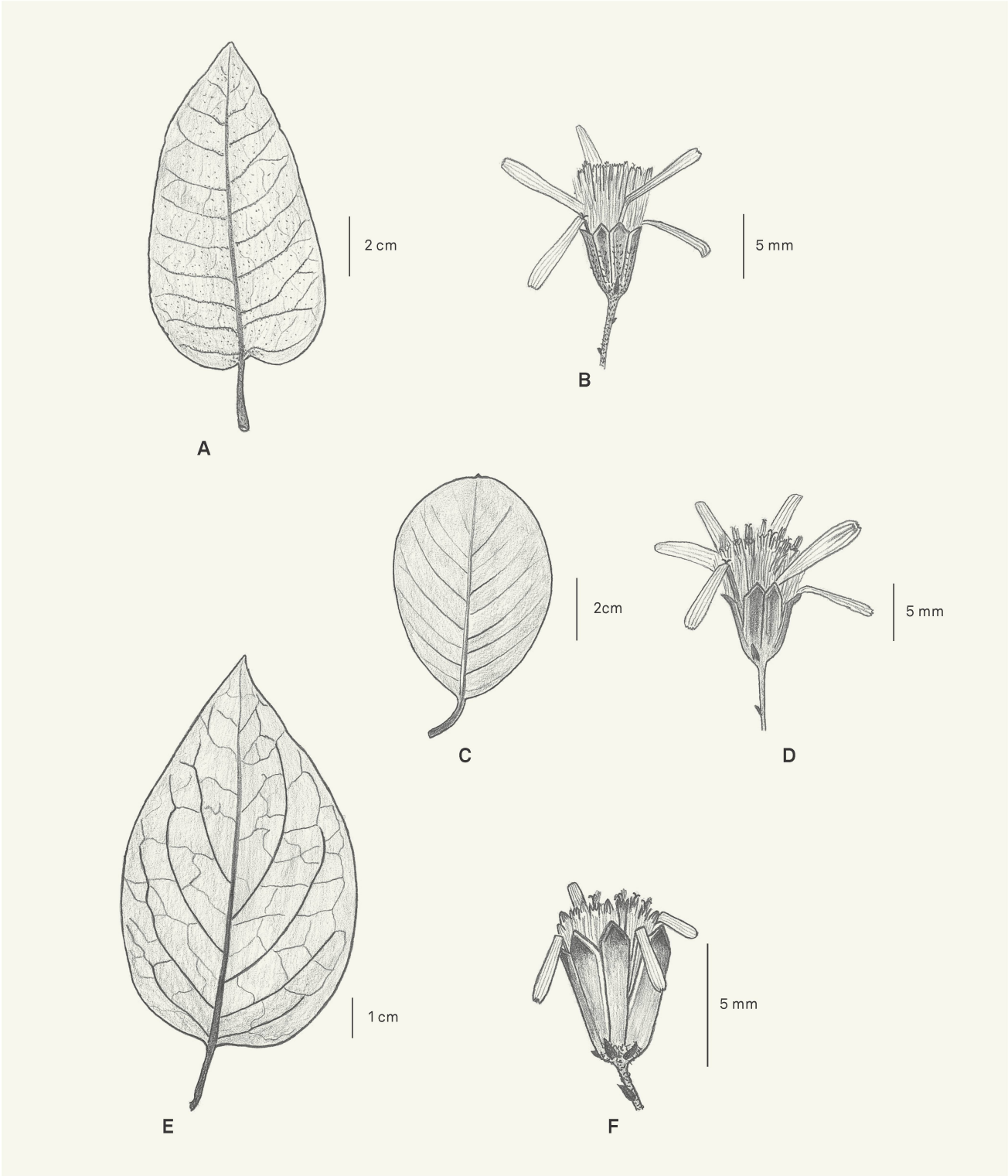


Fig. 7. – *Pentacalia corazonensis* (Hieron.) Cuatrec. **A.** Leaf; **B.** Capitulum. *Pentacalia dorrii* H. Rob. & Cuatrec. **C.** Leaf; **D.** Capitulum. *Pentacalia huilensis* (Cuatrec.) Cuatrec. **E.** Leaf (notice the arched, secondary veins); **F.** Capitulum. [**A:** *Ramos et al. 7426*, US; **B:** *Maguire & C.K. Maguire 44255*, US; **C:** *Dodson & Thien 779*, US; **D:** *Jørgensen et al. 92855*, US; **E, F:** *Webster & Castro 28943*, US] [Drawing: J. Calvo]



Fig. 8. – *Pentacalia disciformis* (Hieron.) Cuatrec. **A.** Habit; **B.** Synflorescence; **C.** Abaxial leaf surface of a sterile shoot compared with the typical leaf morphology; **D.** Capitula (side view, black arrows show the peripheral florets pistillate and tubular); **E.** Capitulum (top view). [**A, E:** Ecuador, Napo, Oyacachi, 11.XI.2018; **B–D:** *Calvo & Benítez 8459*] [Photos: J. Calvo]

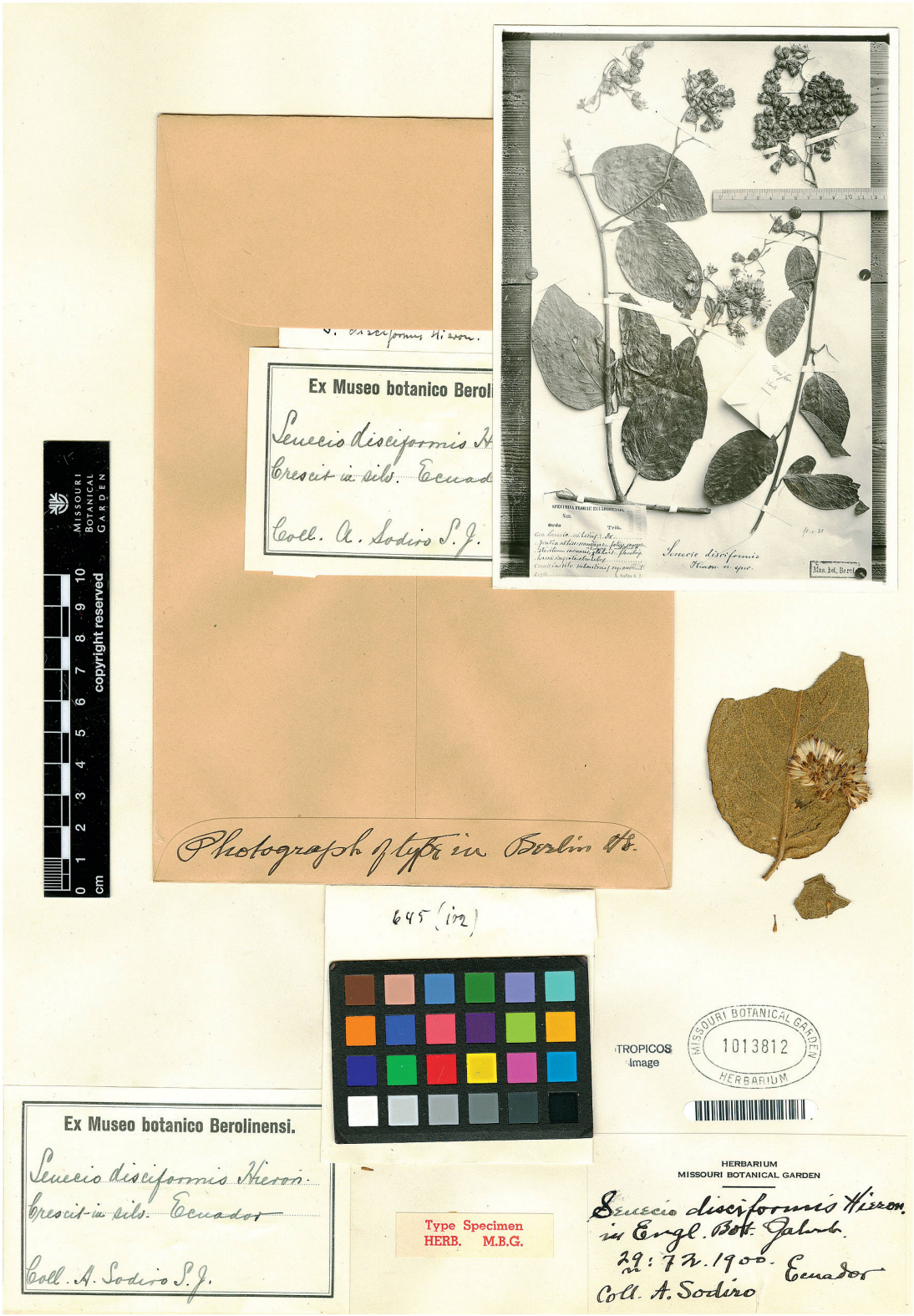


Fig. 9. – Lectotype of *Senecio disciformis* Hieron. at MO.
[*Sodiro s.n.*, MO-1013812; © Missouri Botanical Garden]

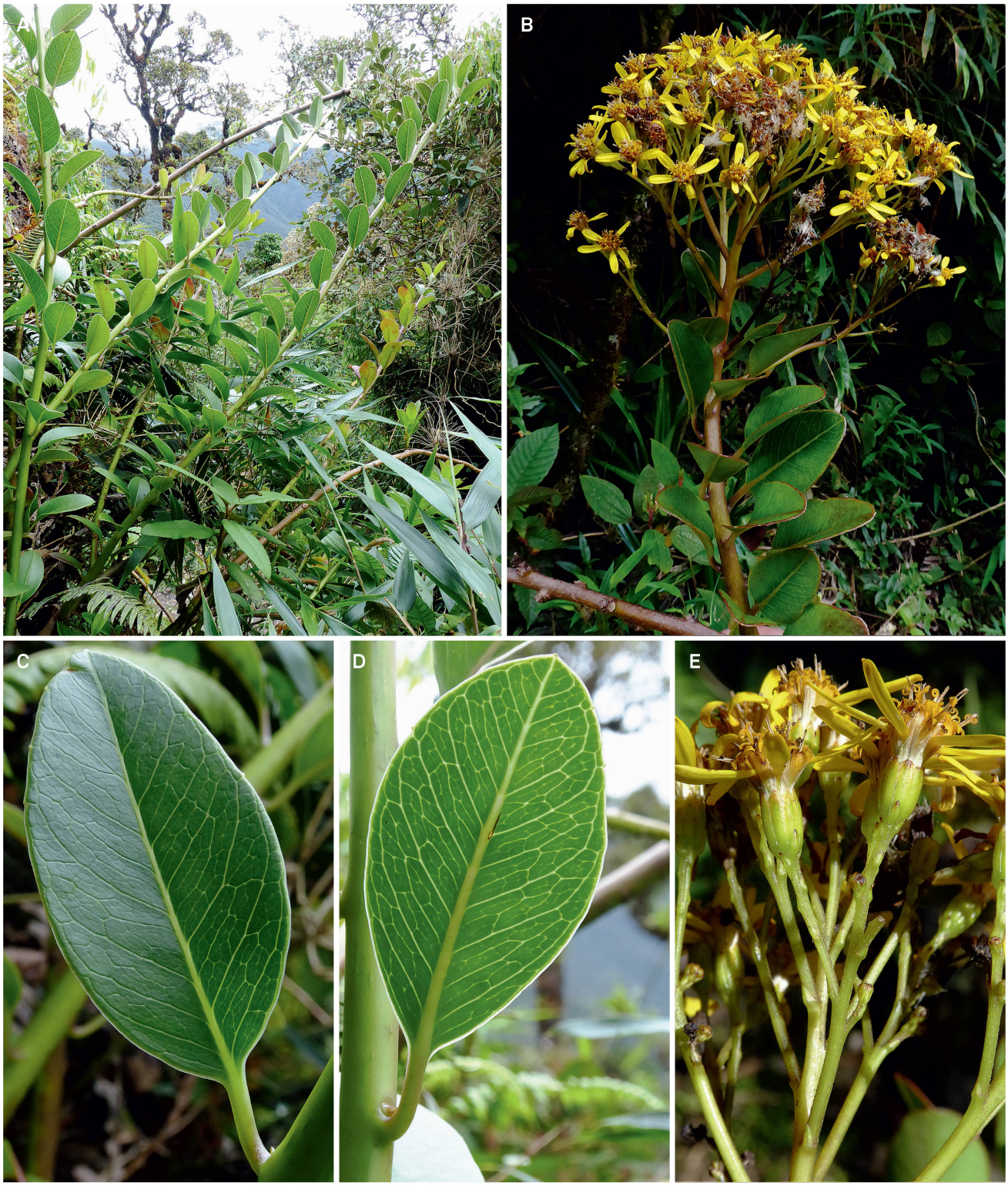


Fig. 10. – *Pentacalia dorrii* H. Rob. & Cuatrec. **A.** Habit and habitat; **B.** Flowering branch; **C.** Adaxial leaf surface; **D.** Abaxial leaf surface (notice the hyaline margin); **E.** Capitula.
[*Calvo & Arnelas 7685*] [Photos: J. Calvo]

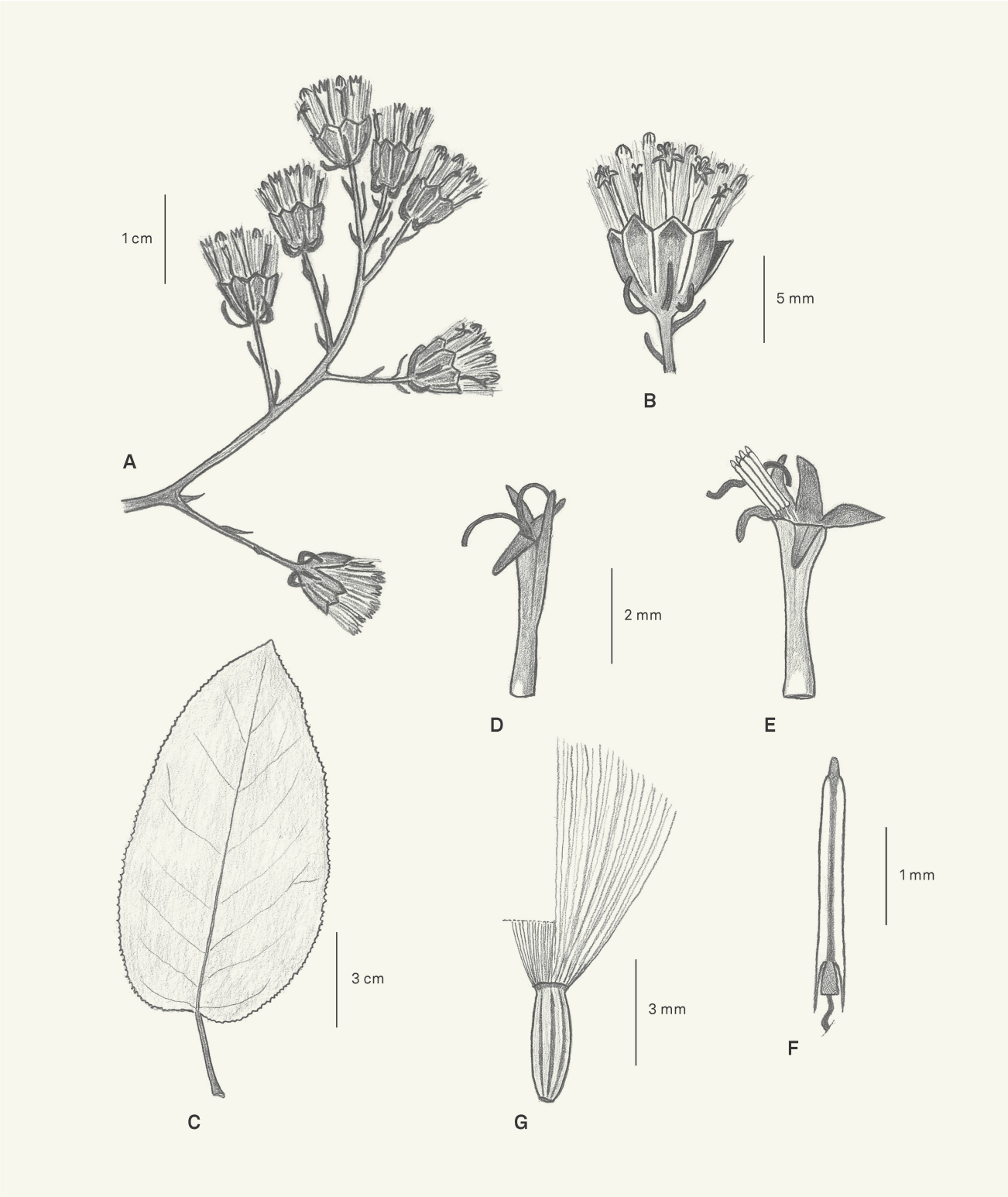


Fig. 11. – *Pentacalia floribunda* Cuatrec. **A.** Synflorescence branchlet; **B.** Capitulum; **C.** Leaf; **D.** Peripheral floret (achene and pappus removed); **E.** Disc floret (achene and pappus removed); **F.** Anther; **G.** Achene. [**A, B:** *Sodiro s.n.*, G; **C:** *Cerón & Alarcón 4842*, US; **D–F:** *Jameson s.n.*, G; **G:** *Mille s.n. [720]*, US] [Drawing: J. Calvo]

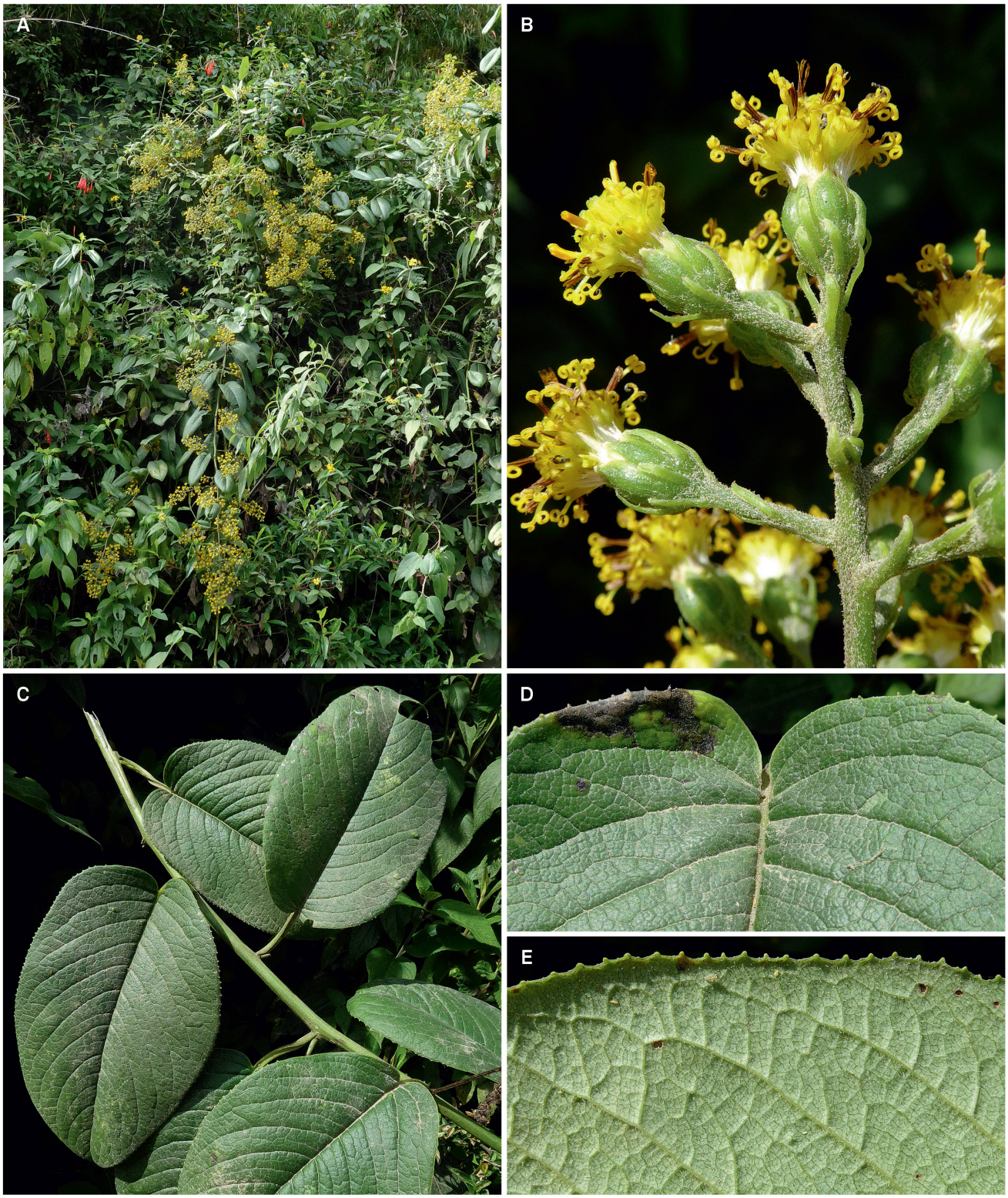


Fig. 12. – *Pentacalia floribunda* Cuatrec. **A.** Habit; **B.** Capitula; **C.** Leaves; **D.** Leaf base (adaxial surface); **E.** Zoom in of abaxial leaf surface. [*Calvo & Benítez 8461*] [Photos: J. Calvo]



Fig. 13. – Holotype of *Senecio hillii* Greenm. at K.
[*Spruce 5587*, K000200583; © Royal Botanic Gardens, Kew]



Fig. 14. – *Pentacalia huilensis* (Cuatrec.) Cuatrec. **A.** Adaxial leaf surface; **B.** Abaxial leaf surface. [*Calvo & Benítez 8480*] [Photos: J. Calvo]

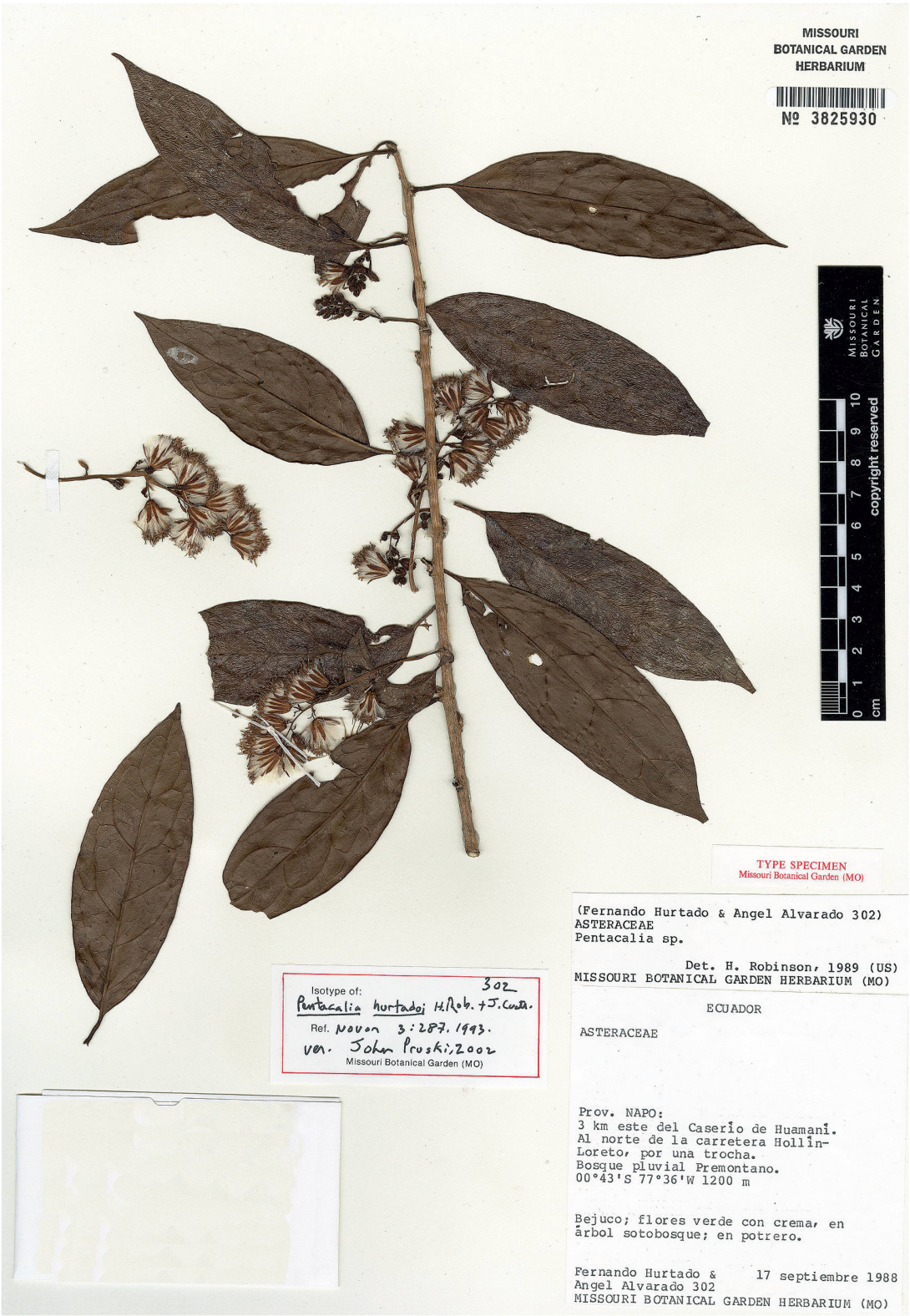


Fig. 15. – Isotype of *Pentacalia hurtadoi* H. Rob. & Cuatrec. at MO.
[*Hurtado & Alvarado 302*, MO-3825930; © Missouri Botanical Garden]



Fig. 16. – *Pentacalia luteynorum* H. Rob. & Cuatrec. subsp. *luteynorum*. **A.** Flowering branch; **B.** Leaf; **C.** Capitulum; **D.** Ray floret (achene and pappus removed); **E.** Disc floret (achene and pappus removed); **F.** Anther; **G.** Achene. [**A–C:** *Wasshausen & Encarnación 896* from N Peru, US; **D–G:** *Boeke 925*, US] [Drawing: J. Calvo]

13b. ***Pentacalia luteynorum*** subsp. ***lutea*** J. Calvo, **subsp. nov.** (Fig. 17A–E → p. 65).

Holotypus: Ecuador. Imbabura: Cotacachi, Plaza Gutiérrez, sector Tabla Chupa, 0°13'N 78°25'W, 3000 m, 18.VII.1992, *Tipaz & Gudiño 1220* (AAU!; iso-: MO-04995557 image!, QCNE-85517!, US [US01844761] image!).

Pentacalia luteynorum subsp. lutea differs from the typical variety in having both ray and disc florets yellow.

Etymology. – The epithet refers to the yellow color of the ray and disc florets, which is the distinctive character of this subspecies.

Distribution, ecology and phenology. – Ecuador (Cotopaxi, Imbabura, Loja, Pichincha, and Zamora-Chinchipe) and N Peru. This species grows in cloud forests and humid montane forests, at elevations of 1760–3000 m. In Pichincha, the species was found co-occurring with *Pentacalia corazonensis*. Specimens in flower have mostly been collected in July and August (Map 7).

Notes. – No other difference other than the color of the florets was found to differentiate the two taxa. Their populations, however, form two geographically very well delimited distribution areas. The typical variety with white ray florets grows through the eastern slopes of the Cordillera Oriental extending to the lowlands of Pastaza, Morona-Santiago, and the Cordillera Campanquiz in Peru (Loreto Department). The subspecies *lutea* is found in the Cordillera Occidental, with two disjunct populations: one in the north (Cotopaxi, Imbabura, Pichincha) and the other in the south (Loja, western Zamora-Chinchipe, and Cajamarca in Peru).

Additional specimens examined. – Ecuador. **Cotopaxi:** Sigchos, Triunfo Grande, 35 km de Sigchos, vía Sigchos–Las Pampas, finca del Sr. Galo Roballo, 0°32'S 78°58'W, 2427 m, 2.VIII.2003, *Ramos, Contreras & L. Ramos 6863* (QCNE, US); Sigchos, abajo de Costa Azul, por el camino a Dos Ríos, casi a 39 km de Sigchos, 0°31'S 79°0'W, 2442 m, 11.VIII.2003, *Ramos et al. 7227* (QCNE, US). **Loja:** Bosque Protector Pucango, carretera Saraguro–Manú, 3°33'S 79°22'W, 2789 m, 14.VII.2011, *Aguirre, Santiana & Tapia PMV-1662* (QCA); Nudo de Sabanilla, W slope on road to Yangana, [4°25'S 79°8'W], 2600 m, 6.II.1985, *Harling & Andersson 21735* (QCA); P.N. Podocarpus, 2500–2910 m, s.d., *Jaramillo, Zak & Valencia 8775* (AAU, QCA); new road Loja–Saraguro, km 17, 3°55'S 79°15'W, 2600–2650 m, 19.III.1989, *Øllgaard & Feil 91116* (AAU). **Pichincha:** Calacalí, Yunguilla, 3.2 km antes de Montecristi, 0°06'33"N 78°33'07"W, 2625 m, 14.VII.2023, *Calvo & Benítez 8467* (QCA); Lloa, Chiriboga, vía Chiriboga–Quito, c. 1 km pasada la estación de bombeo, 0°17'S 78°40'W, 2645 m, 16.VII.2023, *Calvo & Benítez 8482* (QCA); Quito, parroquia Nanegal, bosque protector Maquipucuna, montañas de Maquipucuna, on summit area cerro Montecristi, 0°3'N 78°36'W, 2750 m, 16.VII.1992, *Hrusa 29532* (QCNE); trail along ridge between cerro Guantug Pungo and cerro Montecristi, 0°4'N 78°35'W, 2735 m, 26.VI.1996, *Kelch et al. 31973* (QCNE, US); in silvis siubandinis vulcano Atacatzo [Atacazo] ad Saloya, [0°17'S 78°40'W], VIII.1907, *Sodiro s.n.* (QPLS); Quito, parroquia Nanegal, Bosque Protector Maquipucuna, montañas de Maquipucuna, main ridge of cerro Sosa, 0°4'N 78°36'W, 2250 m, 16.VII.1992, *Webster, Hrusa & Zurinsky 29439* (QCNE). **Zamora-Chinchipe:** Valladolid, track NW of village, 4°34'S 79°8'W, 1760–1850 m, 27.XI.1984, *Jørgensen 56432* (AAU); P.N. Podocarpus, road Yangana–Valladolid, km 21, 4°28'S 79°9'W, 2650–2750 m, 2.XII.1988, *Madsen, Bloch & Christensen 75787* (AAU, LOJA). Peru. **Cajamarca:** San Ignacio, La Coipa, vista Florida–La Laguna, 5°26'S 78°56'W, 2000 m, 11.VI.1997, *Campos & García 3942* (USM); Cutervo, San Andrés de Cutervo, P.N. de Cutervo, arriba de Saucedal pasando por Chorro Blanco, [6°14'S 78°42'W], 2250 m, 3.VIII.1988, *Díaz & Osores 2945* (USM); San Ignacio, San José de Lourdes, Buenos Aires, 5°4'S 78°52'W, 1880 m, 10.XI.2000, *Vásquez et al. 26626* (USM).

14. ***Pentacalia millei*** (Greenm.) Cuatrec. in Phytologia 49: 248. 1981 (Fig. 18 → p. 66).

≡ *Senecio millei* Greenm. in Ann. Missouri Bot. Gard. 25: 809. 1938. **Holotypus: Ecuador. Loja:** Loja, VIII.1847, *Seemann s.n.* [*662*] (K [K000497619] image!; iso-: MO-3532056 fragm. image!).

= *Pentacalia zamorana* H. Rob. & Cuatrec. in Novon 3: 291. 1993, **syn. nov. Holotypus: Ecuador. Loja/Zamora-Chinchipe:** road from Loja to Zamora, km 12–14, 2800 m, 18.XI.1961, *Dodson & Thien 1375* (US [US00406375] image!; iso-: US [US00516663, US01844762] image!, SEL [not located or never received by SEL, B. Holst, pers. comm.]).

= *Pentacalia mikanioides* J. Calvo in Phytotaxa 364: 197. 2018, **syn. nov. Holotypus: Ecuador. Zamora-Chinchipe:** límite provincial Loja-Zamora, carretera antigua a Zamora, 3°58'56"S 79°08'07"W, 2620 m, *Calvo & Arnelas 7698* (2 part-specimen: HUTPL-13587!; iso-: HUTPL-13588 [three specimens]!, LOJA).

Plants scandent; stems terete, furrowed, glabrescent to arachnoid-floccose (rarely tomentose), solid or partially fistulous. *Leaves* alternate, simple, petiolate; petioles 0.5–1.2(–2.6) cm long; laminas 5.6–9(–19) × 2.3–4(–10) cm, lanceolate to elliptic, apex acute to attenuate, base obtuse to subcordate, margin entire or remotely mucronate-denticulate (rarely sinuate-dentate), glabrous or glabrescent on adaxial surface (sometimes with remnants of arachnoid-floccose indumentum), sparsely arachnoid-floccose to glabrescent (rarely tomentulose) on abaxial surface, rather coriaceous (rarely chartaceous), concolorous, secondary and tertiary veins conspicuous on both surfaces, slightly protruding on abaxial surface. *Synflorescences* mostly terminal, thyrsoid-paniculiform, with bracts linear-subulate; synflorescence branches glabrescent to arachnoid-floccose (rarely tomentulose). *Capitula* heterogamous, disciform, sessile or very shortly pedunculate; peduncles 0.5–2 mm long, arachnoid-floccose, with 0–1 linear bracteoles; involucres cylindrical, somewhat arachnoid near base or almost glabrous; involucral bracts 8, (2.3–)3.2–4 × 0.6–1.2 mm, linear-oblong; supplementary bracts 4–5(–7), 0.7–1.6 × 0.4–0.5 mm, linear-subulate, extending to

¼–⅓ the length of involucral bracts. *Peripheral florets* (1–)2–4, pistillate; corollas 2.7–3.3 mm long, tubular, 4(–5)-lobed, whitish. *Disc florets* 8–11, hermaphroditic; corollas (3–)3.6–4.2 mm long, tubular, 5-lobed, whitish; anther bases caudate, ½ to as long as filament collar, appendages c. 0.3 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 1.6–1.8 × c. 0.5 mm, cylindrical, 5–9-ribbed, glabrous; pappus 3–4 mm long, bristles capillary, barbellate, whitish.

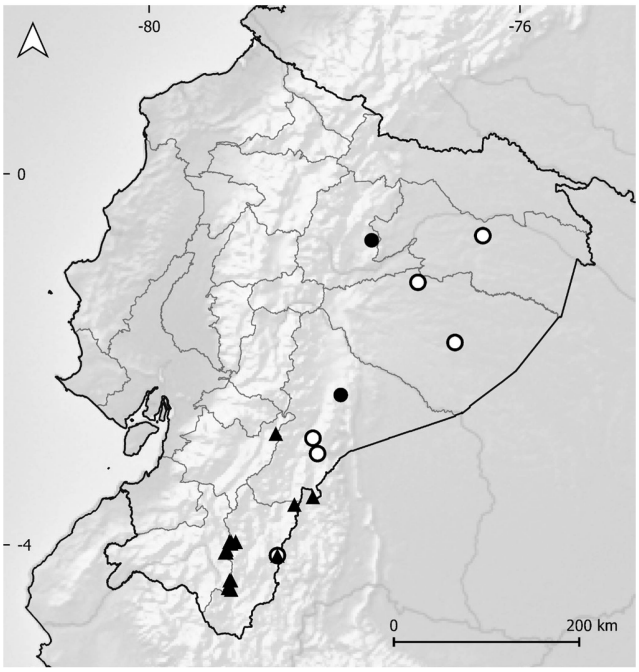
Additional iconography. – Calvo & Buira (2018: 198, fig. 4).

Etymology. – This species is named after the Jesuit Father Luis Mille (1873–1953), a Belgian-born botanist established in Quito and pupil of Luis Sodiro (see details above).

Distribution, ecology and phenology. – Ecuador (Azuay, Loja, Morona-Santiago, Zamora-Chinchipe) and N Peru. This species grows in montane forests, at elevations of 1000–3050 m. Specimens in flower have been collected nearly all year round (Map 8).

Notes. – *Pentacalia millei* is a quite variable species concerning the leaf morphology but well-characterized by its mostly terminal, thyrsoid-paniculiform synflorescences composed of sessile or very shortly pedunculate, disciform capitula rather clustered at distal part of synflorescence branches.

The species was described from material collected by Berthold C. Seemann (1825–1871) nearby Loja. The type material shows elliptic, coriaceous leaves c. 5 cm long with sparse arachnoid-floccose indumentum on both surfaces. Two related species were later described from the same region, i.e., *P. zamorana* and *P. mikanioides*. The former was separated by having glabrous involucres and leaves (rarely with traces of evanescent arachnoid indumentum near the midvein) and sinuate-dentate leaf margin. On the other side, I described *P. mikanioides* as a distinct species based on a collection having very large (10–19 cm long), rather chartaceous leaves and tomentose stems instead of arachnoid. After five years dedicated on the group, I had the opportunity of studying additional collections and coming back to the field. I then concluded that the consistency and size of the leaves is quite variable; one finds the typical forms (*Madsen 75586*) but also specimens with large, chartaceous leaves (*van der Werff et al. 21784*). The leaf indumentum also varies from sparsely arachnoid-floccose (*Palacios 12940*) to almost glabrous (*Øllgaard et al. 74195*) and the leaf margin could be entire (*Mera & Sinche 4927*), remotely mucronate-denticulate (*Madsen 86403*), or sinuate-dentate (*Dodson & Thien 1375*). Since all these forms present a puzzling distributional pattern around the same region (the Loja/Zamora pass between 1900–2800 m), any attempt to recognize more than a single species seems unworkable and would contribute to complicate the taxonomy of this already complex group.



Map 8. – Distribution of *Pentacalia millei* (Greenm.) Cuatrec. (triangle), *P. moronensis* H. Rob. & Cuatrec. (open circle), and *P. napoensis* H. Rob. & Cuatrec. (closed circle).

The collections *Matezki 311* and *417* from San Francisco Scientific Station (Zamora-Chinchipe) are tentatively identified as *Pentacalia millei*. *Matezki 417* does not have strictly peripheral pistillate florets but 1–2 florets with staminodes. *Matezki 311*, from exactly the same locality, presents most capitula with all florets hermaphroditic and a few capitula with 1–2 peripheral florets with staminodes. In addition, the capitula of this latter collection are unusually small (involucral bracts 2.3–2.6 mm long). Considering that the discoid capitula of *Matezki 311* are completely an exception, the only entry of *Pentacalia millei* in the key is by disciform capitula.

Nordenstam (1999) recorded *Pentacalia loretensis* (Cuatrec.) Cuatrec. in Ecuador based on the collection *Gentry 80251* (QCNE), which is here identified as *P. millei* because of the obtuse to rounded leaf bases. The type material of *P. loretensis* shows leaves with cuneate base and conspicuous tertiary veins (in dried specimens). Otherwise, the disciform, sessile capitula and the glabrescent leaves with remnants of an evanescent indumentum match well the variability observed in *P. millei*. These two species may be conspecific, but a deeper study of the Peruvian populations is needed. Likewise, the relation with *P. mucronatifolia* H. Rob. & Cuatrec. from northern Peru should be further examined. This latter species is very similar to *P. millei* and apparently it only differs in having

leaves rounded and abruptly apiculate, which does not seem a discriminating character.

The collection *Beltrán & Foster 1313* (F, US, USM) from the Cordillera del Cóndor (Peruvian slopes) was identified with doubt as *Pentacalia tarapotensis* (Cabrera) Cuatrec. This species was described on the basis of a Spruce collection from the surroundings of Tabalosos, northern part of the San Martín Department in Peru. It is characterized by having coriaceous leaves with evanescent indumentum on the adaxial surface and rather ochraceous arachnoid-tomentose indumentum on the abaxial surface, and disciform small capitula with involucral bracts c. 3 mm long. *Beltrán & Foster 1313* shows glabrous leaves or almost so and capitula with involucral bracts c. 2.8 mm long. Despite the size of the capitula, which are slightly smaller than those of the typical forms of *P. millei*, the remaining characters fall within the variability of this latter species.

Another collection that seems to be related with *Pentacalia millei* and *P. tarapotensis* is *Neill et al. 15903* (LOJA, QCNE), also from the Cordillera del Cóndor. This material has leaves with entire margin, sparse arachnoid-floccose indumentum on the adaxial surface, dense whitish-lanate indumentum on the abaxial surface, and capitula solitary or arranged in lax groups of 2–3 along the synflorescence branches. Because of the whitish-lanate abaxial leaf surface, the specimen also resembles *P. herzogii* (Cabrera) Cuatrec. from southern Peru and Bolivia (Calvo, 2021). This combination of characters prevents me, for the time being, from identifying it.

Additional studies should be carried out in northern Peru to firmly establish the taxonomy of this complex assembly of taxa centered around *Pentacalia millei* (described in 1938). It includes the aforementioned *P. loretensis* (in 1951), *P. tarapotensis* (in 1954), and *P. mucronatifolia* (in 1993), all of them described from a single collection. They have thyrsoid-paniculiform synflorescences composed of sessile or subsessile disciform capitula and thrive in the same region between southern Ecuador (Loja, Zamora-Chinchipe) and northern Peru (Amazonas, Cajamarca, Loreto, San Martín). They were differentiated by leaf characters concerning shape and indumentum that seem to be very variable and therefore scarcely informative for taxonomic purposes.

Finally, it is noteworthy that some specimens corresponding to *Pentacalia millei* has been misidentified as *P. theifolia* (e.g. *Øllgaard et al. 74195*). They can be easily differentiated by the capitulum type (disciform in *P. millei* vs. dicoid in *P. theifolia*) and the peduncles (sessile to subsessile in *P. millei* vs. 3–12 mm long in *P. theifolia*).

Additional specimens examined. – **Azuay:** Sevilla de Oro, límite con el P.N. Río Negro, 2°48'S 78°38'W, 3030 m, 28.VII.2023, *Minga, Calvo & Benítez 4154* (HA). **Loja:** Yangana, cerro Toledo, parte media, 4°23'S 79°7'W, 2875 m, 20.VII.2023, *Calvo, Benítez & Espinosa-Ortega 8507* (HUTPL); road Loja–Zamora, on the border to Zamora-Chinchipe, [3°59'S 79°8'W], 2600–2800 m, 13.IV.1974, *Harling & Andersson 13539* (US); Namanda, 4°3'S 79°10'W, 2560 m, 26.V.2006, *Mera & Sinche 4927* (HUTPL); cerro Toledo, km 15 carretera Yangana–Antenas, 4°23'S 79°7'W, 2920 m, 12.XII.1995, *Merino et al. 4700* (LOJA); P.N. Podocarpus, roadsides above Nudo, 4°5'S 79°11'W, 2750–2850 m, 4.V.1984, *Øllgaard, Madsen & Christensen 74195* (AAU, LOJA, QCA, QCNE, US); P.N. Podocarpus, E of Nudo de Cajanuma, trail E of "centro de información" to crest on trail to lagunas de Compadre, 4°5'S 79°10'W, 2850–3050 m, 7.VI.1988, *Øllgaard 74631* (AAU); P.N. Podocarpus, en cerro Toledo, 4°23'S 79°8'W, 2900 m, I.1995, *Palacios 12940* (US). **Morona-Santiago:** Cordillera del Cóndor, Cuangos, 20 km E of Gualaquiza, 3°29'S 78°14'W, 1500 m, 19.VII.1993, *Gentry 80251* (QCNE). **Zamora-Chinchipe:** El Tambo, carretero viejo a Zamora desde El Tiro, 3°59'S 79°7'W, 2505 m, 19.VII.2023, *Calvo, Benítez & Espinosa-Ortega 8486* (HUTPL); El Tambo, carretero viejo a Zamora desde El Tiro, 3°58'S 79°8'W, 2630 m, 19.VII.2023, *Calvo, Benítez & Espinosa-Ortega 8489* (HUTPL); vicinity of Ecuacorrientes copper mine concession, vicinity of mine site, along trail above parking area near end of road, 3°34'S 78°26'W, 1330–1360 m, 21.IX.2007, *Croat & Ferry 98950* (QCNE); P.N. Podocarpus, new road Loja–Zamora, E of cerro Yanococha, along former indian trail to Zamora, 3°59'S 79°7'W, 2550–2650 m, 26.XI.1988, *Madsen 75586* (AAU, LOJA, QCA, QCNE); P.N. Podocarpus, road Yangana–Valladolid, km 21, 4°28'S 79°9'W, 2700 m, 10.XI.1989, *Madsen 86403* (AAU, LOJA, QCA); Área of Estación Científica San Francisco Research Station, c. 30 km away from the city of Loja on highway towards Zamora, 3°58'S 79°4'W, 1900 m, 9.VIII.2000, *Matezki 311* (HUTPL, LOJA, QCA, QCNE); ibid., s.d., *Matezki 417* (HUTPL, LOJA, QCNE); km 20 de la vía Loja–Zamora, [3°58'S 79°7'W], 2450 m, 30.I.1996, *Merino et al. 4804* (LOJA); Nangaritza Canton, Pachicutza, camino al hito, cordillera del Cóndor, 4°7'S 78°37'W, 1000–1100 m, 19.X.1991, *Palacios, Aymard & Freire 8374* (QCNE, US); Palanda, reserva Tapichalaca, sendero los Pericos, 4°29'S 79°7'W, 2470–2600 m, 20.VI.2014, *Pérez et al. 7097* (G, QCA); road Loja–Zamora, km 16, near the pass to Loja prov., [3°58'S 79°8'W], 2700 m, 20.V.1967, *Sparre 16520* (AAU); Palanda, Reserva Tapichalaca, near road between Yangana and Valladolid, S of Podocarpus N.P., 4°29'S 79°7'W, 2500 m, 29.X.2006, *van der Werff, Gray & Quizhpe 21784* (LOJA); ibid., 2500–2700 m, 31.X.2006, *van der Werff, Gray & Quizhpe 21856* (LOJA, QCNE).

15. ***Pentacalia moronensis*** H. Rob. & Cuatrec. in Novon 3: 288. 1993 (Fig. 19, 20A–E → p. 67, 68).

    Holotypus: Ecuador. Morona-Santiago: along new road Méndez–Morona, km 55–62, 800 m, 23.VIII.1989, *van der Werff & Gudiño 11385* (US [US00406379] image!; iso-: AAU!, MO-3825924 image!, QCNE [QCNE56]!).

Plants scandent; stems terete, furrowed, glabrous, fistulous. *Leaves* alternate, simple, petiolate; petioles 1.5–3 cm long; laminas 10–17 × 3.6–8.5 cm, narrowly to broadly elliptic, apex acuminate, base cuneate to obtuse, margin entire, glabrous on both surfaces, fleshy (drying coriaceous), concolorous, secondary veins barely conspicuous on both surfaces. *Synflorescences* mostly lateral, axillary, racemose-paniculiform, similar or slightly longer than leaf length, with bracts linear-subulate; synflorescence branches tomentulose. *Capitula* homogamous, discoid, pedunculate; peduncles 6–10 mm long, tomentulose, with 1–2 linear-subulate bracteoles; involucres cylindrical, glabrous; involucral bracts 8, 7.8–9.7 × 1.2–2.4 mm, linear-oblong; supplementary bracts 2–3, 2.8–3.9 × 0.5–0.6 mm, linear-subulate, extending to ¼ the length of involucral bracts. *Disc florets* 20–23, hermaphroditic; corollas 8.6–10.8 mm long, tubular, 5-lobed, pale

yellow; anther bases caudate, ½–⅔ as long as filament collar, appendages c. 0.7 × 0.15 mm; style branches truncate with crown of sweeping trichomes. *Achenes* c. 1.5 × 0.5 mm (immature), cylindrical, glabrous; pappus 8.6–10.5 mm long, bristles capillary, barbellate, whitish.

Etymology. – The epithet *moronensis* refers to the provenance of the type material, i.e., the Ecuadorian province of Morona-Santiago.

Distribution, ecology and phenology. – Endemic to Ecuador (Morona-Santiago, Orellana, Pastaza, Zamora-Chinchipe). This species grows in tropical rainforests (Amazon rainforest), at elevations of 230–1000 m. Collected in flower between July and October (Map 8).

Notes. – This species is well-characterized by its glabrous leaves with inconspicuous secondary and tertiary veins, the lateral, axillary synflorescences, which are racemose-paniculiform and lax, and the long-pedunculate and relatively large capitula. As discussed in the protologue of *Pentacalia moronensis*, this species is very similar to *P. freemanii* (Britton & Greenm.) Cuatrec. [= *P. nigella* (V.M. Badillo) Cuatrec.] from Guyana, Trinidad and Tobago, and Venezuela. *Pentacalia retroflexa* from Huila (Colombia) is also morphologically very close. These two latter species have leaves smaller than those of *P. moronensis*, but otherwise no useful characters exist to differentiate one from another. They may fall within the variability of a single species, but their apparent well-delimited and distant distribution areas prevent me, for the time being, to propose the synonymy. Additional collections would help to better understand the variability and distribution of these three close taxa.

The overall morphology of this species also resembles that of *Pentacalia maynasensis* H. Rob. & Cuatrec., a species described from the Amazonian lowlands of the Peruvian department of Loreto. They differ in capitulum type (discoid in *P. moronensis* vs. disciform in *P. maynasensis*).

Additional specimens examined. – **Morona-Santiago:** along new road Méndez–Morona, km 30–35, [2°51'S 78°14'W], 800 m, 19.VIII.1989, *van der Werff & Gudiño 11260* (AAU, US). **Orellana:** P.N. Yasuní, estación científica Yasuní, contiguo al río Tiputini, 7 km E de la carretera Repsol-YPF, km 44, desvío hacia el pozo Tivacuno, 0°40'S 76°24'W, 200–300 m, 10.X.2012, *Zambrano 6468* (QCA). **Pastaza:** pozo petrolero "Golondrina" de Petro-Canada, 25 km (aprox.) al NW de Curaray, 1°10'S 77°6'W, 400 m, 23.VI.1989, *Rubio & Gudiño 205* (AAU, QCNE); pozo petrolero "Garza" de Tenneco, 35 km (aprox.) al NE de Montalvo, 1°49'S 76°42'W, 260 m, 2–12.VII.1989, *Zak & Espinoza 4751* (QCNE, US). **Zamora-Chinchipe:** Nangaritza, río Nangaritza, Pachicutza, camino al hito de Pachicutza, 4°7'S 78°37'W, 900–1000 m, 18.X.1991, *Palacios et al. 8232* (LOJA, QCNE, US, USM).

16. ***Pentacalia napoensis*** H. Rob. & Cuatrec. in Novon 3: 289. 1993 (Fig. 21 → p. 69).

Holotypus: Ecuador. Napo: 3 km este del caserío de Huamaní, al norte de la carretera Hollín–Loreto, 0°43'S 77°36'W, 1200 m, 17.IX.1988, *Hurtado & Alvarado 478* (US [US00406378] image!; iso-: AAU!, MO-3809304, QCNE [QCNE57]!).

Plants scandent; stems terete, furrowed, glabrous, fistulous. *Leaves* alternate, simple, petiolate; petioles 2–3.2 cm long; laminas 10–14.5 × 3–6.8 cm, narrowly elliptic to elliptic, apex acute to attenuate, base attenuate to cuneate, margin entire, glabrous on both surfaces, somewhat fleshy (drying coriaceous), concolorous, secondary and tertiary veins conspicuous on both surfaces. *Synflorescences* mostly lateral, axillary, racemiform, similar in length than leaves, with bracts linear-subulate; synflorescence branches tomentulose. *Capitula* homogamous, discoid, pedunculate; peduncles 3–5 mm long, tomentulose, with 1–2 linear-subulate bracteoles; involucres cylindrical, glabrous; involucral bracts (7–)8, 7.7–10 × 1.1–1.7 mm, linear-oblong; supplementary bracts 2–3, 1–1.8 × c. 0.5 mm, linear-subulate, extending to < ¼ the length of involucral bracts. *Disc florets* 12–14, hermaphroditic; corollas 10–11 mm long, tubular, 5-lobed, pale greenish-yellow; anther bases caudate, ¾ as long as filament collar, appendages c. 0.4 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* c. 2 × 0.6 mm, cylindrical, 7–8-ribbed, glabrous; pappus 6.2–8 mm long, bristles capillary, barbellate, whitish.

Etymology. – The epithet *napoensis* refers to the provenance of the type material, i.e., the Ecuadorian province of Napo.

Distribution, ecology and phenology. – Endemic to Ecuador (Morona-Santiago, Napo). This species grows in premontane rainforests, at elevations of 700–1400 m. Collected in flower in August and September (Map 8).

Notes. – This species is known only from the type material (Napo) and one additional collection from the region of Macas (Morona-Santiago). It is morphologically very close to *Pentacalia hurtadoi*, from which it can mainly be differentiated by its leaves with prominent secondary and tertiary veins and the longer and narrower capitula. As indicated in *P. hurtadoi* (see comments under that species), additional collections are needed for better understanding the variability of these species and firmly establish their taxonomy.

Additional specimen examined. – **Morona-Santiago:** trail Jordán (77°59'W 2°21'S) to Santa Rosa (77°55'W 2°27'S), 20–30 km SE of Macas, [2°23'S 77°56'W], 700–1400 m, 24.VIII.1996, *Ståhl, Balslev & Bernal 2923* (AAU, QCA).

17. ***Pentacalia nordenstamii*** J. Calvo, **sp. nov.** (Fig. 20F–I, 22 → p. 68, 70).

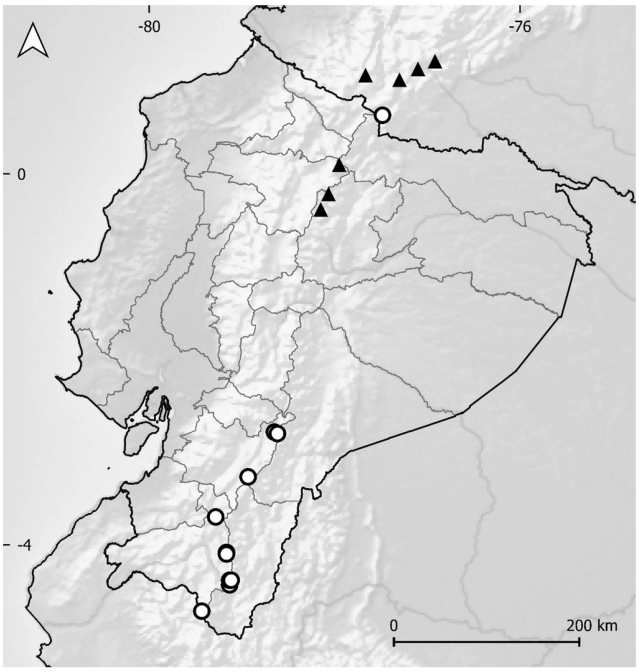
Holotypus: Ecuador. Napo: Oyacachi, just E of the village, 0°13'S 78°04'W, 3100 m, 7.III.1996, *Ståhl, Øllgaard & Navarrete 2141* (QCA [QCA18391]!; iso-: AAU!, QCNE-154496!, S).

Pentacalia nordenstamii belongs to the species group with terminal, thyrsoid-paniculiform synflorescences composed of radiate capitula with reduced limbs. It differs from the closest species P. magnusii (Hieron.) Cuatrec. by the capitula with longer peduncles, which results in a laxer synflorescence, and the usually longer limbs. From P. corazonensis, the new species further differs in having reduced, curved downward limbs (vs. well-developed, patent) and shorter peduncles.

Plants scandent; stems terete, furrowed, tomentose, solid. *Leaves* alternate, simple, petiolate; petioles 1.2–2.1 cm long; laminas 6.5–14.5 × 5.2–9.8 cm, broadly elliptic to ovate (concave in living plants), apex obtuse, sometimes mucronate or barely acuminate, base rounded, margin entire to remotely mucronate-denticulate, glabrous or with some trichomes on the midrib and secondary veins on adaxial surface, sparsely pilose-tomentose on abaxial surface, rather chartaceous, concolorous or barely discolorous, secondary and tertiary veins conspicuous on both surfaces, slightly protruding on abaxial surface. *Synflorescences* mostly terminal, thyrsoid-paniculiform, with bracts linear, reduced; synflorescence branches tomentose. *Capitula* heterogamous, radiate, pedunculate; peduncles 3–12 mm long, tomentose, with 1–4 linear-subulate bracteoles; involucres cylindrical, with scattered trichomes; involucral bracts 8, 5.2–7.8 × 1.2–2.2 mm, linear-oblong; supplementary bracts (1–)3–5, 1.9–4.8 × c. 0.5 mm, linear-subulate, extending to ⅓–½ the length of involucral bracts. *Ray florets* 5, pistillate; corollas 6.6–13 mm long, limbs (1.6–)4.4–7 × 0.8–1.5 mm, curved downward and slightly involute, subentire to 3-toothed, yellow. *Disc florets* (9–)11–16, hermaphroditic; corollas 7–9.2 mm long, tubular, 5-lobed, yellow initially, becoming burgundy when they mature; anthers orange, anther bases caudate, as long as to slightly longer than filament collar, appendages c. 0.5 × 0.2–0.3 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 2.5–3 × 0.5–0.6 mm, cylindrical, 7–8-ribbed, glabrous; pappus 6.5–6.7 mm long, bristles capillary, barbellate, whitish.

Etymology. – Species named after Bertil Nordenstam, Swedish botanist and specialist in neotropical *Senecioneae*. Nordenstam prepared the treatment of the tribe *Senecioneae* for the *Catalogue*.

Vernacular names and uses – According to *Chindoy 117* (COL) this species is a medicinal plant and in southern Colombia it is known under the vernacular names "Shajansäbeunjąja" or "Chontará".



Map 9. – Distribution of *Pentacalia nordenstamii* J. Calvo (triangle) and *P. oronocensis* (DC.) Cuatrec. (open circle).

Distribution, ecology and phenology. – Colombia (Nariño, Putumayo) and Ecuador (Imbabura, Napo). This species thrives in the montane forests and in the transitional habitats between the montane forest and the paramo ecosystems, at elevations of 3100–3420 m. It was observed growing along with *Calceolaria microbefaria* Kraenzl. (*Scrophulariaceae*), *Dendrophorbium tipocochense* (Domke) B. Nord. (*Compositae*), *Jaltomata viridiflora* (Kunth) M. Nee & Mione (*Solanaceae*), *Pentacalia disciformis*, *P. oellgaardii* J. Calvo (described below), *Polylepis pauta* Hieron. (*Rosaceae*), *Senecio involucratus* DC. (*Compositae*). Specimens in flower have been collected in March, July, and December (Map 9).

Notes. – *Pentacalia nordenstamii* has been confused with *P. carmelana* (Nordenstam, 1999), species here synonymized with *P. huilensis* (see above). The new species differs in having leaves somewhat tomentose on the abaxial surface, chartaceous, with secondary veins almost as prominent as tertiary veins and not arched (vs. glabrous, rarely with scattered pilose indumentum, coriaceous, with very prominent and arched secondary veins), tomentose involucres (vs. glabrous), longer supplementary bracts (1.9–4.8 mm vs. 1.2–2.6 mm), and curved ray floret limbs (vs. patent).

This species may be also confused with *Pentacalia corazonensis* because of the similar leaf morphology, synflorescence type,

and involucre architecture. They mainly differ in the size and shape of the ray floret limbs ((1.6–)4.4–7 × 0.8–1.5 mm, curved downward in *P. nordenstamii* vs. 8.3–10.5 × 1.8–2.3 mm, patent in *P. corazonensis*) and peduncle length (3–12 mm in *P. nordenstamii* vs. 8–23 mm in *P. corazonensis*). The leaves of the new species usually are concave, which is readily noticeable in living plants.

The leaves and the capitula of *Pentacalia nordenstamii* also resemble those of the Colombian species *P. magnusii* (Hieron.) Cuatrec. In both species the ray floret limbs are reduced, although these are longer in *P. nordenstamii* ((1.6–)4.4–7 mm vs. c. 2.5 mm). *Pentacalia nordenstamii* further differs in having longer peduncles (3–12 mm vs. subsessile or with a short peduncle up to 2 mm). In *P. magnusii* the capitula are subsessile or very shortly pedunculate, arranged in lax groups of 2–4 capitula at the distal part of the synflorescence branches. The synflorescence is therefore much condensed in *P. magnusii* (see *Giraldo-Cañas et al. 5995*, COL; also https://www.inaturalist.org/observations/130298512). The distribution areas of these species do not overlap; *P. nordenstamii* is known from northern Ecuador and southern Colombia whereas *P. magnusii* is distributed in the central and northern Andes of Colombia. It is noteworthy that *P. magnusii* has often been misidentified with *P. breviligulata* (e.g. *Díaz-Piedrahita 1699*, COL; *Fajardo Gutiérrez et al. 2204*, JBB), a species described from southern Colombia (near Popayán, Cauca) and characterized by its capitula on long, flexuose peduncles, tending to be nodding, and involucres composed of wide involucral bracts. A specimen from Nariño corresponding to the new species was also misidentified as *P. breviligulata* (see *Baca Y164*, COL).

Additional specimens examined. – Colombia. **Nariño:** Tangua, vereda las Piedras, páramo las Piedras, [1°1'N 77°18'W], 3100–3500 m, 9.VI.2006, *Baca et al. Y164* (COL); en límites con el Putumayo, páramo de Bordoncillo, borde de carretera desde Pasto hacia Sibundoy, sector más alto de la vía, [1°8'N 77°6'W], 3700 m, 27.X.2007, *García 668* (MA); volcán Azufral, ascenso al volcán desde pueblo El Espino, margen izquierdo del camino, [1°4'N 77°40'W], 8.XI.2007, *García 694* (MA). **Putumayo:** valle de Sibundoy, 2 km N Sibundoy, [1°13'N 76°55'W], 2475 m, 10.III.1963, *Chindoy 117* (COL). Ecuador. **Imbabura:** Cayambe, lago San Marcos, [0°6'N 77°57'W], 3415 m, 2.XII.1961, *Cazalet & Pennington 5466, 5477* (US). **Napo:** Quijos, Reserva Ecológica Antisana, carretera Pifo–Papallacta, 3 km oeste de La Virgen, laguna Miguacocha–río Tumiguina, 0°23'S 78°9'W, 3420 m, 25.VII.1998, *Vargas et al. 1985* (QCNE, US).

18. ***Pentacalia oellgaardii*** J. Calvo, **sp. nov.** (Fig. 23, 24 → p. 71, 72).

Holotypus: Ecuador. **Napo:** páramo de Guamaní, N of the road Pifo–Papallacta, W of the pass, 0°18'S 78°15'W, 3800 m, 10.XI.1990, *Øllgaard 98236* (G [G00398267]!; iso-: AAU!, QCA [QCA149408]!, QCNE-121868!).

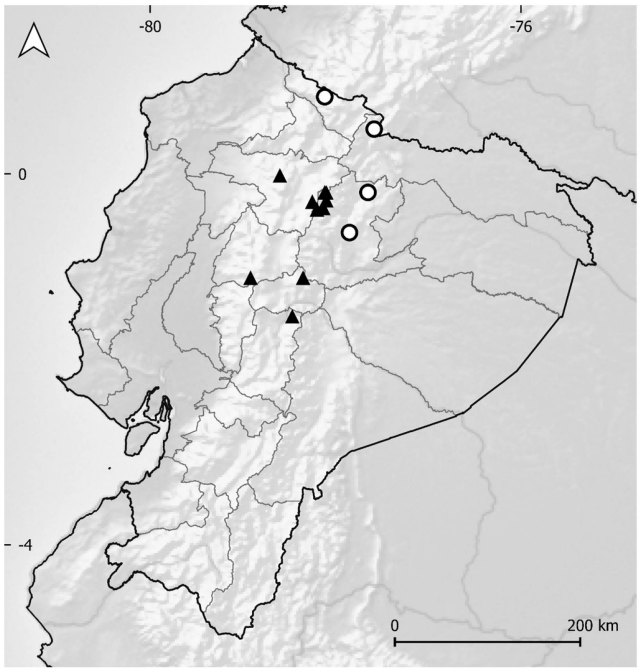
Pentacalia oellgaardii belongs to the species group with terminal, corymbiform synflorescences with radiate capitula and indumentum on the abaxial leaf surface. It differs from the closest species P. popayanensis (Hieron.) Cuatrec. by the well-developed, patent ray floret limbs (vs. reduced and curved downward) and the whitish indumentum of involucres, synflorescence branches, and leaves (vs. ochraceous indumentum).

Plants scandent; stems terete, furrowed, floccose-lanate, becoming glabrescent, solid. *Leaves* alternate, simple, petiolate; petioles 0.7–1.1 cm long; laminas 5–8.3 × 1.8–2.3(–3.9) cm, lanceolate to elliptic, apex acute, base cuneate to obtuse, margin entire, glabrous except for some arachnoid trichomes on the midrib on adaxial surface, whitish lanate on abaxial surface, subcoriaceous, discolorous, secondary veins inconspicuous on adaxial surface, covered by indumentum on abaxial surface. *Synflorescences* mostly terminal, corymbiform, with bracts linear, reduced; synflorescence branches floccose-lanate. *Capitula* heterogamous, radiate, pedunculate; peduncles 5–18 mm long, floccose-lanate, with 2–4 linear-subulate bracteoles; involucres cylindrical, arachnoid to floccose; involucral bracts 8, 5.9–6.3 × 1.2–2 mm, linear-oblong; supplementary bracts 4–5, 2–4.7 × 0.7–0.8 mm, linear-subulate, extending to ⅓–½ the length of involucral bracts. *Ray florets* 5–7, pistillate; corollas 11.5–13 mm long, limbs 6–8 × 2.1–2.2 mm, patent, apex 2–3-toothed, yellow. *Disc florets* 14–15, hermaphroditic; corollas 7.8–8.9 mm long, tubular, 5-lobed, yellow; anther bases caudate, as long as to slightly longer than filament collar, appendages c. 0.5 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 2.8–3.1 × 0.6–0.8 mm, cylindrical, 5–6-ribbed, glabrous; pappus 6.3–8.4 mm long, bristles capillary, barbellate, whitish.

Etymology. – This species is named after the Danish botanist Benjamin Øllgaard, who widely travelled and collected in Ecuador.

Distribution, ecology and phenology. – Endemic to Ecuador (Chimborazo, Cotopaxi, Napo, Pichincha, Tungurahua). The species grows in montane forests, at elevations of 3250–3800 m. Some species observed in the same habitat are: *Baccharis* spp., *Munnozia jussieui* (Cass.) H. Rob. & Brettell, *Pentacalia nordenstamii* (*Compositae*), *Polylepis pauta* Hieron. (*Rosaceae*), and *Valeriana microphylla* Kunth (*Valerianaceae*). Specimens in flower have mostly been collected between September and December (Map 10).

Notes. – *Pentacalia oellgaardii* is characterized by the mostly terminal, corymbiform synflorescences composed of radiate capitula with well-developed, patent limbs and by having lanate indumentum on the abaxial leaf surfaces. Slight variability, however, has been observed in leaf shape and indumentum color. The typical forms have whitish indumentum and they come from the Cordillera Oriental around the limit between the provinces of Pichincha and Napo. Two specimens



Map 10. – Distribution of *Pentacalia oellgaardii* J. Calvo (triangle) and *P. palaciosii* H. Rob. & Cuatrec. (open circle).

collected farther south (Tungurahua, Chimborazo) show elliptic leaves, significatively wider. A third specimen from the Cordillera Occidental (Alaspungo, Pichincha) has rather ochraceous lanate indumentum. This specimen was collected by Sodiro in September 1899 and is kept at QPLS. It bears a Sodiro handwritten label with the following information: "*Senecio fuligineum Sod. Differt a S. corazonense Hier. indumento, inflorescentia, capitulis magis congestis, bracteis involucri*". The name *Senecio fuligineus* Sodiro was never published and I did not retrieve the epithet because it means dirty-brown, sooty, most probably referring to the indumentum color. Since the typical forms display a rather whitish indumentum, I prefer naming this species after the collector of the type material.

As pointed out by Sodiro (in sched.), the species bears a resemblance to *Pentacalia corazonensis*, but this latter species mainly differs in having abaxial leaf surfaces glabrescent to tomentose instead of lanate. Their leaves are also larger (7–13 × 3.9–8 cm vs. 5–8.3 × 1.8–2.3(–3.9) cm in *P. oellgaardii*) and the involucres only bear some scattered trichomes or they are sparsely tomentulose (vs. arachnoid to floccose in *P. oellgaardii*). Confusion with *P. popayanensis* may also occur (see comments under that species).

Additional specimens examined. – **Cotopaxi:** 7 km from the point where the Ingapirca–Corazón road divides from the Angamarca road, 1°7'S 78°55'W, 3590 m, 11.XI.1984, *Brandbyge & Jørgensen 42872* (QCA, US); Pinjupamba–Utuñac, [1°32'S 78°28'W], 3250–3330 m, 3.XII.2008, *Jaramillo 28063* (QCA). **Napo:** Reserva Ecológica Oyacachi, camino hacia Salve Facha, 0°17'S 78°6'W, 3776 m, 14.IX.2010, *Cárate et al. 1334* (QCA); Quijos, Reserva Ecológica Antisana, carretera Pifo–Baeza, páramo de la Virgen, 0°23'S 78°12'W, 3730 m, 24.XI.1998, *Freire-Fierro, Vargas & Narváez 2875* (QCNE, US); prope Papallacta, [0°22'S 78°8'W], 3300 m, IV.1918, *Mille 736* (QPLS); about 3 km W of Oyacachi, 0°12'S 78°6'W, 3550 m, 27.III.1996, *Ståhl & Navarrete 2272* (AAU, QCA, QCNE, S); W of Oyacachi, 0°12'S 78°6'W, 3600 m, 3.VI.1996, *Ståhl, Báez & Navarrete 2589* (AAU); about 15 km W of Oyacachi, 0°12'S 78°7'W, 3550–3600 m, 7.X.1996, *Ståhl & Ternéus 3046* (AAU, QCA). **Pichincha:** in silvis m. Pichincha prope Alaspungo, [0°1'S 78°36'W], IX.1899, *Sodiro 74* (QPLS). **Tungurahua:** Santiago de Píllaro, P.N. Llanganates, 500 m al E del río Millín, 1°7'S 78°21'W, 3600 m, 12.X.1998, *Narváez & Quizhpe 325* (QCNE, US).

19. ***Pentacalia oronocensis*** (DC.) Cuatrec. in Phytologia 49: 248. 1981 (Fig. 25, 26 → p. 73, 74).

≡ *Senecio oronocensis* DC., Prodr. 6: 423. 1838. **Lectotypus** (designated by Cabrera, 1954: 594): **Peru. Huánuco:** mont Orinoci, s.d., *Haenke s.n.* (P [P01816695]!; isolecto-: PR-612162 image!, PRC [PRC453194] image!).

= *Senecio baccharidiflorus* Rusby in Bull. New York Bot. Gard. 4: 397. 1907. **Lectotypus** (first-step designated by Cuatrecasas, 1981: 248; second-step designated by Calvo, 2021: 359): **Bolivia. La Paz:** Unduavi, IX.1894, *Bang 2494* (NY [NY00259115] image!; isolecto-: K [K000497617] image!, NY [NY00259114] image!).

= *Senecio cuzcoensis* Cabrera in Notas Mus. La Plata, Bot. 9(45): 196. 1944. **Holotypus: Peru. Cusco:** Paucartambo, Pillahuata, 2800 m, 18.VI.1940, *Vargas 1908* (LP [LP000463] image!).

= *Senecio ramonii* Cuatrec. in Fieldiana, Bot. 27(2): 53. 1951. **Holotypus: Peru. Huánuco:** Carpish, entre Huánuco y Tingo María, 2800–2900 m, 9.VIII.1947, *Ferreyra 2310* (US [US00123457]!).

= *Senecio megaphlebius* Greenm. & Cuatrec. in Cuatrecasas in Collect. Bot. (Barcelona) 3: 288. 1953. ≡ *Pentacalia megaphlebia* (Greenm. & Cuatrec.) Cuatrec. in Phytologia 49: 248. 1981. **Holotypus: Peru. Huánuco:** Villcabamba, hacienda on río Chinchao, c. 1830 m, 17–26.VII.1923, *Macbride 5157* (F [F0076946F]!; iso-: MO-908046 image!).

= *Senecio gibbiflorus* Cuatrec. in Brittonia 8: 42. 1954. ≡ *Pentacalia gibbiflora* (Cuatrec.) Cuatrec. in Phytologia 49: 246. 1981, **syn. nov. Holotypus: Ecuador. Azuay:** the eastern Cordillera, 1–8 km north of the village of Sevilla de Oro, 2440–2745 m, 27.VII–12.VIII.1945, *Camp E-4580* (F [F0076914F] image!; iso-: G [G00356017]!, GH [GH00012130] image!, K [K000497625] image!, MO-1649986 image!, NY [NY00259181] image!, P [P01816951]!, UC [UC986393] image!, US [US00123298] image!, VEN [VEN34460] image!).

Plants scandent; stems terete, furrowed, arachnoid-floccose, solid. *Leaves* alternate, simple, petiolate; petioles 1–2 cm long; laminas 7.6–11 × 3.3–5.5 cm, lanceolate to narrowly elliptic, apex attenuate to acuminate, base cuneate to obtuse, margin entire or remotely mucronate-denticulate, glabrous or glabrescent on adaxial surface (floccose initially), ochraceous-lanate on abaxial surface (sometimes rather whitish), rather coriaceous, discolorous, secondary veins slightly protruding (covered by indumentum) on abaxial surface. *Synflorescences* mostly terminal, thyrsoid-paniculiform, with bracts linear-subulate; synflorescence branches lanate to floccose. *Capitula* heterogamous (rarely homogamous), disciform (rarely discoid), sessile or subsessile (rarely shortly pedunculate with a peduncle up to 2 mm long); involucres cylindrical, arachnoid to lanate, usually ochraceous; involucral bracts 8, 3.3–3.5 × 0.9–1.8 mm, linear-oblong; supplementary bracts 3–5, 1.2–1.7 × 0.2–0.4 mm, linear-subulate, extending to ⅓ the length of involucral bracts. *Peripheral florets* (0–)3–5, pistillate; corollas 3.6–4.4(–5.6) mm long, tubular, 2–5-lobed, whitish to pale greenish-yellow. *Disc florets* 11–15, hermaphroditic; corollas 3.8–6.1(–7.5) mm long, tubular, 5-lobed, whitish to pale greenish-yellow; anther bases caudate, ½ as long as filament collar, appendages c. 0.5 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 1.5–3.2 × 0.4–0.5 mm, cylindrical, 7–8-ribbed, glabrous (rarelly papillose); pappus 3.8–7.2 mm long, bristles capillary, barbellate, whitish.

Additional iconography. – Cabrera (1944: 197, fig. 3, sub *Senecio cuzcoensis*); Calvo (2021: 361, fig. 13).

Etymology. – The epithet *oronocensis* refers to the mountains of Huánuco in central Peru. See additional comments in Calvo (2021).

Distribution, ecology and phenology. – Bolivia, Colombia?, Ecuador (Azuay, Loja, Morona-Santiago?, Sucumbíos, Zamora-Chinchipe), and Peru. It grows in humid low montane forests, at elevations of 2440–3420 m. In Sevilla de Oro (Azuay), this species was found co-occurring with *Pentacalia millei*, *P. ruficaulis*, and *P. theifolia*; in San Francisco Scientific Station (Zamora-Chinchipe) with *P. andrei* and *P. todziae* H. Rob. & Cuatrec.; and in Cajanuma (Loja) with *P. dorrii*. Specimens in flower have mostly been collected between July and January (Map 9).

Notes. – *Pentacalia oronocensis* is a quite variable species widely distributed from northern Ecuador to Bolivia (Calvo, 2021). The species is characterized by having an ochraceous lanate indumentum on the abaxial leaf surfaces, but a few specimens from Ecuador show a rather whitish indumentum (e.g. *Jørgensen et al. 819*, US).

Cabrera (1954) described the species as having 1–7 peripheral pistillate florets, these sometimes being absent. Later, Greenman and Cuatrecasas in Cuatrecasas (1953) described *Senecio megaphlebius* (here treated as a synonym, see Calvo & Beltrán, 2018) as a discoid species but pointed out that some capitula bear 1–2 peripheral florets. *Senecio gibbiflorus*, which is known only from the type, has also discoid capitula but otherwise it perfectly falls within the high variability that *P. oronocensis* shows throughout its wide distribution. The synonymy is here proposed.

There is a collection from Sucumbíos (*Jaramillo 7672*, AAU, QCA) that has entire leaves, involucres only slightly arachnoid at the base, and papillose achenes. Otherwise, there are no further characters to separate it from *Pentacalia oronocensis*. It represents the northermost collection of this species and because of the proximity to the border, its presence in Colombia is expected.

Additional specimens examined. – **Azuay:** Jima–San Miguel de Cuyes, km 17.2, páramos de Palcurco, 3°16'S 78°56'W, 3140 m, 4.XII.1990, *Jørgensen, Ulloa & Luteyn 92823* (AAU, QCA, QCNE); Sevilla de Oro, límite con el P.N. Río Negro, 2°48'S 78°37'W, 3120 m, 28.VII.2023, *Minga, Calvo & Benítez 4151* (HA). **Loja:** Cajanuma, Podocarpus, sendero del bosque nublado, pr. el refugio, 4°6'S 79°10'W, 2910 m, 13.XII.2017, *Calvo & Arnelas 7687* (HUTPL); Yangana, cerro Toledo, parte media, 4°23'S 79°7'W, 2875 m, 20.VII.2023, *Calvo, Benítez & Espinosa-Ortega 8508* (HUTPL); cordillera de Las Lagunitas, Amaluza–Jimbura–Zumba, km 36, 4°43'S 79°26'W, 3420 m, 23.XI.1994, *Jørgensen et al. 819* (LOJA, QCA, QCNE, US); road Loja–Saraguro km 52, track to Fierro Urco, km 1.5, 3°42'S 79°17'W, 3200 m, 14.XI.1996, *Lewis & Lozano 2805* (AAU, LOJA, QCA, QCNE, US); Yangana, cerro Toledo, 4°23'S 79°7'W, 2950 m, 20.II.2002, *Lozano et al. E-762* (LOJA); P.N. Podocarpus, E of Nudo de Cajanumo, just N of "centro de información", 4°5'S 79°10'W, 2900 m, 27.X.1988, *Madsen 75516* (AAU, LOJA, QCA); P.N. Podocarpus, carretera Yangana–Toledo, 4°23'S 79°8'W, 2600 m, I.1995, *Palacios 12989* (QCNE, US). **Sucumbíos:** carretera Santa Bárbara–La Bonita 8–10 km de Santa Bárbara, [0°38'N 77°29'W], 2864 m, 22.V.1985, *Jaramillo 7672* (AAU, QCA). **Zamora-Chinchipe:** camino cercano a la estación eléctrica San Ramón, 3°58'S 79°3'W, 29.X.2018, *Arnelas, Calvo & Armijos 1104* (HUTPL); Podocarpus N.P., nudo de Sabanilla ridge, on the continental divide, upper río Chinchipe watershed, near road pass between Yangana and Valladolid, 4°26'S 79°8'W, 2760 m, 26.IX.2007, *Neill et al. 16031* (LOJA).

20. ***Pentacalia palaciosii*** H. Rob. & Cuatrec. in Novon 3: 289. 1993 (Fig. 27 → p. 75).

Holotypus: Ecuador. Napo: cantón El Chaco, margen derecha del río Quijos, finca la "La Ave Brava" de Segundo Pacheco, 1800–1900 m, 0°12'S 77°39'W, 7–10.IX.1990, *Palacios 5303* (US [US00406377] image!; iso-: MO-4245549 image!, QCNE [QCNE58]!, TEX).

Plants scandent; stems terete, scarcely furrowed, usually with stout, straw-colored trichomes widened at base, partially fistulous. *Leaves* alternate, simple, petiolate; petioles 0.7–1.5 cm long; laminas (6–)10–15.5 × (2.5–)4.7–5.5 cm, lanceolate to elliptic or broadly elliptic, apex acute to attenuate, base cuneate to obtuse, margin entire, glabrous on both surfaces

(sometimes pilose on abaxial surface), somewhat fleshy (drying coriaceous), rather concolorous, secondary veins conspicuous on abaxial surface, tertiary veins conspicuous or barely visible. *Synflorescences* mostly lateral, axillary, racemiform (rarely racemose-paniculiform), similar in length or longer than leaves, with bracts foliose or linear-oblong; synflorescence branches tomentulose. *Capitula* heterogamous, disciform, pedunculate; peduncles 5–14 mm long, tomentulose, with 0–1 linear-subulate bracteoles; involucres cylindrical, glabrous; involucral bracts (8–)9–11, 4.5–5.2(–7) × 0.8–1.8 mm, linear-subulate; supplementary bracts 2–3, 2–5 × 0.6–1 mm, linear-subulate, extending to ¾ the length of involucral bracts. *Peripheral florets* 4–5, pistillate; corollas 3.9–4.2(–5) mm long, tubular, 4–5-lobed, creamy to whitish. *Disc florets* 15–20, hermaphroditic; corollas 4–5(–7.4) mm long, tubular, 5-lobed, creamy to whitish; anther bases caudate, ¼–½ as long as filament collar, appendages c. 0.4 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* c. 2 × 0.5 mm, cylindrical, 6–7-ribbed, glabrous; pappus 5–6 mm long, bristles capillary, barbellate, whitish.

Etymology. – This species is named after the Ecuadorian botanist Walter A. Palacios.

Distribution, ecology and phenology. – Putative endemic to Ecuador (Carchi, Napo, Sucumbíos). This species occurs in premontane rainforests and humid montane forests, at elevations of 1800–2600 m. Collected in flower between August and October (Map 10).

Notes. – The type specimen of this species shows lanceolate, glabrous leaves, which are 10–15.5 cm long, racemose-paniculiform synflorescences, and involucres composed of c. 8, 6–7 mm long involucral bracts. The remaining collections identified as such have strictly racemiform synflorescences and involucres with 9–11 involucral bracts, 4.5–5.2 mm long, and characteristically subulate. Moreover, two of these collections from northern Ecuador, *Reyes et al. 4358* and *Palacios 12788*, have remarkably smaller laminas (with pilose indumentum on the abaxial surface in the case of *Palacios 12788*). This species has scarcely been collected, which makes the species circumscription difficult. For the time being the aforementioned variability is treated as part of a single species. When the synflorescences are not strictly racemiform (see holotype), the capitula are racemosely arranged on long peduncles (5–14 mm long).

Pentacalia palaciosii resembles *P. aedoi* J. Calvo & Buira from southern Colombia. Both species have disciform capitula, but the latter species differs in having abaxial leaf surfaces slightly arachnoid (vs. glabrous or pilose); synflorescences narrowly racemose-paniculiform, composed of capitula clustered in groups of 2–3(–4), subsessile or on short peduncles (vs. usually strictly racemiform, or if racemose-paniculiform, the capitula are not clustered but on peduncles 5–14 mm long); and 8 involucral bracts (vs. (8–)9–11). The secondary veins of *P. palaciosii* are also more protruding than in *P. aedoi*. Another similar species is *P. zakii* H. Rob. & Cuatrec. (see comments under that species).

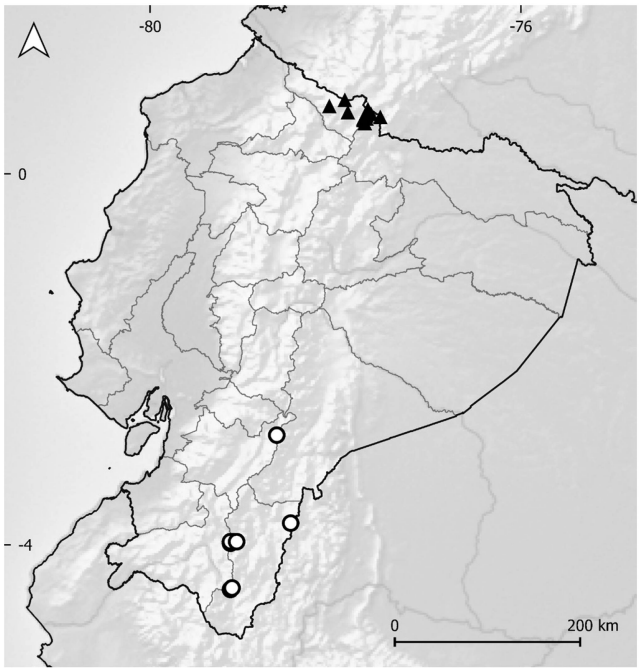
The collection *Ollgaard 38397* (AAU, QCA) from Morona-Santiago has very small leaves (c. 3 × 1 cm) with lateral synflorescences greatly exceeding those. The leaves are glabrous, fleshy in leaving plants, drying coriaceous with secondary veins only barely visible beneath. The synflorescences are strictly racemose, composed of solitary capitula subtended by foliose bracts that decrease in size upward (proximal ones c. 15 × 6 mm, petiolate, with some trichomes on the midvein). The basal capitula are longly pedunculate (up to 25 mm). If conspecific or not with *P. palaciosii* should be further studied through additional collections.

Additional specimens examined. – **Carchi:** Espejo, río Golondrinas, 0°50'N 78°7'W, 1900–2100 m, VIII.1994, *Palacios 12788* (QCNE, US). **Napo:** Reserva Ecológica Antisana, Cordillera de Guacamayos, along old mule-trail, 2 km SW of highway at La Virgen, 0°38'S 77°51'W, 2000 m, 1.X.1997, *Neill, Freire & Vargas 10971* (QCNE, US). **Sucumbíos:** La Bonita, 0°29'N 77°35'W, 2600–3000 m, 26–28.X.2008, *Reyes et al. 4358* (QCNE).

21. ***Pentacalia popayanensis*** (Hieron.) Cuatrec. in Phytologia 49: 249. 1981.

≡ *Senecio popayanensis* Hieron. in Bot. Jahrb. Syst. 28: 638. 1901. **Lectotypus** (designated by Cuatrecasas, 1981: 249): **Colombia. Valle del Cauca:** páramo de las Delicias, Central-Andes de Popayán, 3300–3600 m, I.[1886–87], *Lehmann 8502* (K [K000497616] image!; isolecto-: F [F0076974F] image!, MO-1039921 fragm. image!).

Plants scandent; stems terete, furrowed, tomentose to lanate, solid. *Leaves* alternate, simple, petiolate; petioles 1–1.4 cm long; laminas 7.5–12.5 × 4.5–5 cm, elliptic, ovate or lanceolate, apex acute (sometimes mucronate), base obtuse to subcordate, margin entire, glabrescent on adaxial surface, ochraceous lanate on abaxial surface, chartaceous to subcoriaceous, discolorous, secondary veins barely conspicuous on adaxial surface, covered by indumentum on abaxial surface but usually slightly protruding. *Synflorescences* mostly terminal, thyrsoid-paniculiform, with bracts linear, reduced; synflorescence branches tomentose to lanate. *Capitula* heterogamous, radiate, pedunculate; peduncles 5–15(–19) mm long, tomentose to lanate, with 2–4 linear-subulate bracteoles; involucres cylindrical, sparsely tomentose to lanate; involucral bracts 8, 4.2–6 × 1.3–2.1 mm, linear-oblong; supplementary bracts 3–5, 2.5–3 × 0.3–0.4 mm, linear-subulate, extending to ½ the length of involucral bracts. *Ray florets* 5, pistillate; corollas 6.5–8.6 mm long, limbs 2–4.6 × 0.7–1.2 mm, curved downward and slightly involute, subentire to 3-toothed, yellow initially, becoming burgundy when they mature. *Disc*



Map 11. – Distribution of *Pentacalia popayanensis* (Hieron.) Cuatrec. (triangle) and *P. riotintis* (Cuatrec.) Cuatrec. (open circle).

florets 11–14, hermaphroditic; corollas 7–7.9 mm long, tubular, 5-lobed, yellow initially, becoming burgundy when they mature; anthers orange, anther bases caudate, as long as to slightly longer than filament collar, appendages c. 0.5 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 2.5–3.4 × c. 0.6 mm, cylindrical, 7–9-ribbed, glabrous; pappus 7–8 mm long, bristles capillary, barbellate, whitish.

Iconography. – Díaz-Piedrahita & Cuatrecasas (1999: 83, fig. 27); Calvo & Pérez (2023: 228, fig. 3A).

Etymology. – The epithet *popayanensis* refers to the city of Popayán, capital of the Colombian department of Cauca, in southern Colombia.

Distribution, ecology and phenology. – Colombia and Ecuador (Carchi, Sucumbíos). This species grows in humid low montane forests and in the paramo ecosystem, at elevations of 3150–3600 m. Specimens in flower have mostly been collected between July and December (Map 11).

Notes. – *Pentacalia popayanensis* is characterized by having ochraceous lanate indumentum on abaxial leaf surfaces, synflorescences branches, and involucres. The capitula are radiate but the ray florets have a reduced limb usually curved downward. Both ray and disc florets are yellow initially and become reddish as capitula mature. Such change in ray floret color has also been observed in *P. atrovinosa* (Calvo & Pérez, 2023).

This species can be easily separated from the morphologically close *Pentacalia oellgaardii* by the ray floret limbs (reduced, curved downward in *P. popayanensis* vs. well-developed, patent in *P. oellgaardii*) and the color of the indumentum (ochraceous in *P. popayanensis* vs. usually whitish in *P. oellgaardii*). Their distributions areas do not overlap. *Pentacalia popayanensis*, in Ecuador, is restricted to the northernmost part of the country (Carchi, W Sucumbíos), whereas *P. oellgaardii* is known from Napo and Pichincha southward to Chimborazo.

Robinson & Cuatrecasas (1993) did not included this species in the key to the Ecuadorian species, whereas Díaz-Piedrahita & Cuatrecasas (1999) indicated its distribution area extending from Colombia to Peru, but no specimens from Ecuador or Peru were provided. On the other side, Nordenstam (1999) only cited the species in Carchi and noted that the Ecuadorian material might be distinct from the genuine *P. popayanensis* from Colombia. It is then probable that Nordenstam studied some specimens here ascribed to *P. oellgaardii*.

Additional specimens examined. – **Carchi:** Montúfar, loma El Corazón (Bretaña) al SE de Mariscal Sucre, río Minas, 0°35'N 77°42'W, 3150 m, 22–23.XII.1992, *Palacios & Tipaz 10585* (QCNE); Reserva Ecológica El Ángel, El Gritadero, 0°40'N 77°52'W, 3500 m, 1.XI.1993, *Palacios 11725* (QCNE); Tulcán, camino Tufiño, sitio Agua Hedionda, en la base del volcán Chiles, 0°48'N 77°54'W, 3500 m, 8.XI.1993, *Palacios 11848* (QCNE, US); Espejo, alrededor de la laguna Rasococha (Los Ceibos), 0°44'N 78°4'W, 3600 m, 9.XI.1993, *Palacios 11887* (QCNE); El Mirador, a 15 km al S de San Francisco, 0°37'N 77°31'W, 3300 m, 2.VIII.1990, *Palacios & Rubio 5266*, *5287* (QCNE); Tulcán, Mariscal Sucre, Bosque Protector Guandera, en la loma El Corazón al E del caserío Colonia Huaqueña, 0°33'N 77°41'W, 3400 m, 27.V.2000, *Salazar & Pérez 10* (QCA); along road Julio Andrade–El Carmelo–Tulcán, [0°39'N 77°37'W], 3300 m, 7.VIII.1989, *van der Werff & Gudiño 10990* (US); along road Tulcán–El Carmelo, [0°42'N 77°39'W], 3300 m, 8.VIII.1989, *van der Werff & Gudiño 10998* (QCNE, US); Tulcán, Reserva Guandera, c. 6 km E of Fernández Salvador, 0°36'N 77°42'W, 3450–3500 m, 2.VII.1996, *Webster et al. 32067* (QCNE, US). **Sucumbíos:** Cocha Seca, [0°38'N 77°40'W], 3250 m, 27.XII.1986, *Jaramillo 9307* (AAU, QCA, US); El Playón de San Francisco, 0°36'N 77°40'W, 3200–3400 m, 16–18.X.2008, *Reyes et al. 3783* (QCNE).

22. ***Pentacalia riotintis*** (Cuatrec.) Cuatrec. in Phytologia 49: 249. 1981 (Fig. 28, 29A, B → p. 76, 77).

≡ *Senecio riotintis* Cuatrec. in Fieldiana, Bot. 27(1): 28. 1950. **Holotypus: Ecuador. Azuay:** between Campanas and Arenillas, along slopes bordering río Tintas below Arenillas, 10 leagues southeast of El Pan, 2285 m, 13.VII.1943, *Steyermark 53625* (F [F0076982F] image!; iso-: NY [NY00259381] image!).

Plants scandent; stems terete, furrowed, glabrous, usually fistulous. *Leaves* alternate, simple, petiolate; petioles 1.5–2 cm long; laminas 5–10.5 × 3–6 cm, elliptic to obovate, apex acute to obtuse, usually shortly acuminate, base cuneate, margin entire, glabrous on both surfaces, fleshy (drying coriaceous), concolorous, secondary veins barely conspicuous

on both surfaces. *Synflorescences* mostly lateral, axillary, thyrsoid-paniculiform, greatly exceeding leaf length, with bracts oblong, 8–13 × 3–5 mm; synflorescence branches tomentulose. *Capitula* heterogamous, radiate, pedunculate; peduncles 3–9(–15) mm long, tomentulose, with (0–)1–2 linear-subulate bracteoles; involucres cylindrical, glabrous; involucral bracts 7–8, 5.8–8.4 × 1.1–2.1 mm, linear-oblong; supplementary bracts 2–3, 2.4–2.8(–4.8) × 0.4–0.7 mm, linear-subulate, extending to ⅓ the length of involucral bracts. *Ray florets* (4–)6–8, pistillate; corollas 8.3–16 mm long, limbs 4.6–11.7 × 1.3–2.8 mm, patent, apex 3-toothed, yellow. *Disc florets* 16–18, hermaphroditic; corollas 6.5–7.4 mm long, tubular, 5-lobed, yellow; anther bases caudate, slightly longer than filament collar, appendages c. 0.5 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* c. 1.5 × 0.7 mm (immature), cylindrical, glabrous; pappus 6.5–7.4 mm long, bristles capillary, barbellate, whitish.

Additional iconography. – Calvo et al. (2019a: 287, fig. 2, leaves of sterile branches).

Etymology. – The epithet *riotintis* refers to the provenance of the type material, i.e., the stream called río Tintas. It is located on the western slopes of the Cordillera near the village of Sevilla de Oro.

Distribution, ecology and phenology. – Ecuador (Azuay, Zamora-Chinchipe) and N Peru. It occurs in humid montane forests and cloud forests, at elevations of 1500–2700 m. Specimens in flower have mostly been collected between December and April (Map 11).

Notes. – This species is readily distinguishable by its remarkably fleshy leaves and the long, lateral synflorescence composed of radiate capitula. The synflorescence are thyrsoid-paniculiform, which bear a few bracts 8–13 × 3–5 mm, oblong. The proximal branches are longly pedunculate and bear a few capitula.

Pentacalia tillettii H. Rob. & Cuatrec., a species described from the surroundings of Yambrasbamba (Amazonas, Peru), was treated as a synonym of *P. riotintis* by Calvo et al. (2019a). After a deeper study of the type material, I correct myself here and keep *P. tillettii* as a distinct species to *P. riotintis*. *Pentacalia tillettii* can be differentiated by its smaller involucres (involucral bracts c. 4.6 mm long vs. 5.8–8.4 mm long), with lower number and shorter disc florets (10–11, 4.6–5.3 mm long vs. 16–18, 6.5–7.4 mm long). The ray florets are also smaller (c. 7.2 mm long with a limb c. 3.8 mm long vs. 8.3–16 mm long with a limb 4.6–11.7). The synflorescences are also remarkably denser in *P. tillettii*, where each division bears higher number of capitula. Lastly, *P. riotintis* displays involucral bracts that are typically irregular in width whereas in *P. tilletti* they are rather regular. This latter species is known only from the type and was collected c. 120 km farther south of the known distribution area of *P. riotintis*. Their distributions do not overlap according to the available collections.

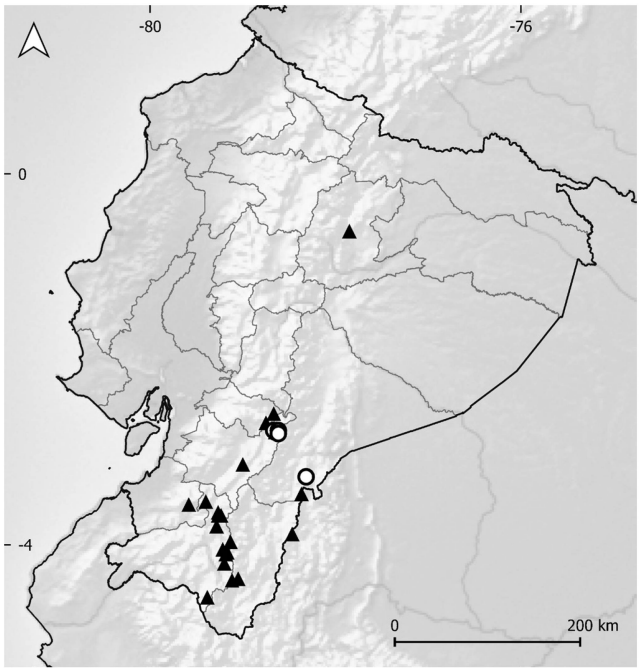
Pentacalia riotintis co-occurs with *P. todziae* and both develop mostly lateral, axillary synflorescences. For distinguishing one from another see comments under *P. todziae*.

Additional specimens examined. – **Zamora-Chinchipe:** límite provincial Loja–Zamora, carretera antigua a Zamora, 3°58'S 79°8'W, 2705 m, 19.XII.2017, *Calvo & Arnelas 7700* (HUTPL); Yantzaza, parroquia Los Encuentros, campamento "Las Peñas" (Fruta del Norte), sendero cerca del límite con el bosque protector el Cóndor, 3°46'S 78°29'W, 1500–1600 m, 8.III.2022, *Fernández et al. 6* (G, QCA); cuesta Carrizal, bajando del cerro Cruz Grande, enfrente del refugio de Quebrada Honda, en la carretera Yangana–Valladolid, 4°28'S 79°7'W, 2520 m, 9.X.1995, *Garmendia & Paredes 628* (MA); above Valladolid on road to Yangana, [4°29'S 79°8'W], 2700 m, 2.II.1985, *Harling & Andersson 21441* (QCA); road Loja–Zamora, km 17, 3°59'S 79°8'W, 2400 m, 16.IV.1973, *Holm-Nielsen et al. 3567* (AAU, US); area of ECSF (Estación Científica San Francisco) Research Station approx. 30 km away from the city of Loja on the highway towards Zamora, 3°58'S 79°4'W, 1820 m, 13.XI.1999, *Matezki 83* (QCNE); ibid., 2000 m, 23.III.2000, *Matezki 226* (HUTPL); ibid., 1990 m, 16.III.2002, *Matezki 500* (HUTPL); km 17 de la vía Loja–Zamora, quebrada Navidad, 3°58'S 79°7'W, 1950 m, 30.I.1996, *Merino & Pedersen 4763* (LOJA); quebrada San Francisco on new road Loja–Zamora, 3°58'S 79°5'W, 2000 m, 19.II.1996, *Ståhl 2104* (AAU, QCA); Parque Nacional Podocarpus, vía Loja–Zamora, San Francisco, IV–V.1992, *Vivar, Sarango & Balcázar 3979* (AAU, LOJA); área of Estación Científica San Francisco, road Loja–Zamora, c. 35 km from Loja, 3°58'S 79°4'W, 1850 m, 24.XII.2006, *Werner et al. 2157* (LOJA).

23. ***Pentacalia ruficaulis*** (Greenm. & Cuatrec.) Cuatrec. in Phytologia 49: 249. 1981 (Fig. 29C–G, 30 → p. 77, 78).

    ≡ *Senecio ruficaulis* Greenm. & Cuatrec. in Brittonia 8: 44. 1954. **Holotypus: Ecuador. Azuay:** eastern Cordillera, 4–6 km north of the village of Sevilla de Oro, 2745–3050 m, 14.VIII.1945, *Camp E-4703* (F [F0076984F] image!; iso-: G [G00356098]!, K [K000497612] image!, MO-1650088 image!, NY [NY00259386] image!, P [P01816504]!, S-R-5736 image!, UC [UC986399] image!, US [US00123351] image!, VEN [VEN34466] image!).

Plants scandent; stems terete, barely furrowed, hirsute-tomentose, solid. *Leaves* alternate, simple, petiolate; petioles 0.4–1.1 cm long; laminas 2.5–5.2 × 1.1–3.2 cm, elliptic to ovate, apex acute or obtuse and mucronate, base attenuate to rounded, margin entire, sparsely hirsute-pilose on adaxial surface, denser on abaxial surface, rather chartaceous, concolorous, secondary and tertiary veins conspicuous on abaxial surface, slightly protruding. *Synflorescences* mostly terminal, corymbiform, with bracts foliose; synflorescence branches hirsute-tomentose. *Capitula* heterogamous, radiate, pedunculate; peduncles 4–15 mm long, pilose-tomentose, with 3–6 linear-subulate bracteoles; involucres cylindrical, glabrous; involucral bracts 8(–12), 4.7–6.1 × 0.7–2 mm, linear-oblong; supplementary bracts 2–4, 2.3–2.7 × 0.4–0.5 mm, linear-subulate, extending



Map 12. – Distribution of *Pentacalia ruficaulis* (Greenm. & Cuatrec.) Cuatrec. (open circle) and *P. sevillana* (Cuatrec.) Cuatrec. (triangle).

to ⅓ the length of involucral bracts. *Ray florets* 8, pistillate; corollas 12–17.8 mm long, limbs 8.7–13.3 × 1.8–2.5 mm, patent, subentire to 3-toothed, yellow. *Disc florets* 13–18, hermaphroditic; corollas 7–8.6 mm long, tubular, 5-lobed, yellow; anther bases shortly caudate, ¼ as long as filament collar, appendages c. 0.5 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* c. 2.5 × 0.5 mm, cylindrical, c. 6–7-ribbed, glabrous; pappus 5.6–6.6 mm long, bristles capillary, barbellate, whitish.

Etymology. – The epithet *ruficaulis* refers to the reddish tomentum prevailing on the branchlets.

Distribution, ecology and phenology. – Endemic to Ecuador (Azuay, Morona-Santiago). It grows in low montane forests, at elevations of 2450–3200 m. This species has only been collected nearby Sevilla de Oro (Azuay) and in the northern part of the Cordillera del Cóndor (Morona-Santiago). Some species observed in the same habitat are: *Gynoxys azuayensis* Cuatrec., *Mikania stuebelii* Hieron., *M. harlingii* R.M. King & H. Rob., *Pentacalia millei*, and *P. theifolia* (*Compositae*). Collected in flower between July and September (Map 12).

Notes. – Species with radiate capitula and corymbiform synflorescences. The stems have a hirsute-tomentose, rusty indumentum. The capitula greatly resemble those of *Pentacalia corazonensis*, but they can easily be differentiated by the leaf morphology (2.5–5.2 × 1.1–3.2 cm, base attenuate to rounded in *P. ruficaulis* vs. 7–13 × 3.9–8 cm, base obtuse to subcordate in *P. corazonensis*). Other species with similar involucre and well-developed ray floret limbs are *P. andrei*, *P. dorrii*, and *P. oellgaardii*. The two former species differ, among other characters, in having glabrous leaves. *Pentacalia oellgaardii* can be differentiated by its whitish arachnoid involucral bracts and abaxial leaf surfaces.

Pentacalia ruficaulis was described as having 12 involucral bracts based on the type material, but in the discussion it was highlighted that specimens with 8 involucral bracts (*Camp E-5229*) and also intermediate forms exist (Cuatrecasas, 1954). The study of the type material revealed that the capitula have 10–12 involucral bracts, but the available specimens for this study (e.g. *Katán et al. 428*, *Øllgaard & Balslev 9437*) have 8–9 involucral bracts; these seem to be the most frequent forms. Although the number of involucral bracts usually is a stable character in *Pentacalia*, no other character suggests a possible distinction as it was already commented by Cuatrecasas.

Additional specimens examined. – **Azuay:** 1–8 km N of the village of Sevilla de Oro, [2°47'S 78°39'W], 2440–2740 m, 27.VII–12.VIII.1945, *Camp E-4427* (US); ridge between El Pan and Guachapala, [2°46'S 78°40'W], 2285–2990 m, 4.IX.1945, *Camp E-5229* (G); Sevilla de Oro, en el camino Sevilla de Oro–Méndez, antes de llegar a la laguna, 2°48'S 78°37'W, 3100 m, 4.X.1996, *Garmendia & Igual 1522* (MA); Sevilla de Oro, límite con el P.N. Río Negro, 2°48'S 78°37'W, 3120 m, 28.VII.2023, *Minga, Calvo & Benítez 4163* (HA); Sevilla de Oro, approx. 10 km NNE of the village, 2°46'S 78°37'W, 3000–3200 m, 13.IX.1976, *Øllgaard & Balslev 9437* (AAU). **Morona-Santiago:** San Juan Bosco, cima de la Cordillera del Cóndor, centro Shuar Numpatkain, 3°16'S 78°19'W, 2700–2820 m, 22.VII.2005, *Katán, Morales & Embrey 428* (QCNE).

24. ***Pentacalia sevillana*** (Cuatrec.) Cuatrec. in Phytologia 49: 250. 1981 (Fig. 31 → p. 79).

    ≡ *Senecio sevillanus* Cuatrec. in Brittonia 8: 45. 1954. **Holotypus: Ecuador. Azuay:** eastern Cordillera, 1–8 km north of the village of Sevilla de Oro, 2440–2745 m, 27.VII–12.VIII.1945, *Camp E-4323* (F [F0076990F] image!; iso-: GH [GH00012199] image!, K [K000497610] image!, NY [NY00259409] image!, P [P01816528]!, S-R-5741 fragm. image!, US [US00123358] image!).

Plants scandent; stems terete, finely furrowed, glabrous, partially fistulous. *Leaves* alternate, simple, petiolate; petioles 1.5–3 cm long; laminas 9.5–12 × 4.2–6 cm, broadly elliptic to lanceolate, apex acute to attenuate, base cuneate, margin entire, glabrous on both surfaces, somewhat fleshy (drying coriaceous), concolorous, secondary and tertiary veins conspicuous on both surfaces. *Synflorescences* mostly lateral, axillary, narrowly thyrsoid-paniculiform, usually longer than leaf length, with bracts oblong to lanceolate, 10–20 × 5–8 mm; synflorescence branches tomentulose. *Capitula* heterogamous, disciform, subsessile or very shortly pedunculate; peduncles 0.5–2 mm

long, tomentulose, with 0–1 lanceolate bracteoles; involucres cylindrical, glabrous or with a few scattered trichomes near base; involucral bracts 8–10(–12), 4.7–6.5 × 1.2–1.9 mm, linear-oblong; supplementary bracts 3–5, (2.5–)4.1–6.1 × 1–1.8 mm, linear-subulate to lanceolate, extending to ½ or almost equaling the length of involucral bracts. *Peripheral florets* 5–7, pistillate; corollas 4.5–5.5 mm long, tubular, 3–5-lobed, creamy to whitish. *Disc florets* 15–20, hermaphroditic; corollas 5.9–7.1 mm long, tubular, 5-lobed, creamy to whitish; anthers red, becoming brownish, anther bases caudate, ⅓–½ as long as filament collar, appendages c. 0.4 × 0.2 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 1.6–2 × 0.5–0.6 mm, cylindrical, 6–7-ribbed, glabrous; pappus 4.6–6.3 mm long, bristles capillary, barbellate, whitish.

Etymology. – The epithet *sevillana* refers to the Ecuadorian village of Sevilla de Oro in northeastern Azuay.

Distribution, ecology and phenology. – Ecuador (Azuay, Cañar, El Oro, Loja, Morona-Santiago, Napo, Zamora-Chinchipe) and Peru? It grows in montane forests, at elevations of (1800–)2100–3200 m. In the provincial limit Loja/Zamora-Chinchipe, this species was found co-occurring with *Pentacalia dorrii and P. millei*. The collection *Neill & Quizhpe 16155* comes from the border between Ecuador and Peru, and therefore, the presence of *P. sevillana* in Peru is expected. Specimens in flower have mostly been collected between September and March (Map 12).

Notes. – Species that can be differentiated by its mostly lateral, thyrsoid-paniculiform synflorescences composed of disciform capitula, which are shortly pedunculate or subsessile. The synflorescence bracts are oblong to lanceolate, 10–20 × 5–8 mm. The leaves are glabrous and, when dried, secondary and tertiary veins are visible, and the apical part usually appears to be somewhat arched. In the protologue, the involucres were described as having 12 involucral bracts. After the study of the isotype at P besides all the specimens detailed below, I can conclude that this species rather has 8–10 involucral bracts.

The synflorescences of *Pentacalia sevillana* are similar to those of *P. poyasensis* (Cuatrec.) Cuatrec., a species described from northern Peru (Chachapoyas, Amazonas). Both species have disciform capitula but *P. poyasensis* differs in having longer supplementary bracts, which are almost as long as the involucral bracts. Furthermore, the secondary leaf veins of *P. poyasensis* are inconspicuous whereas those of *P. sevillana* are prominent and visible (especially in dried specimens).

The collection *Vargas & Narváez 3455* was identified as *Pentacalia moronensis* by H. Robinson (in sched., 2000). Although the synflorescences are immature, they exhibit the typical oblong to lanceolate bracts of *P. sevillana*. The leaves also differ from those of *P. moronensis* by having the secondary and tertiary veins visible and the apical part somewhat arched. It represents the upper limit of distribution of this species and appears quite isolated from the remaining known collections that come from farther south.

According to the key provided by Robinson & Cuatrecasas (1993), *Pentacalia sevillana* keys out next to *P. pailasensis* H. Rob. & Cuatrec., a species that differs from the former in having mostly racemiform synflorescences not longer than subtending leaves and with shortly pedunculate capitula. Since the type material of this species appears to be lost, *P. pailasensis* rests as a doubtful name (see additional comments under this section).

Additional specimens examined. – **Azuay:** Loma de San Carlos, propiedad de Ricardo Bautista, 2°41'S 78°45'W, 2850 m, 15.I.1999, *Serrano, Minga & Verdugo 432* (HA); Cumbe, San Francisco, 3°8'S 79°0'W, 3083 m, 29.III.2006, *Verdugo & Minga 720* (HA). **Cañar:** at pas on road Pindilig–Rivera ("La Virgen"), [2°35'S 78°40'W], 3200 m, 9.III.1985, *Harling & Andersson 22970* (QCA). **El Oro:** Zaruma, parroquia Huertas, 3°34'S 79°35'W, 1811 m, 18.IX.2019, *Armijos 3103* (HUTPL). **Loja:** Saraguro, bosque nativo Hushapampa, c. 6 km S of Saraguro, 3°39'S 79°16'W, 2910 m, 6.IV.2005, *Clark, Bennett & Bohs 9071* (QCNE); Acacana (unos 30 km N Loja), 3°41'S 79°14'W, 2400–2500 m, 11.III.1947, *Espinosa 1444* (LOJA); Horta–Naque, 4°12'S 79°12'W, 2500 m, 8.XI.1946, *Espinosa 960* (LOJA); Loma Santiago, 3 km S of Santiago and 14 km S of San Lucas, [3°48'S 79°17'W], 2900 m, 18.II.1993, *Harling & Ståhl 26481* (QCA); 7 km N of San Lucas on the road to Loja, [3°41'S 79°16'W], 2680 m, 27.I.1979, *King & Almeda 7841* (QCA); dirt road Manu–Saraguro, km 4, dirt track to paramo, km 4.2, 3°32'S 79°24'W, 3050 m, 21.XI.1996, *Lewis et al. 2853* (AAU, LOJA, QCA, QCNE); Cajanuma, 4°6'S 79°11'W, 2600 m, 31.I.2002, *Lozano, Merino & Delgado E-601* (LOJA); Yangana, cerro Toledo, 4°23'S 79°7'W, 2950 m, 20.II.2002, *Lozano et al. E-771* (LOJA); P.N. Podocarpus, S of Loja, at the "centro de información" E of Nudo de Cajanuma, 4°5'S 79°10'W, 2850–2950 m, 21–22.II.1985, *Øllgaard et al. 57816* (AAU, QCA, US); Amaluza, mountain ridges 810 km ENE of the village (Potrero del Medio), 4°34'S 79°23'W, 2700–2900 m, 23.IX.1976, *Øllgaard & Balslev 9757* (AAU); Punzara Alto (Quilloyacu), 4°3'S 79°13'W, 2750 m, 6.VIII.2007, *Rivas & Guanín 142, 153* (LOJA). **Morona-Santiago:** Gualaquiza, campamento Achupalla, Cordillera del Cóndor, 15 km E of Gualaquiza, 3°27'S 78°22'W, 2100 m, 23.VII.1993, *Gentry 80381* (QCNE). **Napo:** Quijos, Reserva Ecológica Antisana, cruce del oleoducto de la compañía ARCO, helipuerto a 50 m del río Vinillos, 0°37'S 77°51'W, 2195 m, 11.I.1999, *Vargas & Narváez 3455* (QCNE, US). **Zamora-Chinchipe:** límite provincial Loja–Zamora, carretera antigua a Zamora, 3°58'S 79°8'W, 2640 m, 19.XII.2017, *Calvo & Arnelas 7693* (HUTPL); El Tambo, carretero viejo a Zamora desde El Tiro, 3°58'S 79°8'W, 2630 m, 19.VII.2023, *Calvo, Benítez & Espinosa-Ortega 8488* (HUTPL); Yantzaza, Cordillera del Cóndor, Machinaza plateau summit area, at end of trail from upper Paquisha military post, at Ecuador–Peru, 3°53'S 78°28'W, 2420 m, 15.III.2008, *Neill & Quizhpe 16155* (LOJA, QCNE); Chinchipe, P.N. Podocarpus, La Esmeralda (Cooperativa San Francisco de Numbala Alto), 4°22'S 79°3'W, 2250 m, I.1994, *Palacios & Tirado 13032* (QCNE).

25. ***Pentacalia theifolia*** (Benth.) Cuatrec. in Phytologia 49: 250. 1981 (Fig. 32, 33 → p. 80, 81).

≡ *Senecio theifolius* Benth., Pl. Hartw.: 210. 1845. **Holotypus: Colombia. [Cundinamarca]:** Cordillera de los Andes nr. Bogotá, s.d., *Hartweg 1166* (K [K000497608] image!; iso-: F [F0077009F fragm.] image!, G [G00398268]!, P [P01816562 fragm.]!).

= *Senecio chachapoyensis* Greenm. in Ann. Missouri Bot. Gard. 25: 801. 1938. ≡ *Pentacalia chachapoyensis* (Greenm.) Cuatrec. in Phytologia 49: 245. 1981, **syn. nov. Holotypus: Peru. Amazonas:** Chachapoyas, 1835, *A. Mathews 1356* (K [K000497630] image!; iso-: E [E00524193, E00524272] image!, G [G00398269]!, MO-1130243 fragm. image!, P [P01816860]!).

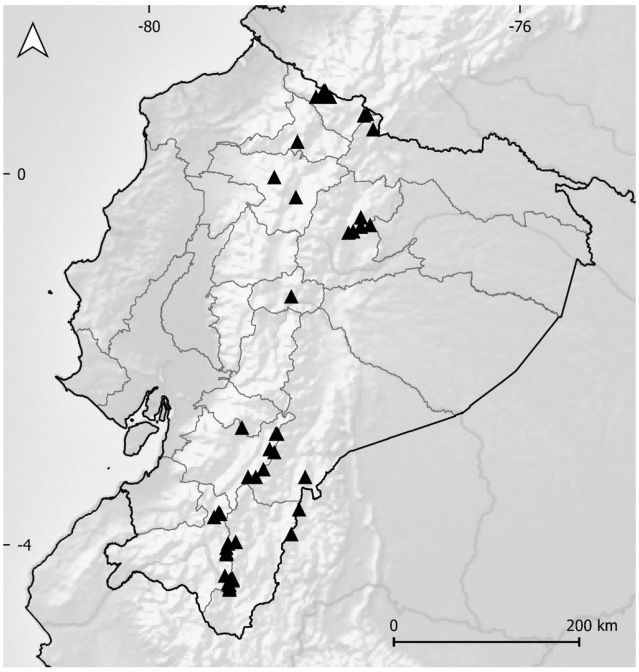
= *Senecio hitchcockii* Cuatrec. in Feddes Repert. Spec. Nov. Regni Veg. 55: 139. 1953. ≡ *Pentacalia hitchcockii* (Cuatrec.) Cuatrec. in Phytologia 49: 247. 1981. **Holotypus: Ecuador. Loja:** between San Lucas and Oña, 2200–3100 m, 7.IX.1923, *Hitchcock 21525* (GH [GH00012140] image!; iso-: NY [NY00259201] image!, US [US00123307] image!).

= *Senecio huamaliensis* Cabrera in Darwiniana 10: 596. 1954. ≡ *Pentacalia huamaliensis* (Cabrera) Cuatrec. in Phytologia 49: 247. 1981. **Holotypus: Peru. Huánuco:** Huamalíes, cerros al sudoeste de Monzón, 2500–2900 m, s.d., *Weberbauer 3409* (MOL; iso-: LP [LP000520, LP000521] image!).

Plants scandent or suberect leaning over adjacent vegetation; stems terete, slightly furrowed, glabrous to tomentulose, solid. *Leaves* alternate, simple, petiolate; petioles 0.8–1.3 cm long; laminas 3.3–8 × 1.2–2.6 cm, lanceolate to narrowly elliptic (rarely oblanceolate), apex acute (rarely obtuse), base attenuate to cuneate, margin entire to finely dentate, glabrous on both surfaces, rather chartaceous, concolorous or slightly discolorous, secondary and tertiary veins moderately conspicuous on both surfaces, barely protruding on abaxial surface. *Synflorescences* mostly terminal, thyrsoid-paniculiform, with bracts linear-subulate; synflorescence branches glabrous to tomentulose. *Capitula* homogamous, discoid, pedunculate; peduncles 3–12 mm long, glabrous to tomentulose, with 1–3 linear-subulate bracteoles; involucres cylindrical, glabrous; involucral bracts 8, (3.2–)4.8–5.9 × 0.7–1 mm, linear-oblong; supplementary bracts 4–6, 1.2–1.9 × 0.3–0.6 mm, linear, extending to ¼ the length of involucral bracts. *Disc florets* 10–11, hermaphroditic; corollas (3–)4–4.5 mm long, tubular, 5-lobed, whitish; anther bases very shortly caudate, ¼ as long as filament collar, appendages c. 0.3 × 0.15 mm; style branches truncate with crown of sweeping trichomes. *Achenes* c. 2 × 0.4–0.5 mm, cylindrical, 5–7-ribbed, glabrous; pappus (2.8–)4–4.5 mm long, bristles capillary, barbellate, whitish.

Additional iconography. – Cabrera (1954: 586, fig. 15D, sub *Senecio huamaliensis*); Díaz-Piedrahita & Cuatrecasas (1999: 131, fig. 45); Calvo et al. (2019a: 288, fig. 3).

Etymology. – The epithet *theifolius* means tea-leaved, i.e., with leaves resembling those of *Thea* L. (= *Camellia* L.).



Map 13. – Distribution of *Pentacalia theifolia* (Benth.) Cuatrec.

Distribution, ecology and phenology. – Colombia, Ecuador (Azuay, Cañar, Carchi, Imbabura, Loja, Morona-Santiago, Napo, Pichincha, Sucumbíos, Tungurahua, Zamora-Chinchipe), and Peru. This species occurs at the edge of montane forests and in the paramo ecosystem, at elevations of 1820–3500 m. Flowering nearly all year round (Map 13).

Notes. – *Pentacalia theifolia* is characterized by having mostly terminal, thyrsoid-paniculiform synflorescences composed of pedunculate, discoid capitula. The leaves usually are lanceolate to narrowly elliptic (rarely oblanceolate), attenuate to cuneate at base, rather chartaceous, entire to finely dentate, with venation moderately marked. The branchlets are typically glabrous or glabrescent, but specimens with tomentulose indumentum also exist, e.g., *Matezki 442* (QCNE) from Zamora-Chinchipe and *Palacios & Clark 12499* (QCNE, US) from Carchi. The most similar species is *P. arborea*, with which it partially overlaps in distribution in northern Ecuador (see additional comments under this species).

The anther bases of this species were described as auriculate by Lapp et al. (2015), but a detailed study of some specimens revealed that the anther bases are rather very shortly caudate as in *Pentacalia arborea* (see Díaz-Piedrahita & Cuatrecasas, 1999: 122, fig. 41E). These authors mentioned the same matter for the Colombian species *P. sonsonensis* (Díaz-Piedrahita & Cuatrecasas, 1999: 80).

Senecio chachapoyensis was described from the Amazonas Department in northern Peru and separated from *S. theifolius* by its hirtellous-papillose stems (vs. glabrous), which is quite

variable within the species as commented above. No other character supports its recognition as a distinct species. The presence of *Pentacalia theifolia* in the Peruvian department of Amazonas was expected (Calvo et al., 2019a). The holotype of *Senecio chachapoyensis* is numbered as "1356 (bis)" but the isotypes only bear the number "1356" and the collection in the protologue is also indicated as such.

The species has been recorded from Sumaco (*Holm-Nielsen et al. 17360*, *Lozano et al. 117*), a volcano quite isolated from the main chain of the Andes on the border between the provinces of Napo and Pastaza. The plants from there have significatively smaller involucres, with involucral bracts 3.2–3.3 mm long, florets 3–3.1 mm long, and pappus c. 2.8 mm long. Otherwise, the number of involucral bracts, number of florets, and leaf morphology fall within the variability of *Pentacalia theifolia*.

The collection *Palacios & van der Werff 3920* (AAU, QCNE, US) was cited as *Pentacalia theifolia* in the *Catalogue* (Nordenstam, 1999). In accordance with Cuatrecasas (in sched., 1993), it is here identified as *P. arborea*.

Additional specimens examined. – **Azuay:** road Gualaceo-Limón, km 17, [2°58'S 78°42'W], 3150 m, 9.X.1993, *Borchsenius 159* (AAU, QCA); Gualaceo, páramo de la virgen de Patococha, 3°0'S 78°39'W, 3545 m, 3.XI.2018, *Calvo 7827* (HA); Machángara–Tomebamba, Saucay, hacienda del Sr. Montesinos, 2°44'S 79°0'W, 3100 m, 28.XI.1998, *Cerón et al. 200* (LOJA); Sevilla de Oro, [2°48'S 78°38'W], 2950 m, 18–20.IV.1968, *Harling, Storm & Ström 8486*, *8488* (QCA); Jima San Miguel de Cuyes, km 17.2, páramos de Palcurco, 3°16'S 78°56'W, 3140 m, 4.XII.1990, *Jørgensen, Ulloa & Luteyn 92836* (AAU, QCA, QCNE); Sevilla de Oro, límite con el P.N. Río Negro, 2°48'S 78°37'W, 3120 m, 28. VII.2023, *Minga, Calvo & Benítez 4150* (HA). **Carchi:** approx. 6 km above Maldonado, just below Puente de Palo, 0°54'N 78°6'W, 2275 m, 23.V.1993, *Boyle & Bradford 1943*, *1968* (QCNE); cerro Golondrinas area, access via Chamorro property above El Carmen, above Hualchán, approach to peak, 0°50'N 78°12'W, 2800 m, 24.VII.1993, *Boyle & Hibbs 2318* (QCNE); cerro Golondrinas, on crest of N ridge, just below peak, 0°51'N 78°8'W, 3000–3060 m, 24.VII.1994, *Boyle et al. 3388* (QCNE); N-facing slopes c. 3 km SW of El Carmelo, 0°39'N 77°39'W, 3150–3350 m, 16.IV.1979, *Løjtnant, Molau & Madison 12608* (AAU); road Tulcán–Maldonado, 53 km from Tulcán, 0°50'N 78°3'W, 3200 m, 31.VII.1976, *Øllgaard & Balslev 8298* (AAU); Espejo, El Gualtal, cerro Golondrinas Hembra, sobre la cresta de la montaña, 0°51'N 78°8'W, 2600–2800 m, 20.VIII.1994, *Palacios & Clark 12444* (QCNE); Espejo, El Gualtal, cresta del cerro Golondrinas Hembra, 0°51'N 78°8'W, 3000 m, 21.VIII.1994, *Palacios & Clark 12499* (QCNE, US), *12504* (QCNE); above Maldonado, [0°54'N 78°7'W], 2500 m, 1.VIII.1989, *van der Werff & Gudiño 10835* (AAU, QCNE, US); Espejo, Reserva Golondrinas, El Corazón, recorrido por el sendero a La Cortadera hasta El Mirador, 0°50'N 78°6'W, 2390 m, 23.I.2004, *Vargas et al. 4313* (QCNE). **Imbabura:** Siempre Verde Cloud Forest Reserve, trail near El Mirador, 0°21'N 78°24'W, 3300 m, 31.VIII.2016, *Jones 11411* (QCA). **Loja:** Yangana, cerro Toledo, parte cacuminal, 4°23'S 79°6'W, 3270 m, 20.VII.2023, *Calvo, Benítez & Espinosa-Ortega 8499* (HUTPL); Yangana, cerro Toledo, parte superior, 4°22'S 79°7'W, 2985 m, 20.VII.2023, *Calvo, Benítez & Espinosa-Ortega 8506* (HUTPL); P.N. Podocarpus, above Nudo de Cajanuma, trail to Mirador, above "centro de información", 4°5'S 79°10'W, 3000–3500 m, 27.VII.1988, *Christensen 75028* (AAU, LOJA, QCA, QCNE); 6.6 km E of Loja control, on road to Zamora, 2225 m, 17.VIII.1982, *Clemants 2337* (QCNE); P.N. Podocarpus, E of Nudo de Cajanuma, near "centro de información", 4°5'S 79°10'W, 2900 m, 29.III.1989, *Eriksen 91160* (QCA); Zamora-Huaico [Zamora Huayco], [4°2'S 79°10'W], 2300–2400 m, 3.VII.1947, *Espinosa 1557* (LOJA); cerro Toledo, jeep track to "La Torre", 10–12 km SE Yangana, [4°22'S 79°6'W], 3000–3200 m, 6.IV.1985, *Harling & Andersson 23759* (QCA); carretera Saraguro–Loja, Loma del Oro, 3°40'S 79°15'W, 2525 m, 24.VI.2008, *Jaramillo, Buenaño & Santillán 26805* (QCA); carretera Loja–Zamora, km 15, [3°59'S 79°9'W], 2500 m, 16.VIII.1983, *Jaramillo & Winnerakjold 5790* (AAU, QCA); carretera Loja–Saraguro, Loma del Oro siguiendo la vía que conduce a las antenas militares, [3°40'S 79°14'W], 2800 m, 23.VIII.1983, *Jaramillo & Winnerskjold 5874* (QCA); carretera Yangana–Zumba, km 18 de Yangana, [4°26'S 79°8'W], 2520 m, s.d., *Jaramillo 8682* (AAU, QCA); carretera antigua Yangana–Vilcabamba, 1–6 km de Yangana, [4°20'S 79°11'W], 1820 m, s.d., *Jaramillo, Zak & Valencia 8704* [probably the correct number is *8602*] (AAU, US); carretera Yangana–Valladolid, apr. 5 km N del paso, [4°25'S 79°9'W], 2600 m, 3.IX.1985, *Larsen 202* (QCA); P.N. Podocarpus, Cajanuma, El Mirador, 4°6'S 79°10'W, 3000 m, 20.V.1997, *Lewis & Cotton 3320* (AAU, LOJA, QCA, QCNE, US); P.N. Podocarpus, Cajanuma, track to El Mirador, 4°6'S 79°10'W, 3000 m, 29.X.1997, *Lewis 3675* (AAU, LOJA, QCNE); P.N. Podocarpus, above Nudo de Cajanuma around "centro de información", 4°5'S 79°10'W, 2800–3000 m, 6.IX.1988, *Madsen & Ellemann 75224* (AAU, LOJA, QCA, QCNE); P.N. Podocarpus, E of Nudo de Cajanuma, just N of "centro de información", 4°5'S 79°10'W, 2900 m, 14.X.1989, *Madsen 86235* (AAU, LOJA, QCA, QCNE); P.N. Podocarpus, road Yangana–cerro Toledo, 4°23'S 79°7'W, 2800–2850 m, 27.II.1985, *Øllgaard et al. 58309* (AAU, QCA); P.N. Podocarpus, around entrance to the park on road Yangana–cerro Toledo, 4°23'S 79°8'W, 2600–2800 m, 3.VI.1988, *Øllgaard, Madsen & Christensen 74616*, *74624* (AAU, LOJA, QCA); cerro Toledo, pasando Yangana, [4°22'S 79°6'W], 3200 m, 28.XII.1988, *Ríos et al. 244* (QCA); carretera Loja–Saraguro, desvío a Fierro-Urcu, [3°42'S 79°18'W], 3500 m, 12.III.1989, *Romoleroux 768* (AAU, QCA). **Morona-Santiago:** along road between Gualaceo and Gualaquiza, 34.2 km SE of Sigsig, 15.1 km NW of Chigüinda, 3°11'S 78°46'W, 2938 m, 13.IX.2007, *Croat & Ferry 98556* (QCNE); cima de la Cordillera del Cóndor, centro Shuar Numpatkaim, 3°16'S 78°19'W, 2700–2820 m, 22.VII.2005, *Katán, Morales & Embrey 360* (LOJA, QCNE); Gualaquiza, bosque protector Tambillo, parroquia S. Miguel de Cuyes, en el sendero hacia río Moriré, 3°16'S 78°51'W, 2940 m, 5.II.2006, *Minga, Verdugo & Clavijo 1072* (HA); ibid., 29.IV.2006, *Minga, Verdugo & Clavijo 1200* (HA); San Juan Bosco, Cordillera del Cóndor, comunidad Shuar Numpatkaim, sendero hacia la cima del cerro más alto de la cordillera, 3°16'S 78°19'W, 2790 m, 22.VII.2005, *Morales & Embrey 1346* (HA, LOJA, QCNE), *1377* (LOJA, QCNE). **Napo:** N side of cerro Sumaco, loma NW of campsite, 0°34'S 77°43'W, 3200 m, 27.IV.1979, *Holm-Nielsen, Jaramillo & de Vries 17360* (AAU, QCA, US); Guagra Urcu, loma Jaramillo, SW of the pass between río Borja and río Suno, 0°28'S 77°43'W, 2800 m, 27.IX.1980, *Holm-Nielsen et al. 27344* (AAU); Guagra Urcu, near summit, 0°28'S 77°43'W, 3150 m, 29.IX.1980, *Holm-Nielsen et al. 27594* (AAU); Guagra Urcu, lomita SE of summit, 0°28'S 77°43'W, 2900 m, 29.IX.1980, *Holm-Nielsen et al. 27635* (AAU); Tena, cordillera de los Huacamayos, entre Chacana Loma–Sisahua, [0°37'S 77°48'W], 2100–2320 m, 9.VIII.1995, *Jaramillo & Tapia 18484* (LOJA, QCA); Archidona, volcán Sumaco, Reserva Biosfera Sumaco, zona de transición al páramo, 0°33'S 77°37'W, 3301 m, 16.XII.2012, *Lozano, Yangora & Grefa 117* (QCA); Quijos, Reserva Ecológica Antisana, cordillera de los Guacamayos, creuce del oleoducto de la compañía ARCO, El Mirador, 0°38'S 77°51'W, 2400 m, 6–10.I.1999, *Vargas & Narváez 3426* (QCNE). **Pichincha:** loma La Bola–cerro El Campanario, sendero entre la cima de La Bola y colinas justo antes del cerro El Campanario, 0°2'S 78°39'W, 2560–2712 m, 12.IX.2001, *Freire, Morales & Mites 3263* (QCNE); 10 km S of Tumbaco, lower slopes of cerro Ilaló, 0°15'S 78°25'W, 2650 m, 7.IV.1979, *Holm-Nielsen, Silva & Velastegui 16878* (AAU). **Sucumbíos:** 8 km E of the Pan American hwy. on rd. to La Bonita, S at Cocha Seca 1.2 km, 0°38'N 77°41'W, 3000 m, 1.III.1992, *Funk & Gavilanes 11054* (QCA, QCNE, US); parroquia La Bonita, 0°29'N 77°35'W, 2600–3000 m, 26–28.X.2008, *Reyes et al. 4293* (QCNE). **Tungurahua:** vicinity of Patate, hacienda Leito, [1°19'S 78°28'W], 2800 m, 5.VIII.1939, *Asplund 8066* (QCA, US). **Zamora-Chinchipe:** de la carretera Yangana–Valladolid, antes del refugio de Quebrada Honda, a 10 m de la cresta, cerca del camino, 4°28'S 79°8'W, 2720 m, 9.X.1995, *Garmedia & Paredes 674* (LOJA, MA, QCA); area of ECSF (Estación Científica San Francisco) Research Station approx. 30 km away from the city of Loja on the highway towards Zamora, 3°58'S 79°4'W, 2100 m,

27.VII.2000, *Matezki 306* (HUTPL, LOJA, QCNE, US); ibid., 2550 m, 27.XI.2001, *Matezki 442* (QCNE); El Pangui, Cordillera del Cóndor, ridge crest, 2 km N of Cóndor Mirador military post, 3°37'S 78°23'W, 1975 m, 6.IX.2003, *Neill et al. 14413* (LOJA, QCNE); Palanda, Tapichalaca Reserve, S of Podocarpus N.P., E of road between Yangana and Valladolid, 4°29'S 79°8'W, 2550 m, 25.IX.2007, *Neill, Davidson & Christoph 15997* (LOJA); Paquisha, barrio Río Blanco, entrando por Los Encuentros, Cordillera del Cóndor, sendero y cima de la meseta de Machinaza, 3°53'S 78°28'W, 2000–2440 m, 26.VI.2014, *Pérez et al. 7450* (QCA).

26. ***Pentacalia todziae*** H. Rob. & Cuatrec. in Novon 3: 297. 1993 (Fig. 34 → p. 82).

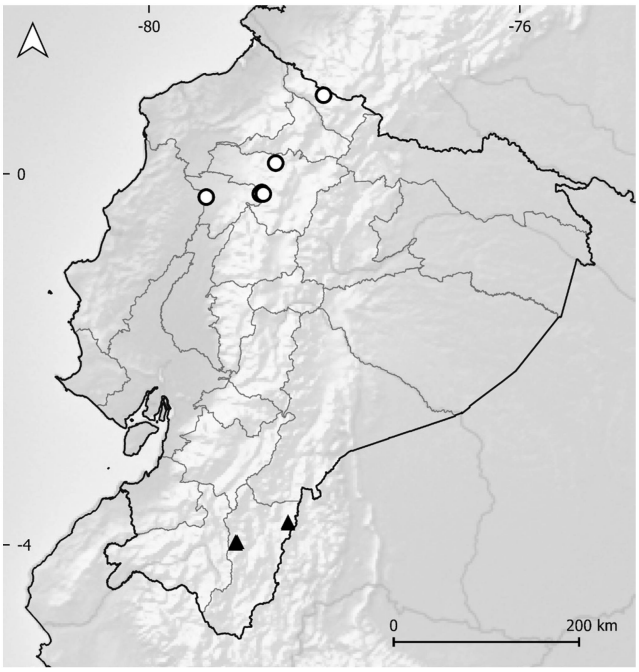
Holotypus: Peru. San Martín: Rioja, 99 km from Rioja on road to Pomacocha, 5°45'S 77°35'W, 1900 m, 15.II.1985, *Stein & Todzia 2180* (US [US00406371] image!; iso-: F [F0076819F] image!, MO-4398794 image!, USM-71634!).

Plants scandent; stems terete, furrowed, glabrous, usually fistulous. *Leaves* alternate, simple, petiolate; petioles 2.1–4.3 cm long; laminas 11.5–16.2 × 6.3–10.2 cm, ovate-elliptic, apex obtuse (rarely acute), base obtuse to rounded (sometimes asymmetrical), margin entire, slightly hyaline, glabrous on both surfaces, coriaceous (somewhat fleshy in living plants), concolorous or barely discolorous, secondary veins conspicuous on both surfaces, not protruding, usually whitish. *Synflorescences* mostly lateral, axillary, thyrsoid-paniculiform, greatly exceeding leaf length, with bracts oblong, 30–57 × 7–17 mm; synflorescence branches tomentulose. *Capitula* heterogamous, radiate, pedunculate; peduncles 6–27 mm long, tomentulose, with (0–)1–2 linear-subulate bracteoles; involucres cylindrical, with scattered trichomes near the base; involucral bracts 11–13, 6–7.5 × 1–1.7 mm, linear-oblong; supplementary bracts 5–6, 1.7–4.8 × 0.3–0.4 mm, linear-subulate, extending to ¼–½ the length of involucral bracts. *Ray florets* 7–8, pistillate; corollas c. 13 mm long, limbs 7–8 × c. 2.5 mm, patent, apex 3-toothed, yellow. *Disc florets* 22–25, hermaphroditic; corollas 8.2–9.5 mm long, tubular, 5-lobed, yellow; anther bases caudate, as long as filament collar, appendages c. 0.3 × 0.13 mm; style branches truncate with crown of sweeping trichomes. *Achenes* 2.9–3 × 0.5–0.7 mm, cylindrical, 7–8-ribbed, glabrous; pappus 6.6–7.8 mm long, bristles capillary, barbellate, whitish.

Additional iconography. – Calvo et al. (2019b: 152, fig. 5).

Etymology. – Species named after the American botanist Carol A. Todzia, one of the two collectors of the type material.

Distribution, ecology and phenology. – Ecuador (Zamora-Chinchipe) and Peru (San Martín). In Ecuador, this species thrives in montane cloud forests and in the Andean tepuis of the Cordillera del Cóndor, at elevations of 1625–2100 m. Other species of the genus that were observed growing in the same habitat are *P. andrei* and *P. riotintis*. It can be found in bloom at any time of the year (Map 14).



Map 14. – Distribution of *Pentacalia todziae* H. Rob. & Cuatrec. (triangle) and *P. zakii* H. Rob. & Cuatrec. (open circle).

Notes. – *Pentacalia todziae* was described on the basis of a single collection from San Martín, northern Peru. The type material shows very large, broadly ovate leaves, 10–14 cm wide, subcordate at the base, and sparsely puberulous on the abaxial surface. As commented in Calvo et al. (2019b), the Ecuadorian populations differ in having leaves narrower, obtuse to rounded at base, and glabrous on both surfaces. Otherwise, all characters fit well. Until additional material will be available, I prefer considering it as part of the variability of *P. todziae*.

This species is characterized by having mostly lateral, axillary synflorescences, which are rather thyrsoid-paniculiform and greatly exceed the leaf length. The capitula are radiate and have 11–13 involucral bracts. In living plants the midrib and secondary veins of the leaves are light-colored and conspicuous (not protruding), and they usually become remarkably whitish when dried.

Pentacalia todziae is restricted to southern Ecuador and the type locality in Peru. In Zamora-Chinchipe it co-occurs with *P. riotintis*, a species also with mostly lateral, axillary synflorescences and radiate capitula. However, they can be easily separated by the number of involucral bracts (11–13 in *P. todziae* vs. 7–8 in *P. riotintis*), and the leaf size (11.5–16.2 × 6.3–10.2 cm in *P. todziae* vs. 5–10.5 × 3–6 cm in *P. riotintis*). Moreover, *P. todziae* has denser synflorescences and the leaf venation is conspicuous (vs. barely visible in *P. riotintis*).



Fig. 17. – *Pentacalia luteynorum* subsp. *lutea* J. Calvo. **A.** Flowering branch; **B.** Capitula (side view); **C.** Adaxial leaf surface; **D.** Abaxial leaf surface; **E.** Capitula (top view). *Pentacalia luteynorum* H. Rob. & Cuatrec. subsp. *luteynorum*. **F.** Capitula (top view).
[**A, C–E:** *Calvo & Benítez 8467*; **B:** *Calvo & Benítez 8482*; **F:** Ecuador, Napo, entre San Francisco de Borja y El Chaco, 9.I.2021]
[Photos: **A–E:** J. Calvo; **F:** R.A. Gelis]



Fig. 18. – *Pentacalia millei* (Greenm.) Cuatrec. **A.** Flowering branch; **B.** Zoom in of the synflorescence; **C.** Abaxial leaf surface (glabrous form); **D.** Abaxial leaf surface (sparsely arachnoid-floccose form); **E.** Leaf variability (**E1**: form originally described as *P. mikanioides*; **E2:** typical form of *P. millei*).
[**A, D, E2:** *Calvo et al. 8486*; **B:** *Minga et al. 4154*; **C:** Ecuador, Zamora-Chinchipe, carretero viejo a Zamora desde El Tiro, 19.VII.2023; **E1:** *Calvo et al. 8489*] [Photos: J. Calvo]



Fig. 19. – *Pentacalia moronensis* H. Rob. & Cuatrec. **A.** Habit (notice the lateral, axillary synflorescences); **B.** Adaxial leaf surface; **C.** Capitula. [Ecuador, Pastaza, vía a Canelos km 1.5, finca Heimatlos Eco Lodge, 21.VII.2023 (buds), 6.VIII.2023 (capitula)] [Photos: E. Schulz]

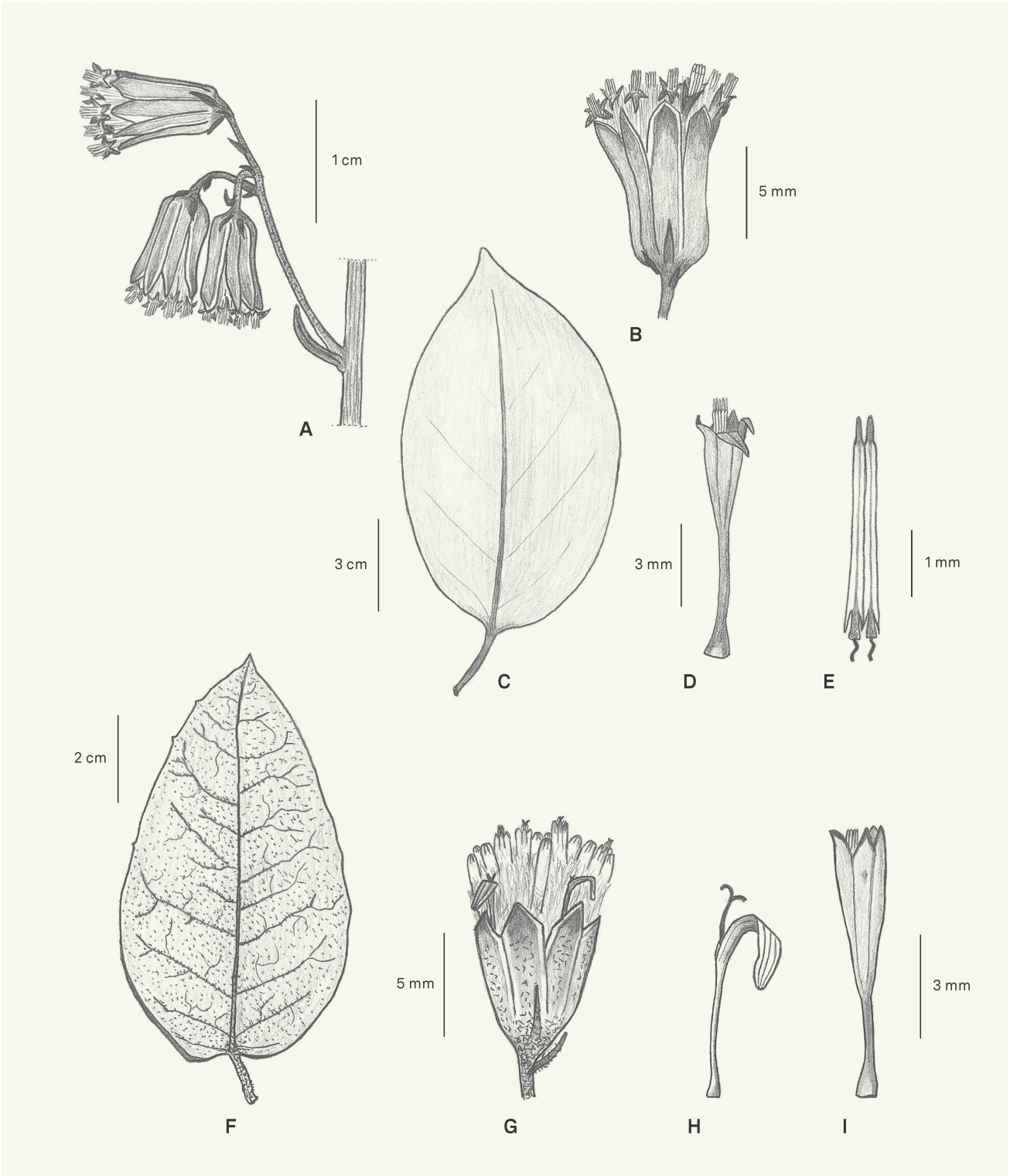


Fig. 20. – *Pentacalia moronensis* H. Rob. & Cuatrec. **A.** Synflorescence branchlet; **B.** Capitulum; **C.** Leaf; **D.** Disc floret (achene and pappus removed); **E.** Anthers. *Pentacalia nordenstamii* J. Calvo: **F.** Leaf; **G.** Capitulum; **H.** Ray floret (achene and pappus removed); **I.** Disc floret (achene and pappus removed). [**A–C:** *van der Werff & Gudiño 11385*, US; **D, E:** *Palacios et al. 8232*, US; **F–I:** *Ståhl et al. 2141*, AAU] [Drawing: J. Calvo]



Fig. 21. – Holotype of *Pentacalia napoensis* H. Rob. & Cuatrec. at US.
[*Hurtado & Alvarado 478*, US00406378; © United States National Herbarium]

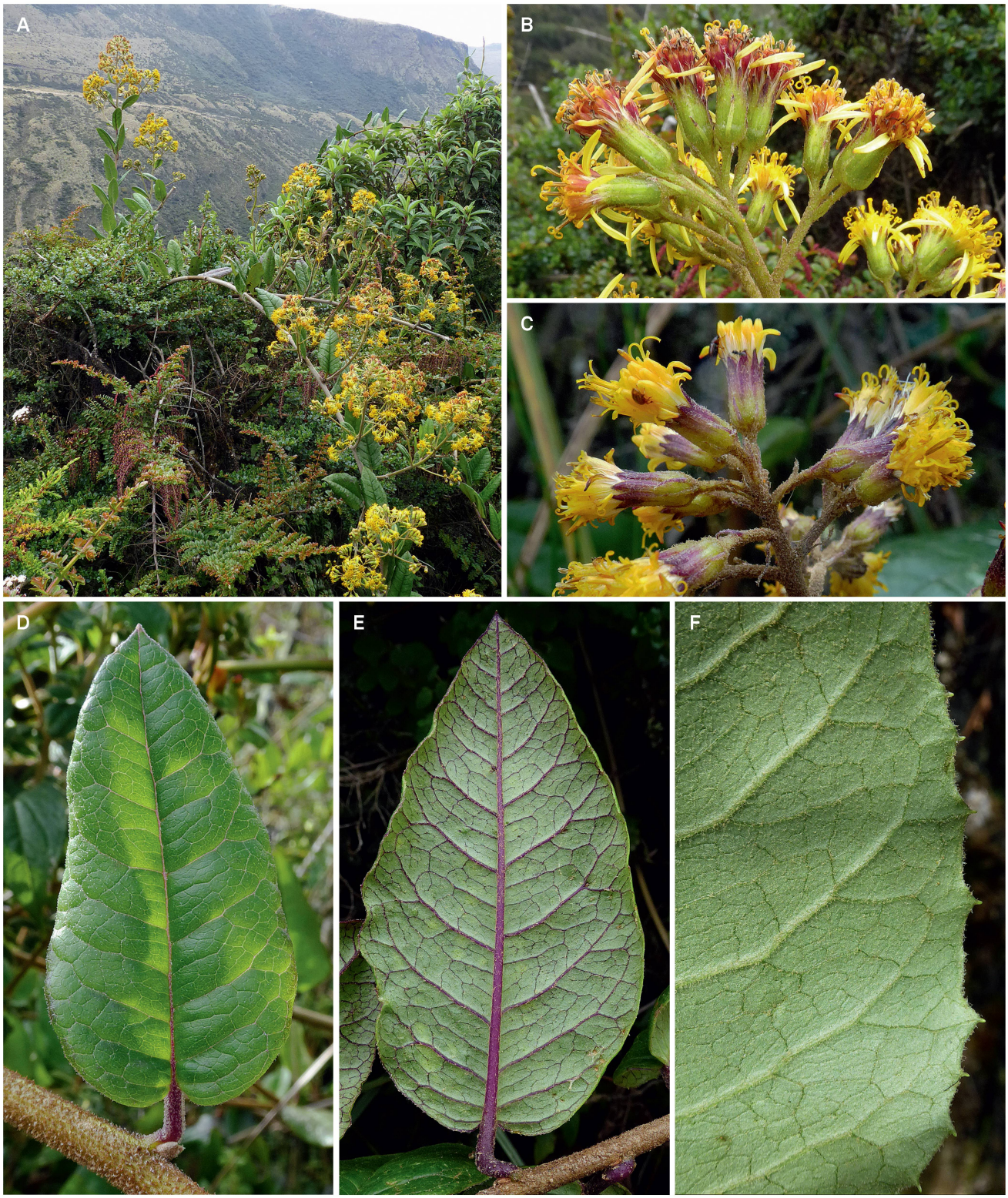


Fig. 22. – *Pentacalia nordenstamii* J. Calvo. **A.** Habit and habitat; **B, C.** Capitula (notice the variability of the limb length of the ray florets); **D.** Adaxial leaf surface; **E.** Abaxial leaf surface; **F.** Zoom in of the abaxial leaf surface.
[**A, B:** Ecuador, Napo, Oyacachi, 11.XI.2018; **C–F:** Ecuador, Napo, Papallacta, 18.X.2018] [Photos: J. Calvo]



Fig. 23. – *Pentacalia oellgaardii* J. Calvo. **A.** Flowering branch; **B.** Leaf; **C.** Capitulum; **D.** Ray floret (achene and pappus removed); **E.** Disc floret (achene and pappus removed); **F.** Anther; **G.** Achene.
[**A:** *Freire-Fierro et al. 2875*, US; **B–G:** *Øllgaard 98236*, G] [Drawing: J. Calvo]



Fig. 24. – *Pentacalia oellgaardii* J. Calvo. **A.** Habitat; **B.** Habit; **C.** Capitula; **D.** Adaxial leaf surface; **E.** Abaxial leaf surface; **F.** Zoom in of the ray florets.
[Ecuador, Napo, Oyacachi, 11.XI.2018] [Photos: J. Calvo]

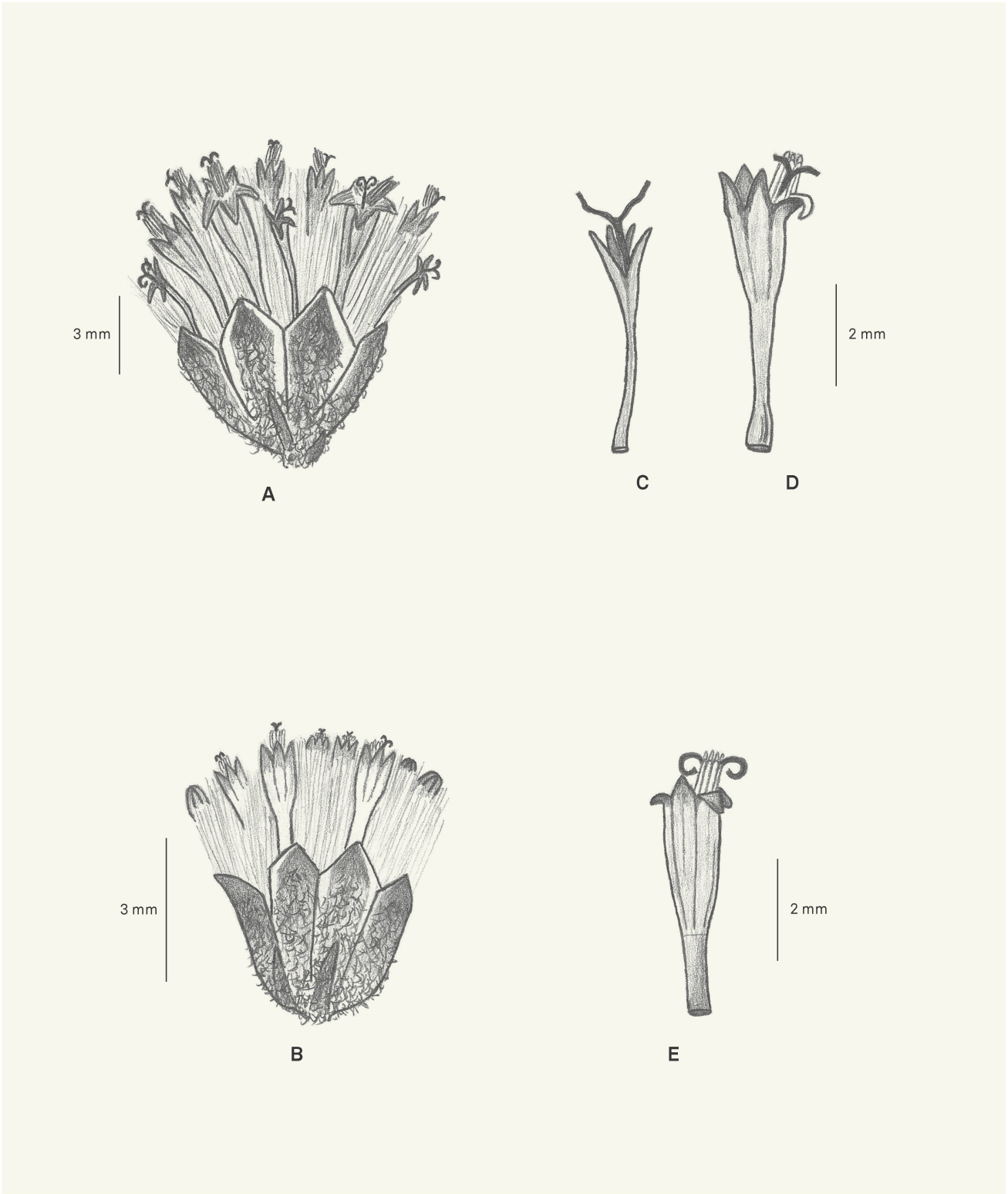


Fig. 25. – *Pentacalia oronocensis* (DC.) Cuatrec. **A.** Disciform capitulum; **B.** Discoid capitulum; **C.** Peripheral floret (achene and pappus removed); **D, E.** Disc floret (achene and pappus removed).
[**A, C, D:** *Jørgensen et al. 92823*, US; **B, E:** *Camp E-4580*, G] [Drawing: J. Calvo]



Fig. 26. – *Pentacalia oronocensis* (DC.) Cuatrec. **A.** Habit; **B.** Synflorescence; **C.** Adaxial leaf surface; **D.** Abaxial leaf surface. [**A:** *Arnelas et al. 1104*; **B, D:** *Calvo & Arnelas 7687*; **C:** *Calvo et al. 8508*] [Photos: J. Calvo]



Fig. 27. – Holotype of *Pentacalia palaciosii* H. Rob. & Cuatrec. at US.
[*Palacios 5303*, US00406377; © United States National Herbarium]



Fig. 28. – *Pentacalia riotintis* (Cuatrec.) Cuatrec. Flowering branch (notice the lateral, axillary synflorescences). [*Fernández et al. 6*] [Photo: N. Zapata]

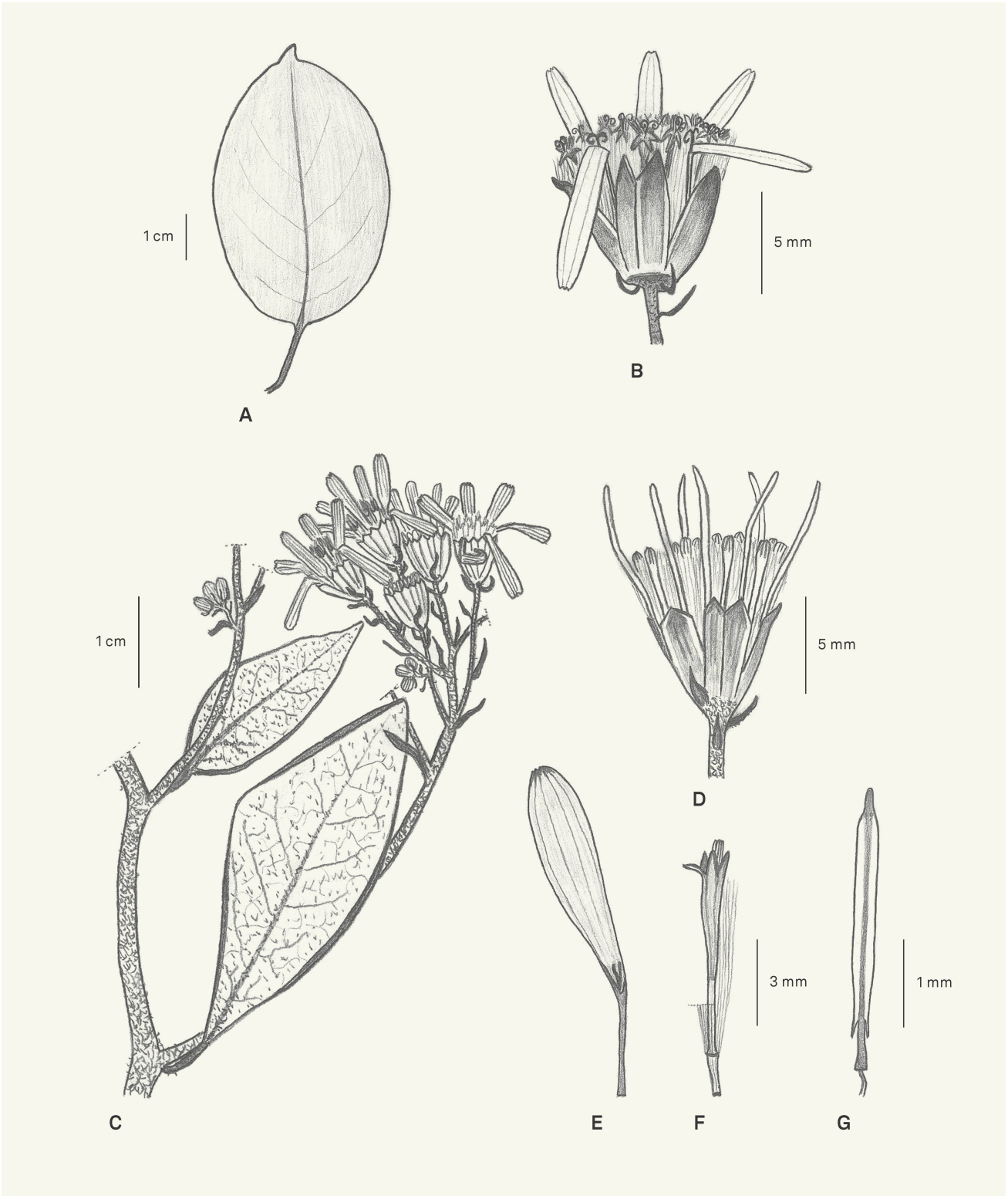


Fig. 29. – *Pentacalia riotintis* (Cuatrec.) Cuatrec. **A.** Leaf; **B.** Capitulum. *Pentacalia ruficaulis* (Greenm. & Cuatrec.) Cuatrec. **C.** Synflorescence branch; **D.** Capitulum; **E.** Ray floret (achene and pappus removed); **F.** Disc floret; **G.** Anther. [**A, B:** *Fernández et al. 6*, G; **C, E, F:** *Camp E-4703*, G; **D, G:** *Camp E-5229*, G] [Drawing: J. Calvo]



Fig. 30. – *Pentacalia ruficaulis* (Greenm. & Cuatrec.) Cuatrec. **A.** Flowering branch; **B.** Capitula; **C.** Adaxial leaf surface; **D.** Abaxial leaf surface (notice the stem indumentum).
[*Minga et al. 4163*] [Photos: J. Calvo]



Fig. 31. – *Pentacalia sevillana* (Cuatrec.) Cuatrec. **A.** Habit; **B.** Developing synflorescences (notice that they are lateral, axillary synflorescences); **C.** Synflorescence; **D.** Capitula; **E.** Adaxial leaf surface.
[*Calvo & Arnelas 7693*] [Photos: J. Calvo]



Fig. 32. – *Pentacalia theifolia* (Benth.) Cuatrec. **A–C.** Leaves (notice the variability); **D.** Capitulum; **E.** Disc floret (achene and pappus removed); **F.** Anther; **G.** Achene.
[**A, D–F:** *Matezki 306*, US; **B:** *Funk & Gavilanes 11054*, US; **C:** *Lewis & Cotton 3320*, US; **G:** *van der Werff & Gudiño 10835*, US] [Drawing: J. Calvo]



Fig. 33. – *Pentacalia theifolia* (Benth.) Cuatrec. **A.** Habit; **B.** Zoom in of the synflorescence; **C.** Adaxial leaf surface; **D.** Abaxial leaf surface. [*Calvo et al. 8506*] [Photos: J. Calvo]



Fig. 34. – *Pentacalia todziae* H. Rob. & Cuatrec. **A.** Apical part of the synflorescence; **B.** Leaves. [**A:** *Zapata et al. 754*; **B:** *Arnelas et al. 1099*] [Photos: **A:** N. Zapata; **B:** J. Calvo]



Fig. 35. – *Pentacalia zakii* H. Rob. & Cuatrec. **A.** Leaves; **B.** Capitula; **C.** Stem and adventitious roots. [**A, C:** *Calvo & Benítez 8478*; **B:** Ecuador, Pichincha, Mindo, X.2020] [Photos: **A, C:** J. Calvo; **B:** R.A. Gelis]

Additional specimens examined. – **Zamora-Chinchipe:** camino cercano a la estación eléctrica San Ramón, 3°58'S 79°3'W, 29.X.2018, *Arnelas, Calvo & Armijos 1099* (HUTPL); Parque Nacional Podocarpus, San Francisco, XI.1993, *Cárdenas & Tello 18* (LOJA); Parque Nacional Podocarpus, San Francisco, 2000 m, 25.IX.1993, *Lozano, Merino & Tello 25* (LOJA); área of ECSF (Estación Científica San Francisco), research station approx. 30 km away from the city of Loja on the highway towards Zamora, 3°58'S 79°4'W, 2050 m, 15.II.2000, *Matezki 167* (LOJA, QCNE, US); San Ramón, planta eléctrica, 3°59'S 79°4'W, 1900 m, 17.IV.2002, *Merino & Delgado E-1336* (HUTPL, LOJA); San Ramón, [3°58'S 79°3'W], 1900 m, 12.XII.2002, *Tinitana 1020* (HUTPL); area of Estación Científica San Francisco, road Loja-Zamora, c. 35 km from Loja, above Sabanilla village, 3°58'S 79°4'W, 1990 m, 7.II.2005, *Werner 1473* (LOJA); Yantzaza, parroquia Los Encuentros, campamento "Las Peñas" (Fruta del Norte), sobre la meseta de Hollín, sector "Colibrí 4", 3°45'S 78°30'W, 1770 m, 14.II.2021, *Zapata et al. 754* (G, QCA).

27. ***Pentacalia zakii*** H. Rob. & Cuatrec. in Novon 3: 290. 1993 (Fig. 35 → p. 83).

Holotypus: Ecuador. Pichincha: reserva florística-ecológica "Río Guajalito", km 59 de la carretera antigua Quito–Sto. Domingo de Los Colorados, a 3.5 km al NE de la carretera, estribaciones occidentales del volcán Pichincha, 0°13'53"S 78°48'10"W, 1800–2200 m, 18.IX.1986, *Zak 1213* (US [US00406376] image!; iso-: AAU [2 specimens]!, F [F0076820F] image!, MO-4062172, QCA [QCA18394]!).

= *Pentacalia cazaletii* H. Rob. & Cuatrec. in Novon 3: 286. 1993, **syn. nov. Holotypus: Ecuador. Santo Domingo de los Tsáchilas:** 20 km W of Santo Domingo de los Colorados, c. 305 m, 18.X.1961, *Cazalet & Pennington 5064* (US [US00406383] image!; iso-: B, K [K000497631] image!, NY).

Plants scandent; stems terete, finely furrowed, glabrous, solid. *Leaves* alternate, simple, petiolate; petioles 1.4–1.8 cm long; laminas 10–13 × 5–6.5 cm, elliptic, apex attenuate to acuminate, base obtuse, margin entire, glabrous on both surfaces, somewhat fleshy (drying coriaceous), concolorous, secondary veins usually barely conspicuous on both surfaces. *Synflorescences* mostly lateral, axillary, narrowly thyrsoid-paniculiform, greatly exceeding leaf length, usually with bracts foliose; synflorescence branches tomentulose. *Capitula* heterogamous, disciform, subsessile or shortly pedunculate; peduncles 0.5–3 mm long, tomentulose to slightly arachnoid, with 1–2 linear-subulate bracteoles; involucres cylindrical, glabrous or with a few scattered trichomes near base; involucral bracts (7–)8, 5.4–7 × 1.3–2 mm, linear-oblong; supplementary bracts 3–5, 1.2–1.5 × 0.5–0.7 mm, lanceolate, extending to < ¼ the length of involucral bracts. *Peripheral florets* 4–5, pistillate; corollas 4.9–5.5 mm long, tubular, 4–5-lobed, whitish. *Disc florets* 7–10, hermaphroditic; corollas 5.5–6.2 mm long, tubular, 5-lobed, whitish; anthers brownish, anther bases caudate, ½ as long as filament collar, appendages c. 0.4 × 0.15 mm; style branches truncate with crown of sweeping trichomes. *Achenes* c. 2.5 × 0.7 mm, cylindrical, 8–10-ribbed, glabrous; pappus 4–5 mm long, bristles capillary, barbellate, whitish.

Etymology. – The epithet *zakii* honors Vlastimil Zak (1959–2020), Ecuadorian botanist who extensively collected in the country and founded the Ecological Reserve Río Guajalito.

Distribution, ecology and phenology. – Putative endemic to Ecuador (Carchi, Pichincha, Santo Domingo de los Tsáchilas). This species grows in seasonal rain forests and humid montane forests, at elevations of (300–)1250–2450 m. Collected in flower between July and October and in March (Map 14).

Notes. – This species is characterized by having lateral, axillary synflorescences exceeding the leaf length, coriaceous leaves (somewhat fleshy in living plants), and capitula subsessile or shortly pedunculate and disciform. The branches usually produce short adventitious roots (see holotype and Fig. 35C → p. 83). It keys out next to *Pentacalia palaciosii*, another disciform species with lateral, axillary synflorescences. They differ in synflorescence type (thyrsoid-paniculiform in *P. zakii* vs. racemiform or rarely racemose-paniculiform in *P. palaciosii*), peduncle length (0.5–3 mm in *P. zakii* vs. 5–14 mm in *P. palaciosii*), supplementary bract length (1.2–1.5 mm, extending to < ¼ the length of involucral bracts in *P. zakii* vs. 2–5 mm, extending to ¾ the length of involucral bracts in *P. palaciosii*), and leaf veins (usually barely conspicuous in *P. zakii* vs. secondary veins protruding in *P. palaciosii*).

Pentacalia cazaletii was described from the province of Santo Domingo de los Tsáchilas and basically separated from *P. zakii* by having synflorescences with foliose bracts (vs. naked) and ovate or elliptical leaves (vs. broadly oblong). The type material of *P. zakii* certainly shows naked synflorescences only branched distally, but the four duplicates I studied have synflorescences partially broken. In contrast, the collection *Webster et al. 27739* (QCA) from near Nanegal (Pichincha) displays foliose bracts at the base of some synflorescence branches. It also has to be noted that the paratype cited in the protologue of *P. cazaletii*, *Cerón et al. 8937* (QCNE, US), comes from the type locality of *P. zakii*, near the village of Chiriboga. When I visited this locality in July 2023, the species was not in flower but I can conclude that the slightly difference in leaf shape stated by Robinson & Cuatrecasas (1993) is not a diagnostic character for separating it from *P. cazaletii*. This species is therefore synonymized with *P. zakii*.

The collection *Øllgaard et al. 57816* from Loja, cited as *P. zakii* by Nordenstam (1999), is here identified as *P. sevillana*, and therefore, *P. zakii* remains known only from the northern Cordillera Occidental of Ecuador.

Since the Ecuadorian botanist Vlastimil Zak founded the Ecological Reserve Río Guajalito in the region where this

restricted species seems to be not so rare, I did not hesitate in keeping the epithet *zakii* for this interesting species.

Additional specimens examined. – **Carchi:** Espejo, El Gualtal, faldas de cerro Golondrina Hembra, 0°51'N 78°7'W, 2450 m, 21.VIII.1994, *Palacios 12716* (QCNE, US); Espejo, cerro Golondrinas, 0°51'N 78°7'W, 2450 m, VIII.1994, *Palacios 12779* (QCNE, US). **Pichincha:** Lloa, Chiriboga, c. 0.5 km siguiendo la pista que sale del pueblo y cruza el río Saloya, 0°13'S 78°46'W, 1820 m, 16.VII.2023, *Calvo & Benítez 8478* (QCA); Quito, Chiriboga, en la carretera viaje a Santo Domingo, reserva forestal "La Favorita" del Ministerio Agricultura, 0°12'S 78°47'W, 1600–1800 m, 8.III.1990, *Cerón, Ayala & Jiménez 8937* (QCNE, US); Quito, reserva Maquipucuna, along río Tulambi, W of hacienda El Carmen, c. 4 km airline SE of nanegal, 0°7'N 78°38'W, 1250 m, 18.IX.1989, *Webster, Addison & Colvin 27739* (QCA).

Doubtful name

Pentacalia pailasensis H. Rob. & Cuatrec. in Novon 3: 289. 1993.

Holotypus: Ecuador. Morona-Santiago: trail between Mirador and Pailas, 2010–2255 m, 9.IX.1943, *Steyermark 54275* (F, most likely lost).

Notes. – The specimen *Palacios & Tirado 13032* (QCNE, US) was identified as *Pentacalia pailasensis* by Robinson (in sched., 1998). I did not find any difference from the specimens belonging to *P. sevillana*. Moreover, this specimen and the type locality of *P. pailasensis* fall within the known distribution area of *P. sevillana*.

Pentacalia pailasensis, however, remains as a doubtful species because no type material has been found. The holotype at F appears to have been lost (K. Hansen, pers. comm.) and no duplicates of *Steyermark 54275* have been located.

Taxon to be searched for

***Pentacalia* sp.**

Ecuador. Esmeraldas: San Lorenzo, parroquia Alto Tambo, frente finca del Sr. Lalama, a 1.5 km del sector de El Cristal, 00°50'N 78°30'W, 650 m, 13.V.1992, *Quelal & Luteyn 477* (QCNE-64601!, US [US01844459] image!).

Notes. – The two specimens that I located of *Quelal & Luteyn 477* do not have the capitula developed enough to examine them. The indumentum of leaves, synflorescence branches, and involucres have an indumentum composed of T-shaped trichomes similar than in *Pentacalia subglomerosa* (Greenm.) Cuatrec. from southern Peru and Bolivia (Calvo, 2021).

This collection was identified as *Pentacalia carchiensis* (= *P. aschersoniana*) by Nordenstam (1999), which is not because of the indumentum composed of T-shaped trichomes. It does not match any known species from Ecuador or Colombia. This may probably correspond to a new species.

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Appendix 1: list of accepted names

1. ***Pentacalia andrei*** (Greenm.) Cuatrec.
2. ***Pentacalia arborea*** (Kunth) Cass.
3. ***Pentacalia aschersoniana*** (Hieron.) Cuatrec.
4. ***Pentacalia atrovinosa*** J. Calvo & Á.J. Pérez
5. ***Pentacalia celicana*** J. Calvo & G. Benítez
6. ***Pentacalia corazonensis*** (Hieron.) Cuatrec.
7. ***Pentacalia disciformis*** (Hieron.) Cuatrec.
8. ***Pentacalia dorrii*** H. Rob. & Cuatrec.
9. ***Pentacalia floribunda*** Cuatrec.
10. ***Pentacalia hillii*** (Greenm.) Cuatrec.
11. ***Pentacalia huilensis*** (Cuatrec.) Cuatrec.
12. ***Pentacalia hurtadoi*** H. Rob. & Cuatrec.
13. ***Pentacalia luteynorum*** H. Rob. & Cuatrec.

13a. ***Pentacalia luteynorum*** subsp. ***luteynorum***

13b. ***Pentacalia luteynorum*** subsp. ***lutea*** J. Calvo

14. ***Pentacalia millei*** (Greenm.) Cuatrec.
15. ***Pentacalia moronensis*** H. Rob. & Cuatrec.
16. ***Pentacalia napoensis*** H. Rob. & Cuatrec.
17. ***Pentacalia nordenstamii*** J. Calvo
18. ***Pentacalia oellgaardii*** J. Calvo
19. ***Pentacalia oronocensis*** (DC.) Cuatrec.
20. ***Pentacalia palaciosii*** H. Rob. & Cuatrec.
21. ***Pentacalia popayanensis*** (Hieron.) Cuatrec.
22. ***Pentacalia riotintis*** (Cuatrec.) Cuatrec.
23. ***Pentacalia ruficaulis*** (Greenm. & Cuatrec.) Cuatrec.
24. ***Pentacalia sevillana*** (Cuatrec.) Cuatrec.
25. ***Pentacalia theifolia*** (Benth.) Cuatrec.
26. ***Pentacalia todziae*** H. Rob. & Cuatrec.
27. ***Pentacalia zakii*** H. Rob. & Cuatrec.

Appendix 2: list of exsiccatae

Specimens are listed alphabetically by collector, followed by collection number or date when a collection number was not assigned. Specimens without collection number and date are not listed. The number in parentheses corresponds to the number of the accepted species in the treatment.

Aguirre, Santiana & Tapia PMV-1662 (13b)
Alvarez et al. 405 (11)
André 4520 (1)
Armijos 3103 (24)
Arnelas, Calvo & Armijos-Barros 1092 (1), *1099* (26), *1104* (19)
Asplund 7457 (9), *8066* (25), *17237* (7)
Baca et al. Y164 (17)
Bang 2494 (19)
Benoist 2541 (9), *2676* (7), *3883* (7)
Boeke 925 (13a)
Boeke & Jaramillo 2746 (2)
Bonpland & Humboldt 2070 (2)
Borchsenius 159 (25)
Boyle & Bradford 1943 (25), *1968* (25)
Boyle & Hibbs 2318 (25)
Boyle et al. 3388 (25)
Brandbyge & Jørgensen 42872 (18)
Calvo 7827 (25)
Calvo & Arnelas 7685 (8), *7687* (19), *7693* (24), *7698* (14), *7700* (22)
Calvo & Benítez 8458 (6), *8459* (7), *8461* (9), *8464* (6), *8467* (13b), *8478* (27), *8480* (11), *8482* (13b), *8483* (6)
Calvo, Benítez & Espinosa-Ortega 8486 (14), *8488* (24), *8489* (14), *8491* (8), *8499* (25), *8506* (25), *8507* (14), *8508* (19)
Camp E-1389 (1), *E-4070* (6), *E-4323* (24), *E-4427* (23), *E-4580* (19), *E-4703* (23), *E-5229* (23)
Campos & García 3942 (13b)
Campos, L. Campos & Zurita 5542 (1)
Caranqui, Toapanta & Croat 758 (12)
Cárate et al. 1334 (18)
Cárdenas & Tello 18 (26)
Cazalet & Pennington 5064 (27), *5466* (17), *5477* (17)
Cerón 66161 (7)
Cerón & Alarcón 4842 (9)
Cerón & M. Cerón 4476 (9)
Cerón & Reina 18821 (9)
Cerón & Reyes 59394 (9), *62562* (7)
Cerón, Ayala & Jiménez 8937 (27)
Cerón, Vega & Bravo 267 (9)
Cerón et al. 200 (25)
Chindoy 117 (17)
Christensen 75028 (25)
Clark & Jost 6998 (1)
Clark, Bennett & Bohs 9071 (24)
Clemants 2337 (25)
Croat & Ferry 98556 (25), *98950* (14)
Cuamacás, Gudiño & Gudiño 568 (7)
Cuatrecasas 8485 (11)
Díaz & Osores 2945 (13b)
Dodson & Gentry 12074 (2)
Dodson & Thien 779 (8), *1375* (14)
Dorr & Valdespino 6654 (8)
Eriksen 91160 (25)
Espinosa 960 (24), *1444* (24), *1557* (25)
Espinosa-Ortega, Calvo & Benítez 1043 (5), *1048* (5)
Fernández et al. 6 (22)
Ferreyra 2310 (19)
Freire 211 (8)
Freire, Morales & Mites 3263 (25), *3266* (11)
Freire-Fierro, Vargas & Narváez 2875 (18)
Funk & Gavilanes 11054 (25)
García 668 (17); *694* (17)
García-Barriga & Hawkes 13065 (3)
Garmendia & Igual 1522 (23)
Garmedia & Paredes 561 (1), *628* (22), *674* (25)
Gentry 80251 (14), *80381* (24)
Gentry, Díaz & Ortiz 74971 (7)
González, Ramírez & Urbano 2947 (7)
Hartweg 1166 (25)
Harling 25292 (1)
Harling & Andersson 13539 (14), *21441* (22), *21735* (13b), *22970* (24), *23759* (25)
Harling & Ståhl 26481 (24)
Harling, Storm & Ström 8486 (25), *8488* (25)
Hitchcock 20946 (3), *21525* (25)
Holm-Nielsen & Jeppesen 1386 (6)
Holm-Nielsen, Jaramillo & Coello 29720 (7), *29743* (2), *29921* (2)
Holm-Nielsen, Jaramillo & de Vries 17360 (25)
Holm-Nielsen, Silva & Velastegui 16878 (25)
Holm-Nielsen et al. 3567 (22), *27344* (25), *27594* (25), *27635* (25)
Homeier & Peña 5796 (1)
Hrusa 29532 (13b)
Hurtado & Alvarado 302 (12), *478* (16)
Jaramillo 7672 (19), *8682* (25), *9307* (21), *9359* (7), *28063* (18)
Jaramillo & Boeke 605 (2)
Jaramillo & Coello 4024 (2)
Jaramillo & Proaño 1927 (9)
Jaramillo & Tapia 18484 (25)
Jaramillo & Winnerakjold 5790 (25), *5874* (25)
Jaramillo, Buenaño & Santillán 26805 (25)
Jaramillo, J.A. Jaramillo & Venalcázar 29697 (5)
Jaramillo, Zak & Valencia 8704 [*8602*] (25), *8775* (13b)
Jones 11411 (25)

Jørgensen 56432 (13b), *65928* (9)
Jørgensen, Ulloa & Luteyn 92823 (19), *92836* (25), *92855* (8)
Jørgensen et al. 168 (5), *819* (19), *1271* (8), *1295* (1), *92277* (3)
Katán, C. Morales & T. Embrey 360 (25), *428* (23)
Kelch et al. 31973 (13b)
Killip 6737 (3)
King & Almeda 7841 (24)
King, Peterson & Judziewicz 10136 (2)
Kirkbride & Chamba 4084 (11), *4255* (13a)
Larsen 202 (25)
Lehmann 8502 (21)
Lewis 3675 (25)
Lewis & Bruneau 3557 (8)
Lewis & Cotton 3320 (25)
Lewis & Lozano 2805 (19)
Lewis et al. 2853 (24)
Løjtnant, A. Molau & Molau 13731 (6)
Løjtnant, Molau & Madison 12073 (2), *12335* (11), *12608* (25)
Lozano, Merino & Delgado E-601 (24)
Lozano, Merino & Tello 25 (26)
Lozano, Yangora & Grefa 117 (25)
Lozano et al. E-375 (1), *E-762* (19), *E-771* (24)
Lugo 11 (12)
Luteyn & Cotton 10952 (2)
Luteyn & Lebrón-Luteyn 6510 (6), *6733* (13a)
Macbride 5157 (19)
Madsen 75435 (8), *75516* (19), *75586* (14), *86235* (25), *86250* (1), *86403* (14)
Madsen & Ellemann 75224 (25), *75248* (8), *75982* (1)
Madsen, Bloch & Christensen 75787 (13b)
Maguire & C.K. Maguire 44255 (6)
Matezki 50 (1), *83* (22), *84* (1), *114* (1), *167* (26), *226* (22), *306* (25), *311* (14), *417* (14), *442* (25), *500* (22)
Mathews 1356 (25)
Mera & Sinche 4927 (14)
Merino & Delgado E-1336 (26)
Merino & Pedersen 4763 (22)
Merino, Delgado & Chimbo E-1518 (1)
Merino et al. 4700 (14), *4804* (14)
Mexia 7629 (3)
Mille 264 (7), *724* (7), *736* (18), VII.1896 (9), IX.1896 (7), VII.1899 (9), VII.1917 (9), VII.1919 (9)
Minga, Calvo & Benítez 4150 (25), *4151* (19), *4154* (14), *4163* (23)
Minga, Verdugo & Clavijo 1072 (25), *1200* (25)
Minga et al. 3916 (1)
Montenegro et al. 27 (13)
Mora et al. 132 (7), *140* (2)
Morales & Embrey 1346 (25), *1377* (25)
Moreno 208 (2)
Narváez & Quizhpe 325 (18)
Neill & Kajekai 16634 (26)
Neill & Quizhpe 16155 (24)
Neill, Davidson & Christoph 15990 (1), *15997* (25)
Neill, Freire & Vargas 10971 (20)
Neill, Hurtado & Alvarado 8558 (12)
Neill et al. 14413 (25), *14426* (1), *16031* (19)
Øllgaard 74631 (14), *98236* (18)
Øllgaard & Balslev 8298 (25), *9437* (23), *9626* (1), *9757* (24)
Øllgaard & Christensen 74999 (8)
Øllgaard & Feil 91116 (13b)
Øllgaard & Madsen 90479 (8)
Øllgaard, Madsen & Christensen 74195 (14), *74616* (25), *74624* (25)
Øllgaard et al. 38366 (8), *57816* (24), *58309* (25)
Palacios 5303 (20), *11725* (21), *11798* (2), *11848* (21), *11887* (21), *11978* (7), *12716* (27), *12779* (27), *12788* (20), *12940* (14), *12989* (19)
Palacios & Clark 12444 (25), *12499* (25), *12504* (25), *12524* (11)
Palacios & Rubio 5265 (2), *5266* (21), *5287* (21)
Palacios & Tipaz 10585 (21)
Palacios & Tirado 13032 (24)
Palacios & van der Werff 3920 (2)
Palacios, Aymard & Freire 8374 (14)
Palacios et al. 8232 (15)
Pennell & Killip 6509 (3)
Peñafiel et al. 323 (7)
Pérez et al. 7097 (14), *7450* (25), *11145* (4)
Quelal, Terán & Toasa 16 (9)
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