Phytotaxa 375 (1): 070–080
http://www.mapress.com/j/pt/

Article

ISSN 1179-3155 (print edition)
PHYTOTAXA
ISSN 1179-3163 (online edition)

https://doi.org/10.11646/phytotaxa.375.1.3

Three new caespitose species of *Senecio* (Senecioneae, Compositae) from Central Andes

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Abstract

Three new species of *Senecio* belonging to the group of discoid caespitose species are described from the high Andes of Bolivia. One of them is also recorded from southern Peru. Special emphasis is placed on the color of the anthers, style-branches, and corollas, which are useful characters that were undervalued in previous taxonomic treatments dealing with this species assemblage. The three species are illustrated and pictures of living plants are included when available.

Keywords: Asteraceae, Bolivia, Peru, taxonomy

Introduction

The nearly cosmopolitan genus *Senecio* Linnaeus (1753: 866) has significant centers of diversity in the Mediterranean climate zones, i.e., South Africa, Chile, and the Mediterranean Basin (Calvo *et al.* 2015). A remarkable diversification also occurs through the Andes, especially at mid- and high-elevations. Although a comprehensive revision of this large genus in the Andes is still lacking, some regional catalogues and works are available, i.e., Ávila *et al.* (2016) for Colombia, Nordenstam (1999) for Ecuador, Vision & Dillon (1996) for Peru, Cabrera (1985) and Beck & Ibáñez (2014) for Bolivia, Freire *et al.* (2014) for Argentina, and Cabrera (1949) and Rodríguez *et al.* (2018) for Chile.

In the geographical framework of southern Andes, the main contributions to the taxonomy of *Senecio* were done by the Argentinian botanist A.L. Cabrera (1908–1999), who extensively worked on the family Asteraceae of this region (see Múlgura de Romero & Price 1999 for further details). Because of the large number of species of this genus, he proposed an infrageneric taxonomy composed of sections and series, which has been later adopted by other botanists (Freire *et al.* 2014). However, this classification has not been thoroughly revised and is still awaiting for phylogenetic confirmation.

Cabrera's treatment of the Bolivian *Senecio* includes 114 species, a number to be reduced to ca. 76 if the generic concept is understood in its narrowest sense. It has to be noted that Cabrera did not recognize most of the *Senecio* segregates that nowadays are widely accepted, e.g., *Dendrophorbium* (Cuatrecasas 1951: 72) Jeffrey (1992: 65) and *Pentacalia* Cassini (1827: 461). Recently, Beck & Ibáñez (2014) recorded 99 species from Bolivia, 15 of them being endemic. Among the strictly discoid caespitose taxa, Cabrera (1985) included eight species. Seven of them are also recorded in the border regions of southern Peru, northern Chile, or northwestern Argentina.

Herein, we describe three new species belonging to this group on the basis of morphological evidence, two of them from northern Bolivia and the third from Bolivia and southern Peru. A taxonomic discussion, distribution map, and illustrations are provided for each species, as well as pictures of living plants when available. A dichotomous key including all the discoid caespitose species from Bolivia and Peru is being prepared and it will be promptly published.

The color of anthers and style-branches alongside the corolla color has a remarkable taxonomic importance within this species assemblage, and it has been undervalued in previous taxonomic treatments; it was neither included in

 Accepted by Alexander Sennikov: 20 Oct. 2018; published: 9 Nov. 2018

Cabrera's key nor in its subsequent adaptations, e.g., Freire *et al.* (2014), Montesinos (2014). This character is greatly conspicuous in living plants and usually can also be easily studied on dry specimens. This character lets easily anyone separate the subgroup of species displaying yellowish anthers, style-branches, and corollas from the subgroup with blackish anthers and style-branches and whitish corollas. Our taxonomic treatment intends to highlight the importance of this character, and its use is recommended to any future botanist working on this group.

Material and Methods

This contribution is the result of an intensive review of the published bibliography and the revision of specimens kept at BOLV and LPB. Additionally, photographs of specimens from other institutions were studied: K, MO, SI, and USM; herbarium acronyms follow Thiers (2018). The plant terminology follows Beentje (2010).

Taxonomy

1. ***Senecio madidiensis*** J. Calvo & A. Fuentes, ***sp. nov.*** (Fig. 1, 2)

Type:—BOLIVIA. Dpto. La Paz: Prov. Franz Tamayo, P.N. Madidi, Lampayani, 14º40'S 69º06'W, 4120 m, 13 April 2008, *A. Fuentes, P. Paco & R. Canaza 12495* (holotype: LPB s.n.; isotype: MO2658968).

Within the discoid caespitose species with blackish anthers and style-branches and whitish corollas, this species differs in its leaves linear-oblong, entire or subentire, plane, acute at the apex, plainly glabrous, and fleshy.

FIGURE 1. *Senecio madidiensis*. Habit and detail of the capitula and leaves. Pictures by A. Fuentes at Lampayani *Polylepis* forest near Carcapampa community (Franz Tamayo, La Paz, Bolivia).

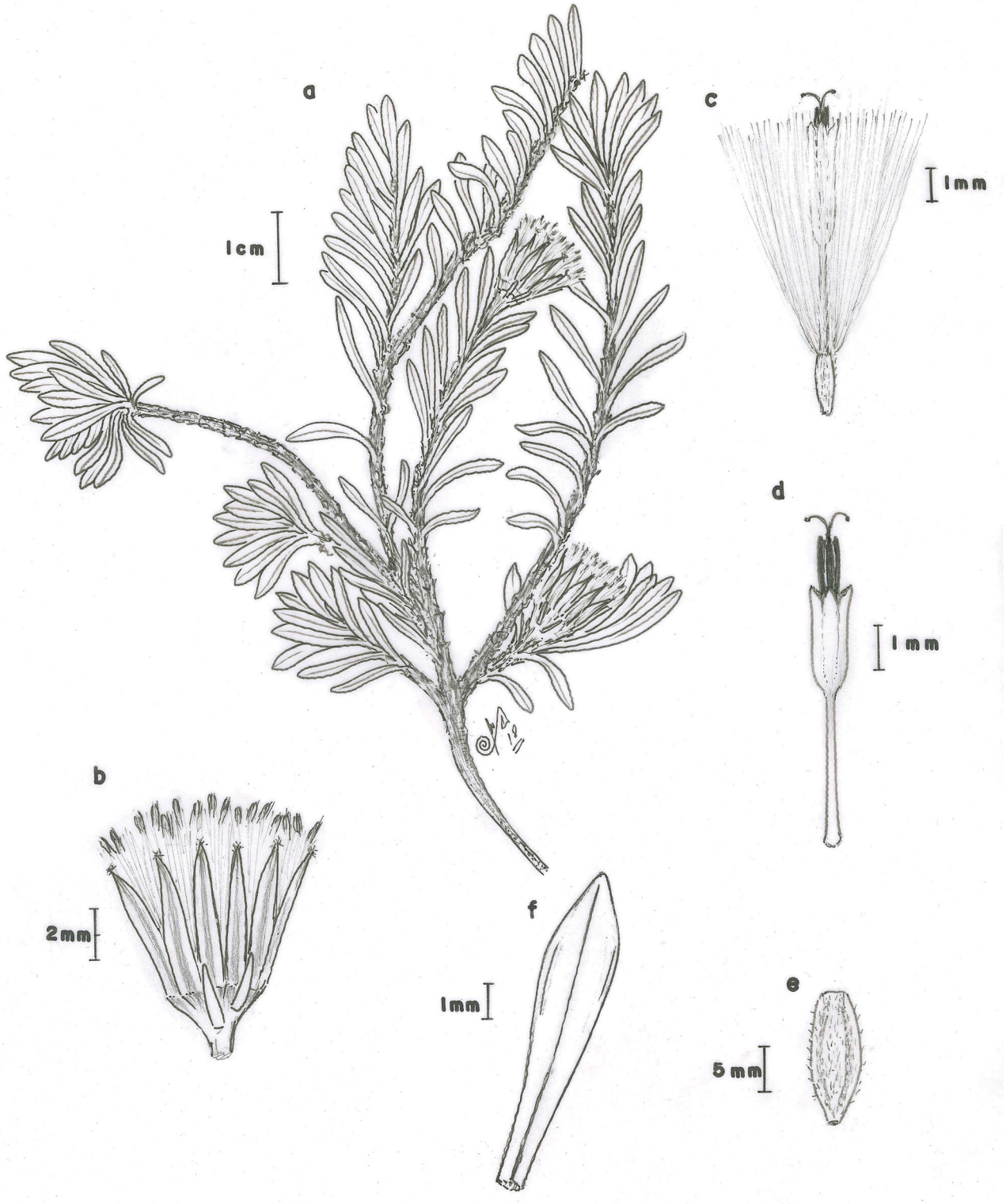

FIGURE 2. *Senecio madidiensis*—A. Habit (drawn from *A. Fuentes 12495*, LPB).—B. Capitulum (drawn from *I. Loza 635*, LPB).—C. Achene with pappus (drawn from *I. Loza 618*, LPB).—D. Disc floret (drawn from *A. Fuentes 12495*, LPB).—E. Achene (drawn from *I. Loza 618*, LPB).—F. Leaf (drawn from *A. Fuentes 12495*, LPB).

Creeping perennial herb. Stems prostrate up to 20–30 cm, glabrous, with remnants of the pseudopetioles, usually purplish. Leaves linear-oblong, 6.3–13 mm long, 1.8–2.5 mm wide, acute at the apex, attenuated in pseudopetiole, entire, sometimes with two obtuse shallow teeth near the apex, plane, glabrous, fleshy, usually with the midrib and the pseudopetiole purplish. Capitulum discoid, solitary, terminal, shortly pedunculate (up to 4.5 mm long); involucre 6.5–8 mm long, (4.2–)4.6–7 mm wide. Involucral bracts (8–)11–13(–14), linear-oblong, 5.1–7.5 mm long, 0.9–2.8 mm wide, smooth, glabrous, with the apex greenish or purplish. Supplementary bracts 3–4, linear-subulate, 4.1–5.7 mm long, 0.6–0.8 mm wide, smooth, a half as long as the involucral bracts, glabrous, usually with the apex purplish. Disc florets (17–)29–30, 5.2–6.8 mm long, 1–1.2 mm wide, 5-lobed, whitish. Anthers auriculate, blackish; filament collar balusterform. Style-branches truncate with a crown of sweeping hairs, blackish. Achenes ca. 1.7 mm long, ca. 0.5 mm wide (immature), covered by whitish unicellular trichomes ca. 0.2 mm long; pappus 6.5–8 mm long, barbellate, whitish. Chromosome number: unknown.

Distribution and habitat:—Bolivia (La Paz). This species is known from the highlands of the Apolobamba mountain range included in the protected areas of Madidi and Apolobamba (Fig. 3). It is also expected in the Peruvian region nearby La Rinconada because of its proximity (Puno Department). *Senecio madidiensis* thrives in areas with very humid climate, usually on rocky slopes, around the transition between the upper montane and alpine bioclimatic belts in environments with little human influence, which mainly includes "páramo yungueño" grassland vegetation, at elevations of 4100–4500 m. The habitat is characterized by species of *Deyeuxia*, *Festuca*, *Luzula*, *Polystichum*, *Gentianella*, with patches of *Polylepis pepei* and *Gynoxys* spp.

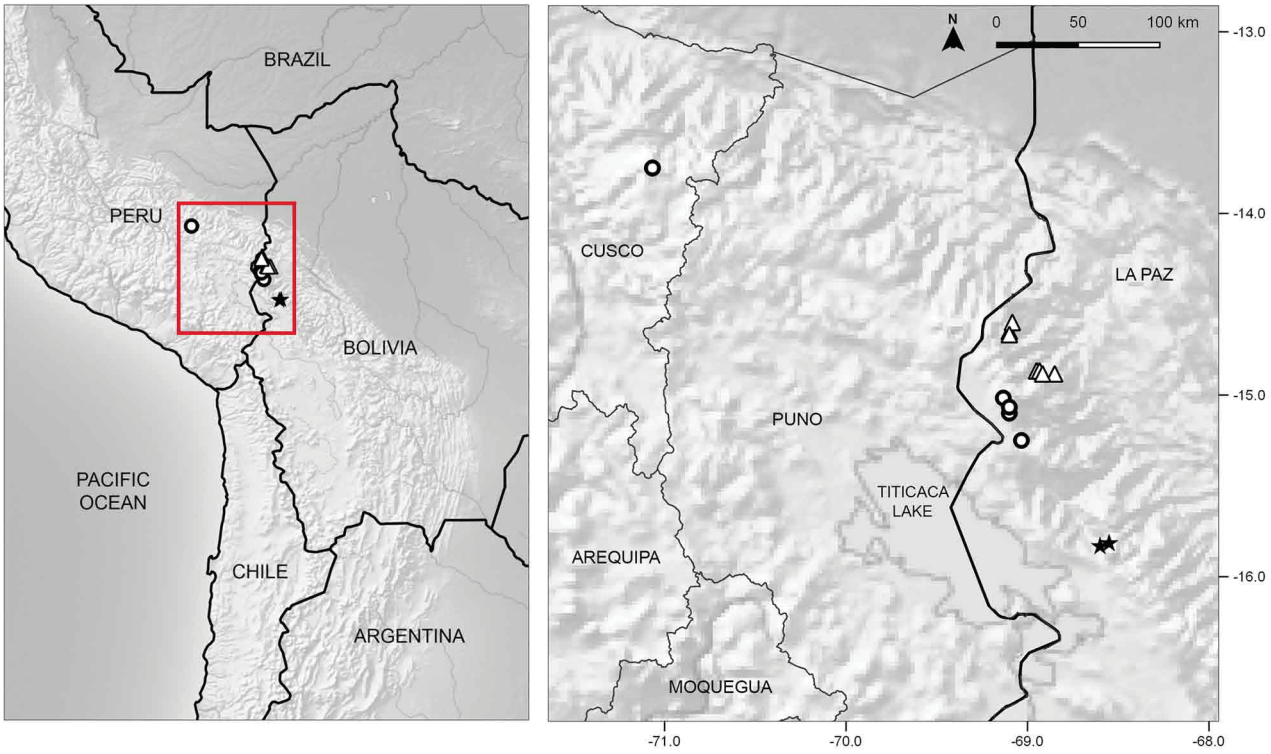

FIGURE 3. Distribution map of *Senecio madidiensis* (open triangle), *S. menesesiae* (open circle), and *S. woodii* (star).

Phenology:—Collected in bloom from April to June and in September.

Etymology:—The epithet *madidiensis* refers to the National Park Madidi, where the type material was collected. One of the largest parks in Bolivia, Madidi embraces from lowland areas to high Andes.

Additional specimens examined (paratypes):—BOLIVIA. Dpto. La Paz: Prov. Bautista Saavedra, área natural de manejo integrado Apolobamba, sector apacheta Pallalani, entre Chiata y Lurisani, 14º52'S 68º56'W, 26 March 2009, *A. Fuentes 13482* (LPB); área natural de manejo integrado Apolobamba, Hilo Hilo, en la laguna que se encuentra por el camino a la localidad de Laji Sorapata, 14º53'S 68º55'W, 6 April 2009, *I. Loza & al. 618* (LPB). Prov. Franz Tamayo, P.N. Madidi, Keara Nuevo, camino a Puina, 14º39'S 69º6'W, 19 June 2005, *A. Fuentes & al. 8406* (LPB, MO n.v.); área natural de manejo integrado Apolobamba, Hilo Hilo, sobre el río Tumamayu en la localidad de Laji Sorapata, 14º53'S 68º51'W, 10 April 2009, *I. Loza & al. 635* (LPB); camino al bosque de Wila Pichini, Chiata Hilo Hilo, 14º52'S 68º57'W, 23 September 2006, *A. Palabral, I. Gómez & J. Alcoreza 453* (LPB); Apolobamba, entre la comunidad de Puina y cerro k'akepununa, 14º36'S 69º5'W, 10 April 2008, *J. Quisbert & al. 827* (LPB, MO n.v.).

Discussion:—*Senecio madidiensis* belongs to the group of discoid caespitose species with blackish anthers and style branches, whitish corollas, and glabrous leaves. It is characterized by its linear-oblong, entire or subentire, plane, and fleshy leaves. The stems are usually purple.

The morphologically closest species is *S. pucapampaensis* Beltrán (2009: 212) [= *S. canoi* Gonzáles *et al.* in Montesinos (2015: 1), *S. sykorae* Montesinos (2014: 6), ***syn. nov.***] from Peru. The new species can be differentiated from the latter by its leaves (linear-oblong, plane, acute at the apex, entire or subentire vs. cuneiform to spatulate, strongly recurved, obtuse at the apex, dentate or pinnatifid (rarely subentire) in *S. pucapampaensis*). Moreover, *S. pucapampaensis* forms tightly compressed mats, whereas *S. madidiensis* is a rather laxly creeping species. The distribution area of the new species does not overlap with the compared species.

Senecio canoi and *S. sykorae* are here considered as part of the variability encompassed by *S. pucapampaensis*. We were not able to find any other difference than the type of leaf denticulation, a character very variable as observed in other related species, i.e., *S. apolobambensis* Cabrera (1984: 14), *S. digitatus* Philippi (1891: 44), *S. menesesiae* (described below), *S. puchei* Philippi (1891: 45), *S. scorzonerifolius* Meyen & Walpers in Walpers (1843: 282). The case of *S. sykorae* is more controversial because the leaves were described as entire but in the picture included in the original publication it can be easily observed that some leaves display 1–2 shallow teeth on each margin, which should be interpreted of an extreme of variability with subentire leaves. The number of florets was described as 13–16. It is also inaccurate because anyone can appreciate on the picture that the number is higher, ca. 20–25, which perfectly fits with the number of florets in *S. pucapampaensis* (20–23). We do not recommend, therefore, the recognition of these taxa due to the lack of diagnostic characters.

2. ***Senecio menesesiae*** J. Calvo, ***sp. nov.*** (Fig. 4, 5)

Type:—BOLIVIA. Dpto. La Paz: Prov. Bautista Saavedra, estancia Joroco (Ulla Ulla-Curva), [15º06'S 69º06'W], 4480 m, 26 February 1983, *X. Menhofer 2038* (holotype: LPB s.n.; isotype: SI s.n.).

It differs from the other species with yellowish anthers, style-branches, and corollas, glabrous leaves, and glabrous achenes by the combination of the following characters: dentate leaves (rarely shallowly crenate), strongly recurved and with the midrib remarkably prominent beneath, and both involucral and supplementary bracts with prominent blackish main nerve.

Caespitose perennial herb. Stems decumbent or suberect up to 6 cm long, glabrescent, with remnants of the pseudopetioles, sometimes purplish. Leaves spatulate, 6–13.5 mm long, 1.6–3.9 mm wide, acute at the apex, attenuated in pseudopetiole, dentate, with 2–4 teeth on each side, rarely only shallowly crenate, strongly recurved, glabrous except for some arachnoid trichomes at the base of the young leaves that fall as plant ages or remain only at the margins of the pseudopetiole, somewhat fleshy, with the midrib remarkably prominent beneath, usually blackish. Capitulum discoid, solitary, terminal, sessile or subsessile; involucre 8.2–12 mm long, 6–8 mm wide. Involucral bracts 13(–14), linear-oblong, 7.7–9.5 mm long, 1.3–1.7 mm wide, with 1(–2) prominent dark-purplish or blackish nerves lengthwise, glabrous. Supplementary bracts (3–)4–6, linear-subulate, 4.2–8 mm long, 0.7–1 mm wide, with the main nerve prominent and blackish, a half to two-thirds as long as the involucral bracts, glabrous. Disc florets 39–46, 6–7.6 mm long, 0.8–0.9 mm wide, 5-lobed, yellowish. Anthers auriculate, yellowish; filament collar balusterform. Style-branches truncate with a crown of sweeping hairs, yellowish. Achenes 2.6–3.1 mm long, 0.7–0.8 mm wide, glabrous, with ca. 9 ribs, straw-yellow; pappus 6.6–7.4 mm long, barbellate, whitish. Chromosome number: unknown.

Distribution and habitat:—Bolivia (La Paz), Peru (Cusco). Known from the highlands of Ulla Ulla, Apolobamba (La Paz) and Cordillera Vilcanota in Cusco, southeastern Peru (Fig. 3). It is also expected in the boundary highlands of Puno Department. This species grows on exposed rocky slopes around the upper limit of vegetation, between elevations of 4400–5300 m.

Phenology:—Collected in bloom from February to April.

Etymology:—The epithet honors the Bolivian botanist Rosa Isela Meneses, who collected the new species in Peru.

Additional specimens examined (paratypes):—BOLIVIA. Dpto. La Paz: Prov. Bautista Saavedra, Charazani, pampa de Ulla Ulla, hacienda Medallani, 15º4'S 69º6'W, 3 April 1992, *P. Gutte 322* (LPB); abra Pumasani, 15º15'S 69º2'W, 20 April 1982, *X. Menhofer 1111* (LPB). Prov. Franz Tamayo, área natural de manejo integrado Apolobamba, cerro Pelechuco Mita, 15º1'S 69º8'W, 26 February 2008, *S. Cuello 221* (LPB). PERU. Depto. Cusco: Prov. Canchis, cordillera de Vilcanota, camino al cerro Orqo Q'ocha, 13º45'S 71º4'W, March 2008, *C. García 84* (LPB); cordillera de Vilcanota, cuenca de la laguna Sibinacocha, cerro Orqo Q'ocha, 13º45'S 71º4'W, 7 April 2012, *R.I. Meneses & al. 5462* (LPB); cordillera de Vilcanota, cuenca de la laguna Sibinacocha, cerro Orqo Q'ocha, 13º45'S 71º4'W, 7 April 2012, *R.I. Meneses & al. 5470* (LPB).

FIGURE 4. *Senecio menesesiae*. A. Habit. Picture by K. Yager at Cordillera Vilcanota, cerro Orqo Q'ocha (Cusco, Peru). B. Detail of the capitula and leaves. Picture by H. Alberto at Cordillera Vilcanota, cerro Rititica (Cusco, Peru). C. Habit. Picture by A. Fuentes near laguna Chirimachaya, Carcapampa community (La Paz, Bolivia).

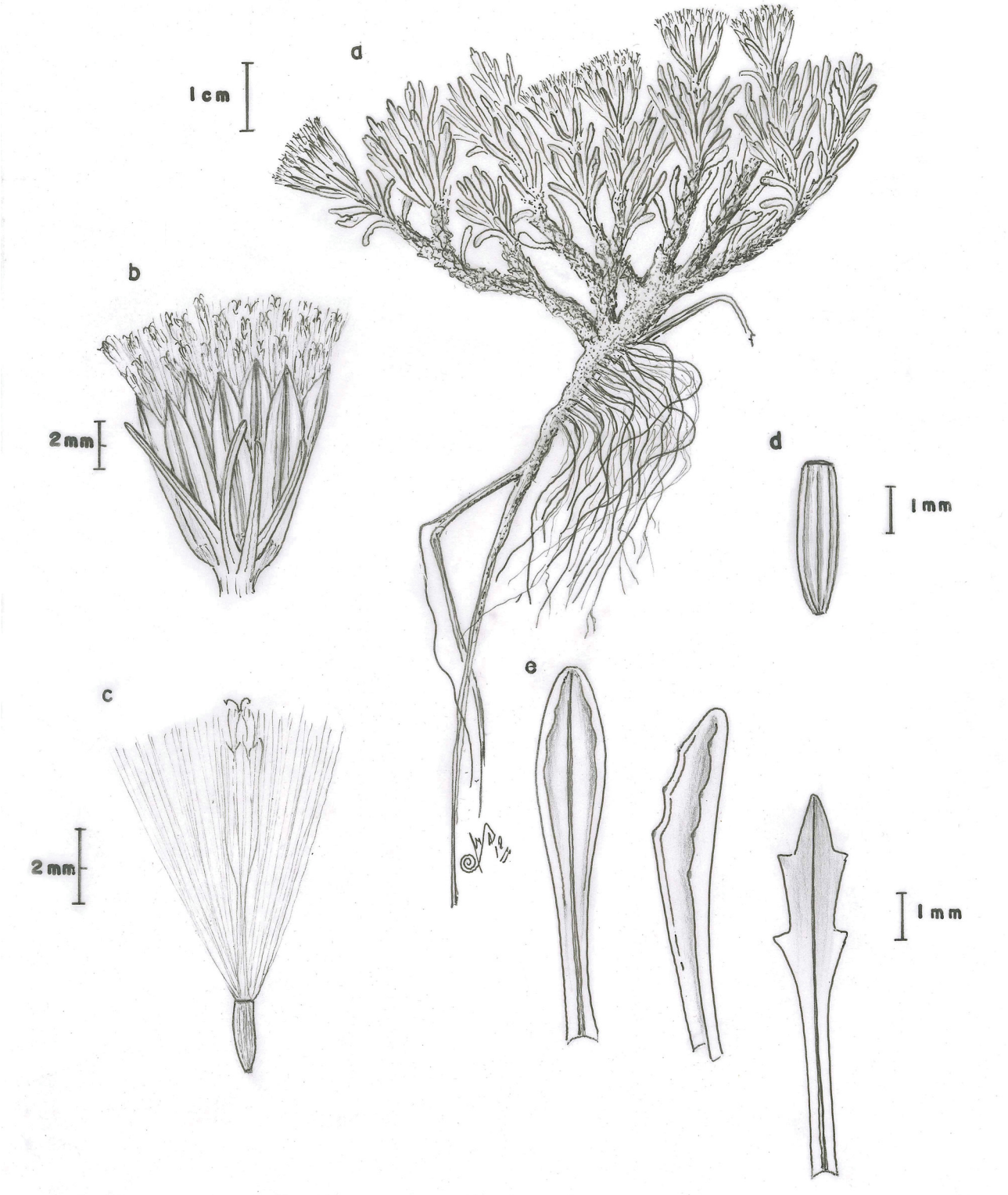

FIGURE 5. *Senecio menesesiae*—A. Habit (drawn from *R.I. Meneses 5462*, LPB).—B. Capitulum (drawn from *R.I. Meneses 5462*, LPB).—C. Achene with pappus (drawn from *S. Cuello 221*, LPB).—D. Achene (drawn from *R.I. Meneses 5470*, LPB).—E. Variability of leaves, from left to right: abaxial surface (drawn from *R.I. Meneses 5462*, LPB), in profile, adaxial surface (drawn from *X. Menhofer 2038*, LPB).

Discussion:—This species belongs to the subgroup of discoid caespitose species with yellowish anthers, style-branches, and corollas, glabrous and dentate leaves (rarely shallowly crenate), and glabrous achenes. It can be differentiated from the related species by its strongly recurved leaves with the midrib remarkably prominent beneath. It is also characterized by the prominent and blackish main nerve of both involucral and supplementary bracts. Although the leaves are usually clearly dentate, some specimens from Puno (southern Peru) display the leaves only somewhat crenate, with a few obtuse shallow teeth.

The morphologically closest species is *S. algens* Weddell (1856: 104), a species quite variable and widely distributed (NW Argentina, Bolivia, N Chile, and Peru). However, the leaf morphology allows anyone to differentiate each other. *Senecio algens* has longer leaves ((15–)20–35 mm long vs. 6–13.5 mm long in *S. menesesiae*), entire (vs. dentate, rarely shallowly crenate). Furthermore, the leaves are plane in *S. algens*, whereas in *S. menesesiae* they are strongly recurved and have the midrib remarkably prominent beneath.

The habit and the leaves of *S. menesesiae* also greatly resemble those of *S. pucapampaensis*, but this latter species displays blackish anthers and style-branches and whitish corollas. With regard to *S. gamolepis* Cabrera (1955: 222) and *S. vegetus* (Weddell 1856: 104) Cabrera (1955: 221), two species that need to be further studied, the new species differs in developing genuine stems. In the compared species the capitula arise directly from rhizome-like stems.

3. ***Senecio woodii*** J. Calvo, ***sp. nov.*** (Fig. 6)

Type:—BOLIVIA. Dpto. La Paz: Prov. Larecaja, Sorata, laguna glacial nevado Illampu, [15º49'S 68º33'W], 5000 m, 20 July 1996, *J.R.I. Wood 11256* (holotype: LPB s.n.; isotype: MO).

Senecio woodii differs from the other discoid caespitose species with yellowish anthers, style-branches, and corollas, and entire or subentire glabrous leaves by its achenes with indumentum, the capitula sessile partially enclosed by the uppermost leaves, and the linear-oblanceolate, somewhat foliose supplementary bracts, almost as long as the involucral bracts.

Caespitose perennial herb. Stems decumbent ca. 5 cm long, glabrescent, with remnants of the pseudopetioles. Leaves linear-oblong to spatulate, 6.3–11 mm long, 2–3.2 mm wide, obtuse at the apex, attenuated in pseudopetiole, entire or with 1–2 obtuse shallow teeth near the apex, slightly recurved (at least on dry specimens), glabrous except for some arachnoid trichomes at the base of the young leaves that fall as plant ages or remain only at the margins of the pseudopetiole, somewhat fleshy. Capitulum discoid, solitary, terminal, sessile, usually partially enclosed by the uppermost leaves, which makes difficult the differentiation between upper leaves and supplementary bracts; involucre 7.5–9.5 mm long, ca. 7 mm wide. Involucral bracts (10–)12–14, linear-oblong, 6.7–8 mm long, 1.4–1.9 mm wide, smooth, glabrous, with the upper part purplish and the apex blackish. Supplementary bracts 5–10, linear-oblanceolate, 6.8–8 mm long, 0.9–1.7 mm wide, smooth, three-quarters to almost as long as the involucral bracts, usually bearing a few scattered arachnoid trichomes, with the upper part purplish and the apex blackish. Disc florets 39–49, 5.9–7.1 mm long, 0.8–0.9 mm wide, 5-lobed, yellowish. Anthers auriculate, yellowish; filament collar balusterform. Style-branches truncate with a crown of sweeping hairs, yellowish. Achenes 1.8–2.1 mm long, 0.7–0.8 mm wide, covered by unicellular trichomes ca. 0.1 mm long; pappus 6.2–7.6 mm long, barbellate, whitish. Chromosome number: unknown.

Distribution and habitat:—Bolivia (La Paz). Only known from two collections from Illampu, which is the fourth highest mountain in Bolivia and belongs to the Cordillera Real (Fig. 3). It grows around the upper limit of vegetation in moist grassy hollows on rocky slopes, between elevations of 4900–5000 m.

Phenology:—Collected in bloom in April and July.

Etymology:—The epithet honors the English botanist John Wood, an outstanding plant hunter who collected the two specimens that serve us to describe this new species.

Additional specimens examined (paratypes):—BOLIVIA. Depto. La Paz: Prov. Larecaja, Sorata, zona de la laguna glacial, nevado Illampu, 15º50'S 68º36'W, 7 April 2004, *J.R.I. Wood 20662* (K, LPB).

Discussion:—This species is well characterized by its discoid capitula with yellowish corollas, the glabrous leaves entire or subentire, the supplementary bracts almost as long as the involucral bracts (somewhat foliose), and the achenes covered by trichomes.

It keys out within the group of species displaying yellowish anthers, style-branches, and corollas, involucral bracts 9–14, and achenes with indumentum. *Senecio moqueguensis* Montesinos (2014: 3) from Peru displays the mentioned characters but its leaves are covered by multicellular trichomes and are dentate. The number of disc florets is also higher in *S. woodii* (39–49 vs. 24–28). Their distribution areas do not overlap.

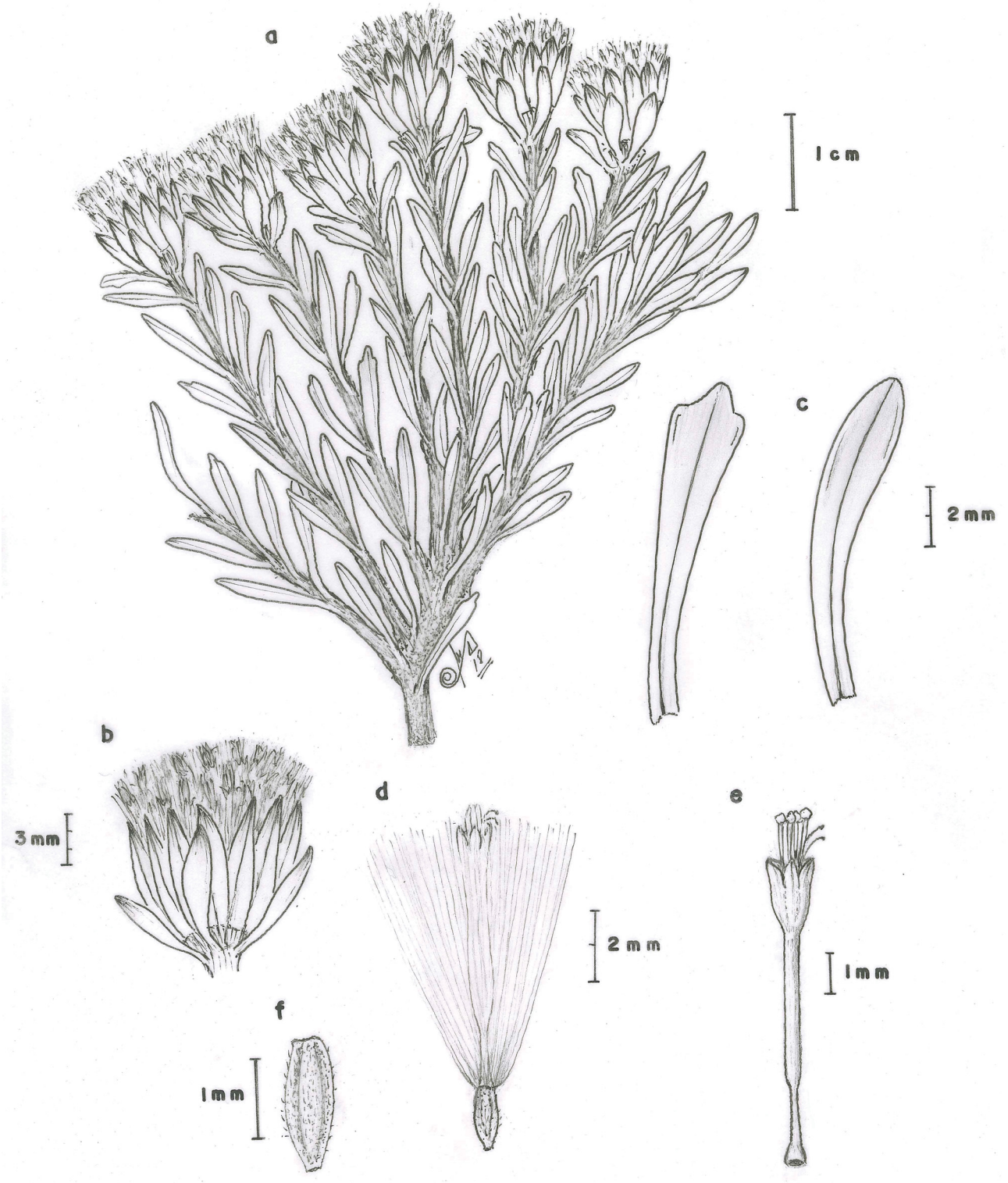

FIGURE 6. *Senecio woodii*—A. Habit.—B. Capitulum.—C. Variability of leaves.—D. Achene with pappus.—E. Disc floret.—F. Achene. All drawings from *J.R.I. Wood 11256* (LPB).

Except the unequivocal difference in the achene indumentum, the new species might be confused with *S. algens*. However, some characters are helpful to discriminate them from each other. *Senecio algens* has longer leaves ((15–)20–35 mm long vs. 6.3–11 mm long in *S. woodii*), which are plane (vs. slightly recurved). Its capitula are usually shortly pedunculate (vs. sessile and partially enclosed by the uppermost leaves in *S. woodii*), and the supplementary bracts are shorter and linear-subulate (vs. linear-oblanceolate, somewhat foliose in *S. woodii*). Their distribution areas likely overlap.

Acknowledgements

We are grateful to the curators of the herbaria mentioned in the text. Special thanks to Carla Maldonado, and all the staff of LPB, and to Magaly Mercado (BOLV) for the kind welcoming and the help provided during the short stage of the first author at the respective herbaria. Carlos Maldonado (LPB) is the author of the illustrations and the pictures of *S. menesesiae* in Peru were taken by Karina Yager and Humber Alberto. The digital image of the isotype of *S. menesesiae* was provided by Manuel Belgrano (SI). The first author is indebted to Arturo Granda (MOL) and Hamilton Beltrán (USM) for providing useful information and insightful comments. This work has been funded by FONDECYT from Chile by means of a postdoctoral fellowship of the first author (project Nº3170270).

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