

Gamochaeta beckii (Gnaphalieae, Asteraceae): A New Species from Bolivia

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Abstract—*Gamochaeta beckii*, a new species found in La Paz, Bolivia is described and illustrated. *Gamochaeta beckii* is similar to *G. purpurea* but it is easily distinguished by stems branched from the base to the inflorescence, oblanceolate leaves, the small capitula arranged in glomerules, forming leafy short and continuous spikes, and short acuminate inner phyllary apices. A key to the species of *Gamochaeta* occurring in Bolivia is presented.

Keywords—Compositae, La Paz, Nor Yungas, Taxonomy.

Gamochaeta Wedd. is one of the largest genera of tribe Gnaphalieae (Asteraceae) and is represented by more than 50 species. The vast majority of species are distributed in South America with only a few known from Central America or reach North America and some are adventives in Asia, Australia and Europe. The taxonomic rank of *Gamochaeta* has long been discussed, beginning when the genus was originally described by Weddell (1855). *Gamochaeta* was later considered a section of *Gnaphalium* L. by Bentham & Hooker (1873) and Hoffmann (1890). Cabrera (1961) reinstated *Gamochaeta* as a distinct genus in having pappus bristles connate at the base into a ring, instead of free as in *Gnaphalium*. Wagenitz (1965) and Drury (1970, 1971), however regarded again *Gamochaeta* as a section of *Gnaphalium*, but Merxmüller et al. (1977) and Hilliard & Burt (1981) followed the view of Drury. More recently, several authors, e.g. Nesom (1990, 2004, 2006), Anderberg (1991), Dillon & Sagástegui (1991a, 1991b), Freire & Iharlegui (1997), Deble & Marchiori (2007), Bayer et al. (2007), Hind (2011), and Chen et al. (2011), recognized *Gamochaeta* as a distinct genus.

Gamochaeta most resembles the genus *Stuckertiella* Beauverd in having style branches truncate with apical sweeping hairs and pappus bristles connate at the base into a ring. It differs from *Stuckertiella*, however, in having bisexual central florets usually with 5-lobed corollas. In contrast, *Stuckertiella* has male central florets with 4-lobed corollas.

According to Anderberg & Freire (1991), *Gamochaeta* is the sister genus of the 'Lucilia group,' which consist of nine genera, *Belloa* J. Rémy, *Berroa* Beauverd, *Chevreulia* Cass., *Cuatrecasasiella* H. Rob., *Facelis* Cass., *Gamochaetopsis*

Anderb. & S.E. Freire, *Jalcophila* Dillon & Sagást., *Lucilia* Cass., and *Luciliocline* Anderb. & S.E. Freire. However, the genera of the 'Lucilia group' differ from *Gamochaeta* in having truncate style branches, with apical and dorsal hairs.

Eleven species of *Gamochaeta*, following the checklist undertaken by Hind (2011) are known from this country. The recently detected new species in Nor Yungas-La Paz, which is described here, clearly belongs to the genus *Gamochaeta* because of its barbellate pappus bristles connate at their base into a ring, truncate style branches with apical hairs, achenes with globose twin hairs, and bisexual central florets with 5-lobed corollas. The new species is distinct from other *Gamochaeta* species in having stems branched from the base to inflorescence, oblanceolate and slightly discoloured leaves, small capitula arranged in glomerules, forming leafy short and continuous spikes, and short acuminate inner phyllary apices.

In this paper we also provide an analytical key to species of *Gamochaeta* that occur in Bolivia, and we compare the new species to other taxa from neighboring regions with which it could possibly be confused.

MATERIALS AND METHODS

Floral parts were dissected and observed after boiling in water and stained with 2% safranin. Characteristics of leaf trichomes were observed and recorded in cleared samples using the technique of Dizeo de Strittmatter (1973). Observations were carried out using LM (Light Microscopy) and a Nikon Microphot-FXA microscope, equipped with a photographic camera.

TAXONOMIC TREATMENT

KEY TO *GAMOCHAETA* AND RELATED GENERA

1. Plants dioecious. Capitula unisexual with either pistillate or male florets *Cuatrecasasiella*
1. Plants monoecious. Capitula bisexual with both pistillate and male or bisexual florets 2
2. Achenes rostrate *Chevreulia*
2. Achenes not rostrate 3
3. Pappus plumose 4
4. Achenes with elongated twin hairs, apical ones (8–12) twisted apically, equalling or slightly shorter than the pappus *Berroa*
4. Achenes with elongated twin hairs similar in length *Facelis*
3. Pappus barbellate 5
5. Capitula shortly pedunculate *Jalcophila*
5. Capitula sessile 6
6. Style branches truncate with apical sweeping hairs 7

- 7. Central florets bisexual, corollas tubular, (4)5-lobed; anthers (4)5, all with equal appendages *Gamochoaeta*
- 7. Central florets male, corollas tubular, 4-lobed; anthers 4, 3 with small appendages and 1 with a long appendage ... *Stuckertiella*
- 6. Style branches truncate, obtuse or acute with apical and dorsal sweeping hairs 8
- 8. Achenes with elongated twin hairs *Lucilia*
- 8. Achenes with globose or clavate twin hairs (rarely elongated) 9
- 9. Stems generally prostrate, usually mat-forming *Belloa*
- 9. Stems erect or ascending 10
- 10. Achenes with clavate twin hairs *Gamochoetopsis*
- 10. Achenes with globose twin hairs *Luciliocline*

Gamochoaeta Wedd. Annual (biennial) or perennial herbs. Leaves alternate, margins entire, linear or oblanceolate to spatulate. Capitula small, disciform, heterogamous, usually in head-like glomerules or in elongated spikes; phyllaries with sterome undivided. Outer florets numer-

ous, female, filiform, and central florets few, bisexual, tubular, (4) 5-lobed; anthers (4)5; style branches truncate with hairs apically. Achenes with globose twin hairs; pappus bristles capillary, barbellate, basally connate into a ring.

KEY TO THE SPECIES OF GAMOCHAETA IN BOLIVIA

- 1. Capitula solitary *G. lullioana*
- 1. Capitula in glomerules 2
- 2. Herbs, 1–10 cm tall 3
- 3. Capitula in interrupted spikes *G. humilis*
- 3. Capitula in continuous spikes 4
- 4. Annual herbs; stems simple; stem leaves approximate *G. monticola*
- 4. Perennial herbs; stems branched from base; stem leaves remote *G. erythraetis*
- 2. Herbs 15 or more than 15 cm tall 5
- 5. Leaves concolorous sparsely arachnoid or tomentose on both surfaces 6
- 6. Leaves spatulate, 25–80 × 4–18 mm *G. pennsylvanica* (probably in Bolivia)
- 6. Leaves linear, 15–80 × 1–4 mm wide 7
- 7. Leaves narrowly linear, 20–80 × 1–2 mm; inner phyllary apices acute *G. sphacelata*
- 7. Leaves linear to narrowly elliptic, 15–25(70) × 2–4 mm; inner phyllary apices obtuse short-acuminate *G. calviceps* (probably in Bolivia)
- 5. Leaves discolorous, glabrous to glabrate or sparsely arachnoid adaxially and white lanate abaxially, 8
- 8. Capitula in interrupted leafy spikes *G. simplicicaulis*
- 8. Capitula in continuous (or interrupted basally) sometimes leafy spikes 9
- 9. Leaves strongly discolorous, adaxially glabrous or glabrate; perennial herbs 10
- 10. Inner phyllary apices short-acuminate *G. americana*
- 10. Inner phyllary apices obtuse to rounded *G. coarctata*
- 9. Leaves slightly discolorous, adaxially sparsely arachnoid; annual or biennial herbs 11
- 11. Stem simple from base to inflorescence (rarely 2); spikes 10–40 mm (usually up to 40 mm long) *G. purpurea*
- 11. Stem branched from base to the inflorescence; spikes 8–10 mm *G. beckii*

Gamochoaeta beckii Urtubey & S.E. Freire sp. nov. — TYPE: BOLIVIA. La Paz: Nor Yungas, camino a Coroico, entrada del camino viejo hacia la Mina Lourdes, 16°19' S, 67°58' W, 3819 m, 30 Mar 2010, *Urtubey, Beck, Freire & Meneses 508* (holotype: SI!).

Gamochoaeta beckii is distinct in having annual habit, stems branched from base to inflorescence, slightly discolorous and oblanceolate stem leaves, globose and continuous spikes, and short acuminate inner phyllary apices. *Gamochoaeta beckii* is most similar to *G. purpurea*, both species have an annual habit (rarely biennial in *G. purpurea*), basal leaves withering at anthesis and discolorous or slightly discolorous stem leaves. However, *G. purpurea* has simple stems, oblanceolate to spatulate leaves, usually elongated and basally interrupted spikes, and acute, not acuminate, inner phyllary apices.

Annual herbs, ca. 20 cm tall, primary stem erect to ascending, branching from base to inflorescence, lower branches ascending. Basal leaves withering at anthesis; stem leaves remote, lower and upper leaves similar, slightly discolorous, white lanate abaxially, sparsely arachnoid adaxially; eglandular eseptate trichomes with apical cell slightly swollen at base, and basal cells expanded; lower leaves 30–35 × 4–4.5 mm, oblanceolate, apex obtuse, base

long-attenuate, upper leaves 22–27 × ca. 1 mm, narrowly oblanceolate, apex acute, base attenuate. Capitula numerous, sessile or shortly pedunculate, in axillary glomerules, forming continuous leafy, short globose spikes, 8–10 × 5–7 mm; involucre ca. 3 × 2 mm, narrowly obdeltate; phyllaries 3-seriate, outer phyllaries 2–2.5 × 1 mm, ovate, apex long-acute, brownish, lanuginose; inner phyllaries 3–3.2 × 0.7 mm, ovate oblong to narrowly obovate, apex short-acuminate, brownish tinged, scarious toward margin, glabrous. Pistillate florets 36–38; corolla whitish, filiform, ca. 2 mm long. Achenes oblong ca. 0.4 × 0.1 mm, with globose twin hairs. Bisexual florets 2–3; corolla whitish, with red-purple pigmented teeth, tubular, ca. 2.2 mm long, 5-lobed; anthers 5, ca. 0.7 mm long, sagittate, tails ca. 0.2 mm long; style branches truncate, ca. 0.2 mm long, with hairs apically. Achenes oblong 0.2–0.3 × 0.1 mm, with globose twin hairs; pappus bristles capillary, barbellate, white, ca. 2.4 mm, connate at base into a ring. Figures 1–2.

Etymology—The specific epithet honours Dr Stephan Beck, who discovered the type material with us and who is an indefatigable protagonist for the conservation of the Bolivian flora.

Distribution, Habitat and Phenology—*Gamochoaeta beckii* is known only from the type collection. It occurs in high altitude

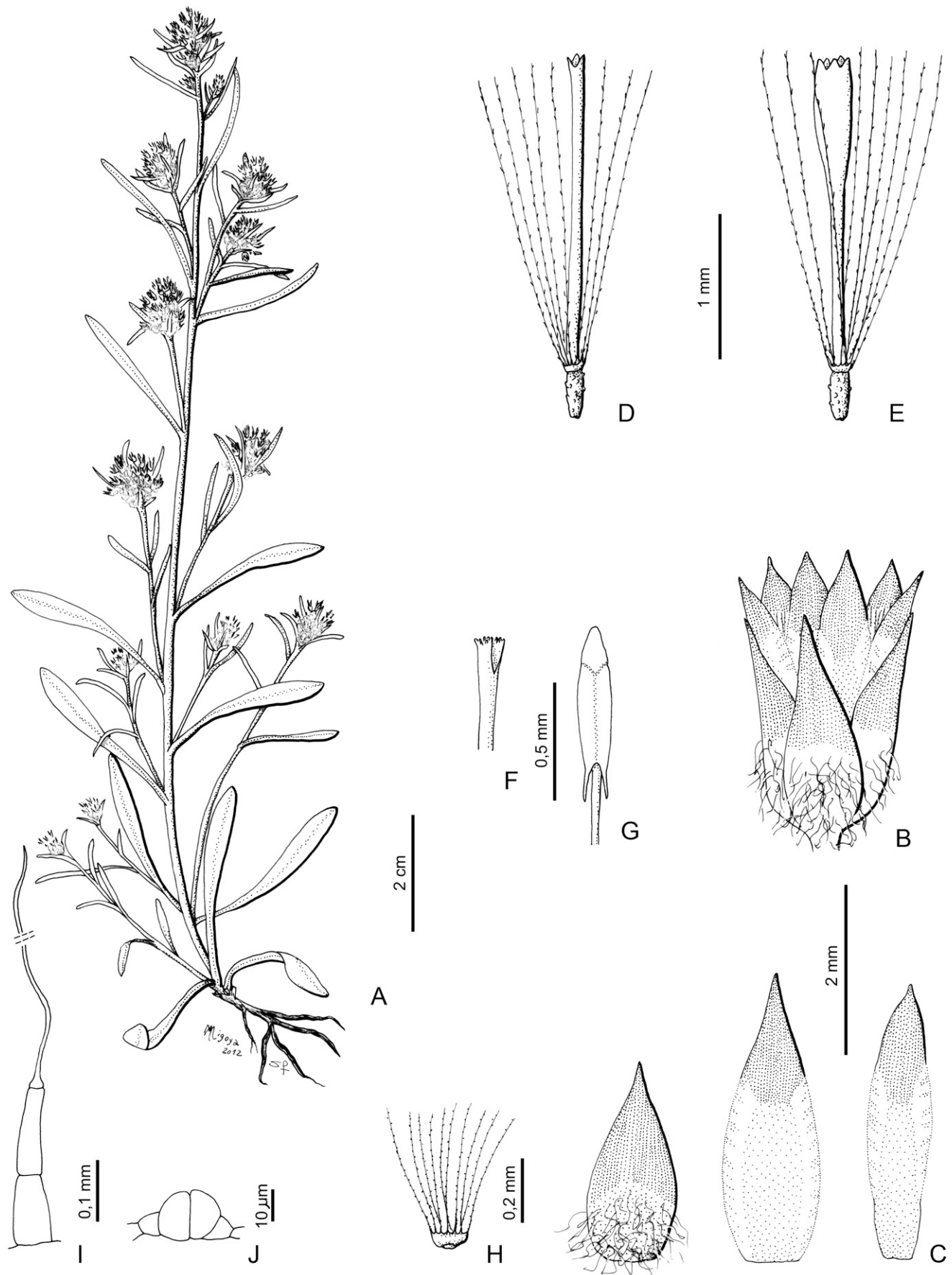


FIG. 1. *Gamochaeta beckii* Urtubey & S.E. Freire. A, habit; B, capitulum; C, phyllaries; D, pistillate floret; E, bisexual floret; F, style branches from bisexual floret; G, anther; H, base of pappus; I, foliar trichome; J, achenial trichome. [Urtubey & al. 508 (SI)].

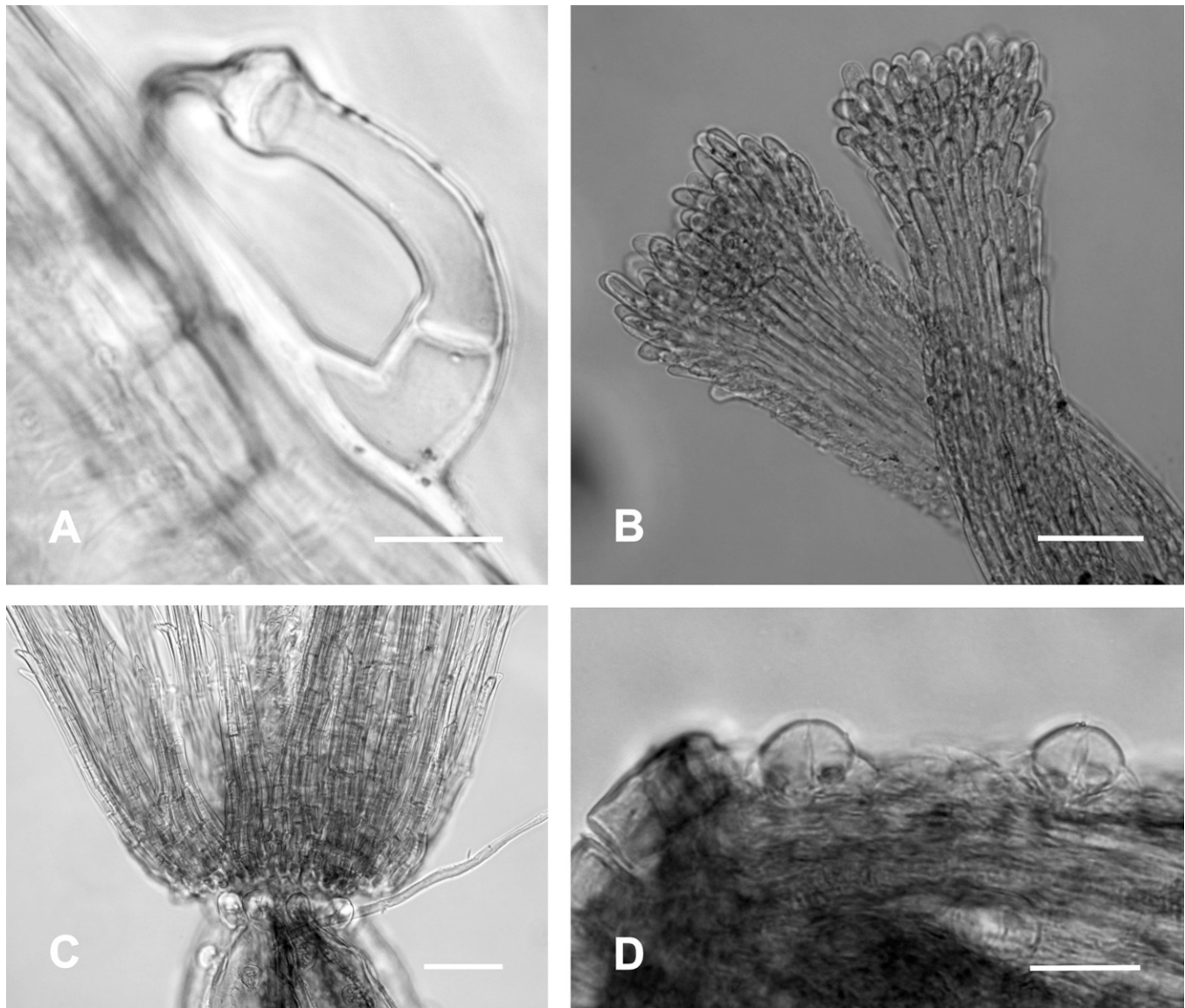


FIG. 2. *Gamochaeta beckii* Urtubey & S.E. Freire. A, foliar trichome; B, style branches from bisexual floret; C, base of pappus; D, achenial trichome. [Urtubey & al. 508 (SI)]. Scale bars: A, D = 20 μ m; B, C = 50 μ m.

forests at ca. 3,800 m elevation in Nor Yungas, at Coroico (Fig. 3), La Paz, Bolivia, where it grows in moist open forest with *Gamochaeta humilis* Wedd., *Belloa longifolia* (Cuatrec. & Aristeg.) Sagást. & Dillon, *Antennaria linearifolia* Wedd. and *Hypochaeris taraxacoides* Ball in rocky areas. The flowering period is during late summer and early autumn, from March to April.

DISCUSSION

Morphological comparisons between *Gamochaeta beckii* and other species of *Gamochaeta* from Bolivia are shown in Table 1. The newly described species is most similar to *G. purpurea*, which is presumably native to North America (Nesom 2006) but also known from Central (Nicaragua, Nesom 2004) and South America (Ecuador, Jørgensen & León-Yáñez 1999; Colombia and Venezuela, Luteyn 1999; Bolivia, without department, Hind 2011; Brazil, Forzza et al. 2010; Paraguay, Freire 1998), and adventive to New Zealand (Drury 1971).

Gamochaeta beckii and *G. purpurea* have an annual habit (rarely biennial in *G. purpurea*), basal leaves withering at anthesis, discoloured or slightly discoloured stem leaves, and foliar trichomes with basal cells expanded. *Gamochaeta purpurea* is amply distinguished by its mostly spatulate stem leaves, involucre 4–4.5 mm high, and inner phyllaries with apically acute lamina (Nesom 2004). *Gamochaeta beckii* is recognized by its oblanceolate to narrowly oblanceolate stem leaves, involucre 3 mm high, and inner phyllaries with apically acuminate lamina. In addition, *Gamochaeta beckii* differs by its stems branched from the base to the inflorescence (vs. simple from the base to the inflorescence, rarely two, in *G. purpurea*), continuous spikes (vs. commonly basally interrupted in *G. purpurea*), 8–10 mm long (vs. usually up to 40 mm long in *G. purpurea*).

Gamochaeta axillaris (J. Rémy) Cabrera from Central Chile resembles *G. beckii* in having glomerules from the base. It is distinct, however, in its branched stems with glomerules aggregated at branches apex to form short continuous leafy



FIG. 3. Distribution map of *Gamochaeta beckii* Urtubey & S.E. Freire in Bolivia.

spikes (vs. simple stems with sessile or shortly pedunculate glomerules forming a long interrupted leafy spike in *G. axillaris*).

Gamochaeta grazielae (Rizzini) Deble from the Atlantic forest in Rio de Janeiro State, Brazil, also resembles *G. beckii* because

of its stems being branched from the base to the inflorescence and with capitula in glomerules forming short leafy continuous spikes. However, *G. grazielae* is distinct in its spatulate leaves, 40–60 × 10–15 mm, capitula with 100–110 florets, and inner phyllaries with long acuminate apices. In contrast,

TABLE 1. Morphological comparison between *Gamochaeta beckii* and other species of *Gamochaeta* from Bolivia.

Species	Life span	Plant height (cm)	Stems	Basal leaves	Leaf blade shape	Leaf surfaces	Adaxial leaf surface	Capitula arrangement	Inflorescence spikes	Inner phyllary apex shape	Number of corolla lobes of central florets
<i>G. americana</i> (Mill.) Wedd.	biennial or perennial	15–35	branched from base	persistent	spathulate	discolorous	glabrous to glabrate	glomerules	continuous (interrupted basally)	short acuminate	5
<i>G. beckii</i> Urbtubey & S.E. Freire	annual	ca. 20	branched from base to inflorescence	withering at anthesis	oblanceolate	slightly discolorous	arachnoid	glomerules	continuous	short acuminate	5
<i>G. caticeps</i> (Fernald) Cabrera	annual	20–40	branched from base to inflorescence	withering at anthesis	linear to narrowly elliptic	concolorous	lanate	glomerules	continuous (interrupted basally)	obtuse to rounded	5
<i>G. coarctata</i> (Willd.) Kerguelen	biennial or perennial	20–50	branched from base	persistent	spathulate	discolorous	glabrous to glabrate	glomerules	continuous (interrupted basally)	obtuse to rounded	5
<i>G. erythraeae</i> (Wedd.) Cabrera	perennial	1–6 (10)	branched from base	persistent	oblanceolate	concolorous	lanate	glomerules	continuous	obtuse to subacute	5
<i>G. humilis</i> Wedd.	perennial	ca. 10	branched from base	persistent	oblanceolate	discolorous	glabrous to glabrate	glomerules	interrupted	acute	5
<i>G. luloana</i> S.E. Freire & Ibarlegui	annual	ca. 1	prostrate, mat-forming	indistinct	oblong-spathulate	concolorous	lanate	solitary	-	acute	4
<i>G. monticola</i> (Phil. ex Reiche) Cabrera	annual	2–4	simple	indistinct	oblanceolate	concolorous	lanate	glomerules	continuous	acute	5
<i>G. pensylvanica</i> (Willd.) Cabrera	annual or biennial	20–50	usually branched from base to inflorescence	withering at anthesis	spathulate	concolorous	arachnoid	glomerules	continuous (interrupted basally)	rounded or shot acuminate	5
<i>G. purpurea</i> (L.) Cabrera	annual (biennial)	20–40	simple (2)	withering at anthesis	oblanceolate	slightly discolorous	arachnoid	glomerules	continuous (interrupted basally)	acute	5
<i>G. simplicicaulis</i> (Willd. ex Spreng.) Cabrera	annual	40–60	simple	withering at anthesis	oblanceolate	discolorous	glabrous to glabrate	glomerules	interrupted	acuminate	5
<i>G. sphacelata</i> (Kunth) Cabrera	perennial	15–20	branched from base	withering at anthesis	narrowly linear	concolorous	lanate	glomerules	continuous (interrupted basally)	acute	5

G. beckii has oblanceolate leaves, 22–35 × 1–4.5 mm, capitula with ca. 40 florets, and inner phyllaries with short acuminate apices.

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