ISSN 0373-580 X
Bol. Soc. Argent. Bot. 45 (3-4): 363-372. 2010

Inkaliabum, a new Andean genus of Liabeae (Asteraceae) from Peru

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Summary: *Inkaliabum*, a new monotypic genus endemic to valleys and slopes of the Andes of Cuzco (Peru), is described. The species of genus *Inkaliabum* is a slender scandent subshrub with pinnately veined leaves, lacking latex, with few capitula in terminal and/or axillary capitulescences, widely campanulate involucres, many phyllaries, many florets per capitulum, and disc florets with corollas slightly differentiated into tube and throat, long style branches, and a short pubescent part of the style shaft. The new combination *Inkaliabum diehlii*, based on *Liabum diehllii* is established, and the species is illustrated. In addition, a key to the genera of Liabeae from Peru plus *Oligactis* is provided.

Key words: Asteraceae, endemism, *Inkaliabum, Inkaliabum diehlii,* Liabeae, *Liabum,* Peru.

Resumen: *Inkaliabum*, un nuevo género andino de Liabeae (Asteraceae) de Perú. Se describe *Inkaliabum*, un nuevo género monotípico endémico de los valles y pendientes de los Andes de Cuzco (Perú). La especie del género *Inkaliabum* es un subarbusto grácil escandente con hojas pinnatinervadas, ausencia de latex, pocos capítulos dispuestos en capitulescencias terminals y/o axilares, involucros anchamente acampanados, filarias numerosas, flores numerosas por capítulo y flores del disco con corolas levemente diferenciadas en tubo y limbo, ramas de estilo largas y la porción pubescente del estilo por debajo del punto de bifurcación corta. Se establece la nueva combinación, *Inkaliabum diehlii*, basada en *Liabum diehllii*, especie que es ilustrada. Además, se provee una clave de los géneros del Liabeae de Perú más *Oligactis*.

Palabras clave: Asteraceae, endemism, Inkaliabum, Inkaliabum diehlii, Liabeae, Liabum, Perú.

Introduction

The small Neotropical tribe Liabeae includes more than 150 species distributed in 18 genera (Dillon *et al*., 2009). Despite being a tribe well defined, news in several taxonomic levels were presented recently based on morphological and molecular data.

Liabeae was divided in three subtribes: Munnoziinae, Paranepheliinae, and Liabinae, based on morphological and palynological characters (Robinson, 1983a; Robinson & Marticorena, 1986). Results from morphological cladistic studies by Bremer (1994), Funk (1985) and Funk *et al*. (1996) demonstrated the monophyly of the first two subtribes but not the Liabinae. Later, however, the monophyly of Munnoziinae was questioned in a further molecular study (Kim *et al*., 2003). Recently, the results of molecular investigations on Liabeae, have recovered consistent placements for several taxa (Gutiérrez *et al*., 2007; Dillon *et al*., 2009). The consensus tree of last phylogeny of Liabeae shows four main clades named as Liabinae, Sinclariinae, Paranepheliinae, and Munoziinae (Dillon *et al*., 2009).

This better knowledge based on morphological and molecular information showed some needed

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changes at the genera and specific levels: the monotypic genus *Bishopanthus* H. Rob. and *Dillandia* Funk & H. Rob. were described (Robinson, 1983b; Funk & Robinson, 2001), the genus *Austroliabum* H. Rob. & Brettell was reduced to synonymy under *Microliabum* Cabrera (Robinson, 1990), the subgenus *Andromachiopsis* of *Oligactis* (Kunth) Cass. was elevated to the generic level as *Sampera* Funk & H. Rob. (Dillon *et al*., 2009), the monotypic genus *Sinclariopsis* Rydb. was resurrected (Dillon *et al*., 2009), and some taxonomical rearrangements have been proposed in *Liabum* Adans. (Gutiérrez & Katinas, 2006) and *Oligactis* (Gutiérrez, 2008; Dillon *et al*., 2009).

Liabum, one of the largest and more wide-distributed genera of Liabeae, contains 26 species which grow in a wide variety of habitats throughout southern Mexico, Central America, the West Indies (Cuba, Jamaica, and Hispaniola), and western South America from northern Venezuela to northwestern Argentina (Gutiérrez, 2003; Gutiérrez & Katinas, 2006; Gutiérrez & Katinas, in prep.). The greatest diversity of this genus is found in Ecuador and northern Peru where not less than 15 species occur. *Liabum* is characterized by a combination of morphological characters: perennial herbs to shrubs (rarely small trees), latex absent, slightly or strongly triplinerved (acrodromous) leaves, leaf abaxial surface albotomentose, capitulescences of usually many capitula, long style branches, disc florets style with its pubescent portion below the bifurcation point equal or shorter than the style branches, yellow pale anthers, eglandular cypselae and subquadrate crystals of cypsela wall.

However, three endemic species from Peru have several morphological features that deviate from *Liabum*: *L. ferreyri* H. Rob. and *L. sandemanii* H. Rob. with densely glandular cypselae and *L. diehlii* H. Rob. with scandent habit and pinnately veined leaves (Gutiérrez, 2004; Gutiérrez & Katinas, in prep.). *L. ferreyri* and *L. sandemanii* are being studied in order to determine their taxonomic ubication (Gutiérrez & Katinas, in prep.).

The species *Liabum diehlii* was described by Robinson (1980) who included it under *Liabum* because of its general aspect and type of cypsela trichomes. However, he recognized that the narrowly elliptical leaves with pinnate venation of this species are commonly found in the genus *Oligactis* s.l. Recently, during the preparation of a revision of *Liabum* (Gutiérrez, 2004; Gutiérrez & Katinas, in prep.), a detailed morphological study of the specimens of *L. diehlii* showed that many systematic characters such as the habit, leaf venation, type and position of capitulescence, size of involucre, number of phyllaries, number of florets, and type of disc florets do not correspond to the genus *Liabum*. According to the findings above *L. diehlii* is proposed to be excluded from *Liabum*.

Materials and methods

This study as a part of the doctoral thesis is based on more than 1500 specimens or digital photographs from the following herbaria (Holmgren *et al*., 1990): B, BAB, BM, CTES, F, FI, G, GH, IJ, K, LIL, LINN, LP, MO, MY, NY, P, PMA, S, SI, US, USM, VEN, W. The data were supplemented by field observations and information from the literature. For microscopic examination, vegetative and reproductive parts were rehydrated, treated with a clearing process, stained with 2% safranin, and mounted on microscope slides. Drawings were made using a stereomicroscope Wild M5 and Olympus CH2 microscope with a camera-lucida attachment.

Results and discussion

As a result of a morphological study, *Liabum diehlii* is excluded from the genus *Liabum* and the new genus *Inkaliabum* is proposed. *Inkaliabum* is morphologically closely related to *Liabum, Oligactis*, and *Sampera* but can be easily differentiated from these genera by a combination of traits, including its slender scandent habit, pinnately veined leaves, capitulescence with few capitula, ca. 200 linear phyllaries, long style branches, and eglandular cypselae. More characters comparing *Inkaliabum* with the genera *Liabum, Oligactis, Sampera*, *Dillandia,* and *Ferreyranthus* H. Rob. & Brettell, which belong to a monophyletic clade in the more recent phylogeny of Liabeae (Dillon *et al*., 2009), are shown in Table 1.

The genus *Inkaliabum* is endemic to Peru, where the greatest diversity in Liabeae is found.

Key to Peruvian genera of Liabeae plus Oligactis

1. Abaxial surfaces of leaves hispide or strigose; leaves and stems with stiff hairs with enlarged bases
    2. Leaves 5-9 palmately veined; pappus of bristles or scales; cypselae usually with 4 ribs
    Erato
    2'. Leaves 3-veined; pappus absent; cypselae with 2 ribs
    Philoglossa

1'. Abaxial surfaces of leaves with white or brown tomentum; leaves and stems without stiff hairs with enlarged bases
    2. Anther thecae dark brown or black
        3. Herbs perennial; leaves in a rosette or grouped close together on a short stem; pappus white
        Chrysactinium
        3'. Usually shrubs or subshrubs, sometimes annual or perennial herbs; leaves cauline; pappus yellow or orange
        Munnozia
    2'. Anther thecae pale yellow
        3. Leaves usually 3-veined, sometimes slightly 5 palmately veined, rarely pinnately veined
            4. Base of petioles not fused into a sheath; pappus of capillary bristles or sometimes somewhat paleate bristles
            Liabum
            4'. Base of petioles fused into a sheath; pappus of capillary bristles or absent
                5. Capitulescence with many capitula densely grouped; approximately 5 ray florets per capitulum; cylindrical involucre; pappus absent
                Cacosmia
                5'. Solitary capitula on leafy peduncles or few (2 or 3) capitula laxly grouped; 20-40 ray florets per capitulum; campanulate involucre; pappus of denticulate or plumose capillary bristles
                    6. Disc corollas yellow; pappus of denticulate capillary bristles
                    Bishopanthus
                    6'. Disc corollas reddish; pappus of plumose capillary bristles
                    Chionopappus
        3'. Leaves conspicuously pinnately veined
            4. Herbs perennial, acaulescent or caulescent
                5. Leaves in a rosettte; capitula sessile or subsessile
                Paranephelius
                5'. Leaves cauline or grouped close together on the stem; capitula pedunculate
                    6. Ray florets of corolla red
                    Pseudonoseris
                    6'. Ray florets of corolla yellow
                    Dillandia
            4'. Shrubs, subshrubs, vines or small trees
                5. Shrubs or small trees; bases of petiole pair fused into a sheath; crystals of cypsela walls elongate; cypselae glandular hairs with head abruptly distinct from the stalk
                Ferreyranthus

5'. Vines or scandent subshrubs; bases of petiole pair not fused into a sheath (sometimes with perfoliate leaf bases); crystals of cypsela walls quadrate; cypselae glandular hairs absent, or when present with head gradually distinct from the stalk

6. Capitulescence with few capitula (2 or 3); phyllaries ca. 200 linear or narrowly long-ovate; cypselae without glandular hairs

Inkaliabum

6'. Capitulescence with several capitula (usually more than 50); phyllaries 25-55 narrowly ovate or ovate; cypselae with glandular hairs

7. Slender vines; axillary and/or terminal, racemose, spiciform or glomerulose cymes; capitula 6-15-flowered; anther apical appendages papillose

Oligactis

7'. Robust vines; terminal, corymbiform cymes; capitula 16-42-flowered; anther apical appendages smooth

Sampera

Taxonomic treatment

Inkaliabum D. G. Gut., gen. nov. Type**:** *Liabum diehlii* H. Rob., *Phytologia* 46: 99. 1980. *Inkaliabum diehlii* (H. Rob.) D. G. Gut.

Lianae vel frutices scandentes. Folia opposita sparsa subsessilia anguste elliptica, supra glabra, subtus albotomentosa, pinnatinervia, falsis stipulis instructa. Capitula in cymis umbelliformibus paucicephalis vel geminata. Capitula heterogama, involucro late campanulato multiseriato, bracteis anguste ovatis vel linearibus apice attenuato. Flores radii ca. 50 et disci ca. 200. Antherae base digitata; rami stigmatici longi involuti pubescentes. Achaenia pilis geminis vestita. Pappus setis scabrosis inaequalibus.

Slender scandent subshrubs or vines. Stems with dense and persistent pubescence. Pseudostipules forming nodal discs. Leaves opposite, sparsely arranged, sessile, elliptical or narrowly ovate, bases clasping, apex attenuate, margins sparcely mucronate-dentate, revolute, adaxial surface glabrous, abaxial surface albotomentous, pinnately veined (camptodromous). Capitulescence with few capitula (2 or 3) grouped in umbelliform or geminate cymes. Capitula heterogamous, radiate, long or shortly pedunculate. Involucre widely campanulate; phyllaries imbricate in 5-7 series, linear or narrowly long-ovate, apex attenuate. Receptacle fimbriate or setiferous with laciniate setae. Ray florets ca. 50, pistillate, fertile, with corollas with limb 3-dentate, yellow; style 2-branched with style branches elongate, coiled, externally glabrous, internally with the stigmatic surface continuous. Disc florets ca. 200, hermaphroditic, fertile, with corollas tubular-funnelform slightly differentiated into tube and limb, deeply 5-lobed, yellow; stamens with anthers pale yellow, linear, shortly calcarate and shortly caudate, digitate at the base, apical appendages smooth, planate, ovate, apically rounded; style 2-branched with style branches coiled, longer than the pubescent part of the style shaft; externally, branches hispidulous, with sweeping hairs formed by 1-celled papillae, triangular in shape, apically acute, and internally with the stigmatic surface continuous. Cypselae cylindrical or obconical, brown, with conspicuous carpopodium, costate, pubescent with twin hairs, eglandular, with quadrate crystals. Pappus 2-seriate, with capillary scabrous bristles, pale yellow, outer series short, few or absent, inner series long, numerous.

Distribution. *Inkaliabum* is endemic to the Department of Cuzco, Peru (Fig. 1) and inhabits in valleys and slopes of the Andes.

Etimology. The generic name refers to *Liabum*, the genus from where the species of *Inkaliabum* was originally described, and "Inka", the name of the original people where *Inkaliabum* occurs.

Inkaliabum diehlii (H. Rob.) D. G. Gut., comb. nov. Basionym: *Liabum diehlii* H. Rob., *Phytologia*

Table 1. Characters comparing Inkaliabum with *Dillandia, Ferreyranthus, Liabum, Oligactis*, and *Sampera*.

Characters	Inkaliabum	Liabum	Oligactis	Sampera	Dillandia	Ferreyranthus
Habit	Slender vines or scandent subshrubs	Scapose herbs, caulescent herbs, subshrubs or shrubs (rarely small trees)	Slender vines or scandent subshrubs	Robust vines or scandent shrubs	Herbs	Shrubs or small trees
Leaf venation	Pinnate	Slightly or strongly triplinervate	Pinnate	Pinnate	Pinnate	Pinnate
Capitulescence ubication	Axillary and/or terminal	Terminal	Axillary and/or terminal	Terminal	Terminal	Terminal
Capitula number	2 or 3	Usually more than 50 (sometimes 2-10)	Usually more than 50	Usually more than 50	(1-2)3-7	40-60
Phyllaries shape	Narrowly elliptical, narrowly ovate, or linear	Narrowly ovate, ovate, oblong, rarely linear	Narrowly ovate or ovate	Narrowly ovate or ovate	Narrowly ovate or ovate	Narrowly ovate or ovate
Phyllaries number	Ca. 200	45-150	25-35	30-55	55-80	45-55
Ray florets per capitulum	Ca. 50	10-120	3-6	6-18	15-40	2-13
Limb shape of ray corollas	Oblong	Oblong, obovate, elliptical or linear	Oblong or obovate	Elliptical	Narrowly oblong or oblong	Oblong or elliptical
Disc florets per capitulum	Ca. 150	12-110	3-9	10-34	10-30	7-28
Length of the portion of the style shaft that bears hairs	Less than the style branches length	Less or equal than the style branches length	Less or equal than the style branches length	Equal or more than the style branches length	More than the style branches length	Less or equal than the style branches length
Glandular hairs on the cypsela	Absent	Usually absent (present only in *L. ferreyri*)	Present	Present	Absent	Present
Crystals of the cypsela wall	quadrate	quadrate	quadrate	quadrate	quadrate	elongate
Number of species	1	26	5	8	3	8
Geographical distribution	Central Peru	Southeastern Mexico to northwestern Argentina, and West Indies	Costa Rica to central-northern Venezuela	Colombia to northern Peru	Eastern Colombia to northern Peru	Central Ecuador to southern Peru

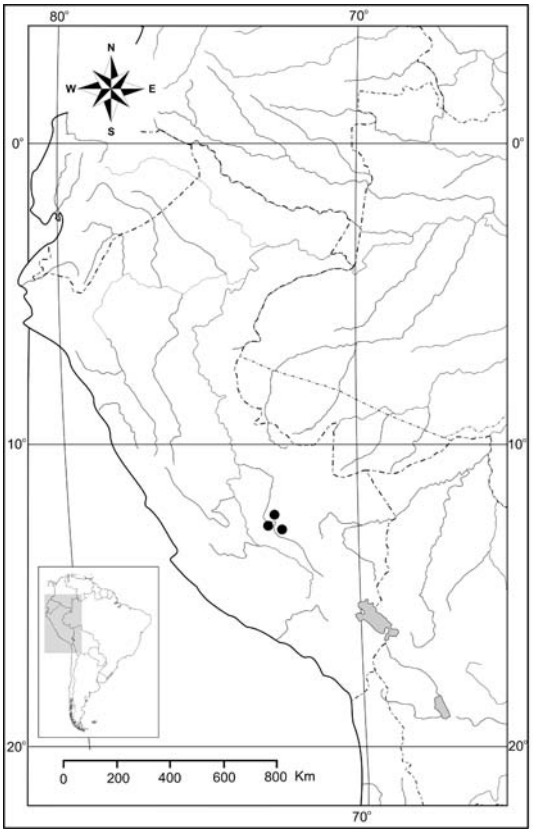

Fig. 1. Geographical distribution of *Inkaliabum diehlii.*

46: 99. 1980. Type: PERÚ. *Cuzco. Prov. La Convención*, Quellouno, 750 m, 22-V-1930, C. Bues s.n. (F!, holotype) (Figs. 2, 3).

Slender scandent subshrubs or vines. Stems terete or slightly hexagonal, densely and persistently albotomentose. Pseudostipules forming nodal discs up to 0.9 cm long on terminal branches, without auricles, adaxial surface glabrescent and abaxial surface densely and persistently albotomentose. Leaves distributed evenly along terminal branches, sessile, 7-15 x 1.5-2 cm, blades narrowly elliptical, narrowly ovate, or linear, bases decurrent, apices attenuate, margins mucronulate, slightly revolute, adaxial surface glabrous, sometimes with a persistent arachnoid pubescence, abaxial surface densely and persistently albotomentose, chartaceous; pinnately veined (camptodromous) with 7-10 secondary veins on each side of the midrib. Capitulescence of 2 or 3 capitula in axillary or terminal cymes (mostly in an umbelliform cyme, rarely in a pair with one capitulum subsessil and the other long pedunculate), sometimes with a pair of leafshaped bracts on the peduncles near the involucre; peduncles, when present, 1.5-3 cm long, persistently and densely albotomentose. Involucre 11-14 x 10-15.5 mm, widely campanulate, phyllaries ca. 200, 3.5-13 x ca. 0.5 mm, slightly wavy, imbricate in 5-7 series, outer series subulate to linear with attenuate apices, arachnoid pubesent, and inner series narrowly long-ovate or linear with attenuate apices, glabrous, pale green. Receptacle fimbriate or setiferous with laciniate setae, 1-1.2 mm long. Ray florets ca. 50, female, fertile, corolla 9-12.5 mm long, true ray, glabrous, yellow, tube 5-6 x 0.25-0.3 mm, limb 4.5-6.5 x 1-1.5 mm, obovate, 4-veined, apex 3-dentate with three reduced equal lobes; style ca. 10 mm long, style branches ca. 2.8 mm long, glabrous. Disc florets ca. 200, hermaphroditic, fertile, corolla 8.5-9.5 mm long, tubulose-funnelform, deeply 5-lobed, slightly and gradually diferentiate into tube and limb, glabrous, yellow, tube ca. 5.5 x ca. 0.25 mm, limb 3.5-4 x 0.5-0.7 mm; lobes 1.5-2 x ca. 0.2 mm, apex pubescent; stames with thecae ca. 3.5 x 0.25 mm, pale yellow, apical appendages ca. 0.47 x 0.15 mm, ovate and smooth; style ca. 10 mm long, styles branches ca. 2.6 mm long, pubescent. Cypselae 0.9-1.2 x 0.4-0.6 mm, cylindrical or obconical, densely setulose with twin hairs. Pappus 0-7,5 mm long, outer series with short bristles up to 1.5 mm long or absent, inner series 7-7.5 mm long, pale yellow.

An interesting morphological variation in the specimens of *Inkaliabum diehlii* was found in its capitulescence. It is a terminal umbelliform cyme with two or three subsessile capitula or with short peduncles of equal length, each one with two leafy bracts near the involucre or without them. However, in the specimen *Diehl 2450a* the capitulescence is an axillary and terminal cyme with paired capitula, one of them subsessile and the other one long-pedunculate, without leafy bracts (Fig. 3. I).

Aditional material examined. PERU. *Cuzco: Prov. Calca,* Hacienda Pavayoc, Valle Lares, IX-1925, A. Diehl 2406 (F); *prov. La Convención*, Quebrada Versalles, IX-1925, A. Diehl 2450a (F); unknown locality (probably Pillpinto in *prov. Paruro*), 700 m, 13-V-1930, C. Bues s.n. (F).

Fig. 2. Holotype of *Inkaliabum diehlii* conserved in F.

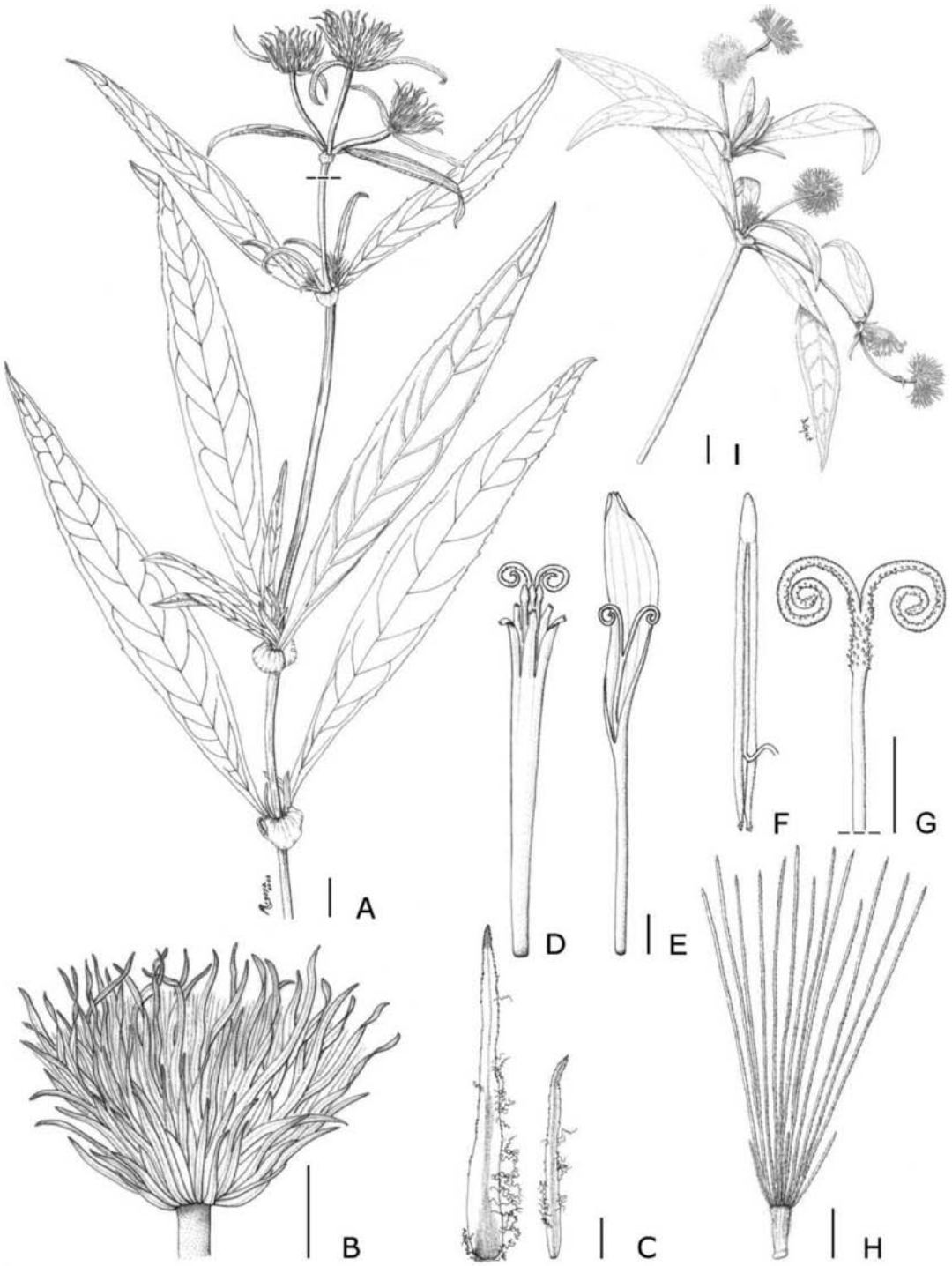

Fig. 3. *Inkaliabum diehlii*. **A.** flowering branch with a terminal umbelliform cyme; **B.** involucre; **C.** inner (left) and outer (right) phyllaries; **D.** disc floret without cypsela; **E.** ray floret without cypsela; **F.** stamen; **G.** disc floret style, showing upper shaft and style branches; **H.** cypsela and pappus (Bues s.n., F); **I.** flowering brach with an axillary and terminal cyme with geminated capitula (Diehl 2450a, F) (Scale bars: **A-I:** 1 mm; scale bars are the same for **D-E** and **F-G**).

Acknowledgements

Thanks are given to Daniel Potter, Liliana Katinas, Gisela Sancho, Mariana A. Grossi, and the reviewers for helpful comments on this manuscript. Also, I thank Michael O. Dillon and Anna Balla for assistance with the specimens of F, M. Alejandra Migoya for the illustration, Daniel A. Giuliano for the Latin diagnosis, and curators. This work was supported by the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina.

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Recibido el 29 de abril de 2010, aceptado el 28 de junio de 2010.