COMPOSITAE NEWSLETTER

Number 49 **22.12.2011**

Scientific Editor: Bertil Nordenstam
Technical Editor: Gunnel Wirénius Nohlin
Published and distributed by The Swedish Museum of Natural History,
Department of Phanerogamic Botany,
P.O. Box 50007, SE-104 05 Stockholm, Sweden

ISSN 0284-8422

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Notes on the generic limits of *Sinosenecio* and *Tephroseris* (Compositae-Senecioneae)

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Abstract

Based on morphological and molecular evidence three new combinations in the tribe Senecioneae (Compositae) are made, viz., *Sinosenecio changii* (B. NORD.) B. NORD., *Tephroseris koreana* (KOM.) B. NORD. & PELSER, and *Tephroseris newcombei* (GREENE) B. NORD. & PELSER. These transfers leave *Sinosenecio* B. NORD. as a genus restricted to eastern Asia (mainly China, with minor extensions into Myanmar, Thailand, Vietnam) and add to the contents of the circumboreal genus *Tephroseris* in north America.

Introduction

The three genera *Sinosenecio* B. NORD., *Nemosenecio* (KITAM.) B. NORD. and *Tephroseris* (RCHB.) RCHB. have been regarded to form a group within subtribe Tussilagininae of the tribe Senecioneae and are sometimes even recognized as a separate subtribe Tephroseridinae C. JEFFREY & Y. L. CHEN (1984, CHEN et al., in press). Since the genus *Sinosenecio* B. NORD. was described (NORDENSTAM 1978) the knowledge of the genus has increased considerably mainly thanks to the contributions by C. JEFFREY and Y. L. CHEN (JEFFREY & CHEN 1984, CHEN 1999) and recent in-depth studies by YANG QINER and LIU YING (e.g., LIU 2010, LIU & YANG 2010, 2011a, b, c, d, LIU et al. 2010). A treatment for the Flora of China is in a final stage of preparation, involving several co-authors (CHEN et al., in press).

NORDENSTAM (1978) initially recognized 27 species in the genus *Sinosenecio*, but the revisions by JEFFREY and CHEN recognized 35 species, all native to China, with small extensions into neighbouring countries. The number of species keeps increasing and the Flora of China treatment now recognizes 41 Chinese species of *Sinosenecio*, all but two of them endemic to China. (Chen et al., in press).

Somewhat surprisingly, a species from Queen Charlotte Islands in Canada was added to *Sinosenecio* by the transfer of *Senecio newcombei* Greene (Janovec & Barkley 1996, cf. also Janovec & Barkley 2006). Janovec & Barkley (1996) wrote: "The plant long called *Senecio newcombei* Greene is a distinctive endemic of the Queen Charlotte Islands, B. C., Canada". These authors realized that the species was not well placed neither in *Senecio*, nor in the aureoid group of *Senecio* now recognized as the genus *Packera* Löve & Löve. They argued that it would fit into the East Asiatic (mainly Chinese) genus *Sinosenecio* B. Nord. and made the combination to that effect. The extraordinary biogeographical consequence of this transfer prompted an inquiry by Golden et al. (2001) into the true relationships of *S. newcombei.* They performed a study of molecular sequence data (ITS) and micromorphology (endothecial tissue) of a selection of North American *Tephroseris* species and two putative representatives of *Sinosenecio* viz. *S. koreanus* (Kom.) B. Nord. and *S. newcombei*. They concluded that *S. newcombei* is closely related to *Tephroseris*, but the overall relationships remained unresolved and the generic limits between the two genera were not clearly definable because of the limited sampling. A broader study including more taxa of these and related genera was recommended.

Janovec & Barkley (1996) assigned *S. newcombei* to the tussilaginoid alliance rather than the senecioid group. This is indicated by micromorphological characters, such as the continuous stigmatic area of the style branches, and the straight and uniform filament collar (not basally thickened). However, the radial (or radial and polar) endothecial tissue of the anthers is an essentially senecioid character. Although some of these characters are found in the Asiatic genus *Sinosenecio*, they are also characteristic of the north circumpolar genus *Tephroseris*. The chromosome number n = 24 in *S. newcombei* (Taylor & Mulligan 1968) is also prevalent in *Tephroseris.* As discussed below the basic number x = 24 is also reported in *Sinosenecio,* viz. in a substantial group of species which are allied to and perhaps congeneric with *Nemosenecio*. On overall morphological features *S. newcombei* is better positioned in *Tephroseris* than in *Sinosenecio*. This also makes sense in a biogeographical context. Moreover, molecular data especially from ITS sequences strongly support the inclusion of *S. newcombei* in *Tephroseris* and disfavour its inclusion in *Sinosenecio* (Pelser et al. 2007, Wang et al. 2009). However, its is not easy to single out any *Tephroseris* sp. as a close ally to *newcombei*.

In our comprehensive phylogenetic analysis of the tribe Senecioneae we have been able to reconstruct a phylogeny of the tribe and resolve many of the problems of generic delimitation and circumscription (Pelser et al. 2007, 2010). Although *Nemosenecio* and *Tephroseris* form a well supported clade with a large number of *Sinosenecio* species, at least *Sinosenecio* is not monophyletic as presently defined and further revisions of the generic boundaries in the assemblage are inevitable (Wang et al. 2009, Liu 2010, Liu & Yang 2011a,b, c). The core of *Sinosenecio* including the type species (*S. homogyniphyllus* (Cumm.) B. Nord.) are characterized by a basic chromosome number of x = 30 and micromorphological characters such as strictly polarized endothecium, confluent stigmatic area of disc floret styles, and large anthers (Liu & Yang 2011a, b). This group of about a dozen species constitute *Sinosenecio* s. str., which is allied to genera in the subtribe Tussilagininae such as *Cremanthodium*, *Farfugium*, *Ligularia* and *Parasenecio.* Another assemblage of *Sinosenecio* species have x = 24 (or rarely 13), polarized and radial endothecium, divided stigmatic areas, and smaller anthers (Liu & Yang 2011a, b). This group of more than 20 species is more closely allied to *Nemosenecio* (and hence also *Tephroseris*) and may have to be merged with *Nemosenecio* or alternatively separated as a new genus.

Results and Discussion

Sinosenecio is a moderately large genus (>40 species) with a distinct centre in the Sichuan Province of China. In the limited study by Golden et al. (2001) the genus was unfortunately not represented by any typical members, only by *S. koreanus* from north Korea and adjacent part of Jilin in NE China and the North American *S. newcombei*. Both of these taxa belong to the *Tephroseris* clade (Pelser et al. 2007, Wang et al. 2009) and should be removed from *Sinosenecio*. The molecular data firmly place *S. koreanus* with the *Tephroseris* taxa, as also corroborated by the data in Golden et al. (2001). In the more extensive ITS phylogeny of Pelser et al. (2007) *S. koreanus* is grouped with *T. kirilowii* (Turcz. ex DC.) Holub and *T. rufa* (Hand.-Mazz.) B. Nord. in the *Tephroseris* clade. A similar result was obtained by Liu (2010), who presented a phylogram from an ITS data set, where *S. koreanus* is nested in the *Tephroseris* clade, as sister to a branch consisting of *T. kirilowii, T. rufa, T. pierotii* (Miq.) Holub and *T. flammea* (Turcz. ex DC.) Holub. Her analyses based on plastid markers (*ndhC-trnV* and *rpl32trnL*) also clearly identified a well supported *Tephroseris–S. koreanus* clade (Liu 2010).

In a previous study mainly based on ITS data (Pelser et al. 2007) we found *Tephroseris* to be sister to a clade composed of *Nemosenecio* and several *Sinosenecio* species. The studied taxa of *Sinosenecio* were all Chinese species centered in the Sichuan Province, viz. *S. septilobus* (Chang) B. Nord., S. *bodinieri* (Vaniot) B. Nord. and *S. globigerus* (Chang) B. Nord. The clade also included the problematic *Tephroseris changii* B. Nord., endemic to Sichuan. This taxon was originally described in *Senecio* and transferred to *Tephroseris* with a new epithet (Nordenstam 1978). In some characters it does not conform well to the generic description of *Tephroseris* as discussed by Jeffrey & Chen (1984), who wrote: "In habit, anther-shape and phyllary number, this species is similar to the scapigerous *Sinosenecio* species and exceptional in *Tephroseris*". The species was accepted in *Tephroseris* with some hesitation by Jeffrey & Chen (1984), who pointed out that the scapiform stem, number of involucral bracts (13), and anther morphology speak for a position in *Sinosenecio*. Molecular evidence from ITS sequences places the taxon in *Sinosenecio* branch, well supported as distinct from the *Tephroseris* clade (Pelser et al. 2007).

The true relationships of *Tephroseris changii* are in the large group within *Sinosenecio* (sensu lato), characterized by x = 24 and related to *Nemosenecio*. In the Flora of China treatment (Chen et al., in press) this group is still maintained in *Sinosenecio*, and *T. changii* is therefore placed there at least provisionally, although we are aware that this is not its final taxonomic position.

In an extended ITS study of 27 species of the *Nemosenecio-Sinosenecio-Tephroseris* assemblage (Wang et al. 2009), *Tephroseris changii* again grouped with several species of *Sinosenecio*, whereas *S. koreanus* and *S. newcombei* were both firmly placed with *Tephroseris*. We here propose the transfer of these two species to *Tephroseris*, although we are aware that *Sinosenecio* remains polyphyletic and that further generic revisions in the group are inevitable (cf. Wang et al. 2009).

These transfers are to some extent also supported by morphological and cytological data. *S. koreanus* is in overall morphology similar to *Sinosenecio* (Liu & Yang 2011a, b), but molecular data firmly place this taxon in *Tephroseris*. Cytological data (chromosome numbers) confirm the polyphyly of *Sinosenecio* as until recently circumscribed and identify three generic groups, viz. one characterized by x = 30 (*Sinosenecio* s. str., including the type, *S. homogyniphyllus*), a second group with x = 29 (= monotypic genus *Hainanecio* Y. Liu & Q. E. Yang of subtribe Senecioninae; cf. Liu & Yang 2011c), and a third group with x = 24 (rarely 13) (a large group probably to be removed from *Sinosenecio* as a new genus or included in *Nemosenecio*; cf. Liu & Yang 2011b). *S. newcombei* and *S. koreanus* both have x = 24, which is congruent with the basic number in *Tephroseris*, where they are now proposed to belong.

1) *Sinosenecio changii* (B. Nord.) B. Nord., comb. nov.

Basionym: *Tephroseris changii* B. Nord., Opera Bot. 44: 44 (1978). – Type: China, Sichuan, W. P. Fang 1145 (N syntype, E, GH, K, P!), W. P. Fang 1180 (PE syntype, E, GH).

Syn.: *Senecio rosuliferus* CHANG, Bull. Fan Mem. Inst. Biol. Bot. 6: 58 (1935), nom. illeg. (non *S. rosulifer* LÉVL. & VANIOT, Feddes Repert. 8: 359, 1910).

2) *Tephroseris koreana* (KOM.) B. NORD. & PELSER, comb. nov.

Basionym: *Senecio koreanus* KOM. in Act. Hort. Petrop. 18: 421 (1901); Fl. Mansh. 3: 710, tab. X (1907). – Type: Korea, near Yalu River, KOMAROV s.n. (LE syntype), near River Segelsu, KOMAROV s.n. (LE syntype), KOMAROV 1601 (K, P, PE).

Syn.: *Sinosenecio koreanus* (KOM.) B. NORD., Opera Bot. 44: 50 (1978).

This taxon has a small distribution area in north Korea and adjacent part of Jilin in NE China, way outside the area of *Sinosenecio*. Its habit is *Sinosenecio*-like with leaf-blades broadly cordate or subtruncate to cuneate but not distinctly palmately veined, and although the petioles are not distinctly winged, they are basally somewhat expanded.

3) *Tephroseris newcombei* (GREENE) B. NORD. & PELSER, comb. nov.

Basionym: *Senecio newcombei* GREENE, Pittonia 3: 249 (1897).

Syn.: *Packera newcombei* (GREENE) W. A. WEBER & Á. LÖVE, Phytologia 49(1): 47 (1981); *Sinosenecio newcombei* (GREENE) JANOVEC & T. M. BARKLEY, Novon 6: 266 (1996). – Type: Canada, B. C., Queen Charlotte Isl., VI. 1897, NEWCOMBE s.n.(US).

As the cited synonymy reveals, this name has travelled from *Senecio* via *Packera* and *Sinosenecio* to now eventually find its home in *Tephroseris*.

The genus *Tephroseris* with ca. 50 species is mainly Eurasian and not well represented in North America - until now six species including *T. palustris* (L.) RCHB. (as ssp. *congesta*) are known there (BARKLEY & MURRAY 2006). The number of *Tephroseris* species in North America is now increased to seven.

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Do the Antillean species of *Gochnatia* KUNTH (Asteraceae) truly belong in that genus? A phylogenetic analysis based on morphological characters

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Abstract

A phylogenetic analysis was carried out on the species of the section *Anastraphioides* JERVIS ex L. KATINAS, S. FREIRE & G. SANCHO of the genus *Gochnatia* KUNTH, along with representatives of the four genera of the subfamily Gochnatiodeae: *Richterago* KUNTH, *Cyclolepis* D. DON, *Cnicothamnus* GRISEB. and *Gochnatia* KUNTH (other sections). The analysis, based on a data matrix of 42 species and 37 morphological, anatomical, and palynological characters, employed TNT (Tree Analysis Using New Technology) version 1.1 (GOLOBOFF et al. 2003). Results showed that the section *Anastraphioides* is a monophyletic, derived group more closely related to *Richterago* than to other sections of *Gochnatia* as currently defined. The species currently in the section *Anastraphioides* of the genus *Gochnatia* present a number of unique characters, suggesting the necessity of taxonomic changes for this group.

Introduction

Since its description in 1819, the genus *Gochnatia* KUNTH (Asteraceae) has generated controversy with respect to its infrageneric classification. Currently it pertains to the tribe Gochnatieae (BENTH. & HOOK. f.) PANERO & V. A. FUNK of the subfamily Gochnatioideae (BENTH. & HOOK. f.) PANERO & V. A. FUNK, along with the genera *Cyclolepis* D. DON, *Cnicothamnus* GRISEB., and *Richterago* KUNTH (PANERO & FUNK 2008), but historically it was placed in the tribe Mutisieae

(Katinas et al. 2008). The genus is characterized by discoid or radiate capitula with tubular or sub-bilabiate flowers, caudate anthers with apiculate appendages, and glabrous style branches (Lessing 1830, De Candolle 1836, Cabrera 1971). During its taxonomic history the genus *Gochnatia* has at various times been thought to include other genera such as *Leucomeris* D. Don, *Anastraphia* D. Don, subgen. *Hedraiophyllum* Less., *Pentaphorus* D. Don, and *Moquinia* DC. This lack of agreement has led several authors to consider *Gochnatia* as an artificial taxon whose clarification is of considerable importance to understanding phylogenetic relationships within the family Asteraceae (Cabrera 1971, Bremer 1994, Freire et al. 2002).

The exhaustive infrageneric treatment by Jervis (1954) recognized five sections in the genus: *Anastraphioides* Jervis ex L. Katinas, S. Freire & G. Sancho, *Gochnatia*, *Hedraiophyllum* (Less.) DC., *Pentaphorus* (D. Don) Less., and *Moquinia* (DC.) Jervis. His work listed 71 species and considered the species formerly included in a separate genus, *Anastraphia,* as the section *Anastraphioides*. In his monograph of the genus, Cabrera (1971) included the species of *Anastraphioides* within the section *Gochnatia* Less. and recognized five other sections: *Pentaphorus* (D. Don) DC., *Moquiniastrum* Cabrera, *Leucomeris* (D. Don) Cabrera, *Hedraiophyllum* (Less.) DC. and *Discoseris* (Endl.) Cabrera, the last section comprising the discoid species of the former genus *Seris* Less.

Roque & Pirani (2001) redefined the genus *Richterago* Kunth to include the species formerly in *Actinoseris* (Endl.) Cabrera and the section *Discoseris* of *Gochnatia*, based on analyses of morphological, anatomical and pollen characters of these species (Roque & Silvestre-Capelato 2001, Roque 2001). Soon afterwards, Freire et al. (2002) published an exhaustive morphological analysis of the species of *Gochnatia* as defined in Cabrera´s (1971) treatment. Among the eight sections redefined by Freire et al. (2002) was once again the section *Anastraphioides*, re-established for the Antillean species of *Gochnatia* as defined by Jervis (1954). The other sections in the treatment of Freire et al. (2002) were *Gochnatia*, *Hedraiophyllum*, *Leucomeris*, *Pentaphorus*, *Glomerata*, *Rotundifolia* and *Discoseris*.

More recent studies have recognized *Pentaphorus* and *Leucomeris* as genera independent of *Gochnatia* (Hind 2007). Molecular phylogenies have shown *Richterago* sensu Roque & Pirani (2001) to be related to *Cnicothamnus* Griseb., *Gochnatia,* and *Cyclolepis* D. Don in the subfamily *Gochnatioideae* (Panero & Funk 2002, 2008). Authors such as Katinas et al. (2008) and Sancho & Freire (2009), however, dispute these criteria. Clearly the genus *Gochnatia* still requires a thorough taxonomic revision.

In this vein, the objective of the present study is the phylogenetic analysis of the Antillean species of *Gochnatia* (sect. *Anastraphioides*), including in the analysis representatives of the sections *Discoseris*, *Glomerata*, *Gochnatia, Hedraiophyllum*, *Leucomeris*, *Pentaphorus*, *Rotundifolia* as well as representatives of the genera *Richterago*, *Cnicothamnus* and *Cyclolepis.* Based on morphological, anatomical and palynological characters, the analysis is intended to elucidate the taxonomic problems of *Gochnatia*, at least as far as species that make up the section *Anastraphioides* and are endemic to the Greater Antilles and the Bahamas.

Materials and Methods

Selection of species

The analysis included representatives of the four genera of the subfamily Gochnatioideae: *Cnicothamnus* (1 species), *Cyclolepis* (1 species), *Gochnatia* (39 species), and *Richterago* (1 species). Following the definition of sections proposed by Freire et al. (2002), the genus *Richterago* was analyzed excluding species of the section *Discoseris* of *Gochnatia* (*Gochnatia amplexifolia* and *G. discoidea*) even though some authors place *Discoseris* in *Richterago*, following the definition of Roque & Piraní (2001). For *Gochnatia,* representatives were included from all the eight sections defined by Freire et al. (2002). For the majority of these sections, the analysis included the type species and whenever possible other species as well. For the section *Leucomeris* as defined by Freire et al. (2002), however, the type species (*G. spectabilis*) was not analyzed; the phylogenetic studies of Panero & Funk (2008) show that this species pertains to the genus *Leucomeris*, which is not included in the tribe *Gochnatieae* nor even the subfamily Gochnatioideae. Following this reasoning, the section *Leucomeris* needs to be redefined. From this point on we will refer to it as the section aff. *Leucomeris*. Finally, *Cyclolepis genistioides* was selected as the outgroup, based on the results of Panero & Funk (2008).

The material examined and analyzed was obtained from the herbaria B, GH, HAC, HAJB, LP, MO, NY, and S, following the acronyms proposed by Holmgren et al. (1990).

Selection of characters

The cladistic analysis of the 42 taxa was based on morphological, anatomical and palynological characters that were selected following an extensive review of character variation. Highly variable characters and characters difficult to delimit were excluded. In total the analysis included 37 characters (Table 1).

Table 1. Character states used in the phylogenetic analysis of *Gochnatia* and representative species of *Cnicothamnus*, *Cyclolepis* and *Richterago* of the subfamily Gochnatioideae.

1.	**Habit:** 0–trees; 1–shrubs; 2–herbs
2.	**Presence of brachyblast:** 0–absent; 1–present
3.	**Position of leaves on branches:** 0–grouped towards branch tip; 1–dispersed along the branch
4.	**Leaf size:** 0–leptophyllous or nanophyllous (<0,25 cm^2 or 0.25–2.25 cm^2 respectively); 1–micropyllous (2.25–20.25 cm^2); 2–nothophyllous (20.25–45 cm^2); 3–mesophyllous (45–182.25 cm^2)
5.	**Presence of spine at leaf tip:** 0–absent; 1–present
6.	**Leaf texture:** 0–chartaceous; 1–coriaceous
7.	**Leaf margin:** 0–entire; 1–denticulate without spines; 2–spinose–dentate
8.	**Non-glandular hairs on leaves:** 0–absent; 1–flagellate septate; 2–biramous
9.	**Leaf venation:** 0–pinnate; 1–three–nerved
10.	**Presence of abaxial epidermis of the leaf getting into the mesophyll:** 0–absent; 1–present
11.	**Presence of sclerenchyme bands in the mesophyll:** 0–absent; 1–present
12.	**Number of layers in hypodermis:** 0– no layer; 1–one layer; 2–two or more layers
13.	**Capitulum type:** 0– heterogamous; 1–homogamous
14.	**Shape of involucre:** 0–wide campanulate; 1–campanulate; 2–turbinate
15.	**Size of involucre:** 0– < 10 mm; 1–10–30 mm; 2– > 30 mm
16.	**Presence of attenuated involucre base:** 0– present; 1– absent
17.	**Position of anthers with respect to corolla:** 0–exserted; 1–not exserted
18.	**Degree of grouping of capitula (capitulescence):** 0–solitary; 1–pseudocorymb; 2–pseudoraceme
19.	**Floral peduncles and bracts:** 0–absent; 1–peduncle without bracts; 2–peduncle with bracts
20.	**Corolla type:** 0–isomorphic; 1–subdimorphic; 2–dimorphic
21.	**Number of capitula per capitulescence:** 0–one (or two–three); 1–few (5–20); 2–many (> 20)
22.	**Number of flowers per capitulum:** 0–few (<10), 1–many (11–20); 2–numerous (>30)

23.	**Number of series of involucral bracts:** 0–up to 4 series; 1–between 5 and 8 series; 2–> 8 series
24.	**Texture of involucral bracts:** 0–glabrous; 1–pubescent
25.	**Pubescence of involucral bracts:** 0–chartaceous; 1–subcoriaceous
26.	**Length of corolla lobes:** 0–scarcely lobed; 1–lobes of same length as corolla tube; 2–deeply lobed
27.	**Presence of leaf petioles:** 0–absent; 1–present
28.	**Shape of corolla lobes:** 0–erect; 1–recurved
29.	**Papillae and hairs at tips of corolla lobes:** 0–absent; 1–papillae only; 2–hairs only; 3–papillae and hairs
30.	**Form of anther tail:** 0–smooth; 1–short laciniate; 2–long laciniate
31.	**Pappus type:** 0–type A; 1–type B; 2–type C; 3–type D; 4–type E as defined by Freire et al. (2002)
32.	**Number of series of pappus bristles:** 0–one series; 1–two series; 2–three or more series
33.	**Grouping of pappus bristles:** 0–free; 1–grouped at the base
34.	**Surface of pollen grain:** 0–echinate; 1–microechinate
35.	**Type of exine:** 0–*Mutisia*; 1–*Wunderlichia*
36.	**Form of anther apical appendage:** 0–abruptly acuminate; 1–acute or attenuate
37.	**Reproductive system:** 0–monoecious: 1–dioecious, polygamous

Characters 10, 11, 12 and 35 were codified as "?" for *Gochnatia arborescens*, where those characters could not be determined from the materials available. Likewise, character 30 was codified "?" for *G. oviedoae* and *G. cristalensis*, and character 35 for *G. wilsonii, G. microcephala, G. picardae, G. oligantha, G. eneantha* and *G. curviflora*. For the last species, character 34 as well could not be determined (Table 2).

Autapomorphies were not included in the cladistic analysis. The data matrix (Table 2) was analyzed with TNT (Tree Analysis Using New Technology) version 1.1 (Goloboff et al. 2003). All analyses were based on a heuristic search with 1,000 random, additive repetitions (RAS), saving up to 10 trees before running the algorithm "bisection-reconnection" (TBR). Bootstrap methods with 1000 replicates (Felsenstein 1985) were used to evaluate the degree of support for branching patterns. The program Winclade version 0.9.9+ (BETA) was used to analyze homologies and homoplasies (Nixon 1999).

Table 2. Data matrix used in the cladistic analysis of *Gochnatia* and related genera of Gochnatioideae, using the morphological, anatomical and palynological characters defined in Table 1. In all 42 species were evaluated, with *Cyclolepis genistioides* as the outgroup. "?"= signifies missing data (see text).

Species	Characters																																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Cnicothamnus lorentzi	0	0	1	3	0	0	1	1	0	0	1	0	1	0	2	1	0	0	0	2	0	2	2	1	0	2	1	1	3	0	3	1	0	0	0	1	0
Cyclolepis genistioides	1	0	1	0	1	0	0	2	1	0	0	0	1	1	0	1	1	0	1	1	1	1	1	0	0	0	0	0	1	2	4	1	0	1	0	0	1
Gochnatia aff.*recurva*	1	0	1	0	1	1	2	1	0	1	1	1	1	0	1	1	0	0	0	0	0	2	1	0	1	1	1	1	3	0	0	1	1	1	1	0	0
G. amplexifolia	2	0	1	2	1	0	1	1	0	0	1	1	1	1	1	1	0	1	1	0	2	2	1	0	1	1	0	0	2	1	0	0	0	0	1	0	0
G. arborescens	0	0	1	1	1	0	0	1	1	?	?	?	1	1	0	1	0	1	1	0	1	1	2	0	0	0	1	0	0	0	1	0	0	1	?	1	0
G. argentina	1	0	1	1	1	0	2	2	0	0	1	0	0/1	1	0	1	1	2	1	1	2	1	0	0	1	2	1	1	0	2	2	1	0	1	0	0	1
G. attenuata	1	0	1	0	1	1	2	1	0	0	1	1	1	1	1	0	0	0	0	0	0	2	2	0	1	0	1	0	3	1	0	0	0	1	1	0	0
G. buchii	0	0	1	0	1	1	2	1	0	0	1	0	1	2	0	1	0	0	0	0	0	0	1	0	1	2	1	0	3	0	0	0	0	0	1	0	0
G. calcicola	1	1	0	0	1	1	2	1	0	0	1	1	1	2	1	1	0	0	0	0	0	0	2	0	0	2	1	0	1	1	0	0	0	0	1	0	0
G. cowellii	1	1	0	0	1	1	2	1	0	1	1	1	1	1	1	1	0	0	0	0	0	2	1	0	1	2	1	1	3	0	0	0	1	1	1	0	0
G. crassifolia	1	0	1	1	0	1	0	1	0	1	1	1	1	1	1	1	0	0	0	0	0	2	1	0	1	1	1	0	1	2	0	0	1	1	1	0	0
G. cubensis	1	0	1	0	1	1	2	1	0	1	1	1	1	2	1	1	0	0	0	0	0	0	1	0	0	2	1	0	1	0	0	0	0	0	1	0	0
G. curviflora	1	0	1	1	0	0	0	1	1	0	0	0	1	1	1	1	1	0	1	0	0	1	0	0	1	0	1	1	1	2	1	1	0	?	?	0	0
G. discoidea	2	0	1	2	1	0	1	0	0	0	1	0	1	1	0	1	1	1	1	0	1	2	1	0	1	1	0	0	2	2	0	0	0	0	1	0	0
G. ekmanii	1	0	1	1	1	0	2	1	0	0	1	2	1	1	1	1	0	0	0	0	0	2	2	0	1	1	1	0	3	1	0	0	0	1	1	0	0
G. elliptica	1	0	1	1	0	1	0	1	0	0	1	2	1	1	0	1	0	0	0	0	0	0	2	0	1	2	1	0	3	1	0	1	0	0	1	0	0
G. ellivarinermis	1	0	1	1	0	1	0	1	0	0	1	2	1	1	0	1	0	0	0	0	0	0	2	0	1	2	1	0	3	1	0	0	0	0	1	0	0
G. eneantha	0	1	0	1	1	1	2	1	0	1	1	2	1	1	1	1	0	0	0	0	0	0	1	0	1	2	1	0	3	1	0	1	0	1	?	0	0
G foliosa	1	0	1	0	1	0	1	0	0	0	0	0	1	1	0	1	1	2	1	0	1	1	1	0	0	1	1	0	1	1	3	1	0	1	1	0	0
G. glutinosa	1	0	1	0	0	0	0	0	1	0	0	0	1	1	0	1	1	2	1	0	1	0	0	0	0	1	0	0	1	1	3	1	0	1	1	0	0
G gomezii	1	1	1	0	1	1	2	1	0	0	1	0	1	2	1	1	0	0	0	0	0	0	1	0	0	2	1	0	1	0	0	0	0	0	1	0	0
G ilicifolia	0	0	1	0	1	1	1	1	0	0	1	2	1	1	0	1	0	0	0	0	0	1	1	0	1	2	1	0	2	1	0	1	0	1	1	0	0
G. intertexta	1	1	1	0	1	1	2	1	0	0	1	0	1	2	1	1	0	0	0	0	0	0	1	0	1	2	1	0	3	0	0	0	0	1	1	0	0
G. maisiana	1	0	1	0	1	1	2	1	0	0	1	0	1	2	1	1	0	0	0	0	0	0	0	0	1	2	1	0	3	1	0	0	0	0	1	0	0
G. mantuensis	1	0	1	0	1	1	2	1	0	1	1	2	1	1	1	1	0	0	0	0	0	2	2	1	0	2	1	0	0	0	0	0	0	1	1	0	0
G mayparviflora	1	0	1	0	1	1	2	1	0	0	1	0	1	2	1	1	0	0	0	0	0	0	0	0	1	2	1	0	3	1	0	0	0	0	1	0	0
G. microcephala	1	1	0	0	1	0	2	1	0	1	1	0	1	1	0	1	0	0	0	0	0	0	0	0	1	1	1	0	2	1	0	1	0	0	?	0	0
G. montana	1	0	1	1	1	1	2	1	0	0	1	2	1	1	2	1	0	0	0	0	0	2	2	0	1	1	1	1	0	1	0	0	1	0	1	0	0
G. obtusifolia	1	0	1	0	0	1	0	1	0	1	1	0	1	1	1	0	0	0	0	0	0	1	1	0	1	1	1	0	2	1	0	0	1	1	1	0	0
G. oligantha	1	1	0	0	1	1	2	1	0	0	1	0	1	2	1	1	0	0	0	0	0	0	1	0	1	2	1	0	3	0	0	1	0	0	?	0	0
G. orbiculata	1	0	1	1	1	0	0	2	0	0	1	1	0/1	1	0	1	1	2	1	1	1	1	0	0	1	0	1	1	1	2	2	1	0	1	0	0	1
G. palosanto	0	0	1	1	1	0	1	1	0	0	0	0	1	1	0	0	1	1	2	0	1	1	0	0	0	1	1	1	1	2	1	1	0	1	1	0	0
G parvifolia	1	1	0	0	0	1	1	1	0	0	1	0	1	2	1	1	0	0	0	0	0	0	1	0	1	2	1	0	0	0	0	0	1	0	1	0	0
G paucifloscul osa	1	1	0	0	1	1	2	1	0	1	1	1	1	1	1	1	0	0	0	0	0	0	1	0	1	2	1	0	0	1	0	0	1	0	1	0	0
G picardae	0	0	1	1	1	1	0	1	0	0	1	2	1	1	2	1	0	0	0	0	0	2	2	0	1	2	1	0	3	1	0	1	0	1	?	0	0
G. recurva	1	0	1	0	1	1	2	1	0	1	1	1	1	1	1	1	0	0	0	0	0	2	1	0	1	1	1	0	3	1	0	0	0	1	1	0	0
G rotundifolia	1	0	1	1	0	0	1	0	1	0	1	0	1	1	1	1	1	0	0	0	0	2	1	0	0	0	1	1	3	2	1	1	0	0	1	1	0
G sagraeana	1	0	1	1	1	1	2	1	0	1	1	2	1	1	2	1	0	0	0	0	0	2	1	0	1	1	1	1	1	1	0	0	1	1	1	0	0
G shaferi	1	0	1	0	1	1	2	1	0	0	1	1	1	1	0	1	0	0	0	0	0	1	1	0	1	1	1	0	3	1	0	0	0	1	1	0	0
G vernonioides	1	0	1	1	0	0	0	1	1	0	1	0	1	1	1	1	0	0	1	0	0	2	1	0	1	0	1	1	1	2	1	1	0	1	1	0	0
G wilsonii	1	1	0	0	1	0	2	1	0	0	1	0	1	1	1	1	0	0	0	0	0	0	1	0	1	2	1	0	3	0	0	0	0	1	?	0	0
Richterago angustifolia	2	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	0	1	1	2	0	2	1	0	1	2	0	0	3	2	0	0	0	0	0	0	0

Results and Discussions

Analyses of the data matrix of 37 characters and 42 taxa (Table 2) provided 24 most parsimonious trees (MPT) with a length of 201 steps, a consistency index (CI) of 0.28, and a retention index (RI) of 0.60. The strict consensus included twelve collapsed nodes. Bootstrap values were low for the majority of the branchings.

The topology of the strict consensus tree demonstrates that the genus *Gochnatia* is not monophyletic when all eight sections defined by Freire et al. (2002) are included. The sections themselves, however, largely remain intact, which suggests independent monophyletic origins for the majority of them in spite of the low bootstrap values (Fig. 1). The strict consensus tree reveals a clade formed by *G. argentina* and *G. orbiculata*, closely related species with BS = 84% (Fig. 1). These species represent the monophyletic section *Hedraiophyllum*, sister group to the large clade that includes the remaining species analyzed. In turn, the second clade is a polytomy between *Gochnatia palosanto* and *G. arborescens,* pertaining to the sections aff. *Leucomeris* and *Glomerata* respectively; the clade representing the section *Pentaphorus*; and a third clade uniting the sections *Rotundifolia*, *Gochnatia*, *Discoseris,* and *Anastraphioides* along with the representatives of *Richterago* and *Cnicothamnus* (Fig. 1).

Because only one species each of the sections aff. *Leucomeris* and *Glomerata* was available for analysis, the monophyly of these sections could not be assessed in this study. Still, the tree reveals independence between these two and the remaining sections of the genus even though the precise relationships are obscured by the polytomy. *Gochnatia foliosa* and *G. glutinosa*, the only two species in the section *Pentaphorus*, are defined as a monophyletic group related to the sections *Glomerata* and aff. *Leucomeris*. Bootstrap values for this clade are lower than 50% (Fig. 1).

Next in order in the cladogram is *G. curvifolia* as the basal species as well as the sister species of the remaining taxa. This species plus *G. vernonioides* make up the sister group of the polytomy that includes *G. rotundifolia* (the only species of the section *Rotundifolia*), *Cnicothamnus lorentzii,* the subclade of *Richterago* including the section *Discoseris* (Fig. 1), and the subclade of the section *Anastraphioides* (Fig. 1). For the section *Gochnatia*, *Gochnatia curvifolia* and *G. vernonioides,* the only representatives analyzed, indicate that this section is paraphyletic. A more thorough study that includes the remaining five species of the section *Gochnatia* is needed, however, to establish this beyond doubt.

The analysis shows that *Richterago angustifolia, Gochnatia amplexifolia* and *G. discoidea* (section *Discoseris*) constitute a monophyletic group (Fig. 1). This result supports the classification by Roque & Pirani (2001), who placed the species of the section *Discoseris* in *Richterago*. The subclade of *R. angustifolia, G. amplexifolia* and *G. discoidea* as a whole represents the sister group of the subclade containing all the Antillean species of *Gochnatia* (section *Anastraphioides*) (Fig. 1).

The section *Anastraphioides* constitutes a derived and monophyletic taxon. The species divide into two groups (Fig. 1). In the first, with 13 taxa, *Gochnatia maisiana* and *G. maisiana* var. *parviflora* make up the sister group of the remaining eleven species. Next in sequence is *G. buchii,* sister species of the polytomy consisting of *G. intertexta*, the subgroup *G. gomezii*, *G. calcicola* and *G. cubensis,* and the subgroup *G. oligantha*, *G. parvifolia*, *G. wilsonii*, *G. pauciflosculosa*, *G. microcephala,* and *G. eneantha* (Fig. 1). The last subgroup of six species is also a polytomy in which *G. parvifolia* and *G. oligantha* are distinct from the remaining four species. The second group, of 15 taxa (Fig. 1), comes out of the analysis as a notable polytomy between five species (*G. attenuata, G. ekmanii, G. mantuensis, G. shaferi, G. recurva*) and four subgroups, all of which display low BS values (Fig. 1).

Analysis of the principal characters contributing to the relationships between the sections of *Gochnatia* and related genera

Fig. 2 shows one of the 24 cladograms produced by the analysis and specifies the characters for each of the cladogram branches.

The grouping of species into the section *Hedraiophyllum* is strongly supported by the exclusive synapomorphy of the presence of pappus bristles of equal width but variable length, with plumes at the tip of the longest bristles (pappus type C, character 31, state 2). Other characters that support this grouping are homoplasies such as the presence of sclerenchyme bands in the mesophyll [character 11(1)], slightly recurved corolla lobes [character 28(1)], and pubescent involucral bracts [character 25(1)] (Fig. 2).

Although the grouping of species into the section *Pentaphorus* (Fig. 2) lacks exclusive synapomorphies, the set of characters as a whole supports the grouping. These include flowers with corolla lobes the same length as corolla tubes [character 26(1)], short laciniate anther tails [character 30(1)], and Type D pappus [character 31(3)], the last character a parallelism shared with *Cnicothamnus lorentzii.*

Each of the two sections *Glomerata* and aff. *Leucomeris* is defined by a set of characters constituting synapomorphies. For example, *Glomerata* has numerous series of involucral bracts on the capitulum [character 23(2)], acute or attenuated anther apical appendages [character 36(1)], and smooth anther tails [character 30(0)] (Fig. 2). The section aff. *Leucomeris* is differentiated by denticulate leaf margins [character 7(1)], capitulum with attenuated involucre base [character 16(0)], and capitulum with bracteate floral peduncules [character 19(2)] (Fig. 2).

Despite appearing on different branches, the species currently making up the section *Gochnatia* differ as a group from *Richterago*, *Cnicothamnus,* and the sections *Discoseris*, *Rotundifolia,* and *Anastraphioides* as follows: three-nerved venation [character 9(1)]; one or a few capitula, whose peduncles also lack bracts [character 19(1)]; flowers where papillae appear only on the tips of the petals [character 29 (1)]; pollen grains with echinate exine surface [character 34(0)]; and achenes with pappus bristles of uniform width but variable length (type B) [character 31(1)] and in two series [character 32(1)] (Fig. 2).

Richterago angustifolia and the species of *Discoseris* share the following characters with the section *Anastraphioides*: pappus bristles of uniform width and length (Type A), unique among the species of Gochnatieae [character 31(0)] and principally in a single series [character 32(0)]; and spiny leaf tips [character 5(1)] (Fig. 2). *Richterago* (including *Discoseris*), however, differs from *Anastraphioides* in the following ways: exclusively herbs or subshrubs [character 1(2)]; leaves primarily nothophyllous [character 4(2)] and sessile (without petioles) [character 27(0)]; capitula grouped in pseudocorymbs [character 18(1)] but with few flowers each [character 21(0)]; and floral peduncles without bracts [character 19(1)] (Fig. 2).

The section *Anastraphioides* is defined by the presence of coriaceous leaves [character 6(1)] with spinose-dentate margins [character 7(2)] and short laciniate anther tails [character 30(1)] (Fig. 2). Other characters that contribute to the definition of this clade are involucre with more than eight series of bracts [character 23(2)], exine surface microechinate [character 34(1)], and leaf hypodermis with more than two cell layers [character 12(2)]. This section divides into two subclades, as discussed above. One is characterized by turbinate involucre [character 14(2)] as an exclusive character, with few flowers per capitulum [character 22(0)], while the other is characterized by monostratified hypodermis in the leaf mesophyll [character 12(1)] and pollen grains with exine surface microechinate [character 34(1)] (Fig. 2).

Taxonomic considerations suggested by the phylogenetic analysis

The results of this study suggest that the current concept of *Gochnatia*, consisting of the eight sections defined by Freire et al. (2002), is actually a paraphyletic group. Most of the individual sections themselves, however, appear to be monophyletic, especially the sections *Discoseris*, *Rotundifolia* and *Pentaphorus* – of which 100% of the species were included in our study – and *Anastraphioides,* of which all species were included except *G. tortuensis*.

The species of the section *Hedraiophyllum* analyzed appear as sister species of *Cyclolepis* (Fig. 1). These *Hedraiophyllum* species constitute a natural group clearly separate from all other sections of *Gochnatia* by reason of subzygomorphic corollas, functionally feminine flowers, and the pappus with half the bristles long with plumose tips and the other half short (type C). Furthermore, these are the only species currently in *Gochnatia* that have biramous T-shaped hairs (SANCHO 2000, FREIRE et al. 2002). These characters and the closer relation with *Cyclolepis genistioides* than with the representatives of other *Gochnatia* sections indicate that the taxonomic status of this section should be reanalyzed, one possible result being the recognition of a new genus related to but independent of *Gochnatia*.

The representatives of the section *Pentaphorus* also constitute a monophyletic group, sister to the majority of the species currently in *Gochnatia* (Fig. 1). These results coincide with HIND´S (2007) recognition of *Pentaphorus* as a genus apart, distinguished by the presence of linear, glandulate-punctate leaves, inflorescences in dense glomerules or pseudoracemes, and pappus bristles of variable length and width (type D).

The section *Discoseris* and the species *Richterago angustifolia* appear as a monophyletic group in the analysis (Fig. 1), coinciding with results of the molecular analysis of PANERO & FUNK (2008). These results also support the classification of ROQUE & PIRANI (2001), but fail to support the classification of CABRERA (1971) often followed by other authors (e.g., FREIRE et al. 2002, SANCHO et al. 2005). Our study supports the concept of the monophyletic genus *Richterago,* characterized by herbaceous or subshrub growth form, scapose capitulum, and pappus basally connate in a ring.

The section *Anastraphioides* also appears as a monophyletic group in the analysis (Fig. 1), more related to *Richterago* than other species of *Gochnatia* as that genus is currently defined. The characters that distinguish the species of the section *Anastraphioides* from those of other sections of *Gochnatia* include: coriaceous and spinose-dentate leaves in the majority of taxa; anthers with acuminate apical appendages and anther tails usually smooth or short laciniate; and pappus of the achenes with bristles of uniform length and thickness (Type A), usually in a single series and either free or joined at the base.

The presence of pappus bristles in a single series, anthers inserted below the throat of the corolla, and leaves with spiny dentate margins are the diagnostic characters with which D. DON (1830) defined the genus *Anastraphia*. The traditional definition of the genus *Gochnatia* (KUNTH 1819) included the character of pappus bristles in two series, in contrast with features of the sections *Anastraphioides* and *Richterago*. Indeed, the nature of the pappus is a key character that reinforces the differences between *Anastraphioides* and *Richterago* on the one hand, with Type A pappus, and the other sections of *Gochnatia* plus related genera on the other hand.

The unique set of characters that separates the current section *Anastraphioides* of the genus *Gochnatia* from related taxa, added to the recognition of the genus *Anastraphia* by D. DON (1830), suggests that a resurrection of the genus *Anastraphia* may be in order. This suggestion is followed up in related works (VENTOSA & HERRERA 2011a, b).

Conclusions

The current section *Anastraphioides* of the genus *Gochnatia* is a monophyletic group more closely related to *Richterago* than to other sections of *Gochnatia*. The characteristics of the pappus reinforce this relationship and distinguish the current section *Anastraphioides* from the other sections of *Gochnatia*, along with characters of leaves, capitula, and flowers. This section makes up a natural group that apparently evolved in the Antilles, principally Cuba, from a common ancestor shared with *Richterago*, a genus with Brazilian origin. The results suggest that the genus *Anastraphia* should be resurrected for the species currently in the section *Anastraphioides*. They further suggest that the other sections currently included in the genus *Gochnatia* be thoroughly reviewed, especially the section *Hedraiophyllum*, which may end up being considered as another genus independent of *Gochnatia* and related to *Cyclolepis*.

Acknowledgements

We thank Drs. GÍSELA SANCHO and MARÍA CRISTINA TELLERÍA of the Natural History Museum of La Plata, Argentina, for their helpful suggestions regarding this analysis. The Red Latinoamericana de Botánica (Latin American Botanical Network) supported the first author´s work in Argentina. PETER FEINSINGER helped with the English translation.

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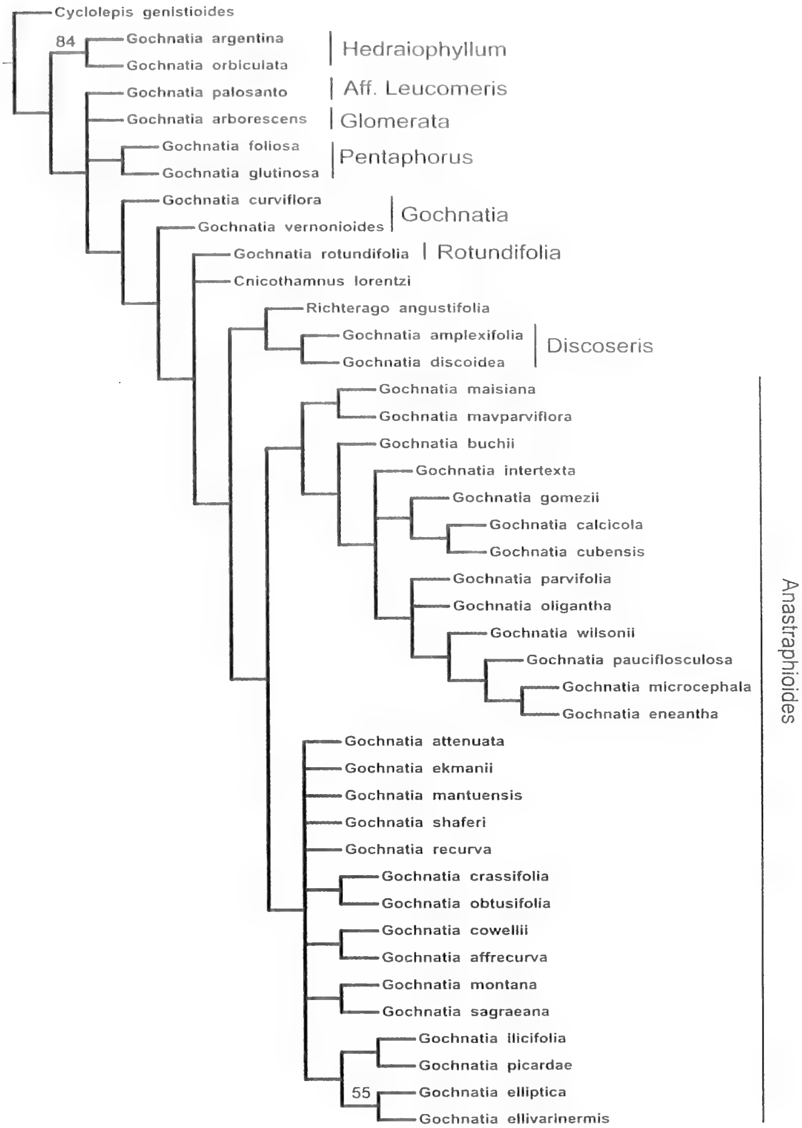

Fig. 1. Cladogram of strict consensus of the 24 most parsimonious trees resulting from the phylogenetic analysis of morphological, anatomical and palynological data of 46 species. Length = 201 steps, consistency index (CI) = 0,28 and retention index (RI) = 0,60. Vertical lines at the right define the sections of the genus *Gochnatia* as discussed in the text. Bootstrap values are presented above nodes.

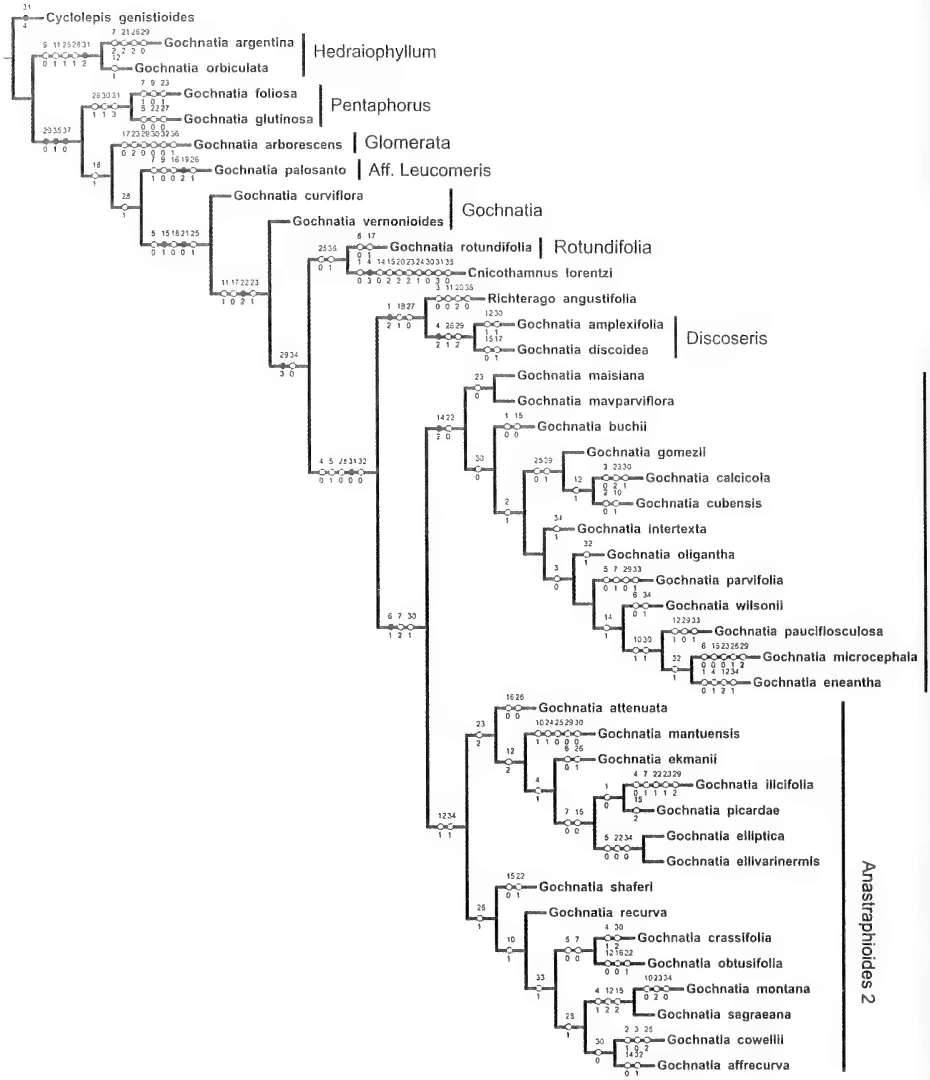

Fig. 2. One of the 24 most parsiminous trees (AMP) resulting from the phylogenetic analysis of morphological, anatomical and palynological data of 46 species (L= 201, CI= 0,28, RI= 0,60). Vertical lines at the right define the sections of the genus *Gochnatia* as discussed in the text. Numbers above branches represent characters (see Table 1), numbers below branches represent states of characters. Black circles represent synapomorphies, white (open) circles homoplasies.

Restoration of the name *Anastraphia* to define the species in the section *Anastraphioides* of *Gochnatia* (Gochnatioideae, Asteraceae)

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Abstract

Evidence from morphological studies on the genus *Gochnatia* KUNTH (Asteraceae) indicates that those species currently placed in the section *Anastraphioides* of *Gochnatia* should be placed in a separate genus. The nomenclatural analysis presented here affirms that the correct generic name for these species is *Anastraphia* D. DON, thereby restoring the genus originally described in 1830. The analysis includes a discussion of the arguments of JERVIS (1954) against the validity of the genus *Anastraphia* and those of LESSING (1832) about the apparent synonymy between *Anastraphia ilicifolia* D. DON and *Gochnatia ilicifolia* LESS. A new specimen is designated as neotype of *Anastraphia ilicifolia* D. DON, type species of *Anastraphia*, and the corresponding taxonomic changes are made for the Cuban species of this genus.

Introduction

The great majority of the species in the section *Anastraphioides* JERVIS ex L. KATINAS, S. FREIRE & G. SANCHO (*Gochnatia*, Gochnatioideae, Asteraceae) were described under the name *Anastraphia* D. DON. The genus *Anastraphia* was defined by D. DON (1830) on the basis of a unique, unnumbered specimen that JOHANNES FRASER collected "in America meridionalis". The type species, *Anastraphia ilicifolia* D. DON, is characterized by having stamens inserted in the throat of the corolla and pappus uniseriate, flat, and with simple apices. DON (1830) stated that "it is not known where in South America this collection was made" and that the specimen was deposited in the Lambertian Herbarium, without citing the existence of any other original material. The type specimen of *Anastraphia* has not been seen since the time when the collections of the Lambertian Herbarium were divided up and sold to other herbaria. The loss of the type specimen, the absence of other original materials that might have clarified the identity of the genus, and the morphological similarities between the Antillean *Anastraphia* and species of *Gochnatia* Kunth led Jervis (1954) in his doctoral thesis to move all 26 species previously described under *Anastraphia* into the section *Anastraphioides* in the genus *Gochnatia.* Jervis (1954) considered *Anastraphia* to be a South American genus of unproven validity.

In his monographic treatment of the genus *Gochnatia*, Cabrera (1971) placed the Antillean species in the section *Gochnatia*, along with eight morphologically similar species from South America. Freire et al. (2002), however, formally recognized the section *Anastraphioides* as originally defined by Jervis (1954). These last two analyses differed in the designation of the type species: Jervis (1954) designated *Gochnatia sagraeana* Jervis & Alain as the type species for the section, whereas Freire et al. (2002) formally defined *Anastraphioides* with *Gochnatia ilicifolia* Less. as the type species. Both Cabrera (1971) and Freire et al. (2002) agreed with Jervis (1954) that *Anastraphia* D. Don was a genus of doubtful validity and that the species described under that name pertained to *Gochnatia* Kunth.

The studies we have carried out on the species of the section *Anastraphioides* include morphological and palynological analyses, examinations of leaf anatomy, and cladistic analyses of these species in the context of the subfamily Gochnatioideae (Ventosa & Herrera 2011 a). Our results strongly indicate that the species of section *Anastraphioides* make up a derived, monophyletic group whose common ancestor, South American in origin, was related to present-day species of *Gochnatia* and *Richterago* Kunth. The principal morphological differences between *Gochnatia*, *Richterago,* and the species of the current section *Anastraphioides* are summarized here in Table 1. These findings provide the basis for the nomenclatural analysis that we report in the present work and clarify the correct genus name for the species currently in the section *Anastraphioides* of *Gochnatia.* We also select a new specimen to typify *Anastraphia ilicifolia* D. Don, and present the revised nomenclature for the species that inhabit Cuba. Some species new to science are described separately (Ventosa & Herrera 2011 b).

Materials and Methods

We reviewed materials from 11 herbaria (B, C, GH, HAC, HAJB, JE, K, LP, NY, S and US; acronyms according to Holmgren et al. (1998)). We also reviewed the protologues and the classic taxonomic works dealing with Cuban species and their relatives in *Gochnatia*. In addition, we consulted Flora de la Española (Liogier 1996) and other Antillean floristic surveys that included species of the genus (Roque & Silvestre-Capelato 2001, Jiménez et al. 2004). Our nomenclatural analysis and typification of the species followed protocols of the Code of Botanical Nomenclature (McNeill et al. 2006).

Results and Discussion

From morphological studies and cladistic analyses (Ventosa & Herrera 2011 a) and from examinations of the protologues of the taxa, we concluded that the species formerly assigned to the section *Anastraphioides* of the genus *Gochnatia* instead belong in the genus *Anastraphia* as defined by David Don (1830).

Research into the nomenclatural history of *Anastraphia ilicifolia* D. Don, type species of the genus, and the type specimen of *Gochnatia sagraeana* collected and so named by Jervis (1954) and later formally described by Alain (1960) as *Gochnatia sagraeana* Jervis & Alain, show that the characters of *G. sagraeana* in fact coincide precisely with D. Don´s (1830) description of *A. ilicifolia*. Indeed, de Candolle (1838) followed similar reasoning, arguing that D. Don´s description of *Anastraphia ilicifolia* corresponded with that of specimens collected by Ramón de la Sagra on the north coast of La Habana, Cuba. This discovery clarified the previously doubtful type locality of *Anastraphia*, no longer simply "in America meridionalis." In later treatments Britton (1915), León (1944), and Carabia (1943) followed de Candolle´s reasoning. Jervis (1954), though, argued that differences existed between David Don´s (1830) original description of *A. ilicifolia*, de Candolle´s (1838) description, and the specimens that he himself collected on the north coast of La Habana, which he described as the new species *Gochnatia sagraeana*.

In fact, said argument in the thesis of Jervis (1954) was based on an erroneous interpretation of three characters listed by Don (1830) in the latter´s original description of *Anastraphia*, and an error in describing a fourth character from Jervis´s own materials. Don (1830) described the species *Anastraphia ilicifolia* as having purple flowers with uniseriate pappus, glabrous corolla with an angular aspect to the tube, and glabrous style with pruinose stigma. Jervis (1954) maintained that in contrast the specimens he himself collected of *Anastraphia ilicifolia* (which he then named *Gochnatia sagraeana*) possessed yellow-orange flowers, biseriate or multiseriate pappus, cylindrical and pubescent corolla tube, and glabrous style instead of the "pruinose style" that, according to Jervis (1954), D. Don (1830) had described. We analyzed these discrepancies one by one.

First, the discrepancy in corolla colour can be attributed to the difference between herbarium specimens, such as the materials that Don examined, and fresh collections. Fresh material of *Gochnatia sagraeana*, such as that upon which Jervis (1954) based his description of that species, has yellow-orange flowers but these turn dark brownish-gray in the herbarium, giving the impression that they were originally purple. Furthermore, in the field dry flowers remaining in the capitulum indeed turn purple. Therefore, the apparent discrepancy in flower colour between *Anastraphia ilicifolia* as described by Don and *G. sagraeana* as described by Jervis – which discrepancy Jervis used as one of his principal reasons to doubt the nomenclature of *A. ilicifolia* and the validity of *Anastraphia* as a genus – does not exist.

Likewise, the discrepancy in descriptions of the shape of the corolla tube is explained by comparing fresh and herbarium specimens. In fresh material or rehydrated herbarium specimens of *Gochnatia sagraeana*, the corolla is indeed cylindrical. Dried herbarium specimens, however, present prominent veins that cross the corolla (also a character noted by D. Don) and create the angular appearance cited by Don for *Anastraphia ilicifolia*.

The question of the "pruinose style" is simply a misreading of Don´s original description, which specified a pruinose stigma but a glabrous style. Jervis (1954) asserted that Don described the style as pruinose, in apparent contrast with the glabrous style of *Gochnatia sagraeana*, but did not discuss the stigma of his collected materials. Our examination of the type specimen of *Gochnatia sagraeana* revealed glabrous styles but pruinose stigmas, just as in Don´s description.

Jervis erred in asserting that *Gochnatia sagraeana* possessed biseriate or multiseriate pappus. The type specimen has uniseriate pappus, as was stated in the formal description of *G. sagraeana* by Alain (1960). Indeed, the great majority of Cuban *Gochnatia* have uniseriate pappus (Ventosa & Herrera 2011 a, b). Only four species have a second set of pappus bristles, and these are chiefly in the angles rather than presenting a second complete series. No Cuban species has multiseriate pappus. Freire et al. (2002) also cited the uniseriate pappus when defining the section *Anastraphioides*, mentioning that a second set of bristles was a rare occurrence among the species in the section.

Finally, the corolla of *Gochnatia sagraeana* is indeed pubescent, apparently contradicting Don´s description of the corolla of *Anastraphia ilicifolia* as glabrous. The majority of hairs are glandular biseriate, not easily visible and sometimes shed in herbarium specimens. Their presence could easily have been overlooked by Don. Furthermore, pubescence of the corolla is often a variable, environmentally sensitive trait not useful as a taxonomic character.

The analyses of these discrepancies, our analysis of the original descriptions of *Anastraphia ilicifolia* and *Gochnatia sagraeana*, our studies on the type specimen of *Gochnatia sagraeana*, and revision of other original specimens studied by Jervis (1954) led to the conclusion that the name *G. sagraeana* is a heterotypic synonym of *Anastraphia ilicifolia* D. Don even though the type specimen of the latter cannot be located at present. Given that the holotype of *Anastraphia ilicifolia* D. Don is lost and no evidence exists that Don subsumed other original material under *Anastraphia ilicifolia*, it is necessary to designate a new type specimen for this species name. We selected the following specimen: Cuba: Habana del Este "Orillas del río Cojimar entrando por Alamar a 2 km de la desembocadura del río, ladera con exposición sur", 13.VI.2010, I. Ventosa, R.Oviedo & I. Fuentes SV-42615. The specimen is deposited in the Herbarium of the Cuban Academy of Sciences (HAC) as the new type for *Anastraphia ilicifolia* D. Don.

Some further complications must now be resolved. In defining the section *Anastraphioides*, Jervis (1954) designated *Gochnatia sagraeana*, now the synonym for *Anastraphia ilicifolia* D. Don as just described, as the type species. Freire et al. (2002), however, designated *Gochnatia ilicifolia* Less. as the type species for this section. Some authors have considered *Anastraphia ilicifolia* and *Gochnatia ilicifolia* to be synonyms, but the two taxa are different, as we will now show.

Gochnatia ilicifolia and *Anastraphia ilicifolia* were both described in 1830, by Lessing and by Don respectively. The original descriptions differ notably from one another, principally in terms of leaf dimensions and other leaf characters. Even so, Lessing (1832) himself proposed that *Anastraphia ilicifolia* D. Don was synonymous with *G. ilicifolia* Less., which initiated nearly 180 years of lumping both species under a single name despite their morphological differences. Authors such as de Candolle (1838) and Britton (1915) also mistakenly treated the two species as a single taxon but under the name *Anastraphia ilicifolia* Don, without taking into account the differences in the two descriptions and of course without observing the type specimens.

Our examination of the type specimen of *G. ilicifolia* Less. showed clearly that this taxon does not fit the description of *Anastraphia ilicifolia* D. Don. Therefore, the two names should not be considered synonyms. The specific epithet "*ilicifolia*" belongs to the species *Anastraphia ilicifolia* D. Don, which name has precedence as the nomenclatural type of the genus according to Article 11.3 of the Code of Botanical Nomenclature (McNeill et al. 2006).

Upon moving to *Anastraphia*, however, *Gochnatia ilicifolia* Less. would generate a posterior homonym of *Anastraphia ilicifolia* Don, according to Article 53.1 of the Code of Botanical Nomenclature (McNeill et al. 2006). Therefore, the species previously designated as *Gochnatia ilicifolia* LESS. must be renamed. This situation is easily resolved, though, because the name *Anastraphia northropiana* GREENM. has previously been applied to this taxon. JERVIS (1954), ALAIN (1960a, 1964) and CABRERA (1971) all considered *Anastraphia northropiana* GREENM. to be a synonym for *Gochnatia ilicifolia* LESS.

The taxonomic treatment and description of the genus *Anastraphia* follow.

Anastraphia D. DON, Trans. Linn. Soc. Bot. 16: 295, 1830.

= sect. *Anastraphioides* JERVIS ex S. E. FREIRE, L. KATINAS & G. SANCHO, Ann. Missouri Bot. Gard. 89: 548, 2002.

Type species: *Anastraphia ilicifolia* D. DON, Trans. Linn. Soc. London 16: 296, 1830.

Shrubs or small trees, branched in some cases with brachyblasts, monoecious. Trunks and mature branches with deeply grooved bark. Young branches albo-pubescent. Leaves alternate, either grouped towards apices of branches or not, simple, microphyllous or nanophyllous, petiolate; leaves coriaceous, elliptical, obovate or oblongate with margins spinose-dentate, denticulate, or entire; pinnately veined, semicraspedodromous, simple craspedodromous or brochidodromous; veins prominent on the lower leaf surface; upper leaf surface generally glabrous or subglabrous, lower surface densely albo-tomentose with flagellate non-glandular hairs and simple glandular hairs with vesicles. Capitula homogamous, discoid, sessile or subsessile, solitary at branch tips, rarely in clusters of 2, 3, or 4. Involucre wide campanulate, campanulate or turbinate, with acute, rounded or attenuate bases. Phyllaries in 4 to 15 series, chartaceous or coriaceous, dorsally tomentose or glabrous. Florets 4 to more than 100 per capitulum, hermaphroditic, isomorphic, actinomorphic, tubular, deeply five-lobed, lobes linear, straight or recurved, petals whitish, yellow, or orange. Stamens five, exserted; filaments fused to the tube from the base to the throat of the corolla; anthers with apical appendages acuminate or strongly acuminate, anther tails smooth or shortly laciniate, anthers white, yellow, or orange (colour of anthers may coincide or not with colour of the corolla). Pollen grain subprolate or prolate (rarely spheroidal), tricolporate, tectum perforated, exine of the type Wunderlichia, surface of the exine mainly microechinate. Style bilobate or shortly bifid; style branches rounded dorsally, glabrous, yellow or orange (coinciding or not with colour of anthers or corolla), not broadening at the base (not bulbous). Cypselae cylindrical or subturbinate with angular corners and prominent veins in some species, tomentose with biseriate non-glandular hairs and biseriate glandular hairs with vesicles. Pappus uniseriate with all bristles of equal length and width, in some species external bristles exist but only in the corner of the cypselae.

The taxonomic treatment of the Cuban species of *Anastraphia* is then as follows.

1. *Anastraphia ilicifolia* Don, Trans. Linn. Soc. London 16: 296, 1830.

≡ *Chuquiraga pardoiana* Gómez & Molinet, Dicc. Bot. Nom. Vulgares Cubanos y Puerto-riqueños: 34, 1889. Neotype: designated here [specimen]: Cuba: Habana del Este "Orillas del río Cojimar entrando por Alamar a 2 km de la desembocadura del río, ladera con exposición sur", 13.VI.2010, I. Ventosa, R. Oviedo & I. Fuentes SV-42615 (HAC, Isoneotypes: HAC, HAJB, LP).

= *Gochnatia sagraeana* Jervis & Alain, Contrib. Ocas. Mus. La Salle 18:9,1960. Holotype: [specimen] Cuba, Habana "Rocas costeras: Playa Jibacoa", 21.III.1941, Hnos. León, M. Victorin, Alain 19708 (HAC!, Isotype: HAC!).

2. *Anastraphia ekmanii* Urban, Repert. Spec. Nov. Regni Veg. 26: 116, 1929.

≡ *Gochnatia ekmanii* (Urb.) Jervis & Alain, Contrib. Ocas. Mus. La Salle 18:9,1960. Holotype: [specimen] Cuba, Pinar del Río "Pinar del Río in Sierra de los Órganos, grupo del Rosario, prope Peña Blanca in saxis calcaricis cr. 700 m alt., Mayo flor et fruct", 16.V.1922, Ekman 13865 (S! Isotypes: NY# 00115480!, HAC!).

3. *Anastraphia montana* Britton, Bull. Torrey Bot. Club 42(7):381,1915.

≡ *Gochnatia montana* (Britton) Jervis & Alain, Contrib. Ocas. Mus La Salle 18:9,1960. Holotype: [specimen] Cuba, Pinar del Río,"Top of Sierra Caliente, south of sumidero", 15-18.VIII.1912, Shafer 13781 (NY # 00115462!, Isotypes: HAC! US [n.v.]).

4. *Anastraphia cowellii* Britton, Bull. Torrey Bot. Club 42(7):381, 1915.

≡ *Gochnatia cowellii* (Britton) Jervis & Alain, Contrib. Ocas. Mus. La Salle 18:8, 1960. Holotype: [specimen] Cuba, Camagüey, "City of Santa Clara, rocky hills, palm barren", 21-22.III.1911, Britton & Cowell 10183 (NY# 00115482!, Isotype: HAC!).

5. *Anastraphia crassifolia* Britton, Bull. Torrey Bot. Club 42(7):382, 1915.

≡ *Gochnatia crassifolia* (Britton) Jervis & Alain, Contrib. Ocas. Mus. La Salle 18:9,1960. Holotype: [specimen] Cuba, "Oriente near mangroves, mouth of Rio Yamanigüey", 1.III.1960, Shafer 4261 (NY # 00115483!, Isotypes: HAC!, NY [n.v.]).

6. *Anastraphia elliptica* León, Contrib. Inst. Bot. Univ. Montreal 49: 84, fig.4, 1944.

≡ *Gochnatia elliptica* (León) Jervis & Alain, Contrib. Ocas. Mus. La Salle 18:9, 1960. Holotype: [specimen] Cuba, Guantánamo. "Oriente Terrase calcaire du

Chivo, Maisí", I.1940, León LS-17580 (HAC!, Isotype: HAC!).

= *Anastraphia elliptica* var. *inermis* León, Contrib. Inst. Bot. Univ. Montreal 49: 86, 1944 ≡ *Gochnatia elliptica* var. *inermis* (León) Jervis & Alain, Contrib. Ocas. Mus. La Salle 18:9, 1960. Holotype: [specimen] Cuba, Guantánamo. "Limestone terrace: Ovando, Maisí.", I.1943, León LS-21269 (HAC!, Isotype: HAC!).

7. *Anastraphia northropiana* Greenm. ex Combs, Transact. Acad. Sci. St Louis 7: 435, t. 36, 1897. Lectotype (Cabrera 1971: 43) [specimen] Bahamas: "Fresh Creek, Andros, Island", VI.1890, John I. & Alice R. Northrop 743 (NY!, Isotype: G [n.v.]).

= *Gochnatia ilicifolia* Less., Linnaea, 5:261,1830. Holotype: [specimen] Locality indefinite, "America (Guiane?)", without date (1786-1787), Richard s/n (C!).

= *Anastraphia northropiana* var. *combsii* Urban, Symb. Antill. 3: 417,1903. Holotype: [specimen] Cuba "prope Calicita in rupibus litoralibus", 24.VIII.1895, Combs 521 (K!, Isotypes:NY # 00115464!, P [n.v.], F [n.v.], MO [n.v.]).

8. *Anastraphia microcephala* Griseb., Cat. Pl. Cub.:158, 1866.

≡ *Gochnatia microcephala* (Griseb.) Jervis & Alain, Contrib. Ocas. Mus. La Salle 18:9,1960. Holotype: [specimen] Cuba, Guantánamo "Cuba oriental sin localidad", (1860-1864), Wright s/n (GOET? [n.v.], Isotypes?: K!, HAC!, GH [n.v.], MO [n.v.], NY [n.v.]).

9. *Anastraphia calcicola* Britton, Bull. Torrey Bot. Club 42(7): 383, 1915.

≡ *Gochnatia calcicola* (Britton) Jervis & Alain, in Candollea, 17:120,1960. Holotype: [specimen] Cuba, Guantánamo "Oriente, Coral rock hillsides and coastal cliffs, United States Naval Station", 17-30.III.1909, Shafer 2042 (NY# 00115481!, Isotype: HAC!).

10. *Anastraphia maisiana* León, Contrib. Inst. Bot. Univ. Montreal 49: 78, fig.2, 1944.

≡ *Gochnatia maisiana* (León) Jervis & Alain var. *maisiana,* Contrib. Ocas. Mus. La Salle 18:9, 1960. Holotype: [specimen] Cuba, Guantánamo "Oriente Forêt de la terrasse calcaire du Chivo, Maisí", 12.VIII.1938, León LS-18243 (HAC!, Isotypes: HAC!, M [n.v.],)

= *Anastraphia maisiana* var. *parviflora* León, Contrib. Inst. Bot. Univ. Montreal 49: 80, 1944.

≡ *Gochnatia maisiana* var. *parviflora* (León) Jervis & Alain, Contrib. Ocas. Mus. La Salle, 18:9 1960. Holotype: [specimen] Cuba, Guantánamo "Oriente Terrase calcaire du Ovando, au sud de Baracoa", I.1940, León LS-17576 (HAC!, Isotype:

HAC!, M [n.v.]).

11. *Anastraphia parvifolia* BRITTON, Bull. Torrey Bot. Club 42(7): 383, 1915.

≡ *Gochnatia parvifolia* (BRITTON) JERVIS & ALAIN, Contrib. Ocas. Mus. La Salle 18:9, 1960. Holotype: [specimen] Cuba, Oriente "Dense thickets in barren savannas southeast of Holguín", 26–29.XI.1909, SHAFER 2938 (NY # 00115469!, Isotypes: NY # 00115470!, HAC!).

12. *Anastraphia shaferi* BRITTON, Bull. Torrey Bot. Club 42(7): 384, 1915.

≡ *Gochnatia shaferi* (BRITTON) JERVIS & ALAIN, Contrib. Ocas. Mus La Salle 18:10,1960. Holotype: [specimen] Cuba "Oriente, Dry cliff, bellow the falls of the Rio Naranja, 450–500 m s. n. m.", 3.II.1910, SHAFER 3865 (NY # 00115475!, Isotype: HAC!, US [n.v.], F [n.v.], G [n.v.]).

= *Anastraphia oblongifolia* URBAN, Repert. Spec. Nov. Regni Veg. 26: 117, 1929. Holotype: [specimen] Cuba, "Oriente Sierra de Nipe in charrascales cerca del Río Piloto, c. 375 m s. n. m.", 3.VII.1924, EKMAN 19169 (S!, Isotypes: NY # 00115465!, HAC!).

= *Anastraphia nipensis* URBAN, Repert. Spec. Nov. Regni Veg. 26:118, 1929. Holotype: [specimen] Cuba, "Oriente, in Sierra de Nipe locis saxocis ad Rio Piloto cr. 750 m alt.", 15.V.1915, EKMAN 5703 (S!, Isotypes: HAC!, G [n.v.]).

13. *Anastraphia gomezii* LEÓN, Contrib. Inst. Bot. Univ. Montreal 49:77, 1944 .

≡ *Gochnatia gomezii* (LEÓN) JERVIS & ALAIN, Contrib. Ocas. Mus. La Salle 18:9,1960. Holotype: [specimen] Cuba. "Oriente Cerro de Miraflores (serpentina), Cananova", III.1942, LEÓN & GÓMEZ LS-28876 (HAC!, Isotype: HAC!).

14. *Anastraphia wilsonii* BRITTON, Bull. Torrey Bot. Club 42(7):3 83, 1915.

≡ *Gochnatia wilsonii* (BRITTON) JERVIS & ALAIN, Contrib. Ocas. Mus La Salle 18:10, 1960. Holotype: [specimen] Cuba "Rocky bank, Río Toyaba, near Trinidad, prov. Santa Clara", 15.III.1910, BRITTON & WILSON 5573 (NY # 00115477, Isotype: HAC!, NY [n.v.]).

15. *Anastraphia intertexta* C. WRIGHT ex GRISEB., Cat Pl. Cub.: 158, 1866.

≡ *Gochnatia intertexta* (C. WRIGHT ex GRISEB.) JERVIS & ALAIN, Contrib. Ocas. Mus. La Salle 18:9, 1960.

≡ *Chuquiraga intertexta* (C. WRIGHT ex GRISEB.) MOLINET & GÓMEZ, Dicc. Bot. Nom. Vulgares Cubanos and Puerto-Riqueños: 35, 1889. Holotype: [specimen] Cuba, Pinar del Río "Cuba occidental, prope San Marcos, distrito Bahía Honda", no date, WRIGHT 2877 (GOET [n.v.], Isotype?: S!, HAC!, K [n.v.], P [n.v.], G [n.v.], BM [n.v.], MO [n.v.]).

16. *Anastraphia cubensis* CARABIA, Mem. Soc. Cubana Hist. Natur. 17:17,1943.

≡ *Gochnatia cubensis* (CARABIA) JERVIS & ALAIN, Contrib. Ocas. Mus. La Salle 18:9, 1960. Holotype: [specimen] Cuba, Holguín. "Oriente Sierra de Nipe, Loma La Bandera", 22.IV.1940, CARABIA 3788 (NY# 00115478!, isotype: HAC!).

= *Anastraphia victorinii* LEÓN, Contrib. Inst. Bot. Univ. Montreal 49:82, 1914. Holotype: [specimen] Cuba, Holguín. "Oriente Charrascal de serpentina, Cueva de abajo, au nord-est de la Sierra de Nipe", à 400 m d'altitude, Oriente, 6.IV.1941, LEÓN & MARIE-VICTORIN LS-19885 (HAC!, isotype: HAC!).

17. *Anastraphia obtusifolia* BRITTON, Bull. Torrey Bot. Club 42(7): 384, 1915.

≡ *Gochnatia obtusifolia* (BRITTON) JERVIS & ALAIN, Contrib. Ocas. Mus La Salle 18:9,1960. Holotype: [specimen] Cuba, Oriente "Camp. La Gloria, south of Sierra Moa", 24-30.XII.1910, SHAFER 8189 (NY # 00115467!, isotypes: HAC!).

= *Anastraphia baracoensis* URB., Repert. Spec. Nov. Regni Veg. 26:117, 1929. Holotype: [specimen] Cuba, Guantánamo "Oriente Baracoa, in carrascales (charrascales) near Río Joa", 28.XI.1914, EKMAN 3683 (S!, Isotypes: HAC!, NY [n.v.], G [n.v.]).

18. *Anastraphia recurva* BRITTON, Bull. Torrey Bot. Club 42(7):386, 1915.

≡ *Gochnatia recurva* (BRITTON) JERVIS & ALAIN, Contrib. Ocas. Mus. La Salle 18: 9, 1960. Holotype: [specimen] Cuba, Oriente "Serpentine hills near of mouth of Yamaniguey", 1.III.1910, SHAFER 4257 (NY # 00115472!, Isotype: HAC!).

= *Anastraphia recurva* var. *integrifolia* MOLDENKE, Phytologia, 2: 214, 1947. Holotype: [specimen] Cuba, Holguín "Oriente, Río Yagrumaje, Moa", 14.IV.1945, ACUÑA 12780 (HAC!, Isotype: HAC!, Fragment of Holotype (NY# 00115473!).

19. *Anastraphia mantuensis* WRIGHT ex GRISEB., Cat. Pl. Cub.: 158, 1866.

≡ *Gochnatia mantuensis* (WRIGHT ex GRISEB.) JERVIS & ALAIN, Contrib. Ocas. Mus. La Salle 18:9,1960.

≡ *Chuquiraga mantuensis* (WRIGHT ex GRISEB.) GÓMEZ & MOLINET, Dicc. Bot. Nom. Vulgares Cubanos y Puerto-Riqueños: 35, 1889. Holotype: [specimen] Cuba, Pinar del Rio. "Cuba occ, in pinetis prope Mantua distrito Nueva Felipa", (1860-1864), C. WRIGHT 2876 (GOET [n.v.], Isotypes?: S!, HAC!, GH [n.v.], MO [n.v.], NY [n.v.]).

20. *Anastraphia attenuata* BRITTON, Bull. Torrey Bot. Club 42 (7): 381, 1915.

≡ *Gochnatia attenuata* (BRITTON) JERVIS & ALAIN, Contrib. Ocas. Mus. La Salle 18:8,1960. Holotype: [specimen] Cuba, Holguín, "Oriente, Moist thickets, Sierra de Nipe, between Piedra Gorda and Woodfred, at 400-500 meters elevation", 8.XII.1909, SHAFER 3113, (NY # 00115487!, isotypes: NY # 00115488!, HAC!, US [n.v.]).

= *Anastraphia lomensis* BRITTON, Bull. Torrey Bot. Club 42 (7): 386, 1915. Holotype: [specimen] Cuba, Holguín, "Oriente, Rocky mountain side, Loma Mensura, about 800 m alt.", 2.II.1910, SHAFER 3811, (NY # 00115457!, Isotype: HAC!).

= *Anastraphia mensuraensis* CARABIA, Mem. Soc. Cub. Hist. Nat. 17:18, 1943. Holotype: [specimen] Cuba, Holguín, "Oriente, Sierra de Nipe, Loma La Mensura", 21.IV.1940, CARABIA 3739 (NY # 00115460!, Isotype: HAC!).

Acknowledgements

We are very grateful to the curators of the herbaria mentioned in the text, for enabling us to examine the specimens used in this study. The Swedish Institute and the Red Latinoamericana de Botánica (Latin American Botanical Network) supported our studies, in particular the trips the first author made to Sweden, Germany, and Argentina. Drs. ELDIS BECQUER and CARLOS SANCHEZ (Cuban Botanical Garden) reviewed the taxonomic treatment. PETER FEINSINGER helped with the translation into English.

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Table 1. Principal morphological traits that distinguish *Anastraphia* from *Gochnatia* and *Richterago*.

Characteristic	***Anastraphia***	***Gochnatia***	***Richterago***
Leaf margin	Spinose-dentate, or when entire in adult leaves at least some juvenile leaves are spinose-dentate.	Entire, rarely denticulate.	Entire or denticulate.
Leaf texture	Coriaceous or strongly coriaceous, rarely chartaceous.	Chartaceous.	Chartaceous.
Number of capitula	Usually solitary, occasionally up to groups of four.	Various capitula grouped together in secondary inflorescences, except for species in the section *Gochnatia*, which have solitary capitula.	Solitary or grouped in panicles of few capitula.

Floral peduncles	Absent.	Present.	Present.
Anthers	Anthers with apical appendage strongly acuminate and tails smooth or shortly laciniate.	Anthers with apical appendage shortly attenuate and tails laciniate.	Anthers with apical appendage caudate and tails laciniate.
Pappus	All bristles of equal length and thickness, pappus type A (FREIRE et al. 2002).	Bristles with different combinations of length, thickness and thickening in the apex of the pappus. Pappus type B, C, D, E (FREIRE et al. 2002).	All bristles of equal length and thickness, pappus type A (FREIRE et al. 2002).
Number of series of pappus bristles and basal fusion of same	Pappus bristles uniseriate and usually fused at the base.	Pappus bristles multiseriate and unfused at the base.	Pappus bristles uniseriate and usually fused at the base.

Five new species of *Anastraphia* D. Don (Gochnatioideae, Asteraceae) from Cuba

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Abstract

As part of the taxonomic revision of the genus *Anastraphia* D. Don (Asteraceae) in Cuba, five new species are described: *Anastraphia herrerae* I. Ventosa, *A. cristalensis* I. Ventosa & P. Herrera, *A. crebribracteata* I. Ventosa & P. Herrera, *A. oviedoae* I. Ventosa & P. Herrera and *A. geigeliae* I. Ventosa & P. Herrera. All five species are strictly endemic to the eastern region of Cuba.

Introduction

Taxonomic studies on the families of the Cuban flora are currently being carried out along with other efforts to enhance knowledge of Cuban biodiversity. One particular objective of these studies is the new "*Flora de la República de Cuba*".

During the taxonomic revision of the Asteraceae, the genus *Anastraphia* D. Don was resurrected, reuniting the species formerly in the section *Anastraphioides* R.N. Jervis ex S. E. Freire, Katinas & G. Sancho of the genus *Gochnatia* Kunth (Ventosa & Herrera 2011). Concurrently, detailed studies of herbarium material in the collections of the Jardín Botánico Nacional of Cuba (HAJB) and the Museum of the University of Jena (JE) identified five new taxa of *Anastraphia*. In the present work we describe and discuss these taxa new to science. Four of them were first collected between 1960 and 1985 during the collaborative German–Cuban botanical expeditions that provided the basis for the *Flora de la República de Cuba*. For that reason the materials were deposited in HAJB and JE. These collections were made after Alain´s (1960, 1964) taxonomic treatment for the first *Flora de Cuba*. In their respective treatments, Cabrera

(1971) and FREIRE et al. (2002) followed ALAIN (1964), having no access to the new materials in HAJB and JE and therefore being unaware of these new species. The fifth new species resulted from a close study of *Anastraphia recurva* BRITTON, the extreme variability of which had been discussed by JERVIS (1954). All five new species of *Anastraphia* inhabit the phytogeograpic subprovince Oriento-Cubanicum (BORHIDI 1991). Of the Cuban species of *Anastraphia*, 60% occur in this subprovince, which has the highest species richness in this genus of all Cuban biogeographical subprovinces.

Materials and Methods

Herbarium materials of the Jardín Botánico Nacional (HAJB) and the Museum of the University of Jena (JE) were examined. Standard morphological measurements were made on all specimens, whenever possible on five leaves and three capítula per specimen. General morphology was characterized using the terminology of FONT QUER (1965). Terminology specific to the family Asteraceae followed the criteria and standards of BREMER (1994), KUBITZKI (2007), and KATINAS et al. (2008). BORHIDI´S (1991) classification was used to characterize leaves by leaf surface area, while qualitative characterization of leaf surface, margins and venation followed the classification of HICKEY (1988).

Pollen studies were carried out in the Laboratory of Palynology of the Swedish Museum of Natural History, Stockholm. Classification of the exine layer and description of general characteristics of pollen grains followed the criteria of TELLERÍA (2008) and the terminology of PUNT et al. (1994).

Results

Analysis of the herbarium materials led to the following descriptions of the new taxa.

1. *Anastraphia herrerae* I. VENTOSA, sp. nov.

Type: [specimen] CUBA, Holguín, "Moa, Mina Yarey, cabezadas del río Jiguaní, 400m snm", 15.V.1983, BISSE, J., BEURTON, C., DIETRICH, H., GUTIÉRREZ, J., LEPPER, L., KÖHLER E., ARIAS, I., RANKIN, R. HFC-49567 (holotype: HAJB!, isotypes: HAJB!, B!). (Fig. 1).

Frutex 2–5 m altus, ramosus. Folia alterna, 43–102 mm longa, 17–35 mm lata, valde coriacea, obovata aut oblonga vel elliptica; ad apicem obtusa vel acuta; ad basin rotundata aut acuta; ad marginem recurvata, 4–13 dentibus spinosis binatim armata; supra pubescentia, subtus dense tomentosa. Capitula duo, terminalia, vel capitulum terminale solitarium, discoideum, multiflorum; involucrum late campaniforme, basi obtusa; phyllaria in 9–10 seriebus disposita, linearia, valde tomentosa et coriacea. Flores isomorphi 20–21 mm longi. Corolla tubularis, profunde quinquelobata; lobis erectis, apex lobulorum sine trichomatibus necque papillis. Antherae 5–7 mm longae; appendix apicalis valde apiculata, cauda 2 mm longa, laevis. Stylus exsertus, glaber, 26–29 mm longus. Cypsela cylindrica vel linearis 4–6 mm longa. Pappus 16–20 mm longus, uniserialis, omnibus setis discretis consimilibus.

Shrubs 2–5 m in height, branching almost dichotomously without brachyblasts. Branches pubescent when young and nearly glabrous when adult, bark grooved. Leaves distributed the length of the branches; petiole subcylindrical without channel, 3–8 mm in length; leaf 42–102 mm long by 17–35 mm wide, microphyllous, strongly coriaceous, obovate or oblong to elliptic with obtuse or acute apex and the base rounded or acute, margin recurved, spinose-dentate with 4–13 pairs of teeth, irregular, simple or compound, spine smaller than the teeth, slightly curved in the apex, venation semicraspedodromous with secondary veins abruptly curved; upper surface pubescent and with prominent veins, lower surface strongly tomentose with very prominent veins. Capitula terminal, solitary or paired, 36–41 mm long; involucre broadly campanulate with obtuse base, 29–33 mm high by 7–12 mm wide at the base and 39–50 mm wide at the apex; involucral bracts in 9–10 series, linear and coriaceous with the external surface strongly tomentose, internal bracts 23–29 mm long, medial bracts 15–19 mm long, and external bracts 6–10 mm long. Florets more than 50 per capitulum, 20–21 mm long. Corolla tubular, deeply five-lobed, lobes 12–13 mm long, erect, apex of the corolla lobes without hairs or papillae. Stamens 5, isomorphic, exserted; filaments fused into a tube from the base to the throat of the corolla; anthers 5–7 mm long, with apical appendage strongly acuminate and smooth tails 2 mm long. Pollen 66–74 µm in polar diameter by 51–56 µm equatorial diameter, large, prolate, tricolporate, exine type Wunderlichia, surface of the exine microechinate. Style exserted, glabrous, 26–29 mm long. Cypsela cylindrical or straight, 4–6 mm long with abundant biseriate glandular hairs with vesicle and biseriate simple (not glandular) hairs. Pappus 16–20 mm long, uniseriate, with all bristles of equal length and thickness, free at the base.

Phenology: Flowering was recorded in April and May.

Distribution and habitat: *Anastraphia herrerae* is distributed along the banks and at the headwaters of the Río Jiguaní, Moa region, Holguín province.

Etymology: This species is named for Dr. Pedro Pablo Herrera Oliver, tireless student of the Cuban flora and especially the composites.

Additional material examined: CUBA: Prov. Holguín: Moa, orillas del río

Jiguaní cerca de Mina Yarey, 1972, Bisse, J. & Berazaín, R., HFC-22469 (HAJB, JE); Prov. Holguín: Moa, Cayo Probado, orillas de las cabezadas del río Jiguaní, 1972, Bisse, J. & Berazaín, R., HFC-22827 (HAJB, JE).

2. *Anastraphia cristalensis* I. Ventosa & P. Herrera, sp. nov.

Type: [specimen] CUBA, Santiago de Cuba, Sierra del Cristal, región superior del macizo central, falda sur, 1000–1250 msm, 22.II.1976, Bisse, J., Díaz Dumas, M. A., González Geigel, L., Gutiérrez, J., & Manitz, H., HFC-30503 (holotype: HAJB!, isotypes: HAJB!, JE!). (Fig. 2).

Frutex 2–5 m altus, pauciramosus. Folia alterna, petiolus crassus valde tomentosus; foliorum lamina 30–40 mm longa, 15–22 mm lata, elliptica vel ovata, ad apicem obtusa vel rotundata, ad basin cordiformia vel rotundata, valde coriacea, integerrima, plana; supra subglabra, subtus valde tomentosa. Capitulum terminale solitarium, discoideum, multiflorum; involucrum late campaniforme, basi rotundata; phyllaria in 8–9 seriebus disposita, coriacea, valde tomentosa. Flores isomorphi 18–25 mm longi. Corolla tubularis; lobuli tubum circa aequantes, parum recurvati, apex lobulorum trichomatibus glandulosis obsitus, sine papillis. Antherae 12–15 mm longae; appendix apicalis valde apiculata, cauda 4–6 mm longa, breviter laciniata. Stylus exsertus, glaber, 18–20 mm longus. Cypsela cylindrica vel linearis 4–5 mm longa. Pappus 19–21 mm longus, uniserialis, omnibus setis discretis consimilibus.

Shrubs 2–5 m in height, with few branches and without brachyblasts. Branches terete, albo-pubescent when young and with grooved bark when mature. Leaves distributed the length of the branches; petiole subcylindrical without channel, stout, 5–7 mm long by 2–4 mm wide, strongly tomentose over the upper surface; leaves microphyllous, 30–40 mm long by 15–22 mm wide, strongly coriaceous, elliptic or ovate with the apex obtuse or rounded and the base cordate or rounded, margins entire and flat; venation brochidodromous with secondary veins abruptly curved, upper surface subglabrous with no prominent veins, lower surface strongly albo-tomentose with very prominent veins. Capitulum terminal, solitary, up to 31 mm long; involucre widely campanulate with the base rounded, 20–30 mm high by 17–18 mm wide at the base and 25–35 mm wide at the apex, involucral bracts in 8–9 series, coriaceous, strongly tomentose, internal and medial involucral bracts linear-lanceolate, respectively 18 mm and 12 mm long, external involucral bracts 6 mm long and ovate. Florets 18–25 mm long. Corolla five-lobed; lobes 11 mm long, approximately the same length as the corolla tube, slightly recurved, apices of the corolla lobes with biseriate glandular hairs and without papillae. Stamens 5, isomorphic, exserted; filaments fused to the corolla tube from the base to the throat of the corolla; anthers 12–15 mm long, with apical appendage strongly acuminate and anther tail 4–6 mm long, shortly laciniate. Pollen 70–76 µm in polar diameter by 47–55 µm in equatorial diameter, large, prolate, tricolporate, exine type Wunderlichia, surface of the exine microechinate. Style exserted, glabrous, 18–20 mm long. Cypsela terete or linear, 4–5 mm long, with abundant biseriate glandular hairs with vesicle and simple (not glandular) biseriate hairs. Pappus 19–21 mm long, uniseriate, with all bristles of equal length and thickness, free at the base.

Phenology: Flowering was recorded in February.

Distribution and habitat: *Anastraphia cristalensis* has been collected only above 1000 m elevation on Pico Cristal in the Sierra Cristal. The vegetation of this zone is subspiny xeromorphic scrub growing on serpentine soils, whose edaphic conditions support plants with characteristics normally associated with much more arid climates.

Etymology: The specific name derives from the geographic home of the new taxon, viz. Pico Cristal in the Sierra Cristal of eastern Cuba.

Additional materials examined: At present the species is known solely from the type specimens deposited in HAJB and JE.

3. *Anastraphia oviedoae* I. Ventosa & P. Herrera, sp. nov.

Type: [specimen] CUBA: Guantánamo, San Antonio, zona por encima de la Mina de Yeso de Baitiquirí, 13.V.1980, Álvarez de Zayas, A., Bisse, J., Gutiérrez, J., Meyer, F.K., HFC-43186 (holotype: HAJB!, isotypes: HAJB!, JE!). (Fig. 3).

Frutex ca. 2 m altus. Folia alterna, 9–22 mm longa, 5–15 mm lata, elliptica vel oblonga; ad apicem obtusa vel rotundata aut truncata, ad basin acuta aut rotundata, coriacea, ad marginem 1–5 dentibus spinosis binatim armata, dentes spinosi acuminati, supra glabra, subtus valde tomentosa. Capitulum terminale solitarium, discoideum, flores 10–12 in quoque capitulo; involucrum late campaniforme, basi acutum; phyllaria in 4–6 seriebus disposita, chartacea, dorsaliter pubescentia. Flores isomorphi 6–11 mm longi; corolla tubularis, profunde quinquelobata, lobi 5–9 mm longi leviter recurvati vel stricti, apex lobulorum trichomatibus glandulosis obsitus, sine papillis. Antherae 5–7 mm longae; appendix apicalis valde apiculata, cauda circa 2 mm longa, breviter laciniata. Stylus exsertus, glaber, 6–10 mm longus. Cypsela cylindrica 3–4 mm longa. Pappus 9–10 mm longus, uniserialis, omnibus setis discretis consimilibus.

Shrubs up to 2 m in height, without brachyblasts. Young branches albo-pubescent, mature branches with grooved bark. Leaves distributed the length of the branches; petiole sub-cylindrical without channel, 2–6 mm long; leaves 9–22 mm long by 5–15 mm wide, nanophyllous, coriaceous, elliptic or oblong, apex obtuse, rounded or truncated, base acute or rounded, toothed margins acuminate, with 1 to 5 pairs of teeth, regular, simple o compound, spines of same length as teeth; venation semicraspedodromous or mixed craspedodromous with secondary veins uniformly curved, upper surface with inconspicuous veins, glabrous; lower surface with prominent veins, strongly albo-tomentose. Capitulum terminal, solitary, 12–17 mm long with 10–12 flowers per capitulum; involucre narrowly campanulate with pointed base, 5–8 mm high by 2–3 mm wide at the base and 6–8 mm wide at the apex, involucral bracts in 4–6 series, chartaceous and dorsally pubescent, internal involucral bracts linear and 7–8 mm long, medial and external involucral bracts lanceolate and respectively 4–5 mm and 2–3 mm long. Florets 6–11 mm long. Corolla tubular, deeply five-lobed, lobes 5–9 mm long and straight or slightly curved, apex of corolla lobes with biseriate glandular hairs and without papillae. Stamens 5, isomorphic, exserted; filaments fused to the corolla tube from base to throat of the corolla, anthers 5–7 mm long, apical appendage strongly acuminate and tails around 2 mm in length, shortly laciniate. Pollen grains 48–54 µm polar diameter by 38–44 µm equatorial diameter, subprolate, tricolporate, exine of type Wunderlichia, exine surface microechinate. Style exserted and glabrous, 6–10 mm long. Cypsela cylindrical, 3–4 mm long, with abundant biseriate glandular hairs with vesicle and simple biseriate (not glandular) hairs. Pappus 9–10 mm long, uniseriate, with all bristles of equal length and thickness, free at the base.

Phenology: Flowering and fruiting were recorded from February to May.

Distribution and habitat: *Anastraphia oviedoae* inhabits xeromorphic coastal and subcoastal scrub in southeastern Cuba. The species has also been reported in the Monte Cristo region, a limestone relict in a primarily serpentine region of eastern Cuba. The geographic distribution includes the provinces of Camagüey, Las Tunas and Guantánamo, and the microhabitats are fully exposed to sunlight.

Etymology: This species is dedicated to M.Sc. Ramona Oviedo Prieto, Head curator of the herbarium of the Academia de Ciencias in the Instituto de Ecología y Sistemática (HAC), who has dedicated her career to the study and conservation of the Cuban flora and the preservation of Cuba´s botanical collections.

Additional materials examined: CUBA: Camagüey, Nuevitas. Península Pastelillo, Loma de Punta Gorda, 0–15 m snm, 1984, Bisse, J. & al., HFC-54112 (HAJB); Las Tunas, El Cupey, La Yaya, Puerto Padre, 1930, Curbelo, M. 524 [HROIG-5221; LS-14457]; Las Tunas, Playa pesquero a Playa Blanca, del Risco, E. & Chiappy, C. SV-33478 (HAC); Guantánamo, Jamaica, subida al altiplano de Monte Cristo (Monte Cristi) por el camino del Diamante, 400m snm, Bisse, J. & al., HFC-39168 (HAJB); Guantánamo, subida por la falda sur de la meseta al norte de Baitiquirí, de la Mina del Yeso hacia arriba, monte seco, Bisse, J. & Köhler, E., HFC-7853 (HAJB, JE).

4. *Anastraphia crebribracteata* I. Ventosa & P. Herrera, sp. nov.

Type: [specimen] CUBA, Guantánamo, Palenque, Cuchillas de Toa, Cayo Fortuna, pinares y charrascos en el trillo de Riíto a Piloto Arriba, 5.IV.1972, Bisse, J. & Berazaín, R., HFC-22259 (holotype: HAJB!, isotype: HAJB!, JE!). (Fig. 4).

Frutex ca. 2 m altus, ramosus. Folia alterna, 13–33 mm longa, 7–14 mm lata, obovata aut oblonga, ad apicem rotundata vel retusa, ad basin asymmetrica et acuta vel cuneata aut rotundata, coriacea, integerrima, supra glabra, subtus valde tomentosa. Capitula terminalia vel lateralia, 1–3 in parvis pseudocorymbis aggregata, subsessilia; involucrum cylindricum-turbinatum, basi valde attenuatum; phyllaria in 5–9 seriebus disposita, chartacea, dorsaliter pubescentia. Flores 7 in quoque capitulo, 6–9 mm longi, corolla quinquelobata, lobi tubum circa aequantes, 3–4 mm longi, apex lobulorum leviter recurvati, trichomatibus glandulosis et papillis obsitus. Antherae 4–5 mm longae, appendix apicalis valde apiculata, cauda 1–2 mm longa, breviter laciniata. Stylus exsertus, glaber, 8–10 mm longus. Cypsela cylindrica 2–4 mm longa. Pappus 5–8 mm longus, uniserialis, omnibus setis discretis consimilibus.

Shrubs to 2 m in height, branched and without brachyblasts. Young branches albo-pubescent, mature branches with grooved bark. Leaves distributed the length of the branches; petiole sub-cylindrical without channel, 2–4 mm long, leaves 13–33 mm long by 7–14 mm wide, nanophyllous, coriaceous, obovate or oblong, apex rounded or retuse, base acute, cuneate or rounded, asymmetrical, margins entire; venation brochidodromous with secondary veins sharply curved, upper surface glabrous with not prominent veins, lower surface strongly tomentose with prominent veins. Capitula terminal or lateral, grouped in small pseudocorymbs of up to three capitula, subsessile, 13–15 mm long with 7 flowers per capitulum; involucre 10–12 mm high by 1–2 mm wide at the base and 5–7 mm wide at the apex, turbinate with the base strongly attenuated, involucral bracts in 5–9 series, dorsally tomentose and chartaceous, internal involucral bracts lanceolate and 6–8 mm long, medial and external involucral bracts ovate, lanceolate, respectively 4–6 mm and 2–4 mm long. Florets 6–9 mm long. Corolla tubular, five-lobed, lobes same length as tube, 3–4 mm long and slightly curved at the apex, with glandular hairs and papillae. Stamens 5, isomorphic, exserted; filaments fused to the corolla tube from base to throat; anthers 4–5 mm long, with apical appendage strongly acuminate and tails 1–2 mm long, shortly laciniate. Pollen grains 51–56 μm in polar diameter by 37–43 μm equatorial diameter, prolate, tricolporate, exine type Wunderlichia, exine surface microechinate. Style exserted, glabrous, shortly bilobed, acuminate in the apex and style branches rounded, 8–10 mm long. Cypsela cylindrical, 2–4 mm long, with abundant biseriate glandular hairs and simple (not glandular) biseriate hairs. Pappus 5–8 mm long, uniseriate with all bristles of equal length and thickness, free at the base.

Phenology: Flowering and fruiting were recorded in April and May.

Distribution and habitat: *Anastraphia crebribracteata* inhabits xeromorphic scrub on serpentine soils and pine forest growing on ferralitic soils also derived from serpentine, in Holguín and Guantánamo provinces in eastern Cuba.

Etymology: The specific epithet refers to the imbricate position of the bracts of the involucre (phyllaries).

Additional materials examined: CUBA: Holguín, Moa, falda sur de la Sierra de Moa, subida por el camino a la Mina Yarey, 1972, Bisse, J. & Berazaín, R. HFC-22048; Holguín, Moa, orillas del río Jiguaní cerca de Mina Yarey, 1972, Bisse, J. & Berazaín, R. HFC-22523; Guantánamo, Cuchillas del Toa, Sierra de Maguey, pluvisilva y charrascales 700m snm, 1972, Bisse, J. & al. 22421 (HAJB, JE).

5. *Anastraphia geigeliae* I. Ventosa & P. Herrera, sp. nov.

Type: [specimen] CUBA, Holguín, Oriente: Meseta unos 400 m de altitud, entre los ríos Cabañas y Moa, IV.1943, Marie Victorin Hno., Clemente Hno. & Alain Hno. LS-21693 (holotype: HAC!, isotype: HAC!). (Fig. 5).

Frutex 2–5 m altus, ramosus. Folia alterna, 10–40 mm longa, 7–15 mm lata, obovata aut elliptica, apice obtusa vel rotundata, basi acuta aut rotundata, asymmetrica, coriacea, supra glabra, subtus valde tomentosa, ad marginem 1–13 dentibus spinosis binatim armata; dentes spinosi acuminati. Capitulum terminale solitarium vel capitula 2–4 in glomerulis aggregata, sessilia, multiflora; involucrum late campaniforme, basi rotundatum; phyllaria in 6–8 seriebus disposita, dorsaliter tomentosa. Flores 7–11 mm longi, corolla quinquelobata, lobi tubum aequantes, 3–6 mm longi, leviter recurvati, apex lobulorum trichomatibus glandulosis biseriatis et papillis obsitus. Antherae 4–7 mm longae, appendix apicalis valde apiculata, cauda 1–3 mm longa, laevis. Stylus exsertus, glaber, 8–14 mm longus. Pappus 6–9 mm longus, biserialis, omnibus setis discretis consimilibus.

Shrubs 2–5 m in height, branched without brachyblasts, branches upright. Young branches albo-pubescent, mature branches grooved. Leaves distributed the length of the branches; petiole terete, 1–6 mm long; leaves 10–40 mm long by 7–15 mm wide, nanophyllous, coriaceous, obovate or elliptic, apex obtuse or rounded, bases acute or rounded, asymmetrical, acuminate toothed margins with 1 to 13 pairs of teeth, regular, simple or compound, spine of the same length as teeth; venation semicraspedodromous with abruptly curved secondary veins, upper surface glabrous, lower surface strongly tomentose. Capitula solitary or two to four in glomerule, 12–20 mm in length, multiflorous; involucre widely campanulate with rounded base, 9–14 mm high by 5–10 mm broad at the base and 7–23 mm broad at the apex, involucral bracts in 6–8 series, dorsally tomentose and chartaceous, internal bracts linear 8–13 mm long, medial and external bracts linear-lanceolate, respectively 6–9 mm and 2–6 mm high. Florets 7–11 mm long. Corolla tubular, five-lobed; lobes 3–6 mm long, of same length as the corolla tube, slightly recurved, apex of the corolla lobes with glandular biseriate hairs and papillae. Stamens 5, isomorphic, exserted. Filaments fused to the tube from the base to the throat of the corolla. Anthers 4–7 mm long, with apical appendage strongly acuminate and tails 1–3 mm, smooth. Pollen grains 47–53 µm polar diameter by 36–43 µm equatorial diameter, subprolate, tricolporate, exine Wunderlichia type, exine surface microechinate. Style 8–14 mm, exserted, glabrous. Cypsela cylindrical or reniform, 2–5 mm long, with abundant biseriate glandular hairs with vesicle and simple biseriate (not glandular) hairs. Pappus 6–9 mm long, biseriate, with all bristles of equal length and thickness, free at the base.

Phenology: Flowering was recorded from December to May, fruiting in June and July.

Distribution and habitat: *Anastraphia geigeliae* inhabits xeromorphic, subspiny matorral on serpentine soils as well as pine forests growing on serpentine-derived ferralitic soils, where *A. crebribracteata* is also found. *Anastraphia geigeliae* is the endemic species of *Anastraphia* that appears most frequently in the serpentine soils of eastern Cuba, specifically in Holguín and Guantánamo provinces.

Etymology: The species name honors Prof. LUTGARDA GONZÁLEZ GÉIGEL, who dedicated her life to the study of the Cuban flora and the training of generations of Cuban botanists.

Additional materials examined: Cuba: Holguín, Pinares de Moa, 1945, ACUÑA J. SV-12782, SV-12784 (HAC); Holguín, Moa, Pinares, camino Gran Tierra, 1945, ACUÑA J. SV-12785, SV-12786 (HAC); Holguín, Moa, Playa Vaca, 1945, ACUÑA J. SV-12787, SV-12788 (HAC); Holguín, Charrascos, Sierra de Moa, aprox. 800 m snm., 1953, ALAIN HNO. 3421 (HAC); Guantánamo, Toa, Charrasco, Peña prieta, Magdalena, aprox. 700 m snm, 1953, ALAIN HNO. 3487 (HAC); Holguín, Charrascales, cerca de la cumbre cristal, 1956, ALAIN HNO. & al. 5693 (HAC); Holguín, sobre la cresta de la Sierra del Cristal, 1955, ALAIN HNO. & LÓPEZ FIGUEIRAS M. Al- 4815 (HAC); Guantánamo, Charrascos, Sierra Azul, Quibiján, Baracoa, alt. aprox. 450-500m, 1960, ALAIN HNO. & LÓPEZ FIGUEIRAS M. Al-7319 (HAC); Holguín, Mayarí arriba, Sierra de Cristal región superior del macizo central 1000-1235 m, 1976, ARECES A. & al. HFC-30506 [SV-30713, 30714] (HAC, HAJB); Guantánamo, Pinalito al sur de la reserva de Cupeyal, 1970, BORHIDI A. & al. 88/ 21 [SV-35520] (HAC, HAJB); Guantánamo, embocadura del Rio Yamaniguey, Charrascal serpentinoso, 1970, BORHIDI A. & al. SV- 27916 (HAC); Holguín, Moa, Playa La Vaca, 1944, CLEMENTE HNO. NSC- 3656 (HAC); Holguín, Cananova, 1949, CLEMENTE HNO., ALAIN HNO. & CHRYSOGONÉ HNO. Al-967 [NSC- 6871] (HAC); Holguín, Playa La Vaca, Moa, 1946, CLEMENTE HNO. &

Chrysogone Hno. NSC-4909 (HAC); Holguín, Buisson du sommet de la Sierra del Cristal (1100-1325 m), 1922, Ekman E. L. 15987 (HAC); Holguín, Cerro de Miraflores, Cananova, 1942, León Hno. LS- 21072 (HAC); Holguín, Cuabal del Centeno, Moa, 1941, León Hno. & Clemente Hno. LS- 20211 (HAC); Holguín, Valle del Río Moa, 1941, León Hno. & al. LS-20184 (HAC); Holguín, Moa, Pinar de los Lirios, sin fecha, León Hno. & al. 20741(HAC); Holguín, Cerro de Miraflores, Cananova, Charrascal serpentinoso, 1954, López Figueiras M. 1243 (HAC), Holguín, Pico de Cristal, Sierra de Cristal, alt. aprox. 600-1200m, 1959, López Figueiras M. UO- 120 (HAC); Holguín, Pinares de Moa, 1943, Marie Victorin Hno. & al. LS- 21587 (HAC); Holguín, Moa, Mina Johnson, 1915, Yero M. JBPI- 964 (HAC); Guantánamo, Baracoa, Charrascos de Yamaniguey, 2003, Ventosa I. & al. SV-42442, 42443, 42444, 42445, 42446, 42447, 42448, 42450, 42451 (HAC); Guantánamo, Baracoa, Charrascos de Yamaniguey, 2004, Ventosa I. & al. SV-42461(HAC); Guantánamo, Baracoa, Río Báez, 2004, Llamacho J., SV-42463 (HAC); Holguín, Segundo frente, Subida al Pico Cristal, por el suroeste, suelo esquelético, 1984, Bisse J. & al. 57231 (HAJB).

Discussion

The species *Anastraphia cristalensis* is described based on a single specimen collected on the peak of the Sierra del Cristal, between 1000 and 1250 m elevation. The new taxon can be defined despite the limited material, given its morphological uniqueness: elliptical leaves with flat, entire margins and cordate bases. Morphologically the new species resembles *A. crassifolia* in that both present leaves > 30 mm long with entire margins, campanulate capitula and flowers with lobes the same length as the corolla tube. The two species differ notably, though, in the shape of leaf bases and apices. Furthermore, *A. crassifolia* and *A. cristalensis* differ in characteristics of the involucral bracts, in the presence of hairs and papillae in the flower, and in characteristics of the cypsela. Efforts to collect additional material of *Anastraphia cristalensis* have not been successful to date, due to the difficulty of access to the central part of the Sierra de Cristal and the difficulty of locating an apparently scarce shrub amidst the complex vegetation of the area.

Anastraphia herrerae also resembles *A. crassifolia* in leaf dimensions, capitulum, texture, and floral characteristics. The two species differ considerably, however, in leaf margins: flat and entire in *A. crassifolia*, recurved and spinose-dentate in *A. herrerae*. This species inhabits the region of the headwaters of the Río Jiguaní in Guantánamo, where according to the herbarium label it grows in serpentine-derived soils similar to those where *A. crassifolia* is found. *Anastraphia herrerae* also resembles *A. ilicifolia* D. Don except with respect to the teeth of leaf margins:

sharply acuminate with prominent spines in two series in *A. ilicifolia,* spines smaller than teeth in *A. herrerae*. These two species also differ in the characteristics of the involucral bracts, which are linear and strongly tomentose in *A. herrerae* but in *A. ilicifolia* ovate-lanceolate and pubescent. The two taxa also differ in distribution and rock types. *Anastraphia ilicifolia* grows in calcareous rocks of western and central Cuba whereas *A. herrerae* is found exclusively in serpentine rock of eastern Cuba. Several specimens exist of the latter species but like *A. cristalensis*, *A. herrerae* has not been been encountered recently.

Anastraphia crebribracteata is another case of a species clearly distinct from its congeners, due to the subsessile capitulum with involucrum with attenuated base and numerous series of imbricate bracts. Furthermore, it is the only Cuban species whose capitula are grouped in small pseudocorymbs. This species morphologically resembles *A. obtusifolia* in terms of the obovate leaves with flat, entire margins. The two taxa also display similar dimensions of capitula and similar characteristics of involucral bracts. *Anastraphia crebribracteata* also resembles *A. attenuata* in the presence of numerous bracts in the involucre, which has an attenuated base, but differs from that species in leaf, flower, and capitulum characteristics. This species inhabits pine woods and charrascales in the north of Guantánamo (the Baracoa sector of the Nipe-Sagua-Baracoa massif) and the Moa region of Holguín.

Anastraphia oviedoae morphologically resembles *A. calcicola* in that both have nanophyllous, toothed and spiny leaves. The two differ, however, in the form of the capitulum: campanulate in *A. oviedoae*, turbinate in *A. calcicola*. On the other hand, *A. oviedoae* resembles *A. northropiana* Greenm. to some extent, but the two differ in leaf and capitulum dimensions, the number of series of bristles of the pappus, and the characteristics of the spines of leaf margins, which are shortly acuminate with small irregular spine, mainly at the apex of the leaves in *A. northropiana* and with regular spines along the whole margin of the leaf in *A. oviedoae*. *Anastraphia oviedoae* is found in xeromorphic coastal and subcoastal matorral in southeastern Cuba.

Anastraphia geigeliae resembles *Anastraphia recurva*. The two differ, however, in leaf shape: obovate or oblong with cuneate base in *A. recurva*, elliptic or obovate with rounded base in *A. geigeliae*. Furthermore, leaf margins differ notably between the two species. In *A. geigeliae* the leaf margin is acuminate toothed with up to 13 pairs of teeth, while leaves of *A. recurva* have entire margins or acuminate toothed margins with only up to three pairs of teeth. The species also differ in that up to four capitula of *A. geigeliae* may exist in a glomerule whereas *A. recurva* usually has solitary capitula. The differences between these two taxa were also discussed by Jervis (1954), who concluded that the two were ecotypes of a single species because of the notable habitat differences. Nevertheless, the substantial morphological differences between the two taxa merit their separation into different species.

Acknowledgements

We thank Dr. WERNER GREUTER for facilitating the examination of specimens deposited in the herbarium of the Museum of the University of Jena (JE) and for his suggestions for naming the species. The Swedish Institute and the Red Latinoamericana de Botánica (Latin American Botanical Network) supported the first author´s travels to Sweden and Germany. PETER FEINSINGER helped with the English translation.

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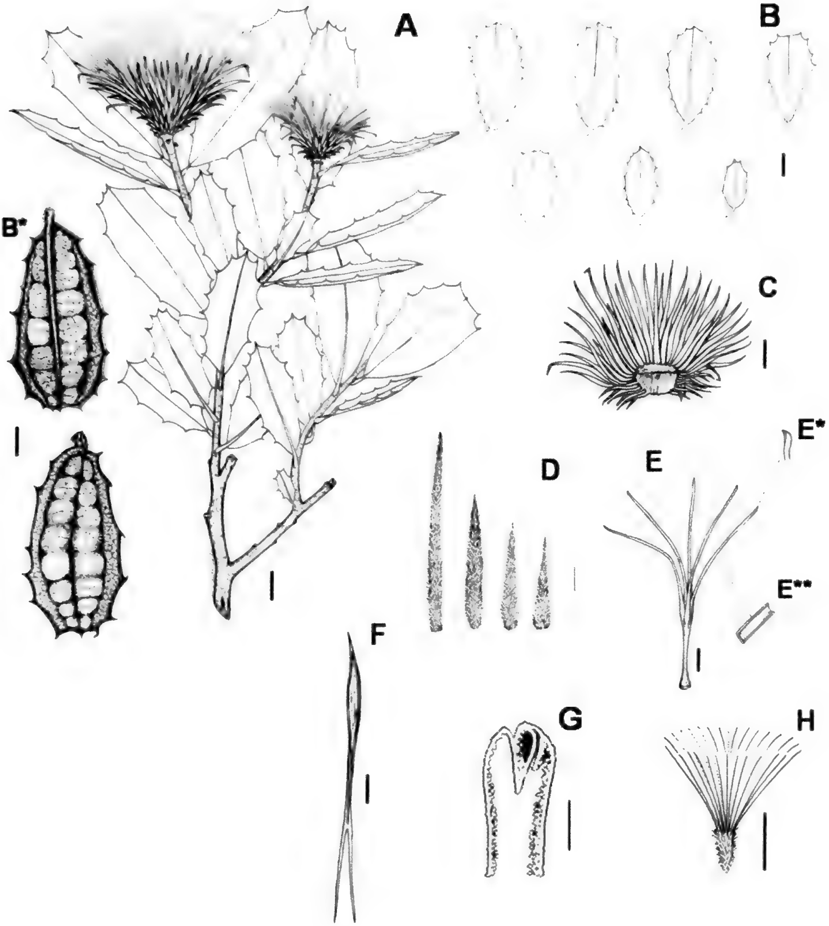

Fig.1. *Anastraphia herrerae* (Bisse, J. & al. HFC-49567 HAJB).

A. Branch (scale: 1cm) **B**. Leaf variability (scale: 1 cm). **B***. Detail of leaf surface (scale: 1cm). **C**. Longitudinal cut of capitulum (scale: 1 cm). **D**. Shape of involucrum bracts (scale: 0.3 cm). **E**. Flower (scale: 0.2 cm). **E***. Scheme of the form of apex of petal lobe. **E****. Scheme of the form of petal lobes. **F**. Anther (scale: 0.1 mm). **G**. Apex of style (scale 0.2 mm). **H**. Fruit (scale: 1 cm). Drawings by Gustavo Pineda.

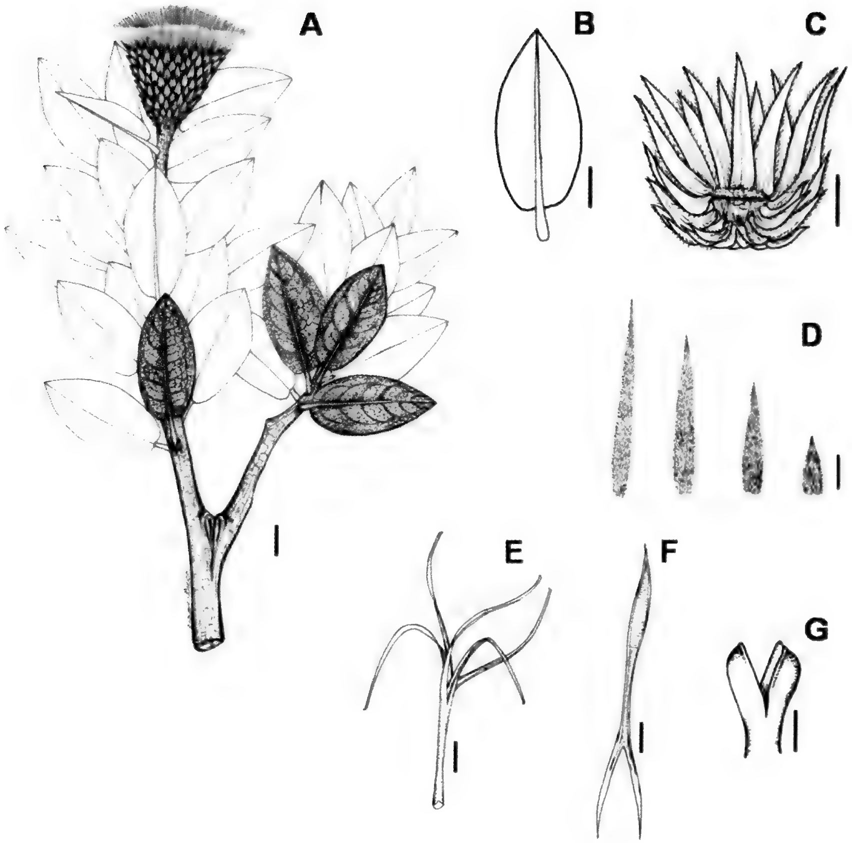

Fig. 2. ***Anastraphia cristalensis*** **(Bisse & et al. 30503 HAJB).**

A. Branch (scale: 1 cm). **B**. Leaf (scale: 1 cm). **C**. Longitudinal cut of capitulum (scale: 1 cm). **D**. Shape of involucrum bracts (scale: 0.2 cm). **E**. Flower (scale: 0.2 cm). **F.** Anther (scale: 0.1 mm). **G**. Apex of style (scale: 0.5 mm). Drawings by Gustavo Pineda.

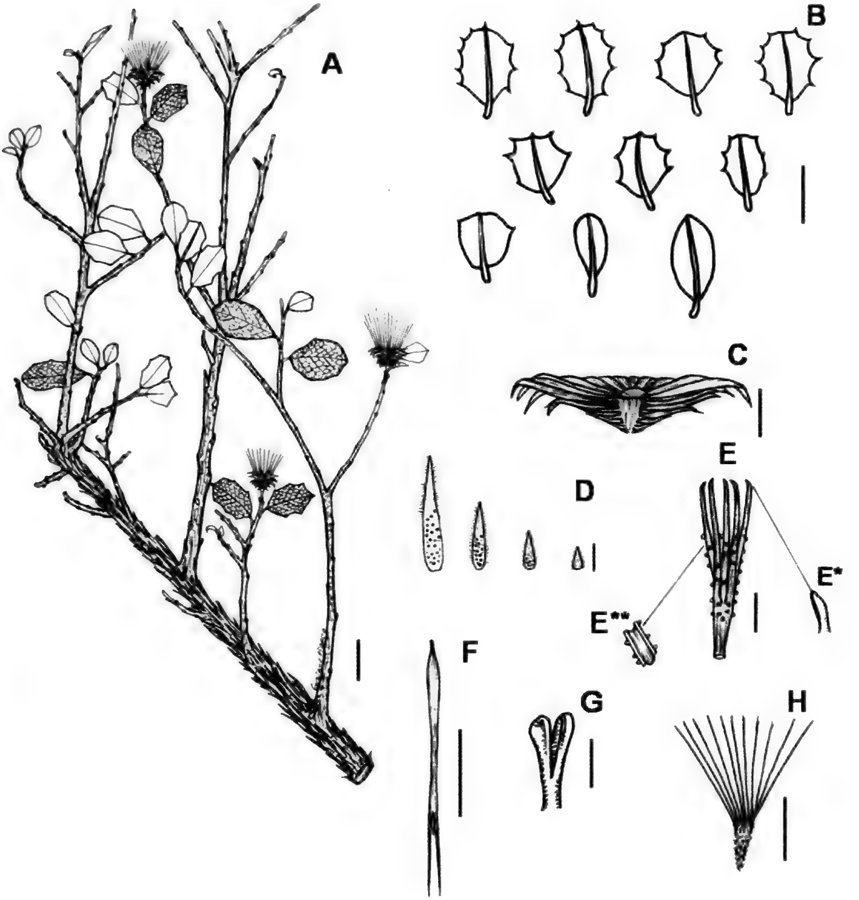

Fig. 3. ***Anastraphia oviedoae*** **(Álvarez & et al. 43186 HAC).**

A. Branch (scale: 1 cm). **B**. Leaf variability (scale: 1 cm). **C**. Longitudinal cut of capitulum (scale: 0.2 cm). **D**. Shape of involucrum bracts (scale: 0.1 cm). **E**. Flower (scale: 0,2cm). **E***. Scheme of the form of apex of petal lobe. **E****. Scheme of the form of petal lobes. **F**. Anther (scale: 0,3mm). **G**. Apex of style (scale: 0,1mm). **H**. Fruit (scale: 0,4cm). Drawings by Gustavo Pineda.

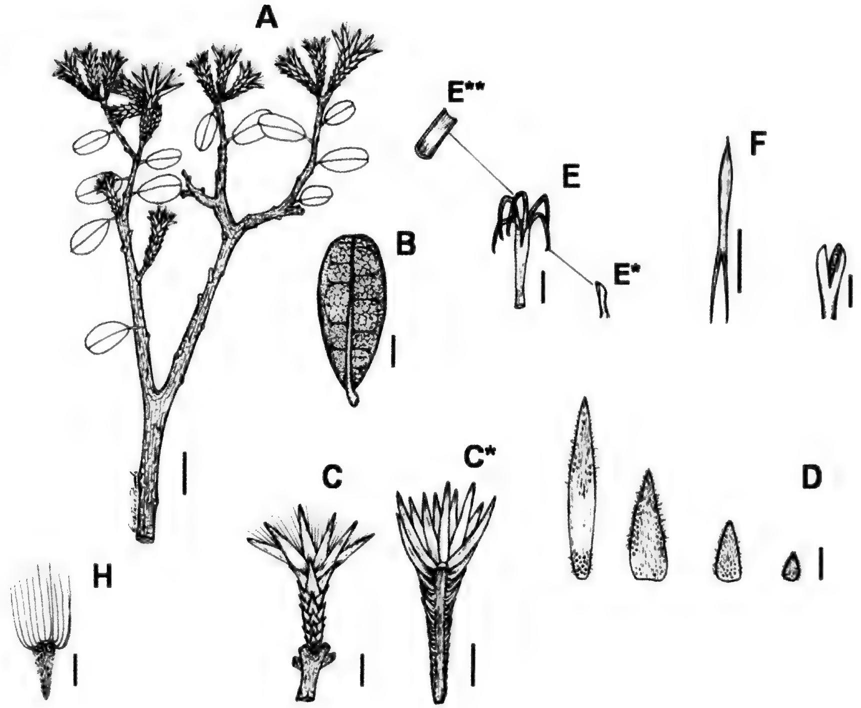

Fig. 4. ***Anastraphia crebribracteata*** **(HFC 22259, HAJB).**

A. Branch (scale: 1 cm). **B.** Leaf (scale: 0,3cm). **C.** Capitulum (scale: 0,3 cm). **C*.** Longitudinal section of capitulum (scale: 0.2 cm). **D.** Shape of involucral bracts (scale: 0.1 cm). **E.** Flower (scale: 0,2 cm). **E*.** Schematic shape of apex of petal lobe. **E**.** Schematic shape of petal lobes. **F.** Anther (scale: 0,1 mm). **G.** Apex of style (scale: 0,3 mm). **H.** Fruit (scale: 0,2 cm).
Drawings by Gustavo Pineda.

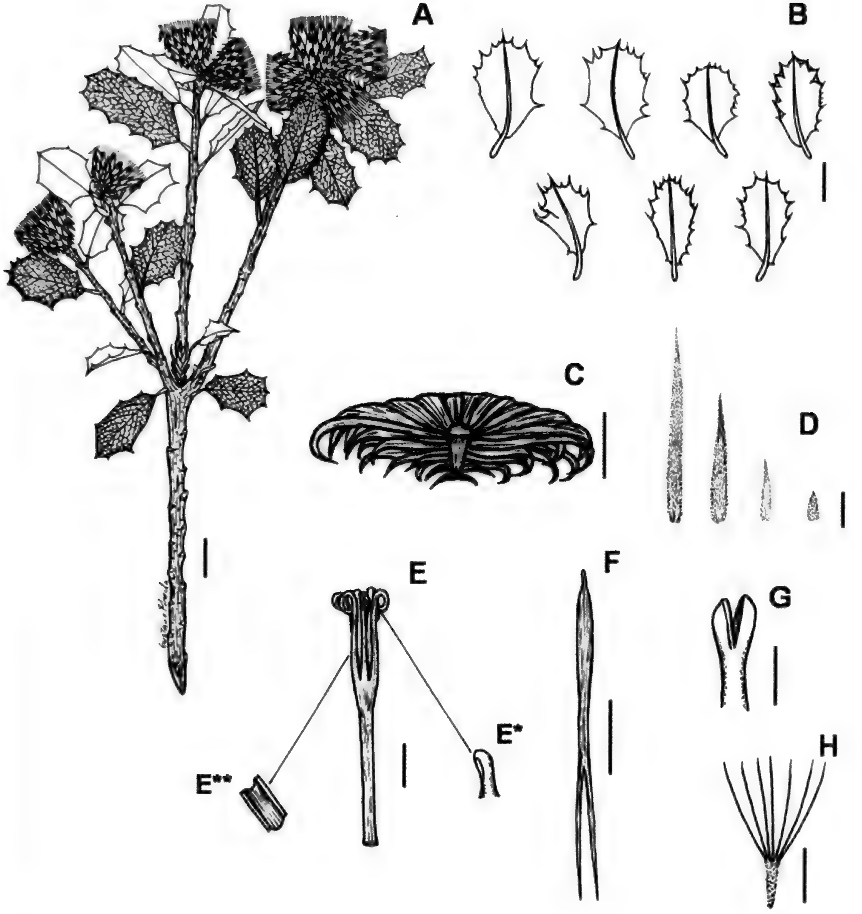

Fig. 5. ***Anastraphia geigeliae*** **(Marie Victorin HNO, Clemente HNO, & Alain HNO, LS-21693, HAC).**
A. Branch (scale: 1 cm). **B.** Leaf variability (scale: 1 cm). **C.** Longitudinal section of capitulum (scale: 0.2 cm). **D**. Shape of involucral bracts (scale: 0,2 cm). **E.** Flower (scale: 0,2 cm). **E*.** Schematic shape of apex of petal lobe. **E**.** Schematic shape of petal lobes. **F.** Anther (scale: 0,1 mm). **G.** Apex of style (scale: 0,1 mm). **H.** Fruit (scale: 0,5 cm). Drawings by Gustavo Pineda.

Senecio krascheninnikovii Schischk. (Asteraceae, Senecioneae), a new record for Iran

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Abstract

Senecio krascheninnikovii Schischk. is reported as a new record from Iran. Distribution map and drawings of the species are presented. In Iran, the closest related species to *S. krascheninnikovii* is *S. eligulatus* B. Nord., Moussavi & Djavadi, from which it differs by the shape and margin of leaves, radiate capitula and cypsela indumentum.

Keywords: new record, *Senecio*, Senecioneae, Asteraceae, Iran.

Introduction

The genus *Senecio* L. (Asteraceae, Senecioneae) with about 1,000 species is one of the largest genera of Asteraceae as well as flowering plants (Pelser et al. 2007). *Senecio* L. possesses six endemic species in Iran including *S. joharchii* F. Ghahrem., Ezazi, Rahchamani & Attar (sect. *Crociseris*), *S. vulcanicus* Boiss., *S. kotschyanus* Boiss., *S. iranicus* B. Nord. *S. eligulatus* B. Nord., Moussavi & Djavadi, and *S. subnivalis* Y. Ajani, J. Noroozi & B. Nord. (sect. *Senecio*). All are local endemics, distributed mainly in mountainous regions with high elevation. Nordenstam (1989) recognized four sections in the Flora Iranica area, but since then sect. *Jacobaea* has been resurrected as the genus *Jacobaea* Mill., and the members of sect. *Quadridentati* Boiss. have been transferred to the genus *Iranecio* B. Nord. Two sections of *Senecio* now remain in the genus in Iran, with altogether 14 species including *S. krascheninnikovii* reported here. Sect. *Senecio* is largest with ten Iranian species. Two of them were recently described, viz. *S. eligulatus* and *S. subnivalis* (Nordenstam et al. 2002, Noroozy et al. 2010). *S. joharchii* of sect. *Crociseris* (Reichb.) Hall & Wohlf. is also a recently described Iranian endemic (Ghahremaninajad et al. 2010). *S. krascheninnikovii* (sect. *Senecio*), which is reported here as a new record to Iran, was collected from Zagros Mountains.

Material and Methods

The present paper, as a part of the project "Tribe Senecioneae Cass. in Iran", is mainly based on the study of c. 400 herbarium specimens available in TUH and IRAN herbaria (acronyms as in Thiers 2008+). The specimen discussed here was collected in July 2000 from Saverz Mountain in the Zagros range, and maintained in TUH. The description covers the Iranian material only, not the total variation of the species (cf. Nordenstam 1989).

Description and Discussion

Senecio krascheninnikovii Schischk., Not. Syst. Leningrad (= Bot. Mater. Gerb. Bot. Inst. Komarova Akad. Nauk S.S.S.R.)15: 410 (1953).

Annual, branching herb, sometimes woody at the base, with moniliform curled multicellular, white or brownish hairs. Stem erect, 20–30 cm high, grooved, 3–5 mm in diameter at the bottom, brown or purple, green or purplish above, glabrous, puberulent or villous, densely villous at the apex and on the peduncle. Stem leaves alternate, sessile, obovate or oblong, 2–5 cm long, 1.5–2.5 cm wide, pinnatisect, herbaceous or subsucculent, with prominent midrib; lobes in 2–4 pairs, 5–15 mm long, 1–3 mm wide, entire or lobate, margin manifestly revolute, glabrous or puberulent or laxly villous, green or dark green. Capitula radiate with yellow florets, arranged in lax paniculate synflorescence; peduncle 1–2 cm long. Involucre campanulate, 5–7 mm long, and 4–5 mm in diam.; bracts 11–13 uniseriate, lanceolate-oblong, 4–5 mm long, 1–1.5 mm wide, 1–3-veined, herbaceous, green, margin subscarious, glabrous or puberulent, acuminate, apex hairy; calycular bracts 6–10, lanceolate or linear, acute, 1.5–2 mm long, 0.3–0.5 mm wide, green, glabrous or puberulent. Receptacle naked, plane, alveolate. Ray

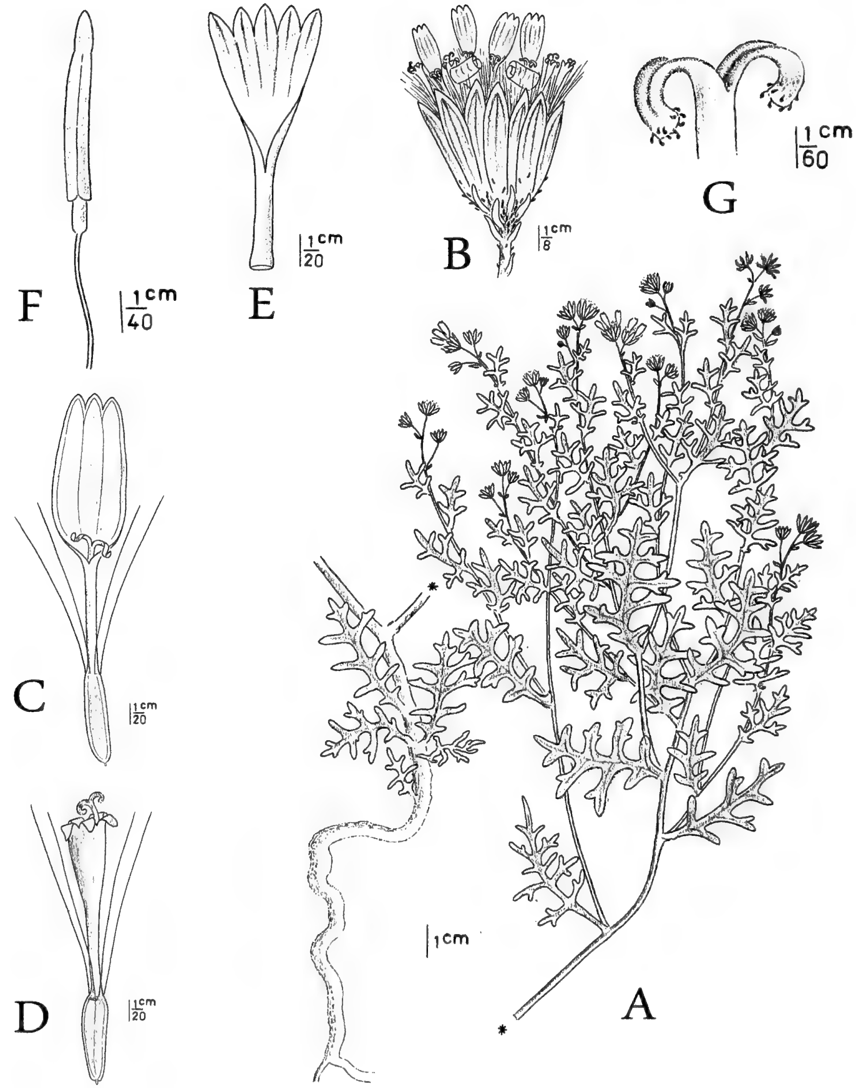

Fig. 1. ***Senecio krascheninnikovii*** **Schischk. (Ghareman et al. 26354, TUH).**

A. Habit, **B.** Capitulum, **C.** Ray floret, **D.** Hermaphroditic disk floret, **E.** Corolla of disk floret, **F.** Stamen, **G.** Style branch of disk floret.

florets c. 8 in number, female, tube 2.5–3 mm long, limb 3–4 mm long, 1.5–2.5 mm wide, oblong-elliptic, 4–5-nerved, apex 3-toothed; style branches 1–1.2 mm long, apex truncate and with short brush-like hairs. Disk florets c. 20 in number, bisexual, corolla 4–5 mm long, tube slender, 2–2.5 mm long, limb funnelshaped, 2–3 mm long, 5-lobed; lobes triangular-ovate, 0.5–0.7 mm long, with median resinous canal, outside at apex papillose. Anthers 1.8–2 mm long, sagittate at base, obtuse, ecaudate; filament collar balustriform. Style branches 0.8–1 mm long, apically truncate with short brush-like hairs; stigmatic areas separated. Cypselas narrowly-oblong, 2.8–3 mm long, 0.3–0.5 mm wide, 10-ribbed, dark brown, laxly beset with very short hairs. Pappus 5–6 mm long, white, nearly smooth, caducous. – Fig 1.

Specimen examined: IRAN, Province Kohkiluye and Boyer Ahmad, Yasouj to Dehdasht, Saverz Mountain, 2,000 m, 24.VII.2000, A. GHAHREMAN, F. ATTAR & K. MAMAHDIGHOLL, 26354-TUH. – Fig. 2.

Distribution: Afghanistan, Pakistan, NE India, Iran (Zagros), Tian Shan, Pamir-Alaj, Central Asia, W China.

Taxonomic remarks: *Senecio krascheninnikovii* is a much variable species in habit, leaf shape and number of capitula and involucral bracts, also the species can be found as simple-stemmed to much-branched specimens (NORDENSTAM 1989). Although an annual, our specimen was branching and woody at lower and middle part of stem, becoming herbaceous upwards. In Iran, *S. krascheninnikovii* is similar to *S. eligulatus* in habit but, there are some clear differences between the two species listed in Table 1. The capitula of *S. eligulatus* are terminal and disciform with reduced marginal female florets, while *S. krascheninnikovii* has distinctly though shortly radiate capitula, arranged in axillar and terminal synflorescence. The two species are also quite distinct in leaf shape, *S. krascheninnikovii* having pinnatisect leaves with slender and entire lobes, while the leaves of *S. eligulatus* are pinnatilobate with broad and dentate lobes (Table 1).

Table 1. Morphological comparison between *S. krascheninnikovii* and *S. eligulatus*.

Character	*S. kraschenninikovii*	*S. eligulatus*
Leaf shape	obovate	oblanceolate
Leaf margin	pinnatisect	pinnatilobate
Leaf lobes	narrow-entire	broad-dentate
Synflorescence	panicle-like	corymbose
Capitula	radiate, axillar-terminal	disciform, terminal
Cypsela indumentum	very sparsely puberulent	puberulent

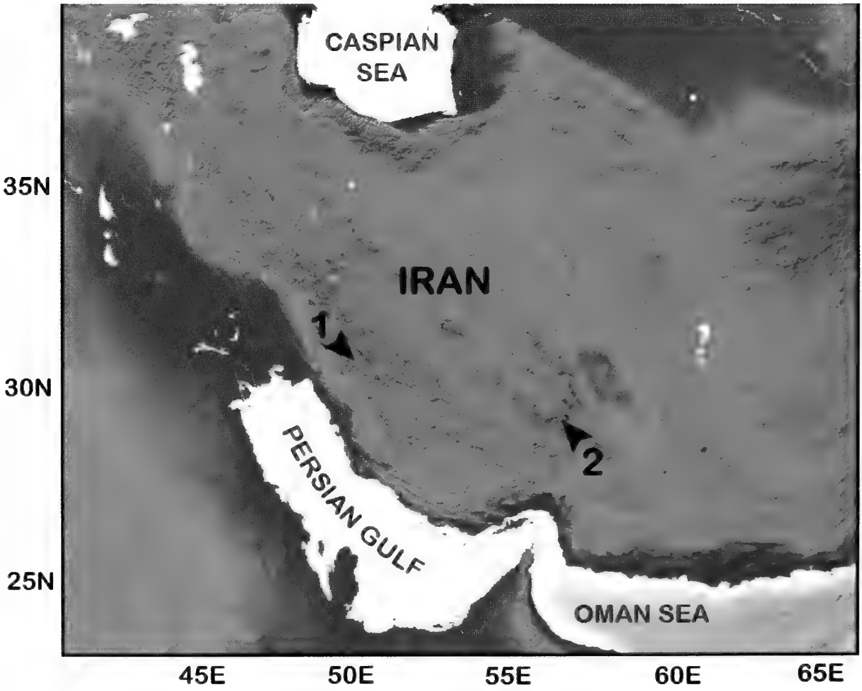

Fig. 2. Distribution map of *Senecio kraschenninikovii* (1) and *S. eligulatus* (2) in Iran.

Acknowledgement

The authors are very grateful to Mr. M. Mehranfard, the artist of the IRAN herbarium, for drawing the illustrations.

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