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COMPARATIVE LEAF ANATOMY IN ARGENTINE *GALACTIA* SPECIES

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Summary: A comparative study of anatomical characters of the leaves of argentine species of Genera *Galactia* was carried out in order to evaluate their potential value in Taxonomy. In Argentine 14 species and some varieties from Sections *Odonia* and *Collaearia* can be found. Section *Odonia*: ***G. benthamiana* Mich.,** *G. dubia* DC.*,* ***G. fiebrigiana* Burkart var*. *correntina* Burkart, *G. glaucophylla* Harms*, G. gracillima* Benth., *G. latisiliqua* Desv.,** *G. longifolia* (Jacq.) Benth.*,* ***G. marginalis* Benth., *G. striata* (Jacq.) Urban,** *G. martioides* Burkart*,* ***G. neesi* D. C. var. *australis* Malme***, G. pretiosa* Burkart var. *pretiosa,* ***G. texana* (Scheele) A. Gray** and ***G. boavista* (Vell.) Burkart** from Section *Collaearia*. The characterization of sections is mainly based on reproductive characters, vegetative ones (exomorphological aspects) are scarcely considered. The present paper provides a description of anatomical characters of leaves in argentine species of *Galactia*. Some of them, may have diagnostic value in taxonomic treatment. Special emphasis is placed on the systematic significance of the midvein structure. The aim of the present study, covering 10 species (named in bold), is a) to add more data of leaf anatomy characters, thus b) to evaluate the systematic relevance and/ or ecological significance.

Key words: leaves anatomy, *Galactia spp.*, Fabaceae.

Resumen: Anatomía comparada de hoja en especies argentinas de *Galactia*. Se realizó un estudio comparativo de la anatomía foliar de especies argentinas del género *Galactia (Fabaceae),* a fin de evaluar su potencial en taxonomía. En la Argentina se reconocen 14 especies (con algunas variedades), 13 de la sección *Odonia* -***G. benthamiana Mich., G. fiebrigiana Burkart var.correntina Burkart , G. gracillima Benth., G. latisiliqua Desv., G. marginalis Benth., G. striata (Jacq.) Urban y G. texana (Scheele) A. Gray,*** *G. dubia* DC.*,* ***G. glaucophylla* Harms,** *G. longifolia* (Jacq.) Benth.*, G. martioides* Burkart*,* ***G. neesi* DC. var. *australis* Malme***, G. pretiosa* Burkart var. *Pretiosa-* y ***G. boavista* (Vell.) Burkart** de la sección *Collaearia* (Burkart, 1971). Los estudios se realizaron en individuos de 10 especies (en negrita) colectadas en su área de distribución y en cultivo. Las Secciones están definidas por caracteres reproductivos, básicamente y algunos pocos caracteres vegetativos (exomorfológicos). En este trabajo se describen los caracteres anatómicos foliares de las especies argentinas del género *Galactia*. Algunos de ellos podrían ser de valor diagnóstico en estudios taxonómicos. Se puso especial énfasis en el significado para la sistemática de algunos de ellos tal como la estructura del nervio medio. El objeto del presente trabajo es: proveer mayor información sobre la estructura anatómica foliar de las especies del género *Galactia* y evaluar la relevancia sistemática y/o ecológica de dicha información.

Palabras clave: anatomía foliar, *Galactia* spp., Fabaceae.

INTRODUCTION

Galactia P. Browne, is a cosmopolitan genus, comprises about 50 species, distributed in tropical, subtropical and warm temperate zones especially in America, also Asia and Africa (Burkart, 1952). The plants vary in habit from perennial herbaceous climbing plants to shrubs (Burkart, 1971) and occupy a diversity of habitats: forests, savannas, hilly environments with poorly developed soils and rocks.

The genus *Galactia* is divided into 3 Sections: *Odonia*, *Galactia* and *Collaearia* (Burkart, 1971), the differences were established by the following characters: the habit, the number of leaflets per leaf, the underground organs (roots, rhizomes and xylopodia), and flowers characters like: the flower

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size, the petals width, the degree of stamens cohesion, etc.

Torres *et al*. (1983) described some anatomical characters (epidermal cells and stomata number/leaf surface, trichomes, palisade and spongy parenchyma, areoles, etc.) indicating that those characters are of taxonomic importance in *Galactia* species of Venezuela (*G. dubia, G. latisiliqua*).

In Argentine 14 species from Sections *Odonia* and *Collaearia* can be found. Section *Odonia*: *G. benthamiana* Mich., *G. dubia* DC., *G. fiebrigiana* Burkart var. *correntina* Burkart , *G. glaucophylla* Harms, *G. gracillima* Benth., *G. latisiliqua* Desv., *G. longifolia* (Jacq.) Benth., *G. marginalis* Benth., *G. striata* (Jacq.) Urban, *G. martioides* Burkart, *G. neesi* DC. var. *australis* Malme, *G. pretiosa* Burkart var. *pretiosa, G. texana* (Scheele) A. Gray and *G. boavista* (Vell.) Burkart from Section *Collaearia*. *G. boavista*, *G. pretiosa*, *G. glacillima*, *G. neesi* var. *australis*, and *G. martioides* are distributed in the northeast of Argentina, while *G. dubia*, *G. texana*, and *G. glaucophylla*, are distributed in the northwest of Argentina. *G. striata*, *G. latisiliqua*, *G. benthamiana* and *G. longifolia* are distributed both in northeast and northwest, finally, *G. marginalis* can be found in north and central Argentina.

It is extremely difficult to distinguish some of the species because they are morphologically very similar.

In Argentina, a study of leaf anatomy (*G. latisiliqua, G. marginalis* and *G. glaucophylla*) as a complement to growth form studies (Basconsuelo *et al*., 1997), focused only on xeromorphic features, was recorded.

The present paper provides a description of anatomical characters in argentine *Galactia* species as well as an assessment of their taxonomic and ecological significance.

Material and methods

The samples (adult leaves) were collected from plants (10 species) within their distribution areas and from living plants obtained from seeds and grown at "Lucien Hauman" Botanical Garden, Faculty of Agronomy, Buenos Aires (34º 35'S, 58º 29'W), Argentine, since 1995 to 2000. Field material was fixed and stored in FAA. No material was available from four species: *G. dubia, G. longifolia, G. martioides* and *G. pretiosa* var. *pretiosa*.

Whenever possible, at least three specimens were sampled for each taxon. Mature terminal leaflets were selected for clearing and terminal-lateral leaflets for microtome sectioning.

Samples for permanent slides were dehydrated in ethyl series, embedded in paraffin wax, serially sectioned with a rotary microtome. The 10-15 μm thick transverse sections (median region of the leaflets) were stained with a safranine-fast green combination (D'Ambrogio, 1986) and mounted in Canada balsam.

To study epidermal tissues and venation, leaves were cleared in 5% NaOH and alcohol 96° solution (1:1, v/v) for 5 min at 90°C, bleached in sodium hypochlorite (50%, v/v) for 10 min, washed with distilled water and stored in Chloral hydrate (25%, w/v) until needed, and then were mounted in glycerin-jelly (Dizeo de Strittmatter, 1973). The leaves architecture was described following Hickey (1973).

The material was observed and drawn with a Wild M20 microscope. Photomicrographs and respective scales were taken on a Zeiss photomicroscope.

Supplementary studies were carried out on herbaria vouchers (BAA, SI, M, CTES).

The specimens marked with*, represent herbaria vouchers (BAA) of cultivated plants at the Faculty of Agronomy (See Appendix). The herbaria are cited sensu Holmgren et al., 1990 (Index Herbariorum)

Results

General leaf morphology

Phyllotaxis is generally alternate. The leaves are trifoliolate, except in *G. benthamiana*, *G. marginalis* and *G. boavista*, where the absence of the two basal leaflets determines a pseudo-single leaf.

Venation

The leaves venation is brochdodromous with pentagonal areoles and linear veinlets (Fig. 2 A).

Leaf anatomy -mesophyll and veins structure-

In general the dorsiventral mesophyll formed by 1-3 rows of palisade parenchyma and 1-2 spongy parenchyma cell layers with abundance of chloroplasts (Fig. 1 A & C). Central layers of mesophyll occupied by cells containing less chlorophyll, and often filled with tanniferous contents (Fig. 1 C), wich are coloured brown in dried material. The palisade cells sometimes present crystals, mostly solitary, rhomboedral or styloid (rod-shaped crystals) in shape.

The midveins of all species –except *G. boavista* (Fig 1 B)-consisting of a single vascular strand (Fig.

1 C & D) with a non-phothosynthetic parenchymatic tissue and a group of fibers (sclerenchyma). This parenchyma often presents cells with rhomboedral (Fig. 1 D) or styloid crystals. A group of a few cells of collenchyma is present in the vein rib on both sides of the vein beneath the epidermis (Fig. 1 D).

The leaves of *G. glaucophylla* (Fig. 1 C), *G. marginalis* (Fig. 1 A) and *G. texana* (Fig. 1 D) present abundant fibers surrounding the midvein and the small vascular bundles. *G. marginalis* presents conspicuous sclerenchyma at the marginal vein (Fig. 1 A).

An annular arrangement of opposite bundles surrounding a pith-like tissue occurs in the midvein of *G. boavista* (Fig. 1 B). The ground tissue has mucilaginous-tanniferous idioblasts (Fig. 1 B). An important hypodermis is observed at the main vein beneath the epidermis, at both sides of the leaf (Fig. 1 B).

Epidermis and stomata

• *Epidermal cells*

Transverse section. Cuticle well developed, variable in thickness (4,2 μm to 1,05 μm), *G. marginalis* (Fig. 1 A) and *G. texana* show the most thick ones (Fig. 1 D).

Cells uniseriate, irregularly shaped. Vacuoles often containing tanniferous substances (Fig. 1 B), specially observed in voucher materials.

Surface view. Amphistomatic leaf, with lower density of stomata at upper surface. Cells polygonal, 4-many sided, straight-walled (adaxial) and ondulate-walled (abaxial) (Fig. 2 B & C).

• *Stomatal complex*

Transverse section. Stomata dispersed randomly over adaxial surface, at same level of other epidermal cells (Fig. 1 C).

Surface view. Stomata anisocytic surrounded by 2-3 subsidiary cells (Fig. 2 C).

Foliar trichome types and lithocysts

Both epidermis present non glandular uniseriate trichomes with a variable (1-2) number of short basal cells and an elongated terminal cell (Fig. 2 C) and glandular trichomes (club-shaped) formed by 8-12 cells with a short stalk (Fig. 2 B). Abaxial surface trichomes often conspicuous (Fig. 2 B).

Our results are useful to prepare a key to the species, mainly based on the midrib structure.

Key to the species

A. Unifoliolate leaves

B. Midvein with an annular arrangement of several bundles surrounding a pith-like tissue. Perivascular fibers present.

G. *boavista* (Fig. 3 A)

BB. Midvein with a single collateral vascular bundle

C. Midvein with a non-phothosynthetic parenchyma around the bundle.

G. benthamiana (Fig.3 B)

CC. Midvein with sclerenchymatic tissue well developed (inner) and paren-chyma (outer) around the bundle.

G. marginalis (Fig. 3 C)

AA. Trifoliolate leaves

D. Midvein with a layer of no phothosyntetic parenchyma (endo-dermis)

E. With perivascular fibers

F. Perivascular fibres borde-ring phloem tissue, paren-chyma tissue bordering xylem

G. gracillima (Fig. 3 D)

FF. Perivascular and xylary fibers

G. With no-photosynthetic parenchyma extension

G. fiebrigiana (Fig. 3 E)

GG. Without parenchymatic extension. *G. texana* (Fig.3 F)

EE.without perivascular fibers

G. latisiliqua (Fig. 3 G)

DD. Midvein with sclerenchymatic tissue well developed (inner) and parenchyma (outer) around the bundle.

H. Midvein with narrow parenchymatic tissue without extensions. With perivascular fibers

G. striata (Fig. 3 H)

HH. Midvein with sclerenchymatic tissue well developed and extension to adaxial epidermis

I. Parenchyma tissue with idioblasts cells absents.

G. neesi (Fig 3 I)

II. Parenchyma tissue with idioblastic cells present

G. glaucophilla (Fig. 3 J)

Discussion

The foliage leaves of the following species, *G. benthamiana, G. boavista, G. fiebrigiana, G. glaucophylla, G. latisiliqua, G. marginalis* and *G. texana*, present epidermal cells with thin cuticle, and abundant trichomes, most fibers and clear dorsiventral mesophyll with high accumulation of crystals. (Fahn & Cutler, 1992). Most of these anatomical leaf features are associated with xeromorphy, and represent a defense against herbivory (Solbrig & Orians, 1977).

Basconsuelo *et al*. 1997, remarked these xeromorphic characters in *G. glaucophylla, G. latisiliqua, G. marginalis* and *G. texana*, and a reduction of the leaf blade. The leaf blade reduction is more important in *G. glaucophylla* and *G. marginalis*. The latter species occur in hilly environments, in rock fissures or in poorly developed sandy to gravel soils.

The anatomical features are not useful to define the Section Odonia species. All species have dorsiventral mesophyll, with subepidermal chlorenchyma, dense palisade below the adaxial epidermis and spongy one over the abaxial one. A single collateral bundle (midrib) surrounded by a parenchyma tssue and fibers, connecting the parenchyma with less collenchyma to the adaxial epidermis.

G. boavista, from Section *Collaearia* presents differences with the otherspecies midribs. An annular arrangement of opposite bundles surrounding a pith-like tissue occurs in the midvein of *G. boavista*. This structure was cited by (Metcalfe & Chalk, 1950), in other tribes of Fabaceae.

Further studies must be performed in other members of the same section.

Most leaves in tribe *Phaseoleae* are pinnately trifoliolate. The lateral leaflets are sometimes absent, producing an unifoliolate leaf, in what seems a random selection across the spectrum of the tribe (Lackey, 1978, 1983). Occasional specimens or species in genera which are essentially trifoliolate have more or less than three leaflets (eg. *Handerbergia, Rynchosia*) including *Galactia* (Lackey, 1983; Burkart, 1971).

In the monography about genus *Galactia* (Burkart, 1971), specimens with reduced basal leaflets are mentioned (eg. *G. benthamiana* Pedersen 5463, *G. dubia* Burkart 13.126) and *G. martii* with more than three leaflets.

The development of leaves (simple or compounds) is defined by the activity of several meristems provided by the shoot meristem. A group of genes is expressed to define the leaf morphology (Hofer & Ellis, 1998; Sinha, 1999; Chen *et al*., 1997). These genes and their interactions, rule the variation rate from simple to compound leaves (Hofer & Ellis, 1998; Marx, 1987).

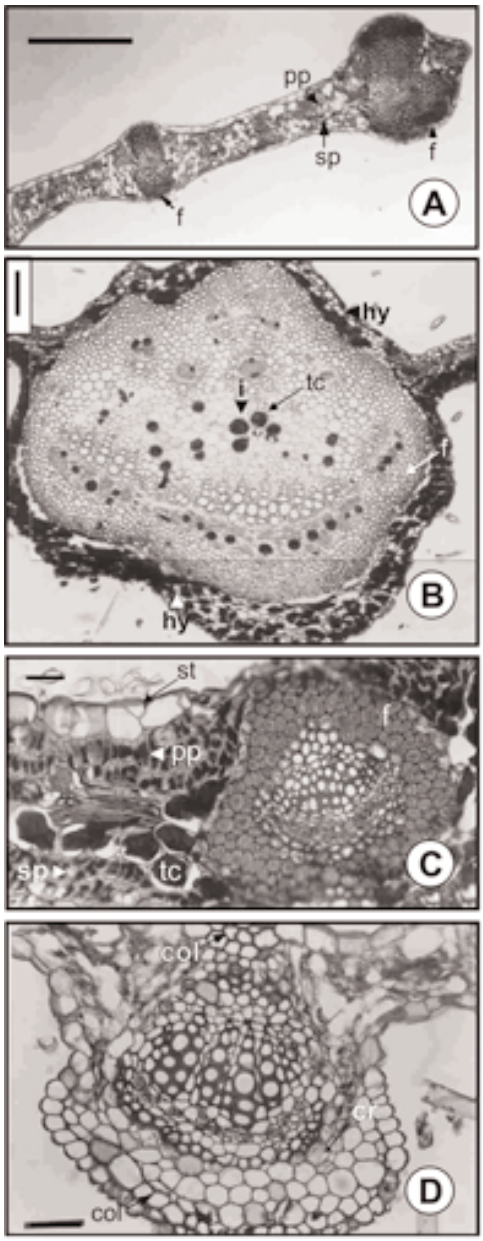

Fig. 1. A-D: Leaf and leaflets transverse section of *Galactia* species.

A. *Galactia marginalis*. Showing sclerenchymatic sheaths and conspicuous sclerenchyma at the marginal vein. **B.** *G. boavista*. Midvein with an annular arrangement of several bundles surrounding a pith-like tissue. Pericyclic fibers present. **C.** *G.glaucophylla* abundant fibers surrounding the midvein. **D.** *G. texana*. Midvein with a single vascular bundle surrounded by a layer of non-phothosyntetic parenchyma with crystals. Scale bars: **A** & **B** 110 μm; **C** & **D** 40 μm. References, col: collenchyma, cr: crystals, f: fibers, hy: hypodermis, i: idioblasts, pp: palisade parenchyma, sp: spongy parenchyma, st: stomata.

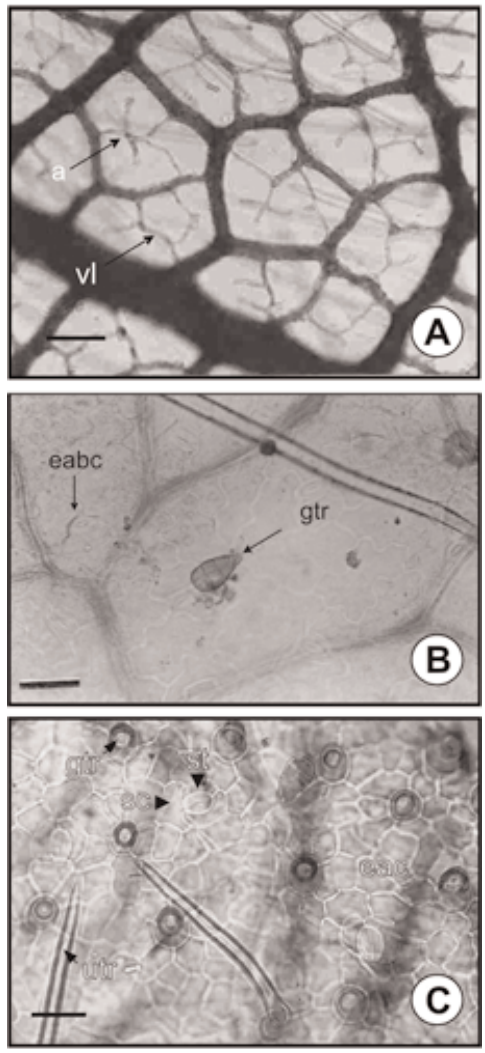

Fig. 2. A-C: Clarified leaves of *Galactia* species.

A. *G. neesi,* pentagonal areolas and linear veinlets. **B.** *G. texana*, venation and abaxial epidermis. **C.** *G. latisiliqua,* adaxial epidermis showing epidermal cells, anisocytic stomatas, glandular and non glandular trichomes. Scale bars: **A** 110 μm, **B** & **C** 40 μm. References, a: areoles, eabc: epidermal abaxial cells, eadc: epidermal adaxial cells, gtr: glandular trichomes, sc: subsidiary cells, st: stomata, st: stomata, utr: uniseriate trichomes, vl: veinlets.

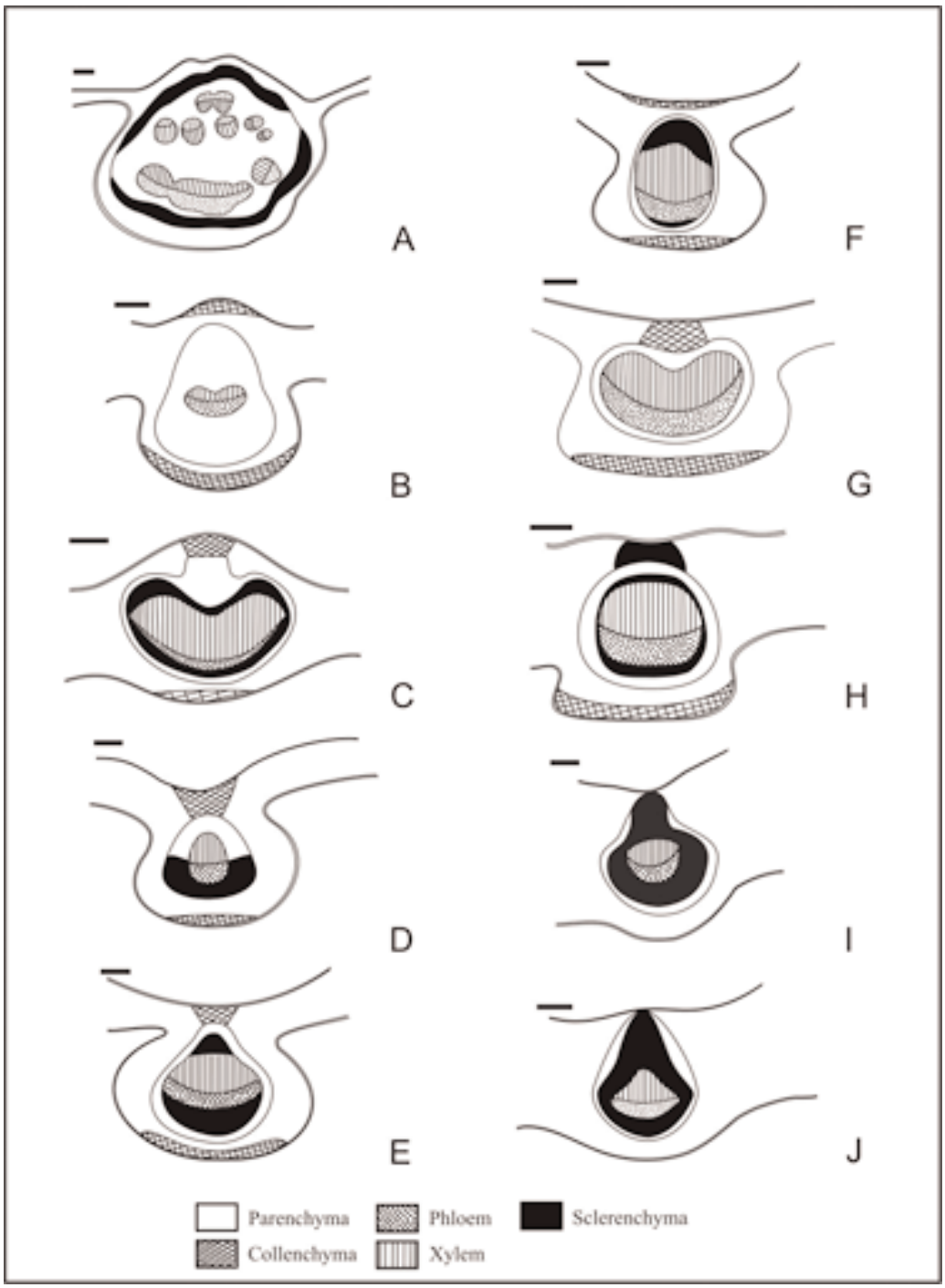

Fig. 3. Diagrammatic representation of midribs transverse sections. **A.** *Galactia boavista*. **B.** *G. benthamiana*. **C.** *G. marginalis*. **D.** *G. gracillima*. **E.** *G. fiebrigiana* **F.** *G. texana* **G.** *G. latisiliqua*. **H.** *G. striata*. **I.** *G. neesii*. **J.** *G. glaucophylla*. Scale bars: **A**, **C**, **D** & E 40 μm; **B**, **F**, **G**, **H** & **I** 110 μm.

Conclusions

We exhibit the importance of the transverse sections of main vascular bundles, due to their anatomical characters can be considered of taxonomic diagnostic value in the *Galactia* argentine species. We identified main vein 10 types, each for every species analized.

The blade reduction, the increase of sclerenchymatic tissue (sheath fibers, fibers by collenchyma as supporting tissue, perivascular fibers) are interpreted as a sequential increase in xeromorphism. These adaptive strategies associated with geographical distribution, can clearly be illustrated at species level (*G. glaucophylla, G. neesi, G. boavista)*.

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Appendix

Section *Odonia*. *G. benthamiana*. ARGENTINA. *Prov. Corrientes,* Dpto. Santo Tomé, 28º 27.174 S 55º 87.072 W 140 msm, 5/X/2001, Roitman y Pereyra s/n (en cultivo)*; Ruta 14, en las afueras de Sto.Tomé, 28º 26.956 S, 56º 06.455 W 128 msm, 24/III/2002, Roitman y Tourn s/n (BAA 24.836 y 24.837)*; cruce de Ruta 14 con la 40 a Colonia Pellegrini, 28º 21.361 S 56º 06.648 W, 109 msm, 26/III/2002, Roitman y Tourn s/n (BAA 24.842)*; Ruta 94 de Sto. Tomé a Garruchos, bañado grande Iburá Ocay, 28º 26.583 S 56º 00337 W, 25/III/2002, Roitman y Tourn s/n (BAA 24.838/40)*; *G. dubia*. ARGENTINA. *Prov. Jujuy*, Quebrada de Humahuaca, El Volcán, playa del Volcán a 2100 msm., planta rastrera, flor morada, 16/I/1918, Castillón 622.324 (SI); *Prov. Salta*, Campo Quijano, cerros, flores rojo-violetas, estambre vexilar libre desde el botón floral, raquis nodoso, 18/XI/1942, Burkart 13126 (SI). *G. fiebrigiana* var. c*orrentina*.ARGENTINA. *Prov. Corrientes***,** Dpto. San Roque, ruta 17, 33 Km SE de Saladas, en palmar de *Butia yatay*, suelo arenoso, Cáceres 429, 10/V/1995 (BAA)*; Dpto. Concepción: ruta 17, 10 Km E de Santa Rosa, en palmar de *Butia yatay*, suelo con arena colorada, Cáceres 434, 10/V/1995 (CTES)*; Tabay, en suelo arenoso, Krapovickas y Cristóbal, 28/I/1968 (SI); Dpto.Ituzaingó: Ituzaingó, Spegazzini, I/1947 (BAA 10063); Ituzaingó, II/1949, Martínez Crovetto y Leguizamón 5506 (SI); Dpto. San Miguel: ruta 17, 12 Km NE de San Miguel, gemifera, ramas mas o menos 2 m long. con los extremos volubles, en lomada arenosa, 10/V/1995, Cáceres 435, (CTES)*; ruta 17, 12 km NE de San Miguel, en lomada arenosa, 10/V/1995, Cáceres 436 (CTES)*; *Prov. Entre Ríos*, Dpto. Concordia, Ayuí, muy parecida a *G. latisiliqua*, 14/XI/1979 *G. fiebrigiana* var. *fiebrigiana*. ARGENTINA. *Prov. Salta*, Dpto. Sta. Victoria, Sta. Victoria, perenne, acostada, flor violeta, 8/II/1956, Hjerting et al. 152 (SI); I/1968 , Bolsi et al. 4 Bis (SI). BOLIVIA.

Rua y Aagesen 6, GHR 319 (BAA 23.308). *G. glaucophylla*. ARGENTINA. *Prov. Córdoba*, Dpto. San Alberto, entre Mina Clavero e Icho Cruz, 2/II/1980, Cusato s/n (BAA 17.125); Dpto. Punilla, camino a San Marcos Sierra, 4/II/2002, Roitman et. al, s/n. (BAA 24.814)*; *Prov. San Luis*, Dpto. Capital, Los Puquios, Serranía junto al arroyo, 15/I/1984, Valla s/n (BAA 18.949). *G. gracillima*. ARGENTINA. *Prov. Corrientes,* Dpto. Santo Tomé, Santo Tomé, 14/V/2001, Roitman y Castillo s/n (BAA 24710)*, Ruta 14, en las afueras de Sto.Tomé, 28º 26956 S, 56º 06455 W, 128 msm, 24/III/2002, Roitman y Tourn s/n (BAA 24.835)*. *G. latisiliqua*. ARGENTINA. *Prov. Corrientes*, Dpto. Empedrado, Arroyo Riachuelo y ruta 12. Obs. en lomada arenosa, flores violáceas, 1/III/1995, Cáceres 428 (CTES)*; *Prov. Córdoba*, Dpto. Punilla, Los Cocos, 4/II/2002, Roitman et al. s/n (BAA 24.813)*; El Zapato, 4/II/2002, Roitman et al. s/n (BAA 24.811)*; Cascada de Olaen, 6/II/2002, Roitman et al. s/n (BAA 24.810)*; *Prov. Entre Ríos*, Dpto. Colón, Pque. Nac. El Palmar, frente a la Intendencia, 9/V/2000, Roitman y Tourn s/n (BAA 24711)*; Pque. Nac. El Palmar, cantera frente a la bajada de la Selva en galería, 12/I/2001, Roitman y Tourn s/n (BAA 24713)*; Dpto. Concordia, Parque Bernardino Rivadavia, suelo arenoso-pedregoso, cercano al estacionamiento, 10/V/2000, Roitman y Tourn s/n (BAA 24.486)*; Parque Bernardino Rivadavia, suelo arenoso-pedregoso, cercano al estacionamiento, 11/I/2001, Roitman y Tourn s/n, (BAA 24.712)*. URUGUAY. *Dpto*. *Salto*. Arenitas Blancas, 30/X/2001, Roitman y Tourn s/n, (BAA 24.812)*. Cultivo Jardín Botánico "Lucien Hauman", ejemplar BAA 24.712. Cosecha: 2/IV/2002. *G. longifolia*. ARGENTINA. *Prov. Entre Ríos,* Dpto. La Paz, ruta de acceso a Sta. Elena, saliendo de ruta 126, 29/I/1981, Troncoso 3054 (SI); La Paz, vías férreas, 18/I/1960, Burkart 21.222 (SI); *Prov. Formosa*, Dpto. Pilcomayo, Parque Nacional Río Pilcomayo, 21/III/1984, Cusato 3401 (BAA); Dpto. Laishi, Puerto Vélaz, a lo largo del Río Bermejo, X/1976, Morgan 8 (BAA). *G. marginalis*. ARGENTINA. *Prov. Buenos Aires*, Pdo. Carlos Casares, 4 km al SW de Hortensia, vías de FFCC, en pajonal de *Eryngium* y *Stipa*, flores lilacinas, 13/I/1987, León 3759 (BAA); Pdo. Coronel Suárez, Villa Arcadia, en cerros bajos próximos al Arroyo Sauce Corto, Balneario Los Angelitos, 13/I/99, Seijo 1397 (CTES 306.573); *Prov. Córdoba*, Dpto. Punilla: El Zapato, 10/X/2000, Roitman y Castillo s/n (BAA 24714)*; El Zapato, 4/II/2002, Roitman et al. s/n (BAA 24.816)*; Cascada de Olaen, 6/II/2002, Roitman et al. s/n (BAA 24.817)*; *Prov. Corrientes*, Dpto. Santo Tomé, Aº Pariopá, en terrenos inundables de la cuenca del arroyo, flores lilas, 21/I/1983, Guglianone et al. 810 (SI); Ruta 94 de Sto. Tomé a Garruchos, bañado grande, 28º 26.583 S 56º 00337 W, 25/III/2002, Roitman y Tourn s/n (BAA 24.834)*; *Prov. Entre Ríos*, Dpto. Colón, Pque. Nac. El Palmar, pastizal en Prefectura y en Cantera Salvia, 9/IV/1982, Cusato et al. 1213 (BAA); Pque. Nac. El Palmar, pastizal con suelo areno-pedregosos, en el camino vehicular a las ruinas de Barquín, 11/I/2001, Roitman y Tourn s/n (BAA 24708 y BAA 24.815)*. *G. martioides*. ARGENTINA. *Prov. Misiones*. Dpto. Candelaria, Bonpland, X/1906, van de Venne (SI 7483). *G. neesi* var. *australis*. ARGENTINA. *Prov. Corrientes*, Dpto. Santo Tomé, Gobernador Virasoro, NE de la provincia, XI/1966, INTA Castelar (SI 26.388); 8km E de Gobernador Virasoro, camino a Garruchos, en campo alto con *Butia yatay*, flores celestes, 5/XII/1970, Krapovickas et al. 17.121 (BAA); 28º 27.155 S 55º 87.070 140 msm , 5/X/2001, Roitman y Pereyra s/n (en cultivo)*. *G. pretiosa*. ARGENTINA. *Prov. Misiones*, Dpto. San Ignacio, Teyucuaré, en sabana pedregosa, planta erecta, flores violáceas,13/II/1945, Burkart 15.325 (SI). *G. striata*. ARGENTINA. *Prov. Corrientes*, Dpto. San Martín, Yapeyú, en matorral costero, voluble, flores lilas, 28/I/1976, Krapovicas y Cristóbal 28988 (SI); Yapeyú, en matorral costero, voluble, flores lilas, 24/III/2002, Roitman y Tourn s/n (BAA 24.841)*; *Prov. Entre Ríos*, Dpto. Colón, Pque. Nac. El Palmar, playa cercana a las Ruinas de Barquín, flores blancas, 9/V/2000, Roitman y Tourn s/n (BAA 24.484)*; Pque. Nac. El Palmar, playa cercana a las Ruinas de Barquín, flores lilas, 10/I/2001, Roitman y Tourn s/n (BAA 24706)*; Dpto. Concordia, Parque Bernardino Rivadavia, en cercanías de la playa, 10/V/2000, Roitman y Tourn s/n (BAA 24491)*; Parque Bernardino Rivadavia, en cercanías de la playa, 29/III/2000, Roitman y Tourn s/n (BAA 24.709)*; Parque Bernardino Rivadavia de la ciudad de Concordia, enredadera en bosques ribereños, 21/I/1997, Muñoz 4400 (SI); *Prov. Jujuy*, Dpto. El Carmen, entre Barro Negro y San Juancito, planta voluble, 19/III/1979, Cabrera et al. 30282 (SI). Cultivo Jardín Botánico " Lucien Hauman", semillas del ejemplar Rúa 395 , cosecha 3/10/00 (BAA 24096)*. *G. striata* var. *tenuiflora*. ARGENTINA. *Prov. Misiones*, Dpto. San Pedro, ruta 17, 25 km al este de El Dorado, 29/I/1983, flor lila, Guglianone et al. 1082 (SI). *G. texana*. ARGENTINA. *Prov. Córdoba*, Dpto. Cruz del Eje, Cruz del Eje, 27/II/1992, Munin s/n (BAA 22.187). *Prov. La Rioja*, Dpto. Gral. Belgrano, 9/I/1964, Olta et al. s/n (BAA 3728). *Prov. San Luis*, Dpto. Ayacucho, Luján, II/1995 , Roitman s/n (BAA 24715)*. Section *Collaearia*. *G. boavista*. ARGENTINA. *Prov. Misiones*. Dpto. San Ignacio: Santo Pipó, planta rasa, flor violácea, 20/X/1947, Schwarz 4980 (SI); San Ignacio, 1914, Giambiagio s/n (SI 7480); San Ignacio, camino a Teyucuaré, salida a Osonunu, 27º 16.664 S 55º 33.561 W, 25/III/2002, Roitman y Tourn s/n (BAA 24.844/47)*.