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Famatinanthus, a New Andean Genus Segregated from *Aphyllocladus* (Asteraceae)

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Abstract*—*Famatinanthus, a new genus of Asteraceae (Mutisioideae, Onoserideae), is described and illustrated to accommodate one species from the Andes of Argentina, that was previously placed in *Aphyllocladus*, *A. decussatus*, as ***Famatinanthus decussatus*** comb. nov. The new genus is tentatively assigned to the tribe Onoserideae based on its shrubby habit, solitary radiate capitula, style rounded at the apex and dorsally papillose, and 2–3-seriate heteromorphic pappus. *Famatinanthus* is similar to *Aphyllocladus* but it is easily distinguished by the leafy, decussate branches with opposite leaves, multistoried T-trichomes, cream corollas, apiculate apical anther appendages, setuliferous achenes, terete stems, lack of secretory cavities, and pollen with a conspicuous mesoaperture and microechinate-rugulate exine. A key to the genera of the Onoserideae is presented. Affinities of the new genus with other genera of the tribes Gochnatieae, Hyalideae, and Stifftieae are also discussed.

Keywords—Argentina, Asteraceae, La Rioja, Sierra de Famatina, taxonomy.

The genus *Aphyllocladus* Wedd. has been traditionally included in tribe Mutisieae Cass., subtribe Gochnatiinae Benth.& Hook. f. (Cabrera 1977), Mutisiinae Less. s. l. (Mutisiinae s. s. plus Gochnatiinae, Bremer 1994), or in the subfamily Mutisioideae (Cass.) Lindl., tribe Mutisieae Cass. (Hind 2007, Katinas et al. 2008), based on the disc florets with deeply 5-lobed corollas, and anthers with an apical appendage several times as long as wide and basally caudate. In recent molecular studies of the Asteraceae, *Aphyllocladus* is placed in tribe Onoserideae Solbrig, subfamily Mutisioideae (Panero and Funk 2008). The genus was established by Weddell (1855: 11) principally based on its rapidly falling alternate leaves. It currently comprises five species distributed in the Andes of Bolivia, Chile and Argentina, i.e. *A. decussatus* Hieron., *A. denticulatus* (J. Rémy) Cabrera, *A. ephedroides* Cabrera, *A. sanmartinianus* Molfino, and *A. spartioides* Wedd.; *A. decussatus* remained poorly understood (Cabrera 1951) due to insufficient collecting.

In 2011, during field trips to La Rioja Province (Argentina), two of us (G. B. and J. J. C.) discovered populations of *Aphyllocladus decussatus* growing abundantly in metasediments of the Sierra de Famatina complex in northwestern Argentina (Miller and Söllner 2005). This species is sympatric with *Gochnatia glutinosa* (D. Don) Hook. & Arn. and both are easily confused at first sight by their shrubby and glutinous habit, their persistent leaves and their cream corollas.

At first examination, *A. decussatus* is distinct from the remaining species of *Aphyllocladus* by having conspicuously leafy stems (Figs. 1C, D). Although the specimens we gathered matched the morphological features stated in the protologue of this species (except for the cream corollas and not lilac as Hieronymus stated in Hieronymus 1886: 37), it was difficult to confirm the identity of this taxon since only a photo ex B of an isotype (probably destroyed) was available. Subsequently, one of us (L. A. E.) located a second isotype at GH and more recently, at CORD, mixed within unidentified specimens of the Mutisieae, we fortunately found the original material on which Hieronymus based his description of *A. decussatus*. These findings prompted us to investigate the identity of *A. decussatus*.

Our analyses of floral characters (i.e. corollas, anthers, style branches, achenes), trichomes, stem anatomy, and pollen, indicate that *A. decussatus* has a combination of features that do not correspond with the circumscription of *Aphyllocladus* or any other genus within the Onoserideae nor Mutisioideae. Consequently, a new genus, *Famatinanthus* is proposed to accommodate *A. decussatus*.

The objective of this paper is to describe the new genus *Famatinanthus*, provide the necessary combination, and compare it with related genera.

Materials and Methods

***Morphological and Anatomical Observations*—**The present taxonomic study is based on field observations of live plants and the analysis of morphological features as seen in herbarium specimens. Field observations and morphological examination using stereomicroscopy, light microscopy (LM) and scanning electron microscopy (SEM) were carried out on preserved and dried material including the type specimens. Stem, leaves and florets of *A. decussatus* were fixed in formalin-acetic acid-alcohol (FAA). Vegetative organs were dehydrated through an ethyl alcohol/xylol series, embedded in Paraplast plus and serially cut in cross-sections (10 μm thick) using a rotary microtome. Histological serial sections were mounted, and stained with Astra blue and basic fuchsin (Kraus et al. 1998). Trichomes were analyzed from epidermal peels of the different organs. In stem anatomy, the tissues are represented following the classical symbols of Metcalfe and Chalk (1950).

***Palynological Analysis*—**Pollen material was obtained from anthers of herbarium specimens and fixed in FAA (capitula just before anthesis). Samples for LM study were mounted in gelatine; for SEM, non-acetolysed and acetolysed grains were mounted on small stub in a drop of 96% alcohol, and allowed to dry. Acetolysis was made following Erdtman's method (Erdtman, 1960). Samples were coated with gold and examined using a JEOL JSM 35 CF scanning electron microscope (LABMEM, Universidad Nacional de San Luis, Argentina) .The measurements given are based on 15 non-acetolysed pollen grains of type specimen and the collections obtained in the field. Descriptive terminology follows Punt et al. (2007).

Results

***Anatomical Analysis*—**Stem—Circular outline in transverse section (Figs. 2A, C). Primary structure with a single epidermis, a 8–12-layered cortex consisting of collenchyma

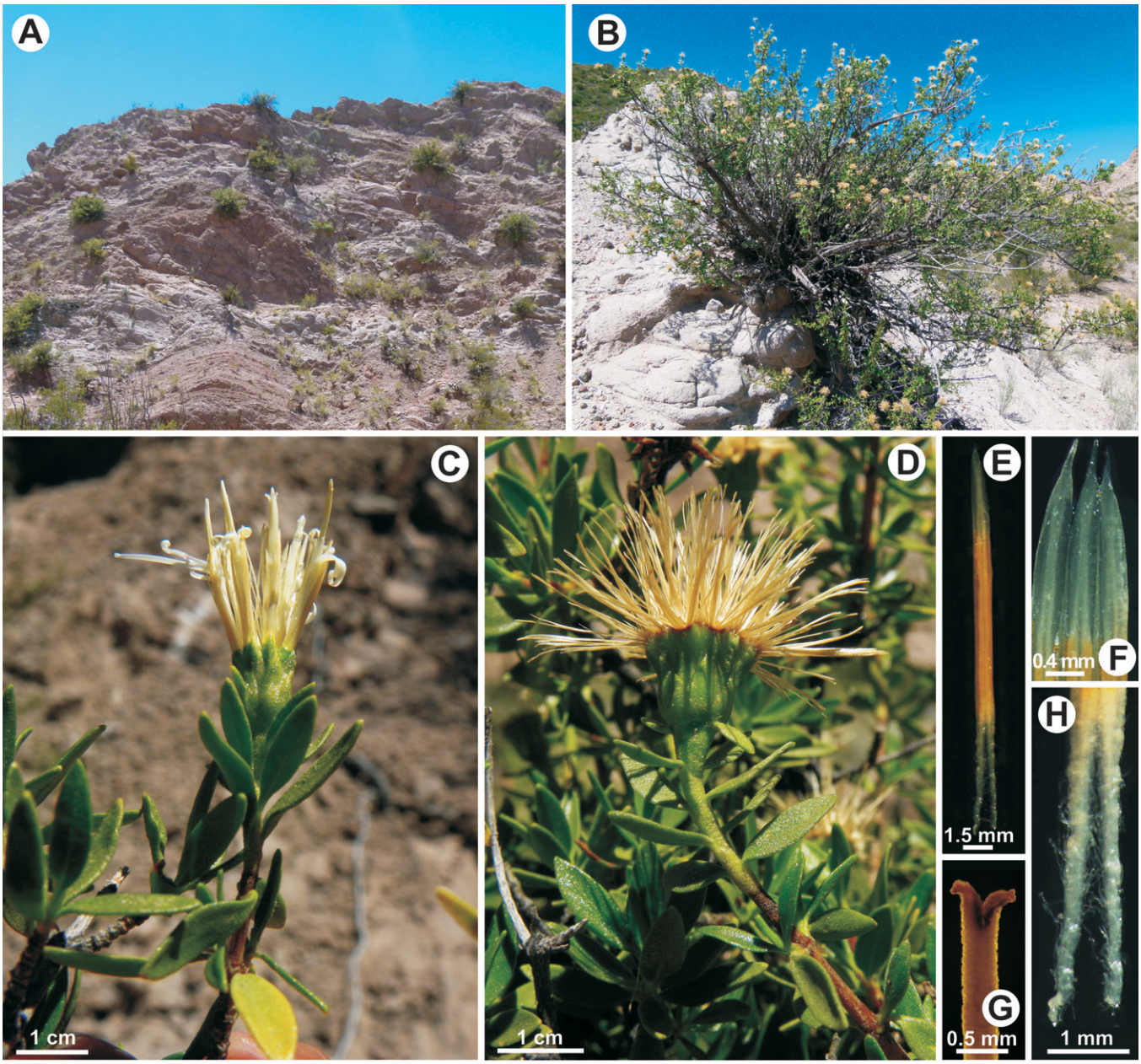

FIG. 1. *Famatinanthus*. A. Habitat in Sierra de Famatina. B. Plant. C. Capitulum. D. Capitulum with immature fruits. E. Anther. F. Apex of three anthers showing the apiculate apical appendages. G. Style apex. H. Anther tail, long pilose.

(1–2 layers) and starchy parenchyma (6–10 layers), and a eustele usually with ca. 14 vascular bundles around a central parenchymatous pith (Fig. 2A). Each bundle is collateral, with a crescent-shaped group of fibers at the outer boundary of the phloem (Fig. 2B), cambium between phloem and xylem and phellogen between fibers and phloem; the latter meristematic tissue will give rise to the peridermis (Fig. 2D). Secondary structure with the persistent degenerating epidermis and primary cortex followed by a secondary cortex (peridermis), a well-developed siphonostele and a pith of thick-walled pitted sclerified cells (Figs. 2C–E). The peridermis consists of a slightly lignified 5–7-layered parenchyma with groups of 30–75 thick-walled pitted sclerotic fibers (Fig. 2D); the secondary phloem also contains groups of fibers (Fig. 2E); xylem with very small vessels (less than 50 μm diam) and abundant fibers similar to the peridermis (Fig. 2E). Secretory cavities are absent (Figs. 2A, C).

LEAVES—Epidermis unistriate, with raised stomata and glandular and eglandular trichomes on both surfaces (Figs. 2F, G). Mesophyll isolateral, with 3–4 layers of compact palisade tissue towards both surface and 10–12 layers of scarcely loose spongy tissue of rounded cells (Figs. 2G, H). Vascular bundle of the main vein with a sheath of starchy parenchyma (Fig. 2G).

STOMATA AND TRICHOMES—Stomata and trichomes are present on stem and leaf. Stomata are very peculiar since they always appear strongly raised with curved outer stomatal cuticle ledges and a large substomatal chamber (Figs. 2A, F, G, I). Conversely, glandular trichomes are sunken on the epidermis (Figs. 2H, 3C).

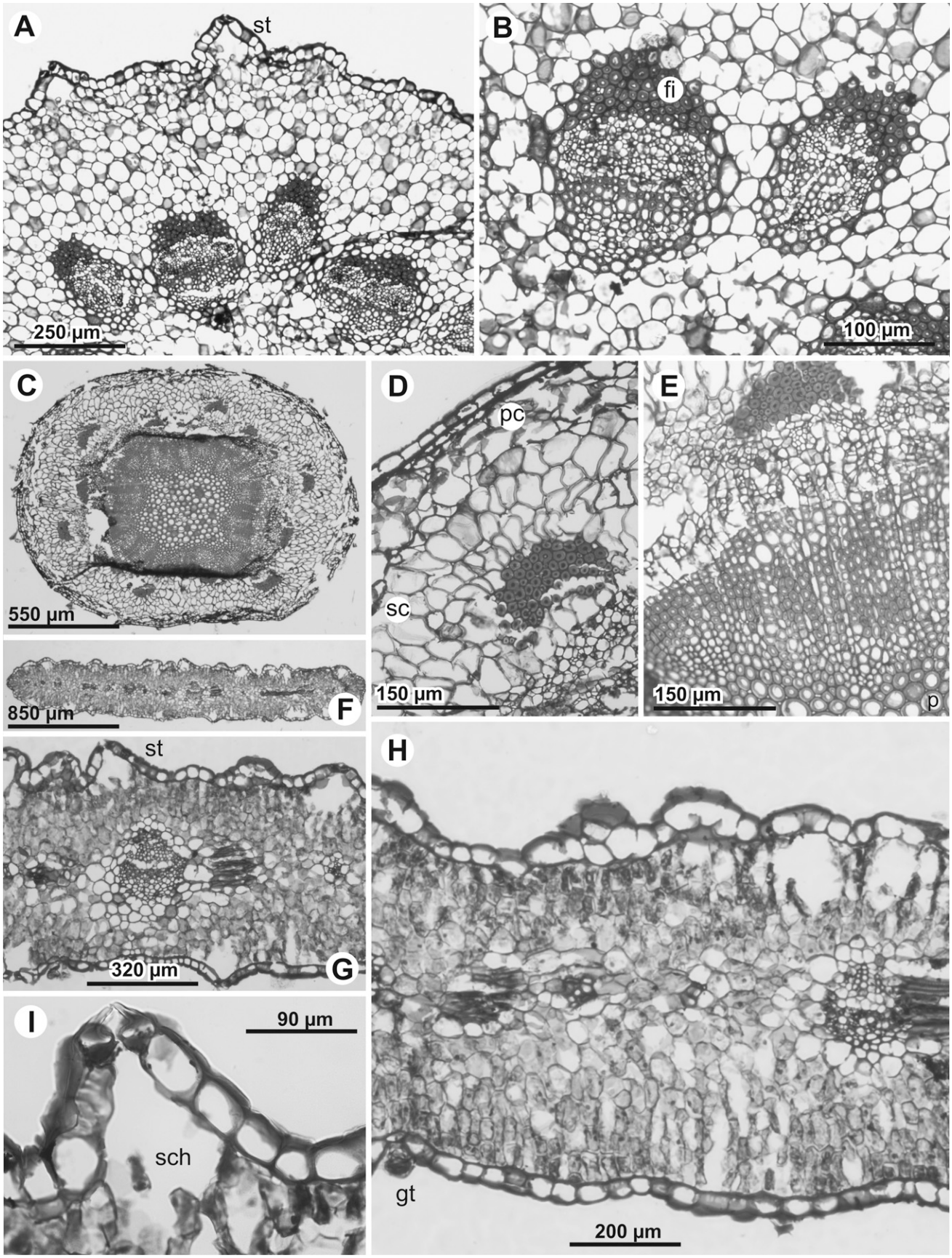

FIG. 2. *Famatinanthus decussatus* (A, B: *Barboza et al.* 3307; C–H: *Barboza et al. 2846*). A. Sector of young stem in cross section. B. Detail of the vascular bundles. C. Mature stem in cross section. D. Detail of primary and secondary cortex. E. Detail of vascular tissues and sclerified pith. F. Leaf outline in transverse section. G. Detail of main veins. H. Detail of mesophyll. I. Raised stomata with large substomatal chamber. Abbreviations: st, stomata; fi, fibers; pc, primary cortex; sc, secondary cortex; p, sclerified pith; sch, substomatal chamber; gt, sunken glandular trichome.

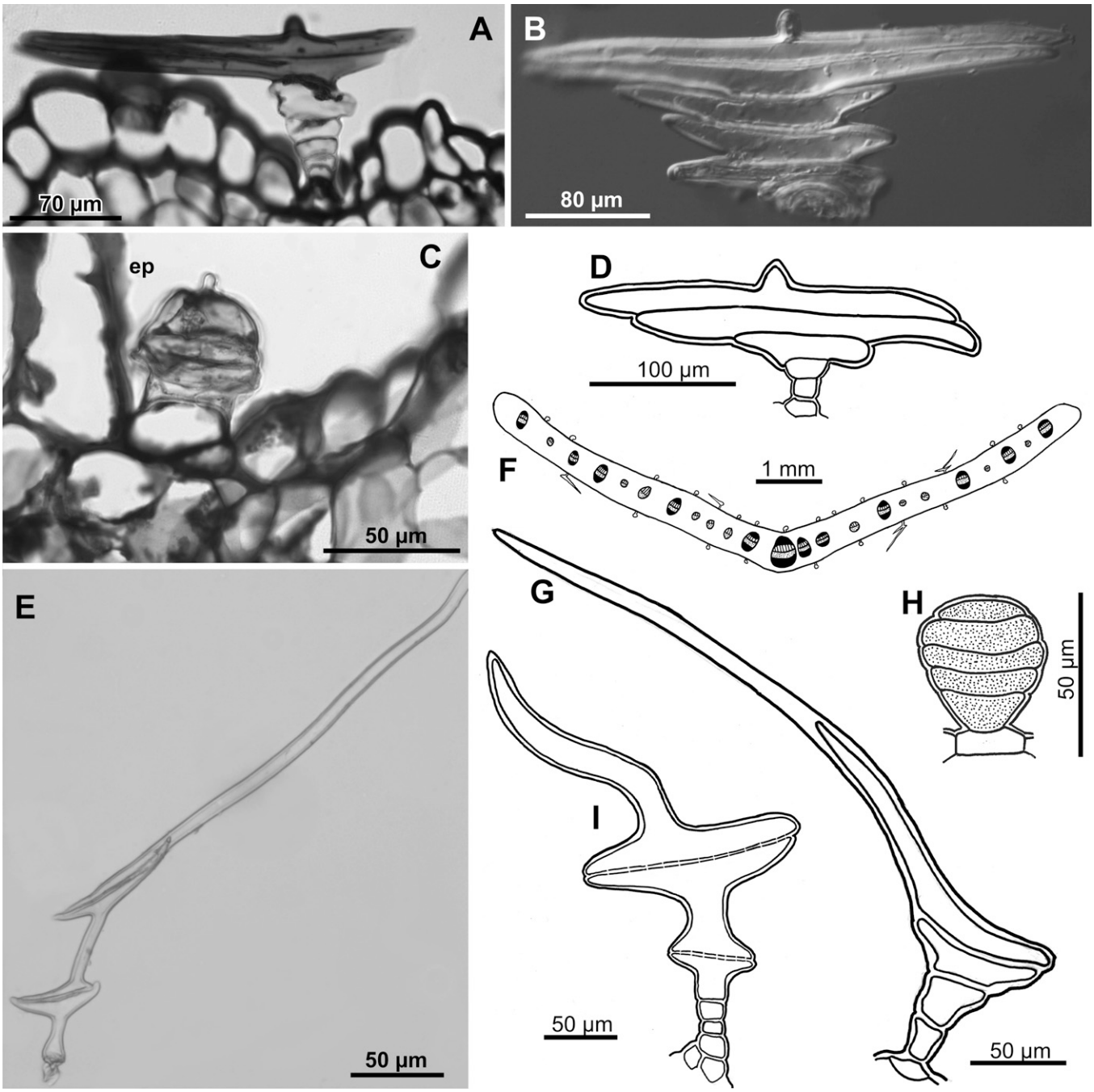

FIG. 3. A–D, H. *Famatinanthus decussatus* (*Barboza et al. 3307*). A, B, D. Multistoried T-shaped trichomes showing different numbers of cells in the stalk and head. C, H. Glandular trichomes. E–G, I. *Gochnatia glutinosa* (*Barboza et al.3306*). E, G, I. Double T-shaped trichomes. F. Leaf outline in transverse section.

Two different types of trichomes are observed: a) Eglandular, multistoried T-shaped trichomes, ca. 150 µm long, with a long uniseriate 2–6-celled stalk and a head comprised of 2–5 one-celled overlapping horizontal layers, the distal cell with a very short branch (Figs. 3A, B, D); this unusual trichome has only been cited for *Ianthopappus* Roque & D.J.N. Hind (tribe Hyalideae) (Melo-de-Pinna and Menezes 2002; Freire et al. 2002) and for *Dresslerothamnus* H. Robinson (tribe Senecioneae) (Robinson 1989); b) Many tiny glandular trichomes are sessile or with a short unicellular stalk and a multicellular globose head (Figs. 3C, H), sunken in the leaf and stem surface and being responsible for the secretion of essential oils (Zygadlo pers. comm.).

Palynological Analysis—Pollen radially symetrical, isopolar; prolate-sphaeroidal; circular in polar view (Fig. 4A), subsphaeroidal outline in equatorial view (Fig. 4C). Size medium to large (P × E = 45–56 µm × 42–47 µm). Tricolporate; mesoaperturate conspicuous (Fig. 4H). Ora 10–12 µm diam. Colpi long with acute ends (Fig. 4A), 38–47 µm long; membrane microgranulate, margins smooth or punctuate (Figs. 4B–D, F). Exine uniformly thickened, ca. 4 µm (Fig. 4G), tectate; sexine 2.5–3 times thicker than the nexine, slightly

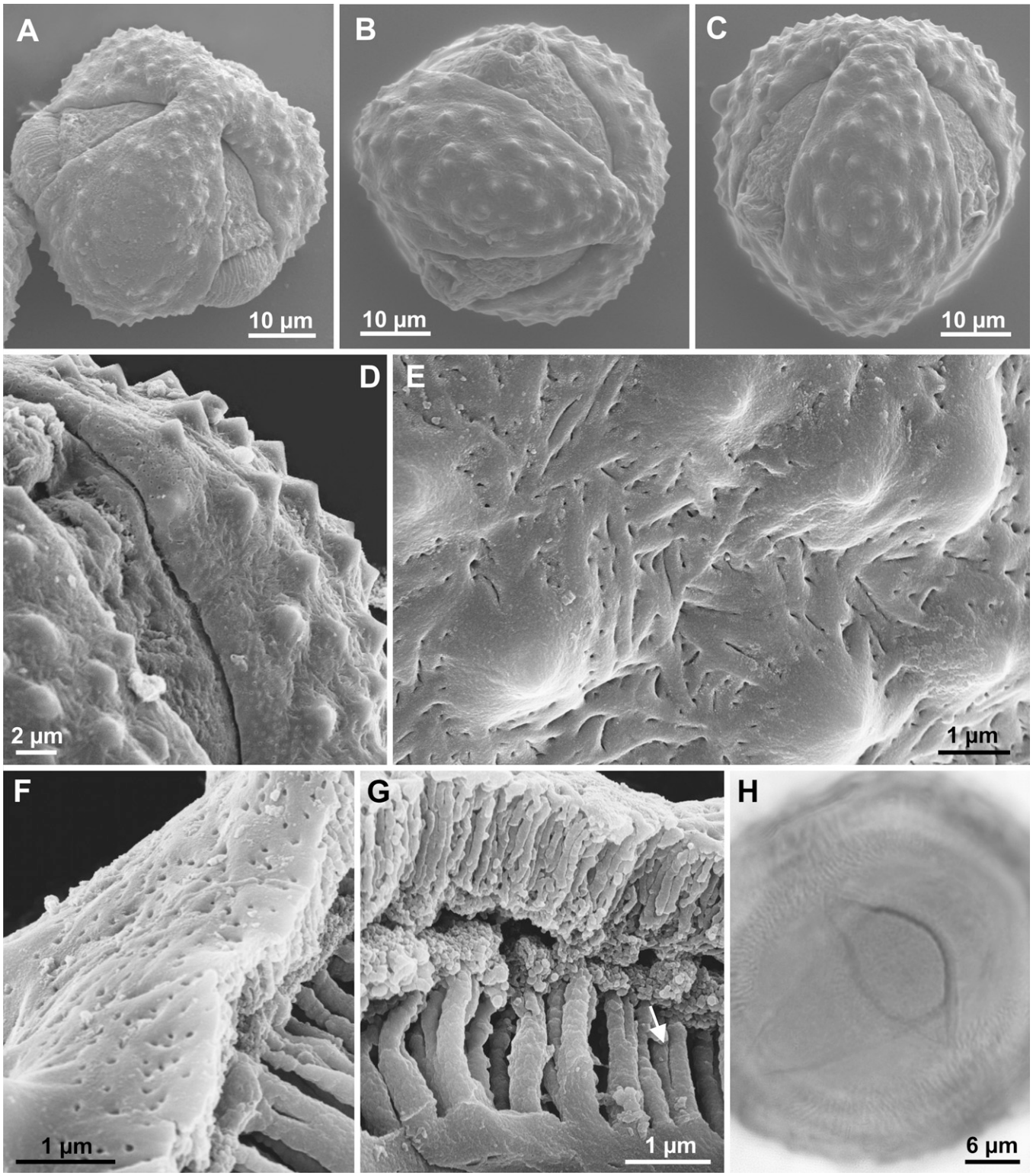

Fig. 4. A–H. Pollen of *Famatinanthus decussatus* (*Barboza et al. 2846*). A–C, H. Non acetolysed pollen grains. D–G. Acetolysed pollen grains. A. SEM polar view. B, C. SEM equatorial views. D. SEM detail of an aperture margin. E. SEM detail of the exine ornamentation in the mesocolpium. F. SEM detail of the exine ornamentation near the aperture. G. Structure of the exine showing the compact ectosexine and the endosexine with ramified columnellae (white arrow). H. Optical view of the mesoaperture.

thinner in the polar area, clearly stratified into a compact ectosexine and an endosexine with ramified columellae (Fig. 4G); nexine thickened at the apertures and forming costae. Tectum microechinate-rugulate (Figs. 4D, E), spines ca. 1.5 µm. (Fig. 4D).

Taxonomic Treatment

Famatinanthus Ariza & S. E. Freire, gen. nov.— TYPE: *Aphyllocladus decussatus* Hieron. = *Famatinanthus decussatus* (Hieron.) Ariza & S. E. Freire.

Famatinanthus is distinguished from *Aphyllocladus* by its conspicuously leafy stems with opposite leaves, multistoried T-trichomes, florets with cream corollas, apiculate apical anther appendages, prolate to sphaeroidal pollen, and setuliferous achenes.

Branched shrubs, young stems pubescent, old stems subglabrous, peridermis black with age. Leaves opposite, simple, sessile; blades small, coriaceous or subcoriaceous, elliptic to linear-obovate, pinnately veined, margins entire. Capitula solitary at tip of branches, homogamous, radiate, sessile; involucre campanulate; phyllaries 3-seriate, imbricate, gradate; receptacle naked. Florets 10 or 11, dimorphic, hermaphrodite, corollas cream. Marginal florets 5 or 6, corolla bilabiate, with an outer 3-toothed limb, inner lip deeply 2-lobed, lobes linear and coiled. Disc florets 5 or 6, corolla deeply 5-lobed, lobes coiled, glabrous; anthers 5, sagittate, tails long, pilose, apical appendages apiculate; style shortly bifid, lobes rounded at apex with an extension of stigmatic surface and dorsally papillose beyond point of bifurcation. Achenes turbinate, setuliferous; carpopodium short-cylindrical; pappus bristles 2–3-seriate, setae barbellate with a reduced number of outer thin short bristles, longest relatively wide and flat, apices of both types subplumose. Pollen tricolporate, prolate to sphaeroidal, exine microechinate-rugulate.

Etymology—The generic epithet refers to the restricted geographical distribution of the species in the Sierra de Famatina (La Rioja, Argentina).

Famatinanthus decussatus (Hieron.) Ariza & S. E. Freire, comb. nov. *Aphyllocladus decussatus* Hieron., Icon. Descr. Pl, Table 5, f. 1, A-S. 1885; Actas Acad. Nac. Ci. Córdoba 2(1): 37. 1886.—TYPE: ARGENTINA. La Rioja. Famatina: Los Corrales, Sierra de Famatina, 10 Feb 1879, *G.* [*H. E. W.*] *Hieronymus & G. Niederlein 831* (lectotype here designated: CORD 00006717!; isolectotypes: CORD 00006718!, GH 00002308!, B^+, photo 15873 ex B: LP!, CORD!).

Shrubs 1.5–1.8 m tall, pubescent with multistoried T-shaped trichomes. Branches divaricate, decussate. Leaves opposite, sessile, coriaceous or subcoriaceous, blades 9–13 × 2–4 mm, elliptic to linear-obovate, base short-attenuate, margins entire, apices acute, pinnately veined. Capitula solitary, homogamous, radiate, sessile; involucre ca. 8 × 10–12 mm, campanulate; phyllaries 3-seriate, outer phyllaries ca. 3 × 1.8 mm, ovate, apex acute to acuminate, dorsally pilose, inner phyllaries ca. 8 × 2–2.2 mm, oblong, apices acute to acuminate, subglabrous. Florets 10 or 11, dimorphic, corollas cream. Marginal florets 5 or 6, corollas 16–17 mm long, bilabiate, with an outer 3-toothed limb 9.5–10 × 1.3–1.5 mm, inner lip deeply 2-lobed, lobes 9.5–10 × 0.3–0.5 mm, linear and coiled. Disc florets 5 or 6, corollas 15–15.5 mm long, tubulose, deeply 5-lobed, lobes 7–8 mm long, coiled, glabrous at apices; anthers ca.10.5 mm long, entirely cream, apical appendages 9–10 mm long, apiculate; tails 1.8–2 mm long, long-pilose; style branches ca. 0.3 mm long. Achenes 5–6 × 1–2 mm, turbinate, setuliferous, setulae of duplex trichomes with apical cells equal or slightly differing in length, apex forked; carpopodium short-cylindrical; pappus bristles 3–12 mm long, 2–3-seriate, barbellate with a reduced number of outer thin short bristles, longest relatively wide and flat, apices of both types of bristles subplumose. Pollen tricolporate, prolate to sphaeroidal (P × E = 45–56 μm × 42–47 μm), exine microechinate-rugulate. Figures 1, 4, 5.

Phenology—Flowering from December to February.

Vernacular Name—It is known as sacansa.

Use—It is used as an anti-slip for saddle horse (fide local people).

Distribution and Habitat—*Famatinanthus decussatus* grows on soils derived from the *Agua Colorada* geological formation (Fig. 1A) of the Sierra de Famatina complex (Miller and Söllner 2005), in northwestern Argentina, at 1,800–2,500 m. The vegetation of this area is dominated by sparse spiny shrubs, cacti, and dwarf shrubs typical of the Monte phytogeographical Province as defined by Cabrera (1976). Associated species found with *Famatinanthus* include *Flourensia hirta* S. F. Blake and *Gochnatia glutinosa* plant communities (Fig. 6).

Conservation Status—This species is an endemic with a restricted geographical distribution in the Sierra de Famatina. Only small parts of this mountain system are officially protected, the main threats to the ecosystem being mining, damage caused by off-road vehicles, and poorly managed livestock grazing. Following IUCN (IUCN 2013), we suggest that this species be assigned a conservation status of vulnerable (VU). It meets criterion B.2: its geographic range, in the form of area of occupancy, is estimated to be less than 2,000 km^2, it is known to exist at no more than 10 locations, and a continuous decline is observed in its extent of occurrence.

Observations—The label of the *Aphyllocladus decussatus* isolectotype specimen at GH (http://plants.jstor.org/specimen/gh00002308) was wrongly transcribed as '*Hieronymus et Niederlein 931*", instead of "831", and "Los Corrales; Tierra Faniatina" instead of "Sierra Famatina".

In the field, *F. decussatus* is easily recognized because of the blackish colour and pulverulent aspect of their branches. This feature was cited by Hieronymus (1886) when describing the species. Microscope observations revealed that mycelia and spores of a sooty mold (Kingdom Fungi, Div. Ascomycota, Subph. Pezizomycotina, Cl. Dothideomycetes, Subcl. Dothideomycetidae) are responsible for the blackish coloration (L. Domínguez pers. comm.).

In addition, we observed some floret stamens without anthers but with filaments, so although these florets appear to be female (true functionally female florets usually have staminodes) their apparent unisexuality is probably to the result of insect herbivory.

Additional Specimens Examined—ARGENTINA. La Rioja: Famatina. Pampa de Achavil, pasando el Rio Achavil rumbo a Tres Piedras, 28°49′17″S, 67°42′29″W, 2,448 m, 3 Feb 2011, *Barboza et al. 2846* (CORD); at the same place, 28°49′16″, 6″; 67°42′22″, 6″, 2,444 m, 20 Dec 2011, *Barboza et al. 3329* (CORD); El Pesebre, 28°52′15″S, 67°41′43″W/28°52′18″, 4″S, 67°41′43″, 1″W, 2,519/2,571 m, 19 Dec 2011, *Barboza et al. 3307 & 3312* (CORD); Alanís, a ca. 5 km sobre el cauce del Río El Durazno, desde Angulo rumbo a Ciénaga Grande, 28°39′23″, 3″S, 67°38′55″, 5″W, 1,799 m, 27 Feb 2013, *Barboza et al. 3819* (CORD, RIOC); Pasando Alanís, 28°40′34″, 9″S, 67°44′22″, 5″W, 2,190 m, 27 Feb 2013, *Barboza et al. 3830* (CORD); Cuesta del Colorado, rumbo a Ciénaga Grande, 28°40′29″, 9″S, 67°40′54″, 3″W, 2,579 m, 27 Feb 2013, *Barboza et al. 3834* (CORD).

Discussion

Systematic Position—The new genus shares with the tribe Onoserideae (Roque and Funk 2013) its shrubby habit (Fig. 1B), solitary capitula (Fig. 1C), bilabiate marginal corollas (Fig. 1C), style branches rounded at the apices and dorsally papillose (Fig. 1G), and 2–3-seriate heteromorphic pappi. *Famatinanthus* shares with tribe Gochnatieae

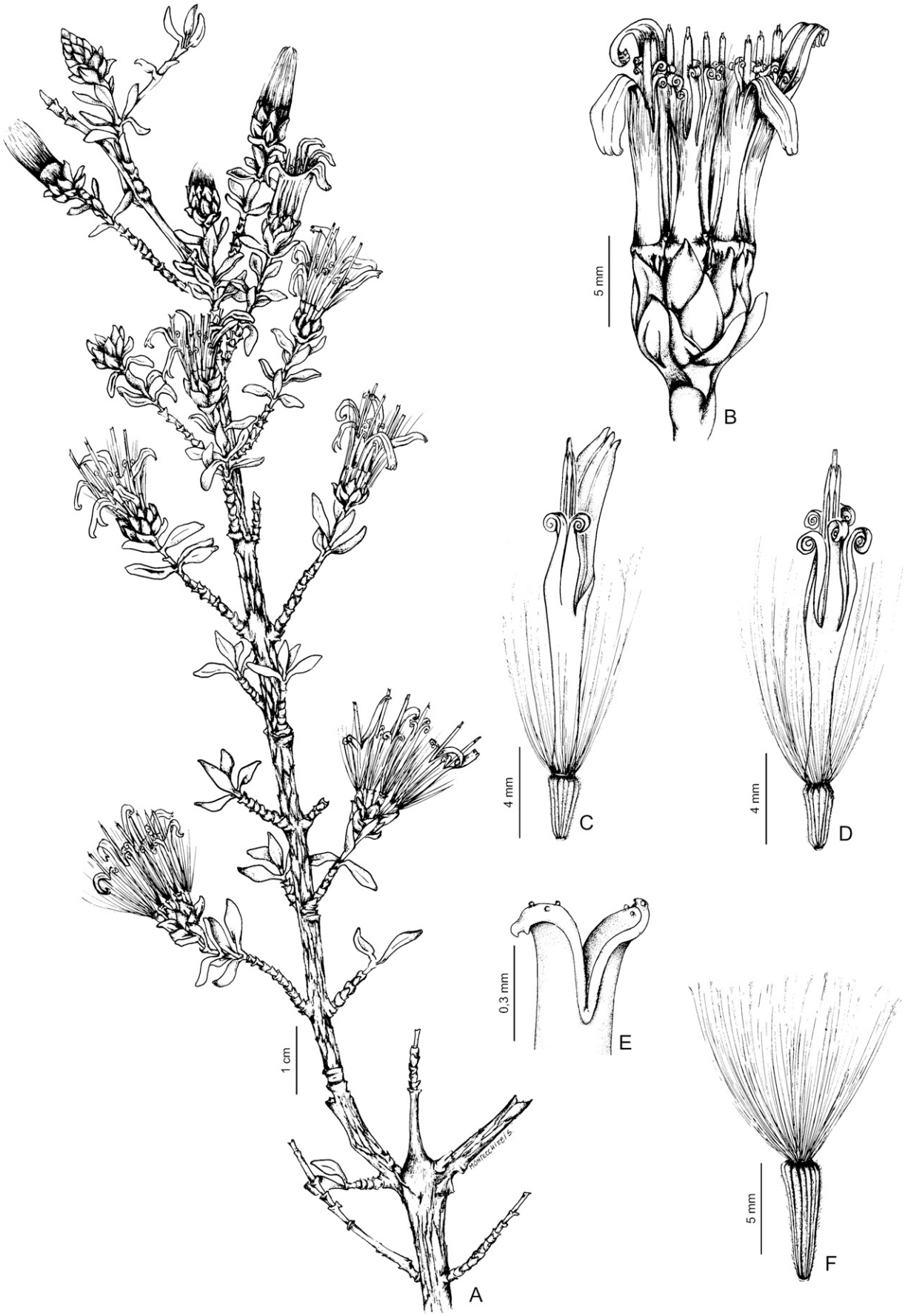

FIG. 5. *Famatinanthus decussatus* (A–E. *Barboza et al. 2846;* F. *Hieronymus & Niederlein 831*). A. Flowering branch. B. Capitulum. C. Marginal floret. D. Disc floret. E. Style apex. F. Achene.

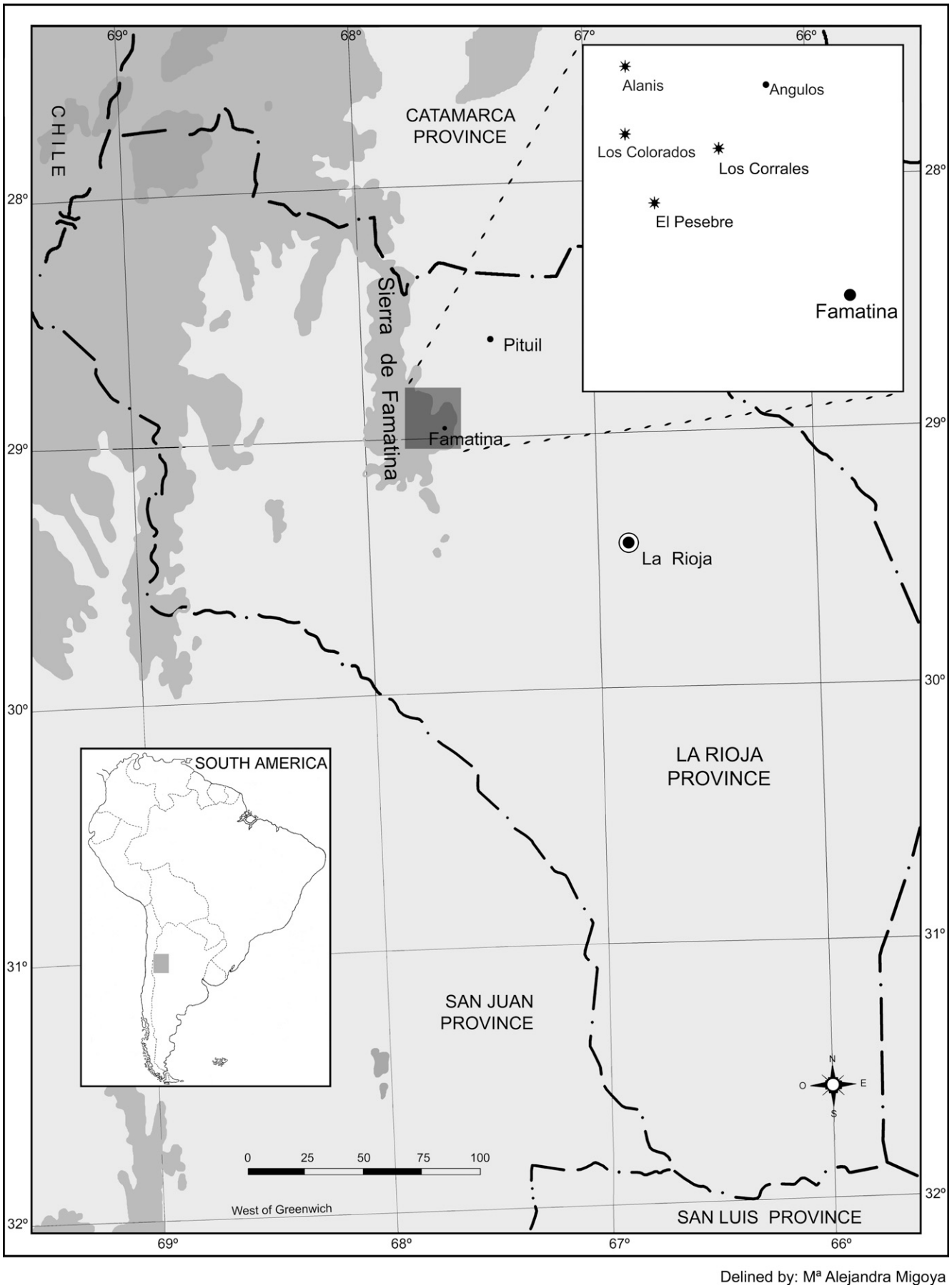

FIG. 6. Distribution map of *Famatinanthus decussatus* in La Rioja province (Argentina). Stars denote localities of collected specimens; dots are towns.

Panero & V. A. Funk and Hyalideae Panero (Sancho and Freire 2009) apiculate anther appendages (Fig. 1F), but smooth style branches of Hyalideae and Gochnatieae mark a departure from the new genus, where the style branches are papillose. *Famatinanthus* also resembles *Hyaloseris* Griseb. (Stifftieae tribe) in its opposite leaves and few-flowered capitula, but *Famatinanthus* is distinct from *Hyaloseris* by its short bifid style branches and dorsally papillose (vs. long and recurved style branches that are papillose above and below the bifurcation), apiculate anther appendages (vs. acute anther appendages), and dimorphic florets (vs. isomorphic florets).

Famatinanthus is therefore tentatively placed in tribe *Onoserideae* (Panero and Funk 2008) pending molecular phylogenetic studies. With the inclusion of this genus, Onoserideae now contains eight genera and approximately 53 species most found in the Andes, i.e. *Aphyllocladus* Wedd., *Famatinanthus*, *Gypothamnium* Phil., *Lycoseris* Cass., *Onoseris* Willd., *Plazia* Ruiz & Pav., *Urmenetea* Phil., and more recently *Paquirea* Panero & S.E. Freire (Panero and Freire 2013).

Comparison of Famatinanthus and Related Genera of the Tribe Onoserideae—*Famatinanthus* shares more morphological features with *Aphyllocladus* than with any other genus of the Onoserideae. They are both monoecious shrubs with linear to spathulate leaves, solitary capitula, disc florets with deeply 5-lobed corollas, long pilose anther tails and dorsally papillose style branches. In addition, both genera share similar habitats. However, the new genus can be distinguished from *Aphyllocladus* by its conspicuously leafy stems with opposite leaves, multistoried T-trichomes, homogamous capitula with dimorphic florets, cream corollas, apiculate apical anther appendages, prolate to sphaeroidal pollen, and setuliferous achenes. *Aphyllocladus* differs from *Famatinanthus* in having rapidly caducous alternate leaves, simple 2–3-cellular flagellate trichomes, homogamous or heterogamous capitula with isomorphic or dimorphic florets, lilac to purple corollas, truncate apical anther appendages, prolate to subprolate pollen, and long-pilose achenes (Table 1).

Anatomically, both genera are also different. *Famatinanthus* has cylindrical terete stems (vs. strongly ribbed stems with inter rib areas covered with tufts of long flagellate trichomes in *Aphyllocladus*), secretory cavities absent (vs. stem ribs with large secretory cavities), secondary cortex with groups of fibers embedded in the parenchyma (vs. secondary cortex without groups of fibers), siphonostele well-developed and secondary phloem with groups of fibers (vs. siphonostele not well developed: continuous secondary phloem bounded mostly by a continuous ring of fibers and a discontinuous xylem bounded by groups of fibers in *Aphyllocladus*), and sclerified pith, without crystals (vs. pith non-sclerified with abundant solitary cubic or prismatic crystal and druses in *Aphyllocladus*), and leaves with thin cuticles and epidermises with raised stomata, (vs. very thick cuticles, epidermises with flat stomata in *Aphyllocladus*) (Figs. 2, 7A, C–G). Some of the anatomical characters of *Aphyllocladus* have already been stated by Cabrera (1951).

Pollen morphology is different between *Famatinanthus* and *Aphyllocladus*. *Famatinanthus* has prolate-sphaeroidal pollen grains, with mesoaperturate conspicuous medium- to large-sized grains, and microechinate-rugulate exines, whereas *Aphyllocladus* has subprolate, or prolate or prolate-subprolate pollen, with mesoaperture diffuse, large-sized grains, and microechinate exines (Tellería and Katinas 2004; Katinas et al. 2008).

Plazia, *Gypothamnium* and *Paquirea* share with *Famatinanthus* the presence of disc florets with deeply 5-lobed corollas. However, the new genus can be easily separated by its opposite leaves (vs. alternate or spiralled), 10 or 11-flowered capitula (vs. > 15), apiculate apical anther appendages (vs. truncate), prolate-sphaeroidal and microechinate-rugulate pollen (vs. subprolate and microechinate, Tellería and Katinas 2004), and setuliferous achenes (vs. glabrous in *Paquirea* and *Plazia*, and long-pilose in *Gypothamnium*).

Differences among *Famatinanthus* and all the genera of tribe *Onoserideae* are presented in the key below.

Key to the Genera of Tribe *Onoserideae*

1. Disc floret corollas deeply 5-lobed, lobes ½–⅓ length of corolla 2
   2. Achenes glabrous 3
      3. Capitula radiate; florets dimorphic; leaves spiralled ..... *Plazia*
      3. Capitula discoid; florets isomorphic; leaves alternate ..... *Paquirea*
   2. Achenes pilose 4
      4. Leaves spiralled, filiform ..... *Gypothamnium*
      4. Leaves alternate or opposite, small, linear to obovate or minute and deltoid 5
         5. Plants appearing leafless; leaves alternate; corollas lilac to purple; achenes long-pilose ..... *Aphyllocladus*
         5. Plants conspicuously leafy; leaves opposite; corollas cream; achenes setuliferous ..... *Famatinanthus*
1. Disc florets corollas shallowly 5-lobed, less than ⅓ length of corolla 6
   6. Plants dioecious (capitula with only female or only male florets) ..... *Lycoseris*
   6. Plants monoecious (capitula with female and hermaphrodite florets or all hermaphrodite) 7
      7. Capitula radiate or discoid; marginal florets corollas, when present, purple or violet ..... *Onoseris*
      7. Capitula radiate; marginal florets corollas white or pink ..... *Urmenetea*

Comparison of Famatinanthus and Related Genera with Apiculate Apical Anther Appendages of Tribes Gochnatieae and Hyalideae—*Famatinanthus* differs morphologically from *Gochnatia* Kunth and *Cyclolepis* D. Don by the presence in the latter genera of subdimorphic or isomorphic florets (vs. dimorphic in *Famatinanthus*) and dorsally smooth style branches (vs. papillose in *Famatinanthus*). However, as stated earlier, because of similar habits, *Famatinanthus* and *Gochnatia glutinosa* at first sight in the field are difficult to distinguish. Anatomically, both species are almost alike, having a similar tissue arrangement in stems (Figs. 7A, B), the same mesophyll structure and glandular trichomes, and lacking secretory cavities at all; but they differ in the type of eglandular trichomes, the stomata, and the leaf vascular bundles. In fact, *Famatinanthus* has multistoried T-shaped trichomes, stomata very raised, and vascular bundles bounded only by a

TABLE 1. Morphological comparison between *Famatinanthus* and its related genera of the tribes Onoserideae, Gochnatieae and Hyalideae.

Character	*Famatinanthus*	*Aphyllocladus*	*Cyclolepis*	*Gochnatia*	*Gypothamnium*	*Hyalis*	*Ianthopappus*	*Plazia*
Capitula	Solitary	Solitary	Spicate	Solitary, corymbs, racemes, panicles or glomerules	Solitary	Corymbs	Corymbs	Solitary
Florets	Dimorphic	Dimorphic (isomorphic)	Subdimorphic	Isomorphic (subdimorphic)	Dimorphic	Dimorphic	Dimorphic	Dimophic
Number of florets	10–11	12–40	10–15	4–150	Numerous	5–6	Ca. 46	17–42
Number of disk florets	5 or 6	Numerous	—	—	Numerous	1	Numerous	Numerous
Florets color	Cream	Lilac to purple	Yellowish	Cream or yellowish	Purple or pinkish-purple	Pink, white or purple	Ray: white; disc: purple	White to pink
Apical anther appendage	Apiculate	Truncate, reddish	Apiculate	Apiculate	Truncate, reddish	Apiculate	Apiculate	Truncate, reddish
Style branches	Papillose	Papillose	Smooth	Smooth	Papillose	Smooth	Smooth	Papillose
Achenes	Setuliferous	Long-pilose	Long-pilose	Long-pilose (setuliferous).	Long-pilose	Long-pilose	Setuliferous	Glabrous
Carpopodium	Short cylindrical	Short cylindrical	Annular	Annular or cylindrical	Scarcely differentiated	Annular	Annular	Not differentiated
Pappus bristles	2–3-seriate, barbellate, unequal in length and width	2–3-seriate, barbellate, unequal in length and width	3-seriate, barbellate, unequal in length and width	1–3-seriate, barbellate, equal to unequal in length and width	2–4-seriate, barbellate, unequal in length and width	Multi-seriate, barbellate, unequal in length	3-seriate, barbellate, unequal in length	Many-seriate, barbellate, unequal in length and width
Leaf duration	Persistent	Rapidly caducous	Rapidly caducous	Persistent	Persistent	Persistent	Persistent	Persistent
Leaf phyllotaxis	Opposite	Alternate	Alternate	Alternate	Spiralled	Alternate	Alternate	Spiralled
2-armed trichomes	—	—	Present	Present	—	Present	—	—
Multistoried T-shaped trichomes	Present	—	—	—	—	—	Present	—
Secretory cavities	—	Present	—	—	—	—	—	Present
Pollen ratio P/E	Prolate to sphaeroidal	Prolate to subprolate	Sphaeroidal to subprolate	Sphaeroidal to prolate	Subprolate	Prolate to subprolate	Prolate	Subprolate
Pollen size	Medium to large	Large	Medium to large	Medium or large	Large	Medium to large	Large	Large
Exine surface	Microechinate-rugulate	Microechinate	Microechinate	Microechinate, scabrate or echinate (spines 1.5–2.5 μm)	Microechinate	Microechinate	Microechinate	Microechinate

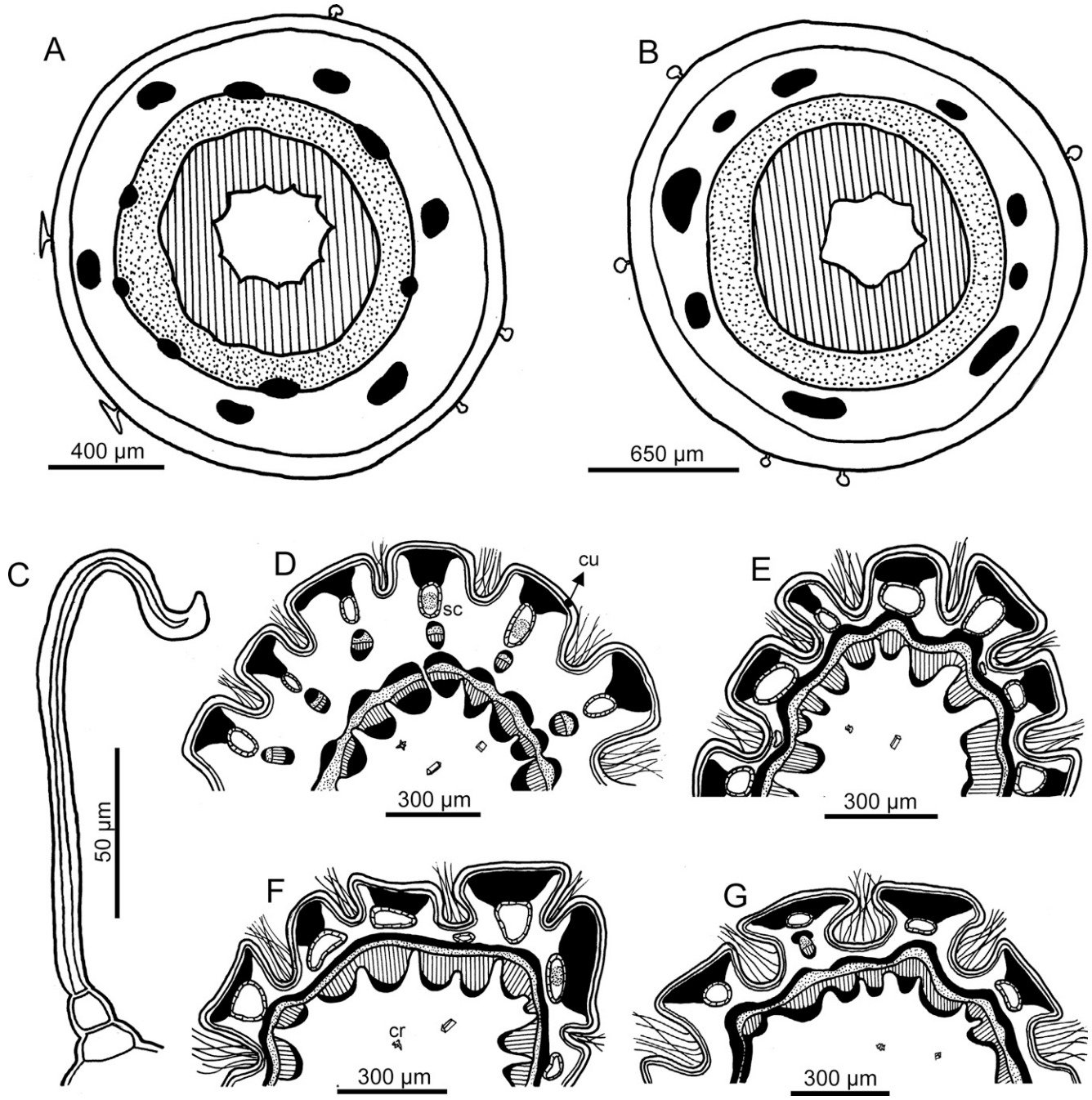

FIG. 7. Stem anatomy. A. Transverse section of *Famatinanthus decussatus* (*Barboza et al. 2846*). B. *Gochnatia glutinosa* (*Barboza et al. 3306*). C. Flagellate eglandular trichome of *Aphyllocladus* spp. (*Hunziker & Caso 6015*). D. *Aphyllocladus ephedroides* (*Hunziker & Caso 4230*). E. *Aphyllocladus sanmartinianus* (*Kurtz 9531*). F. *Apyllocladus spartioides* (*Hunziker & Caso 6015*). G. *Aphyllocladus denticulatus* (*Ricardi 3655*). Abbreviations: cu, cuticle; cr, crystals, sc, secretory cavities.

parenchymatous sheath while *G. glutinosa* has a particular eglandular double T-shaped trichomes (the upper T-shaped cell inverted, Figs. 3E, G, I) here reported for the first time in *Gochnatia*, stomata slightly raised, and vascular bundles bounded by two conspicuous groups of fibers (Fig. 3F). Concerning the Hyalideae genera, *Famatinanthus* resembles *Hyalis* D. Don ex Hook. & Arn. and *Ianthopappus* in having few-flowered capitula, and multistoried T-shaped trichomes, respectively. However, *Famatinanthus* differs morphologically from *Hyalis* and *Ianthopappus* by the presence in the latter genera of dorsally smooth style branches (vs. papillose in *Famatinanthus*) and capitula arranged in corymbs (vs. solitary capitula in *Famatinanthus*) (Table 1).

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