

Two new species of *Galium* (Rubiaceae) from the Iberian Peninsula

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Two new species of the genus *Galium* are described from the Iberian Peninsula: *G. moralesianum* Ortega-Olivencia & Devesa, and *G. talaveranum* Ortega-Olivencia & Devesa. The first grows on limestone or dolomitic-limestone outcrops in south-east Spain (the Segura and Gádor mountain ranges) and shows morphological similarities with *G. boissieranum* Ehrend. & Krendl, which is endemic to southern Spain (mountains of Málaga). The second inhabits the margins of water courses, alder stands and cork-oak dehesas (parkland-type systems) of the west of the Iberian Peninsula, and is morphologically reminiscent of *G. mollugo* L. The chromosome numbers of these two species and of *G. boissieranum* are given. © 2003 The Linnean Society of London, *Botanical Journal of the Linnean Society*, 2003, 143, 177–187.

ADDITIONAL KEYWORDS: *Flora Iberica* – karyology – taxonomy.

INTRODUCTION

The genus *Galium* is represented by approximately 151 species and subspecies in the European flora. Of these, c. 60 are present in the Iberian Peninsula (Ehrendorfer, Krendl & Puff, 1976), which, together with the Balearic Islands, is a major centre of diversity, since 17 of the species (Ehrendorfer *et al.*, 1976) plus one recently described for the Balearic Islands (Torres *et al.*, 2001) are endemic. To these should be added a further seven showing a restricted distribution shared only with France (mostly within the area around the Pyrenees), and another six shared with north-west Africa (principally Morocco).

Study of the *Galium* material of the Iberian Peninsula and Balearic Islands with a view to preparing Volume XV of *Flora Iberica* has shown that there are several clearly delimited populations which cannot be assigned to any previously known species.

MATERIAL AND METHODS

The study involved numerous specimens of *G. boissieranum* and *G. mollugo* preserved in BC, COI,

GDAC, JAEN, MA, MAF, MGC, SEV and UNEX (abbreviations according to Holmgren, Holmgren & Barnett, 1990). In addition, some natural populations were subjected to morphological and ecological examination *in situ*, while others were collected for root production in culture. Roots were pretreated with 0.002 M 8-hydroxyquinoline (Tjio & Levan, 1950) for 4–4½ h at below 4°C, fixed in absolute alcohol/acetic acid (3 : 1) for 3 h at the same temperature and stained with carmine acetic alcohol (Snow, 1963) for 6–8 days. The material was covered with a few drops of 45% glacial acetic acid and squash-mounted for light microscopy observation.

RESULTS AND DISCUSSION

COMPARATIVE MORPHOLOGY OF *G. BOISSIERANUM* AND *G. MORALESIANUM* SP. NOV.

Galium boissieranum is endemic to southern Spain where it grows in two clearly separate zones: the mountains of Málaga and the Segura and Gádor ranges. A comparative morphological study of numerous populations in the two zones revealed that the Málaga plants differed in various aspects from the south-eastern populations, mainly in the type of indumentum of the stem internodes, leaf parts, inflorescence axis, ovary and mericarps.

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The Málaga plants always have stiff leaf parts, with the adaxial surface glossy, green and very rough, markedly scabrous, with tuberculate base antrorse prickles, and the abaxial surface grey-tomentose. *G. boissieranum* is fairly polymorphic with regard to the indumentum of the corolla, ovary and mericarps, as reflected in the great number of taxa that have been described despite its restricted distribution. The plants with externally pubescent corollas, mainly in the lobules and upper part of the tube, and densely hirsute ovaries correspond to *Asperula eriocarpa* Boiss., Elench. Pl. Nov.: 57 (1838) [*A. asperrima* var. *hirsuta* Boiss., Voy. Bot. Espagne: 281, tab. 84 (1840)]. Plants with glabrous corollas and ovaries/mericarps that are glabrous or with few hairs correspond to *Asperula asperrima* Boiss., Elench. Pl. Nov.: 56 (1838) [*A. asperrima* var. *glabrescens* Boiss., Voy. Bot. Espagne: 281, tab. 84 (1840)]. Between these two patterns, there are plants with glabrous corollas and white-tomentose ovaries/mericarps. However, the *in situ* study revealed that this variability is neither stable nor accompanied by other morphological, environmental and geographical characters. In general, the populations inhabiting strongly sunlit sites usually have flowers that are more hairy, but plants with completely glabrous flowers are not infrequently found. Likewise, in populations that inhabit shadier sites, there abound plants with glabrous flowers, but they too cohabit with plants whose flowers are hairy. At times, both glabrous and laxly hirsute ovaries occur on the same inflorescence.

Plants of *G. boissieranum* whose inflorescence is a more or less pyramidal panicle, with generally diffuse, open branches bearing glomerules of either a few or many but laxly agglomerate flowers, correspond to *Asperula effusa* Boiss., Voy. Bot. Espagne: 280, nota, tab. 83 (1840). In this case, the flowers may be either completely glabrous or have hairy ovaries/mericarps. There is no correlation between substrate type or any particular environment. These plants grow in both sunny and shady locations, cohabiting with plants whose panicles are more contracted.

The populations of south-east Spain (Segura and Gádor ranges) are less polymorphic than those of Málaga. Their leaf parts are not stiff, the abaxial and adaxial surfaces may have the same or different colour, glossy or dull adaxially, hirsute-puberulent or hirsute-tomentose, with hairs 0.1–0.3 (0.4) mm long, and with no rough indumentum. Karyologically, the Málaga populations behave as tetraploids ($2n = 44$) compared with those of south-east Spain, which are diploid ($2n = 22$). Ecologically, most of the Málaga populations form part of scrub or thyme heaths growing on serpentine, less frequently on limestone, in both sunny and shady loca-

tions, from 300 to 1450 m. The populations of south-east Spain grow over cracks in rocks, at the foot of limestone rock-faces, or form part of thyme heaths and basophilic scrub on both sunlit and shady sites, from 475 to 1400 m.

These differences, together with others shown in Table 1, indicate that the populations of south-east Spain belong to a new species.

***Galium moralesianum* Ortega-Olivencia & Devesa sp. nov.** (Fig. 1)

G. boissieranum auct. hisp., non (Steud.) Ehrend. & Krendl in Bot. J. Linn. Soc. 68: 270 (1974)

Suffruticosa, tomentosa vel hirsuto-puberulenta. Folia 6–8(9), linearia, apiculata, uninervata, marginibus revolutis, prorsus aut non prorsus paginum inferiorem occultantibus, pagina superiora quidem hirsuto-puberulenta vel hirsuto-tomentosa, non aculeata, inferiore autem – si visibilis – cano-tomentosa. Inflorescentia cylindrica vel anguste pyramidalis, floribus cymosis quidem sed sessilibus aut subsessilibus, glomerulos efformantibus. Corolla tubuloso-infundibuliformis, hirsuta (praesertim in tertia parte superiore), flavida, lobulis quam tubo brevioribus, ovato-triangularibus apiculatisque. Mericarpi globosa, cinerascentia, dense aut laxe hirsuta, pilis 0.4–0.7 mm longis.

Perennial, suffruticose, green, sometimes pale-greenish. STEMS 12–58 cm, generally prostrate-ascendent, or ascendent, with patent or erecto-patent branches; middle internodes smaller than or subequal to the leaves, and the upper internodes up to five times larger, white-tomentose or hirsute-tomentose, with the longest hairs 0.2–0.6 mm. LEAVES 6–8 (9), 4–11 × 0.4–1.1 (1.7) mm, erecto-patent or patent, the lower generally reflexed, linear, with a 0.3–0.7 mm apiculum, with revolute margins that may or may not hide the abaxial surface, single-veined, the abaxial and adaxial surfaces may have the same or different colour, adaxially glossy or dull, hirsute-puberulent or hirsute-tomentose, with hairs 0.1–0.3 (0.4) mm, no prickles, and abaxial surface (when visible) grey-tomentose. INFLORESCENCE 3–25 cm, cylindrical and simple, rarely narrowly pyramidal and with short, generally opposite branches, axis tomentose or hirsute-tomentose with flowers arranged in glomerular cymes, sessile or subsessile. BRACTS: first order, 6–8 at the inferior nodes, 2 opposite at the upper nodes, 2.2–10 × 0.7–1.2 mm, patent, foliaceous, hirsute-puberulent; second order, 1–3 × 0.5–0.8 (1.1) mm, forming with the bracteoles a pseudoinvolucre of generally falcate pieces. FLOWERS hermaphrodite, sessile. Corolla (3.7)

Table 1. Main morphological differences between *Galium moralesianum* sp. nov. and *G. boissieranum*

Taxonomic feature	<i>G. moralesianum</i>	<i>G. boissieranum</i>
Internodes	Tomentose or hirsute-tomentose, with the longest hairs 0.2–0.6 mm in length	Glabrescent in the lower part (sometimes also in the inflorescence) and short tomentose in the remainder, rarely glabrous
Leaves	4–11 × 0.4–1.1(1.7) mm Not stiff, partially or completely revolute; adaxial and abaxial surfaces (when the latter is visible) of similar or different colour. Adaxially, glossy or dull, hirsute-puberulent or hirsute-tomentose, with hairs 0.1–0.3(0.4) mm, no prickles. Abaxially, when visible, grey-tomentose	(5)7–21(27) × 0.6–1.3(2.2) mm Stiff, partially revolute, adaxial and abaxial surfaces of different colour. Adaxially, glossy and rough, markedly scabrous, with rigid, antrorse, tuberculate-based prickles, sometimes reduced only to their base, rarely scabrous-hirsute. Abaxially, grey-tomentose
Axis of inflorescence	Tomentose or hirsute-tomentose	Glabrous, scabridulous, or tomentose
First order bracts	Hirsute-puberulent	Glabrous or tomentose abaxially
Corolla	(3.7)4.5–5.8 mm long. Hirsute	(2.8)3.2–5.3 mm long. Glabrous or hirsute
Gynoecium	Style up to 5.2 mm, reaching or surpassing the level of the anthers in postanthesis flowers. Ovary white-hirsute, with hairs (0.1)0.2–0.5 mm	Style up to 2.6 mm, reaching the base of the anthers in postanthesis flowers. Ovary glabrous, pubescent, or densely hirsute, with hairs 0.1–0.4 mm
Mericarps	1.2–1.6 mm long. Densely or laxly hirsute, with hairs 0.4–0.7 mm	(0.8)1–1.6 mm long. Glabrous, laxly or densely hirsute, with hairs up to 0.2 mm
Chromosome number	2n = 22	2n = 44

4.5–5.8 mm long, tubular-infundibuliform, hirsute, yellowish; tube (2.5) 3–4.2 mm and lobules 1.4–1.8 mm, smaller than the tube, ovate-triangular, with an up to 0.4 mm apiculum, incurved. STAMENS with anthers (0.45) 0.5–0.7 (0.8) mm, oblongoid, yellowish; filaments (0.25) 0.3–0.6 mm, smaller than the anthers. OVARY oblongoid, white-hirsute, with hairs (0.1) 0.2–0.5 mm; style up to 5.2 mm, reaching or surpassing the level of the anthers in anthesis and postanthesis flowers, and stigmas globose or oblongoid. MERICARPS 1.2–1.6 mm, globose, brownish, densely or laxly hirsute, with hairs 0.4–0.7 mm.

Etymology: Named in honour of Concepción Morales Torres, botanist at the University of Granada with a profound knowledge of the flora of south-east Spain.

Holotype: (designated here). ‘Albacete: Elche de la Sierra, bordes de caminos, Mayo 1962, J. Borja (MA 186099)’.

Phenology: Flowering from May to July (August).

Ecology: Scrub and thyme heaths on limestone or dolomitic-limestone rocks at elevations of 475–1300 m.

Distribution: Endemic to south-east Spain, in the Segura mountain range in Albacete and the Gádor

range in Almería. Records of *G. boissieranum* from Murcia province (Selma, 1992) should probably be referred to *G. moralesianum*. The species may also be present in north and east Granada province.

G. moralesianum is a species that fits perfectly into sect. *Galium*, a section which includes, amongst others, species characterized by presenting leaves in whorls of (4) 6–12, single-veined and acute, flowers either sessile or with short pedicels, frequently clustered in glomerular inflorescences and, above all, with infundibuliform or tubular-infundibuliform corollas, more or less yellowish, with acute or apiculate lobules. It is this last character, the type of corolla, that makes some species of this section which are also present in the flora of the Iberian Peninsula (e.g. *G. boissieranum*, *G. baeticum* (Rouy) Ehrend. & Krendl, *G. concatenatum* Coss.) especially reminiscent of certain representatives of the genus *Asperula*. However, of all the aforementioned species, *G. moralesianum* seems to show the closest relationship, at least morphologically, with *G. boissieranum* with which it shares many characters. These include habit, general morphology of leaves and bracts, and morphology of the inflorescence, flowers and fruit. A dichotomous key to these species follows, together with an outline of their nomenclature and chorology.

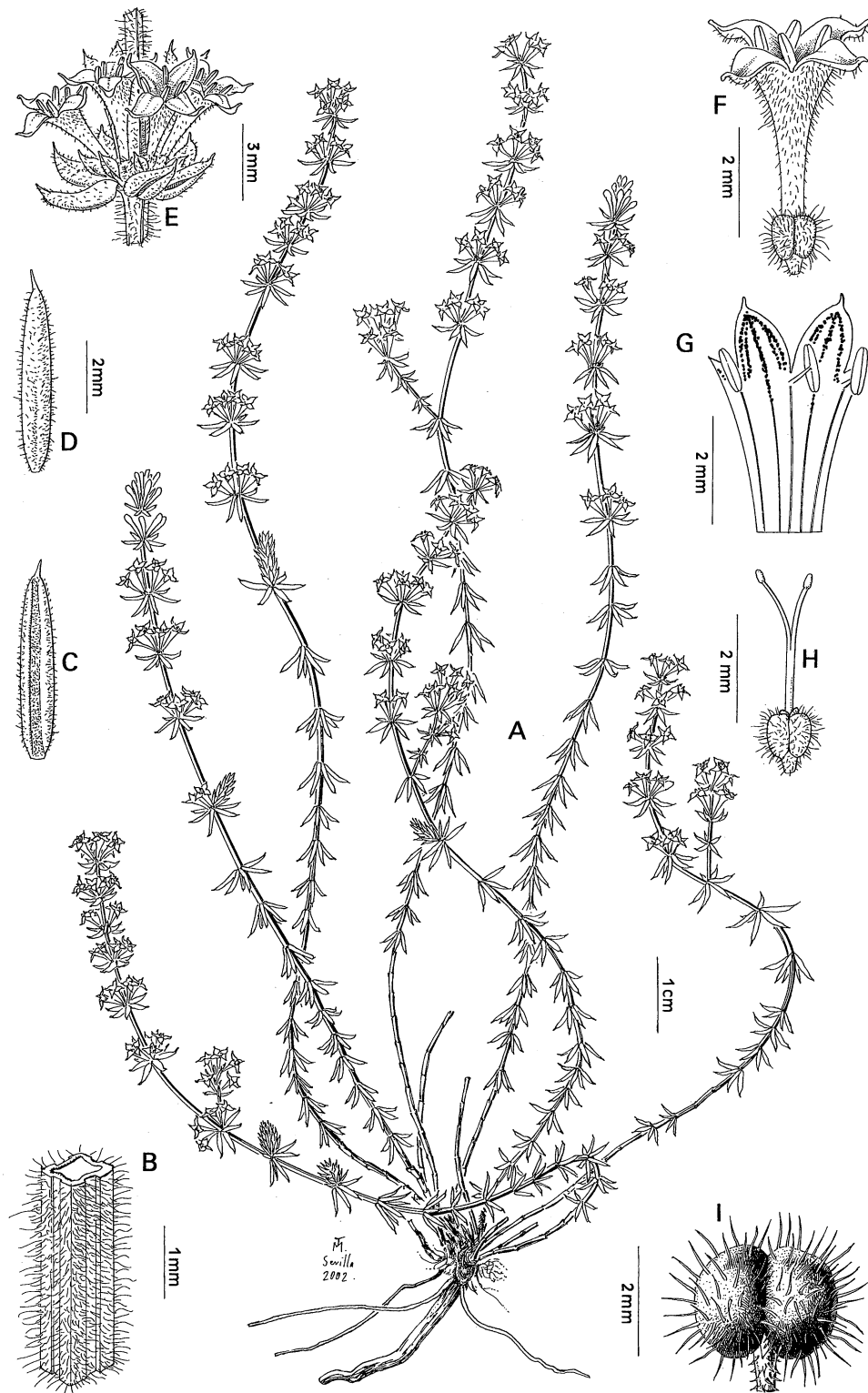


Figure 1. *Galium moralesianum* Ortega-Olivencia & Devesa **sp. nov.** A, habit. B, cross-section of stem. C, detail of abaxial leaf surface. D, detail of adaxial leaf surface. E, glomerular cyme. F, flower. G, section of corolla. H, gynoecium. I, mericarps.

KEY TO SECT. *GALIUM*

- 1 Corolla (2.8) 3.2–5.8 mm long 2
 1 Corolla 1.5–2.6 (3.2) mm long 3
 2 Largest leaves of the principal stems (5) 7–21 (27) mm, with faces markedly unlike in colour. Adaxially, leaf glossy, possessing only robust tuberculate-base antrorse prickles, sometimes reduced only to the tuberculate base *G. boissieranum*
 2 Largest leaves of the principal stems 4–11 mm, abaxial and adaxial surfaces may have the same or different colour. Adaxially, leaf glossy or dull, puberulent-hirsute or tomentose-hirsute, with hairs 0.1–0.3 (0.4) mm, without robust prickles *G. moralesianum*
 3 Leaves with grey-tomentose adaxial surface, sometimes glabrous or glabrescent in the basal leaves *G. baeticum*
 3 All the leaves glabrous adaxially or slightly scabrous on the rib *G. concatenatum*

G. boissieranum (Steud.) Ehrend. & Krendl in Bot. J. Linn. Soc. 68: 270 (1974)

Asperula paniculata sensu Boiss., Elench. Pl. Nov.: 56 (1838), non Bunge in Ledeb., Fl. Altaic. 1: 140 (1829)

A. effusa Boiss., Voy. Bot. Espagne: 280, nota, tab. 83 (September 1840)

A. asperrima Boiss., Elench. Pl. Nov.: 56 (1838)

A. asperrima var. *glabrescens* Boiss., Voy. Bot. Espagne: 281, tab. 84 (1840)

A. eriocarpa Boiss., Elench. Pl. Nov.: 57 (1838)

A. asperrima var. *hirsuta* Boiss., Voy. Bot. Espagne: 281, tab. 84 (1840)

A. boissierana Steud., Nomencl. Bot. ed. 2, 1: 151 (August 1840)

Illustration: Boiss., Voy. Bot. Espagne: 281, tab. 83 (sub *Asperula paniculata*) and tab. 84 (sub *A. asperrima*) (1840); Valdés, Talavera & Galiano (eds.), Fl. Andalucía Occid. 2: 582 (1987).

Distribution: Endemic to the mountains of Málaga (the Ronda highlands, and the Bermeja, Blanca, and Mijas ranges).

G. baeticum (Rouy) Ehrend. & Krendl in Bot. J. Linn. Soc. 68: 270 (1974)

Asperula baetica Rouy in Bull. Soc. Bot. France 38: 80 (1891); Rouy in Magnier in Scrinia Fl. Select. 10: 191 (1891)

Galium boissieranum ssp. *baeticum* (Rouy) Malag., Laboratory Bot. Sennen 4: 1062 (1977)

A. pendula Boiss., Elench. Pl. November 55 (1838)

A. pendula var. *concatenata* (Coss.) Pau in Cavanillesia 5: 176 (1932)

A. pendula var. *scaberrima* Font Quer in Cavanillesia 1: 78 (1928)

A. pendula var. *tubulifera* Font Quer in Cavanillesia 1: 78 (1928)

Illustration: Boiss., Voy. Bot. Espagne: 282, tab. 84a (1840, sub *Asperula pendula*); Valdés, Talavera & Galiano (eds.), Fl. Andalucía Occid. 2: 582 (1987).

Distribution: Mountains of the south-western Iberian Peninsula (Algarve in Portugal, and Cádiz, Huelva and Málaga in Spain) and northern Morocco.

G. concatenatum Coss., Notes Pl. Crit. 38 (1849)

Asperula pendula var. *concatenatum* (Coss.) Pau in Mem. Real Soc. Esp. Hist. Nat. 12 (5): 336 (1924)

A. pendula var. *glabrescens* Emb. & Maire in Mém. Soc. Sci. Nat. Maroc 17: 50 (1927)

A. pendula var. *viridiflora* Emb. & Maire in Mém. Soc. Sci. Nat. Maroc 17: 50 (1927)

Illustration: Valdés, Talavera & Galiano (eds.), Fl. Andalucía Occid. 2: 583 (1987).

Distribution: Southern Spain (Cádiz and Málaga), southern Portugal (Algarve), and northern Morocco.

COMPARATIVE MORPHOLOGY OF *G. MOLLUGO* AND *G. TALAVERANUM* SP. NOV.

Galium mollugo is a species found in almost all of Europe, reaching central European Russia (it is absent from the Mediterranean islands except for Corsica) and Asia Minor. It is naturalized in North America. In the Iberian Peninsula, it is mainly distributed throughout the north-west, being occasionally found in the north-east.

In the west and south-west of the Peninsula exist populations that are apparently reminiscent of *G. mollugo* since they possess a similar habit (perennial stoloniferous herbs), with highly branching stems, 6–9 leaves/whorl, with a morphology similar to that of *G. mollugo*. Also, inflorescences are usually broadly pyramidal, and highly branched; pedicels are divaricate; corollas rotate, glabrous and white, with

apiculate lobules; finally, mericarps are subreniform or oblongoid with a smooth or slightly rough surface. Nevertheless, a detailed inspection indicates that this is simply a superficial resemblance since both the vegetative and floriferous internodes are retrorse-scabrous (they are never scabrous in *G. mollugo*), and the leaves and bracts (at least those of first order) have margins with antrorse and retrorse scabrosity. It is always exclusively antrorse in *G. mollugo*. The comparative morphological study showed these last populations to be quite independent, and they are described here under the name of *G. talaveranum*. Other differences between the two types of population are given in Table 2.

Karyologically, *G. talaveranum* is a diploid species ($2n = 22$), while *G. mollugo* may behave both as a diploid ($2n = 22$; Piotrowicz, 1958; Kliphuis, 1983; Natali & Jeanmonod, 2000) or as a tetraploid ($2n = 44$; Piotrowicz, 1958; Ehrendorfer, 1961; Kliphuis, 1962; Gadella & Kliphuis, 1963). *G. mollugo* is found at altitudes ranging between 100 and 1650 m, in pastures, meadows, the margins of water courses, walls, hedges, and holm oak, chestnut, and beech woods, showing no edaphic preferences. The new species is located mainly in meadows and amid riparian vegetation, alder woods, or cork-oak dehesas, between sea-level and 600 m.

Galium talaveranum Ortega-Olivencia & Devesa
sp. nov. (Fig. 2)

G. mollugo sensu Devesa in Valdés, Talavera & Galiano (eds.), Fl. Andalucía Occid. 2: 583 (1987), non L. (1753)

Herbacea, perennis, stolonifera. Caules 90–155 cm, fortiter quoad angulos retrorse scabridi. Folia 6–9 in caulibus praecipuis, oblonga vel oblongo-obovata, obtusa, rarius elliptica et acuta, apiculata, plana, uninervata, subcoriacea, supra plerumque glabra atque subtus glabra semper, sed parce quoad nervum medium retrorse scabrida marginesque unifarie aculeis retrorsis plurifarieque submarginaliter aculeis antrorsis praedita. Inflorescentia paniculata, late pyramidalis, axe atque ramis primariis retrorse scabridis – ii quidem oppositi atque valde ramificati – floribus in cymas divaricatas pedunculatasque dispositis. Pedicelli fructiferi divaricati, glabri aut parce atque retrorse scabriduli, floriferi autem corolla subaequantur vel ea breviores. Corolla rotata, glabra, alba, lobulis tubo longioribus, ovatis aut ovato-lanceolatis, apiculatis. Mericarpi subreniformia, grisea vel fusca, glabra, laevia prorsus aut paulo rugosa.

Perennial herb, stoloniferous, climber, green or pale green, not blackened when dry. STEMS 90–155 cm, robust, with internodes 2–5.5 times larger than the leaves, strongly retrorse-scabrous at the angles, with prickles 0.1–0.2 mm. LEAVES 6–9 on the principal stems and 5–8 on the branches, 9–18 × 2.1–7.5 mm, reflexed or patent, oblong or oblong-obovate and obtuse, rarely elliptical and acute, with apiculum 0.1–0.3 mm, flat, single-veined, abaxial and adaxial faces more or less the same colour, subcoriaceous; adaxial surface glossy, sometimes dull, glabrous, rarely somewhat antrorse-scabrous; abaxial surface glabrous, with nerve laxly retrorse-scabrous and margins with a row of retrorse prickles and several submarginal rows of antrorse prickles. INFLORESCENCE 33–55 cm, a

Table 2. Main morphological differences between *Galium talaveranum* sp. nov. and *G. mollugo*

Taxonomic feature	<i>G. talaveranum</i>	<i>G. mollugo</i>
Internodes	Strongly retrorse-scabrous at the angles with prickles 0.05–0.2 mm	Glabrous or hirsute, above all in the lower part, with hairs 0.2–0.8 mm, or puberulent; never with prickles
Leaves	Adaxially, glossy or dull, glabrous, rarely antrorse-scabrous. Abaxially, glabrous, with retrorse-scabrous nerve. Margins with a row of retrorse prickles and several submarginal rows of antrorse prickles	Glabrous on both surfaces with margin antrorse-scabrous, or laxly hairy with margin antrorse-hirsute, with hairs 0.3–0.8 mm
Axis of inflorescence	Retrorse-scabrous almost up to the apex	Glabrous or laxly hairy, with no prickles
Peduncles	Retrorse-scabrous	Glabrous or laxly hairy
Pedicels	(0.7)1.3–3.5 mm, generally < than the corolla; the fructiferous pedicels divaricate, glabrous, or retrorse-scabridulous	1.3–5 mm, generally > than the corolla; the fructiferous pedicels strongly divaricate or even reflexed, glabrous
Corolla	3–5 mm diameter, with lobules 1.3–1.9 mm	2.6–3.7(4) mm diameter, with lobules 1.1–1.5(1.8) mm
Mericarps	1.2–2 mm	1–1.5 mm
Chromosome number	$2n = 22$	$2n = 22, 44$

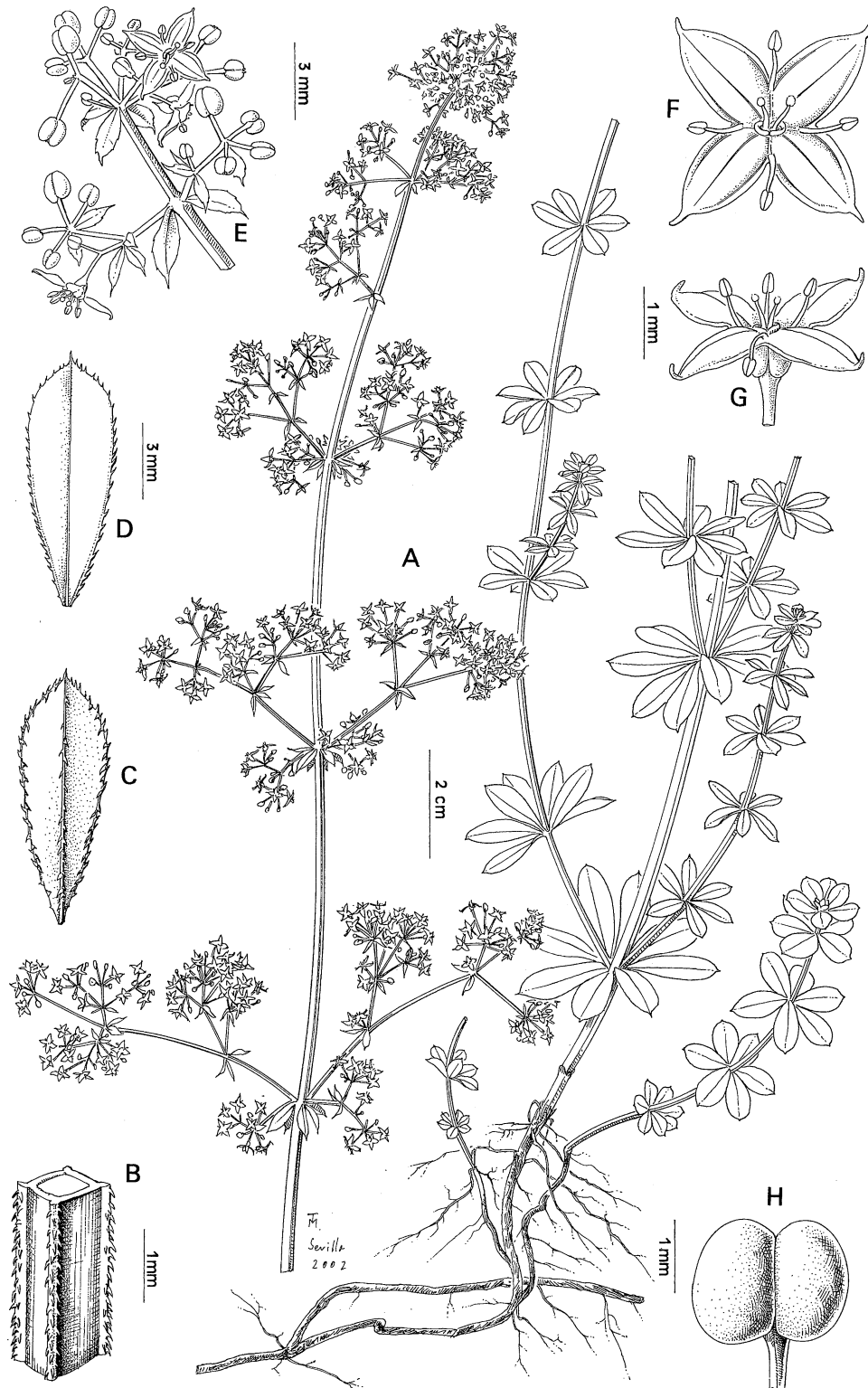


Figure 2. *Galium talaveranum* Ortega-Olivencia & Devesa **sp. nov.** A, habit. B, cross-section of stem. C, detail of abaxial leaf surface. D, detail of adaxial leaf surface. E, detail of partial inflorescence. F and G, flower. H, mericarps.

broadly pyramidal panicle with retrorse-scabrous axis and branches, the latter opposite, erecto-patent or patent, with flowers in divaricate cymes, on retrorse-scabrous peduncles that are larger than the bracts. BRACTS: first order 2–8, 2–10 (15) × 0.7–4.5 mm, reflexed or patent, the lowest being similar to the leaves, the remainder elliptical or lanceolate and acute, glabrous on both surfaces and with margins mostly antrorse-scabrous. Bracteoles absent or rarely one per node, 1.3–1.9 mm, generally smaller than the pedicels. FLOWERS hermaphrodite, pedicellate. Pedicels (0.7) 1.3–3.5 mm, smaller than or subequal to the corolla; the fructiferous pedicels (0.4) 1–4.3 mm, larger than the fruit, thin or subcapillary (0.1–0.2 mm thick), divaricate, glabrous or laxly retrorse-scabridulous. COROLLA 3–5 mm in diameter, rotate, glabrous, white; tube 0.35–0.5 mm and lobules 1.3–1.9 mm, larger than the tube, ovate or ovate-lanceolate, with a 0.25–0.5 mm apiculum. STAMENS with anthers 0.3–0.45 mm, oblongoid and yellowish; filaments 0.5–0.8 mm, longer than the anthers. OVARY oblongoid, glabrous, with style up to 1.1 mm and globose stigmas. MERICARPS 1.2–2 mm, subreniform, brown or blackish-brown, glabrous, with a smooth or slightly rough surface.

Etymology: Named in honour of Salvador Talavera Lozano, botanist at the University of Sevilla who has made an outstanding contribution to *Flora Iberica*.

Holotype: (designated here). 'Badajoz, Arroyo Hinojales, ribera, 23.vi.2002, A. Ortega & T. Rodríguez (UNEX 30811)'.

Illustration: Valdés, Talavera & Galiano (eds.), *Fl. Andalucía Occid.* 2: 583 (1987, sub *G. mollugo*) (Fig. 2).

Phenology: Flowering from (May) June to July (August).

Ecology: Riverbanks, streams, canals, alder woods, and cork-oak dehesas, at elevations of 0–600 m.

Distribution: Endemic to the Iberian Peninsula, being dispersed over western Andalusia, Extremadura, and central and northern Portugal.

G. talaveranum fits into sect. *Trachygalium* K. Schum., which includes perennial herbs, with strongly retrorse-scabrous internodes at the angles, leaves in whorls of 6–10, single-veined, adaxially glossy, with a margin having a retrorse and antrorse-scabrous indumentum, and the morphology of the corolla varying between infundibuliform, crateriform or rotate. In the flora of Europe, only three species are included in this section, *G. rivale* (Sibth. & Sm.) Griseb., *G. uliginosum* L. and *G. viridiflorum* Boiss. & Reut. (Ehrendorfer *et al.*, 1976), with only the last two being present in the Iberian Flora. *G. talaveranum* appears to show no phenetic relationship with any of these species, with the exception of the aforementioned principal characters. A dichotomous key to these species follows, together with an outline of their nomenclature and chorology.

G. uliginosum L., Sp. Pl. 106 (1753)

G. palustre var. *uliginosum* (L.) Fiori, Nuov. Fl. Italia 2: 496 (1927)

Illustration: Fiori & Paol., Iconogr. Fl. Ital. fig. 3230¹ (1933, sub *G. palustre* var. *uliginosum*).

Distribution: Most of Europe, from the north of the Iberian, Italian, and Balkan peninsulas to Scandinavia, north, central, and south-west Asia (naturalized in western Greenland). In the Iberian Peninsula, scattered over north-east Spain (Basque Country and Catalonia).

G. viridiflorum Boiss. & Reut., Pugill. Pl. Afr. Bor. Hispan. 51 (1852)

G. reverchonii Lange, nom. in sched. (COI-Willk, MA 117834)

KEY TO SECT. *TRACHYGALIUM*

- 1 Stems hairy, at least in the floriferous zone and near the nodes, with angles retrorse-scabrous. Corolla greenish or yellowy-greenish, hispidulous. Mericarps hispidulous, with hairs 0.1–0.7 mm. *G. viridiflorum*
- 1 Stems glabrous, with angles retrorse-scabrous. Corolla white, glabrous. Mericarps glabrous. 2
- 2 Corolla crateriform or subrotate, with acute lobules, no apiculum. Mericarps 0.85–1.3 mm, with granular surface. *G. uliginosum*
- 2 Corolla rotate, with acute lobules and 0.25–0.5 mm apiculum. Mericarps 1.2–2 mm, with smooth or slightly rough surface. ***G. talaveranum***

Distribution: Southern Spain (mountains of Málaga) and coast of Granada (near Motril). Recently, Jury & Rutherford (2002) have noticed this species from the western Rif (northern Morocco).

G. talaveranum cannot be confused with either of the other two species, although confusion may be possible with *G. mollugo*, to which it bears a great morphological resemblance. This species fits into sect. *Leiogalium* Ledeb., a section of perennial herbs, with glabrous or hairy stems, but never with retrorse prickles; leaves single-veined in whorls of (4) 6–10 (12), with margins rarely smooth, having antrorse (never retrorse) prickles; flowers pedicellate, with corollas rotate, crateriform, or campanulate, frequently apiculate; mericarps generally glabrous, with a smooth or slightly rough surface. Perhaps one of the reasons for the confusion is related to the observation of the indumentum of their margins. As is the case with many other species of the genus, the best way to discover whether prickles are antrorse, retrorse or of both types on the foliar margin is to observe the leaf abaxially, since, if the margin is a little reflexed, its observation adaxially will reveal only the prickles that exist on the adaxial surface, not on the margin itself which remains almost hidden from view.

SELECTED MATERIAL

Asterisk indicates population studied karyologically.

G. moralesianum. SPAIN. ALBACETE: Sierra de Segura, 23 km SSW of Yeste, Collado de Malandante, 28.vi.1979, P.F. Cannon, P.R. Crane, S.L. Jury & D.M. Moore (SEV 52273); Yeste, 7.vii.1891, Porta & Rigo (MA 117210); near Nerpio, 1.vi.1962, E.F. Galiano (SEV 4116); Río Mundo, 2.4 km near Ayna from Elche de la Sierra, 19.vi.2000, A. Ortega (UNEX 25982); * *ibid.*, 19.iv.2002, A. Ortega (UNEX 30814); Isso, near Hellín, 17.v.1985, J.M. Herranz (MA 361010); Letur, 25.iv.1997, C. Aedo, I. Alvarez, S. Castroviejo, R. Morales, F. Muñoz, M. Velayos *et al.* (MA 591629, 1–3); *ibid.*, 2.5 km from Letur, 19.vi.2000, A. Ortega (UNEX 25985); * *ibid.*, 19.iv.2002, A. Ortega (UNEX 30813); Riopar, 9.viii.1971, S. Rivas Goday, E. Valdés & M. Ladero (GDA 8258); Elche de la Sierra, v.1962, J. Borja (MA 186099 & MA 180650); Nerpio, Río Taibilla, near dam, 19.vi.2000, A. Ortega (UNEX 25981); Embalse del Cenajo, road to dam, 27.vi.1994, F. Muñoz-Garmendia & C. Navarro (MA 564952, 1 & 2); Gallego, río Segura, 28.v.1987, A. Izuzquiza, E. Dorda, R. Elvira & E. Villanueva (MA 401042); El Gallinero, near Riopar, 12.vii.1923, J. Cuatrecasas (BC 27647). ALMERÍA: Berja, Barranco 'Presnos', 3.vii.1982, A. Segura Zubizarreta (MA 591581 & MA 581056).

G. boissieranum. SPAIN. MÁLAGA: Sierra de Carratraca, between Álora and Carratraca, 23.v.1965, E.F.

Galiano (SEV 4145); *ibid.*, 6.4 km from Carratraca, 25.vi.2000, A. Ortega (UNEX 26221); *ibid.*, 1.8 km from Carratraca, 25.vi.2000, A. Ortega (UNEX 26223); *ibid.*, 2.7 km from Carratraca, 25.vi.2000, A. Ortega (UNEX 26222). Sierra de Aguas, arroyo del Tajo Azul, 18.v.1972, G. López (MA 416993, 1 & 2); Carratraca, Cerro del Agua, 21.vi.1926, Gros (BC 113197, 1 & 2). Casarabonela, Sierra de la Robla, 22.ii.1994, P. Navas & A. Pérez-Latorre (MGC 37479). Between Junquera and El Burgo, 11.vii.1978, B. Molesworth Allen (SEV 80093). Sierra Bermeja, Estepona, 11.vii.1991, B. Cabezudo & J.M. Nieto (MGC 43831); *ibid.*, Barranco del Madroño, 29.v.1926, Gros (BC 113194, 1 & 2, BC 113178, 1–3); *ibid.*, Sierra La Romera, 16.v.1919, C. Pau (BC 27644); * *ibid.*, km 11 to Puerto de Peñas Blancas, 6.vi.2002, A. Ortega & T. Rodríguez (UNEX 30816); *ibid.*, Reales de Genalguacil, 15.vii.1976, A. Asensi & B. Díez (MGC 3766). Casares, Garganta de las Acedías, 9.v.1991, V.M. García (MGC 43830). Igualeja, SE Cerro de los Cascajares, 31.x.1988, D. Montilla (MGC 40715). Road S. Pedro-Ronda, 5.vi.1987, B. Díez Garretas & A. Asensi (MGC 21259). Sierra Blanca, Ojén, road to Juanar, 19.v.1994, J.M. Nieto, B. Cabezudo, Y. Gil & P. Navas (MGC 39214); *ibid.*, near Los Púlpitos, 14.vi.1983, J. Guerra & Merino (MGC 11670). Ronda, 25.vi.1956, M.J. Serres (MA 164453). Serranía de Ronda, Cañada del Capuchino, 21.vii.1935, M. Laza, Fl. Malagueña (MA 117186). Coín, Sierra de Alpujata, 20.vii.1993, P. Navas, Y. Gil, A. Pérez & D. Navas (MGC 43809); *ibid.*, crossing Coín-Fuengirola-Mijas-Alhaurín el Grande, 26.vi.2000, A. Ortega (UNEX 26233). Istán, Sierra Real, Arroyo Real, 2.vi.1994, J.M. Nieto, Y. Gil & P. Navas (MGC 46270). Sierra de Tolox, 5.vii.1936, M. Laza (GDA 38451). Road Coin-Tolox, 18.vi.1916, E. Gros (MA 117203); *ibid.*, 19.vi.1919, C. Pau (BC 27646). Between Junquera and Tolox, 5.vii.1931, L. Ceballos (MA 117205). Alhaurín El Grande, 1 km from Los Tableros, 12.vi.1996, J.A. Devesa & A. Ortega (UNEX 30815).

G. talaveranum. SPAIN. BADAJOZ: Badajoz, arroyo Hinojales, riverbank, 23.vi.2002, A. Ortega & T. Rodríguez (UNEX 30811). Badajoz, road to Sevilla, La Pineta, 9.vi.1989, R. Tormo & T. Ruiz (UNEX 16094). Salvatierra de los Barros, 21.iv.1987, F. Vázquez (UNEX 6507). HUELVA: Coto de Doñana, El Rocío, La Rocina, 20.vi.1978, S. Castroviejo, S. Rivas-Martínez & E. Valdés-Bermejo (MA 436220, 1–3). Almonte, Doñana, La Rocina, 31.v.1980, S. Castroviejo & G. López (MA 435255, 1 & 2). Sierra de Aracena, between Fuentetheridos and Galaroza, 7.viii.1979, J. Rivera (SEV 48215); *ibid.*, between Fuentetheridos and crossing to Valdelarco, 2.viii.1978, J. Rivera (SEV 48214). SEVILLA: Constantina, Arroyo del Guadalbarcar, 9.xii.1983, I. López, J.A. Serveto & C. Vázquez

(SEV 105809). Between Cazalla de la Sierra and Guadalcanal, 22.vi.1976, E.F. Galiano *et al.* (SEV 83334). Cazalla de la Sierra, 8.vi.1982, J.L. García & V. Bañez (SEV 83843); *ibid.*, Rivera de Huesnar, Isla Margarita, 29.vii.1979, S. Silvestre (SEV 83333); * *ibid.*, 13.iv.2002, A. Ortega & T. Rodríguez (UNEX 30812). PORTUGAL. ALTO ALENTEJO: Serra de Ossa, riverbank of the Canal, 17.vi.1956, J. Malato-Beliz (MA 299666). BEIRA ALTA: Expedição na Serra da Estrela, viii.1881, J. Daveau (COI). BEIRA BAIXA: Castelo Branco, Mapica near Castelo Branco, 12 km from the city, 14.v.1970, M. Beliz & J.A. Guerra (UNEX 4729). MIÑO: Serra do Gerês, between Caldas and Pedra Bel, 10.vii.1958, M. Beliz, F. Raimundo & J.A. Guerra (UNEX 16089).

G. mollugo. SPAIN. BILBAO: Monte Lequeitio, near Atalaya, 31.vii.1947, E. Guinea (MA 461051). Ría de Lequeitio, 4.viii.1947, E. Guinea (MA 117359). Urberuaga, Herbario Antigo (MA 150802). Gorbea, 16.vii.1946, E. Guinea (MA 164304). Orduña, railway, near La Muera, 10.vii.1947, E. Guinea (MA 117778). CÁCERES: around Guadalupe, 19.v.1949, A. Caballero (MA 117383, 1 & 2). GERONA: Vall de Ribes, S. Amanç, 17.viii.1962, J. Vigo (BC 149072, 1–3); *ibid.*, Sant Amanç (Bruguera), 8.vii.1972, J. Vigo (BC 609164). La Garrotxa, la Pinya, 17.viii.1976, O. de Bolòs (BC 619349). LA CORUÑA: Cariño, Punta dos Aguillons, 21.viii.1987, E. Lago, C. Ferreira & A. Paz (MA 476987, 1 & 2). Dumbría, Ezaro, río Ezaro, 11.viii.1994, R.I. Louzán (MA 581009). Ares, 14.x.1967, R. Alvarez (MA 502205). Puente deume, Playa de Perbes, 20.vii.1987, E. Lago, C. Ferreira & A. Paz (MA 476986). LEÓN: Lago de Babia, 10.vii.1997, T. Ruiz *et al.* (UNEX 24540). Sobrado, 30.v.1990, J. Giménez & J. Amigo (MA 546874). LOGROÑO: Río Ebro, Logroño, Herbario Antigo (MA 150800, 1 & 2). Ribera de las Norias, without specified date and legit., Herbario Antigo (MA 150811). LUGO: Sierra del Caurrel, 30.viii.1993, E. Blanco (MA 567720); *ibid.*, Cebreiro, vi.1990, E. Blanco (MA 567803). Monforte, Chao de Fabeiro, 6.vi.1990, M.I. Romero (MA 530468). Mondoñedo, near Cueva del Rei Cintolo, 22.vi.1990, J. Amigo & J. Giménez (MA 530078). Becerreá, 25.viii.1992, C. Navarro & E. Monasterio-Huellin (MA 530768). Piedrafita de Cebreiros, 6.viii.1990, E. Carreira (MA 513559). Riberas de Lea, 25.viii.1956, E. Carreira (MA 201955). Cervantes, Correal, between El Porelo and Piedrafita del Cebreiro, 28.vi.1994, M.A. Carrasco, M.A. Martín & M. Velayos (MA 543389). MADRID: Cadalso de los Vidrios-Rozas de Puerto Real, 5.v.1982, D. Sánchez-Mata & D. Belmonte (GDAC 24929). Madrid, vi (MA 573403). ORENSE: Castrelo de Miño, 17.vii.1935, A. Rodríguez (MA 117405, MA 117406). OVIEDO: Tragamón, 12.iv.1913, C. Martínez (MA 117356). Asturias, viii.1970, B. Díez (MGC 1322).

Pola de Somiedo, 10.vii.1997, T. Ruiz *et al.* (UNEX 24520). Puerto Ventana, 3.viii.1971, E.F. Galiano, S. Silvestre, S. Talavera & B. Valdés (SEV 12188). Luanco, vii.1952, E. Guinea (MA 443896). Desfiladero de los Beyos, 16.vi.1975, O. de Bolòs (BC 618766). PONTEVEDRA: San Adrián, Vilaboa, 18.vii.1970, S. Castroviejo (MA 197186). SALAMANCA: Aldehuela de Yeltes, Cristo de la Laguna, 24.vi.1977, E. Rico (MA 308698). Road to Puerto de Béjar, 8.vi.1945, A. Caballero (MA 117407, 1 & 2). SANTANDER: Liandres, 18.vii.2000, A. Ortega & T. Rodríguez (UNEX 26668). Carriazo, 24.vi.1950, E. Guinea (MA 443894 & MA 443895). VITORIA: Orduña, 10.vii.1947, E. Guinea (MA 164306, 1 & 2); *ibid.*, road to Puerto de Orduña, 19.vii.2000, A. Ortega & T. Rodríguez (UNEX 26659). Elburgo, Añua, 6.ix.1983, G. Morante & J.A. Alejandro (MA 436619, 1 & 2). ZAMORA: Vigo de Sanabria, río Forcadura, 25.vii.1987, P. García & A. Roa (MA 510051). Portilla del Padornelo, 24.vii.1972, E. Valdés-Bermejo (MA 435244). PORTUGAL. BEIRA ALTA: Guarda, Seixo Amarelo, 17.vi.1953, A. Fernandes, R. Fernandes & F. Sousa (MGC 766); *ibid.* Quinta do Prado, Lamas, 20.viii.1948, R. & A. Fernandes (COI 2811). Caldas de Manteigas, rio Xêxere, 3.vii.1951, A. Fernandes, F. Sousa & J. Matos (COI 3782). BEIRA BAIXA: Serta, 17.vi.1954, B. Rainha (MA 299665). BEIRA LITORAL: Coimbra, Dianteiro, ribeira de Valbom, 10.vii.1958, M. da Silva (MA 170914); *ibid.*, Benfeita, Pardieiros, mata da Margaraça, 24.vii.1982, A. Marques (MA 398525). MINHO: Serra do Gerês, between Caldas and Laeonte, rio Gerês, 10.vii.1958, M. Beliz, Raimundo & J.A. Guerra (MA 180395, MA 299667). Serra do Soajo, N.S. de Peneda, vii.1890, A. Moller (MA 117375). Arco de Baúlhe, ix.1941, A. Carvalho (MA 185376). TRAS-OS-MONTES E ALTO DOURO: Bragança, Sta. Maria, Mte. S. Bartolomeu, 17.vi.1991, C. Ajuar (COI). Río Távora, between Valença do Douro and Tabuaco, 9.vii.2002, A. Ortega & T. Rodríguez (UNEX 30817). Pedras Salgadas, vii.1881, M.L. Henriques (COI).

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REFERENCES

- Ehrendorfer F. 1961.** Rubiaceae. In: Löve A, Löve D, eds. Chromosome number of Central and Northwest European plant species. *Opera Botanica (Lund)* **5**: 318–321.

- Ehrendorfer F, Krendl F, Puff C. 1976.** *Galium*. In: Tutin TG, Heywood VH, Burges NA, Moore DM, Valentine DH, Walters SM, Webb DA, eds. *Flora Europaea* 4. Cambridge: Cambridge University Press, 14–36.
- Gadella TWJ, Kliphuis E. 1963.** Chromosome numbers of flowering plants in the Netherlands. *Acta Botanica Neerlandica* **12**: 195–230.
- Holmgren PK, Holmgren NH, Barnett LC. 1990.** Index herbariorum. *Part I: the Herbaria of the World*, 8th edn. Bronx: New York Botanical Garden.
- Jury SL, Rutherford RW. 2002.** *Galium*. In: Valdés B, Redjali M, Achhal el Kadmiri A, Jury SL, Montserrat JM, eds. *Checklist of vascular plants of N. Morocco with identification keys* 2. Madrid: Consejo Superior de Investigaciones Científicas, 601–606.
- Kliphuis E. 1962.** Cytotaxonomical studies on the genus *Galium*. A preliminary report. *Proceedings, Koninklijke Nederlandse Akademie Van Wetenschappen, Amsterdam, Series C* **65**: 279–285.
- Kliphuis E. 1983.** Cytotaxonomical notes on some species of the genus *Galium* L. (Rubiaceae) collected in the North-Western parts of Spain. *Lagascalia* **11**: 229–244.
- Natali A, Jeanmonod D. 2000.** Rubiaceae. In: Jeanmonod D, ed. *Compléments au Prodrome de la Flore Corse*. Genève: Conservatoire et Jardin Botaniques Ville de Genève, 1–203.
- Piotrowicz M. 1958.** Karyological studies in some species of the genus *Galium* L. *Acta Biologica Cracoviensia, Série Botanique* **1**: 159–169.
- Selma C. 1992.** Fragmenta chorologica occidentalia, 4110–4179. *Anales del Jardín Botánico de Madrid* **50**: 96–100.
- Snow R. 1963.** Alcoholic hydrochloric acid-carmines as a stain for chromosomes in squash preparations. *Stain Technology* **38**: 9–13.
- Tjio JH, Levan A. 1950.** The use of oxyquinoline in chromosome analysis. *Anales de la Estación Experimental de Aula Dei* **2**: 21–64.
- Torres N, Sáez L, Mus M, Rosselló JA. 2001.** The taxonomy of *Galium crespianum*. J.J. Rodr. (Rubiaceae), a Balearic Islands endemic revisited. *Botanical Journal of the Linnean Society* **136**: 313–322.