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The taxonomy and conservation of *Campanula primulifolia (Campanulaceae),* a critically endangered species in the Iberian Peninsula

Abstract

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The rare Iberian endemic *Campanula primulifolia,* sometimes treated as a synonym of *C. alata,* was investigated. Its relationships with the two other species placed in *C.* sect. *Pterophyllum,* the disjunct E Mediterranean *C. peregrina* and the NW African *C. alata* s.str., were re-assessed. All three taxa, based principally on morphological and distributional evidence, were shown to merit independent specific status; a determination key is provided. Special emphasis was given to the conservation aspect of *C. primulifolia* in Portugal, where it grows in four widely separated provinces, and in SW Spain. All these small populations are seriously threatened and special protection measures are needed to prevent extinction. Our assessment is that it is Critically Endangered [CR B2 ab (iv,v); C2a (i)]. Nomenclatural and taxonomic errors in earlier publications are rectified.

Additional key words: *Campanula peregrina, Campanula alata, Campanula* sect. *Pterophyllum,* Mediterranean region

Introduction

In the first extensive molecular survey of the *Campanulaceae* using ITS sequence data, Eddie & al. (2003) showed that *Campanula* L. can be divided into two major clades, the rapunculoid clade and the *Campanula* s.str. clade. Surprisingly, *C. primulifolia* and *C. peregrina* formed a polytomy with *Gadellia lactiflora* (M. Bieb.) Schulkina and *Musschia aurea* Dumort., and together with *Jasione* L. and *Wahlenbergia hederacea* (L.) Rchb. occupied an unresolved position separate from the two main *Campanula* clades. Approximately similar results were confirmed for *Musschia* by Borsch & al. (2009) and for the other taxa by Roquet & al. (2009) and by Haberle & al. (2009). With this background, the species in *C.* sect. *Pterophyllum* Damboldt (*C. primulifolia, C. peregrina* and, by implication, *C. alata* s.str.) were investigated further to elucidate their relationships to each other and to *Gadellia* Schulkina and *Musschia* Dumort., given that these taxa occupy disjunctive distributions between the W Mediterranean, Madeira and the E Mediterranean/Caucasus regions. The results of this investigation (Trias Blasi, Phylogenetic relationships of *Campanula* sect. *Pterophyllum*, MSc thesis, Univ. Edinburgh, 2005) form the basis of this paper. During the course of this study, which involved molecular, SEM and morphometric analyses, it was found that the molecular results did not provide evidence for the specific recognition of three species in *C.* sect. *Pterophyllum*. However, morphometric analyses showed that they can be recognised as distinct species and form a morphologically similar cluster separate from

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Musschia and *Gadellia* on the basis of both vegetative characters and floral/fruit characters. This study also confirmed that *Musschia* clusters most closely with *Gadellia* and *C.* sect. *Pterophyllum*. Sáez & Aldasoro (2001) merged *C. primulifolia* with *C. alata,* a decision that was accepted by Lammers (2007). In the course of field work in Portugal and Spain, we (I. H. & F. S.) became alerted to the precarious status of *C. primulifolia* in Portugal and the present paper results from subsequent investigations. We have information relating only to *C. primulifolia* because it is difficult to accurately assess the situation of the lesser known *C. alata* in Algeria and Tunisia, although Floras or checklists usually describe it as uncommon or scattered and probably is as rare as *C. primulifolia.* The situation with *C. peregrina* is somewhat clearer and probably does not give cause for conservation concern although the status of peripheral populations in Syria, Lebanon, Cyprus and northern Israel is unclear and some of them may be endangered.

Over the years, there have been differing opinions on the circumscription, distribution and synonyms of the species. Hoffmannsegg & Link (1820–24) considered *Campanula primulifolia* as a synonym of *C. peregrina;* Munby (1847) wrongly recorded *C. peregrina* from Algeria; Tristram (1884) also wrongly recorded *C. primulifolia* from Lebanon (Beirut). *C. decurrens* Zuccagni has been cited as a doubtful synonym of both *C. alata* and *C. peregrina.* The present paper, inter alia, aims to set straight the previously confusing taxonomy.

The description of *Campanula* sect. *Pterophyllum* given below is slightly amended from that of Damboldt (1978) in Flora of Turkey. A full description of *C. primulifolia* is given while those of the other two species only emphasise differential characters. All of the specimens seen of the three species are cited in Appendix 1.

Taxonomy of *Campanula* sect. *Pterophyllum*

Campanula sect. ***Pterophyllum*** Damboldt in Notes Roy. Bot. Gard. Edinburgh 35: 44. 1976. – Type: *Campanula peregrina* L., Mant. Alt.: 204. 1771.

= *Echinocodon* Kolak. in Soobshch. Akad. Nauk Gruzinsk. SSR 121(2): 386, fig. 1. 1986, non Y. Hong 1984 ≡ *Echinocodonia* Kolak. in Bot. Zhurn. (Moscow & Leningrad) 79(1): 114. 1994. – Type: *Echinocodonia primulifolia* (Brot.) Kolak. (≡ *Campanula primulifolia* Brot.)

= [*Echinocodoneae* Kolak. in Soobshch. Akad. Nauk Gruzinsk. SSR 121 (2): 387. 1986, nom. inval.] *Echinocodonieae* Kolak. in Bot. Zhurn. (Moscow & Leningrad) 79(1): 114. 1994.

Biennials or perennials of robust habit, hispid at least on the stems; hairs eglandular, unicellular, cylindrical, up to 2.5 mm. *Stems* up to 1.5(–2) m, usually simple. *Basal and lower leaves* with winged petioles; *cauline leaves* sessile or shortly petiolate. *Inflorescence* spiciform. *Calyx* without appendages. *Capsule* trilocular, dehiscing subapically (± median). *Style* filiform.

Distribution. — W and, disjunctly, E Mediterranean.

Habitat. — All three species are essentially mesophytic plants growing at the edge of streams or in damp and shady places.

Key to the species

1. Leaves glabrous or almost so; corolla lobes 13–18 × 10–15 mm; seeds 1–1.10 mm; [NW Africa] . . . . . 2. *C. alata*
– Leaves hispid throughout; corolla lobes 7–12 × 5–10 mm; seeds 0.55–0.65 mm 2
2. Capsule obconical; inflorescence a ± compact spike-like raceme with flowers sessile or almost so; base of corolla internally dark blue or whitish; [E Mediterranean] . . . . . 3. *C. peregrina*
– Capsule globose; inflorescence a ± loose raceme with flowers long-pedicellate; base of corolla internally always white or whitish; [Iberian Peninsula] . . . . . 1. *C. primulifolia*

1. *Campanula primulifolia* Brot., Phytogr. Lusitan. Select. fasc. I. n. 9: 17–19, t. I & II. 1800 [as *C. primulaefolia*] ≡ *Echinocodon primulifolius* (Brot.) Kolak. in Soobshch. Akad. Nauk Gruzinsk. SSR 121(2): 387. 1986 [as "*primulifolium*" but see Code Art. 62.2(a); no valid combination has been made in the substitute genus name *Echinocodonia* Kolak.]. – Lectotype (designated here): [icon] Brotero, Phytogr. Lusit. Select. fasc. I: t. I [= lower part of plant individual] & II [= upper part]. 1800.

– *Campanula trachelium* sensu Brotero (1804: 287)
– *Campanula peregrina* sensu Hoffmannsegg & Link (1820–24: 15, t. 83)
– *Campanula alata* sensu Sáez & Aldasoro (2001: 134)

Notes on the typification of Campanula primulifolia. — Although the place of publication is often given as Flora Lusitanica (Brotero 1804), e.g. Greuter & al. 1984, IPNI 2010, the earliest publication is the one given above (König & Sims 1805). We confirmed the existence of a copy this very rare book at the Science Faculty of Oporto University. There was also a microfiche edition published in the 1980s.

The localities cited in the protologue are "[Portugal] in Algarbiis et Beira, ad montium rupes umbrosas et udas: occurrit etiam prope Conimbricam ad fontem vulgo do Gato, et in via meridionali ad praedium do Rangel". Very few herbarium specimens linked with Brotero exist and none of his *Campanula* species has been traced. The only specimen that might have had a link to Brotero is in the Willdenow herbarium, no. 3832 (B-W, microfiche!; Willdenow 1809). Although its label exactly repeats Brotero's original Latin description and refers to his Flora

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Lusitanica (Brotero 1804), there is no indication of date, wild or cultivated provenance and no indication of the collector. Brotero did have contact with both Willdenow and Link at Berlin during the 1790s (Castel-Branco 2004) and there may have been exchange of specimens. Link travelled in Portugal with Hoffmannsegg in 1797–99 prior to the publication of their Flore Portugaise (Hoffmannsegg & Link 1820–24). After Willdenow's death in 1812, Link succeeded him as director of the Berlin Botanic Garden, to be followed by Schlechtendal; his name, added at a later date, is also on this herbarium sheet.

Given the lack of definitely original material, we here select the illustrations in the protologue as lectotype. The illustrations in Brotero (1800) are excellent (Scouler 1845) and there is evidence that Brotero closely supervised their making (Castel-Branco 2004). The artist could have been Basílio, but only the names of the engravers, Vieira and Santos, are on the plates.

Icones. — Brotero (1816: t. 19, 20 [= 1800: t. I+II); Hoffmannsegg & Link (1820–24: 15, t. 83 as *Campanula peregrina)*; Hooker (1855: t. 4879 as *C. primulaeflora*); Gallego (1987: 563); Sáez & Aldasoro (2001: 135 as *C. alata*).

Further references. — Brotero (1804: 288; 1816: 43); Candolle (1830: 317; 1838: 478); Coutinho (1901: 37–38; 1913: 601; 1939: 711); Fedorov & Kovanda (1976: 79); Franco (1984: 325).

Perennial up to 1.5(–2) m. *Stem* erect-ascending, usually single and unbranched, cylindrical, angular, fistulose, densely hispid with almost stinging hairs 1–1.5 mm long. *Basal leaves* in a rosette, narrowly obovate, 13–17(–23)×4–6 cm, long-attenuate into a winged petiole, irregularly 2-crenate, adaxial surface with scattered hairs to 1.5 mm, abaxial surface densely hispid with 2–3 mm long hairs along the midrib decreasing in size along the smaller veins. *Cauline leaves* alternate, sessile, narrowly obovate, 4–10(–15)×1–3(–4.5) cm, both sides hispid especially along the venation, auriculate, shortly decurrent, irregularly 2-crenate to crenate, acute. *Inflorescence* a raceme; flowers 1–3 in the upper leaf axils; pedicels to 3.5 cm; bracts foliose, of similar length as flowers. *Calyx lobes* 13–17 × 4–6 mm, hispid especially abaxially. *Corolla* purple-blue, whitish at the base internally, broadly campanulate, generally glabrous with some hairs at the apex and veins; tube 10.5–12 mm long; lobes 14–16 mm long, 8–12 mm wide a base. *Stamens* 12–13 mm; filaments 5 mm, hairy and strongly dilated (4 mm) at base; anthers 6×1 mm, linear, basifixed; pollen grains 28.26 µm diameter. *Style* filiform, 8–14 mm; stigma trifid, lobes 4–7 mm. *Capsule* globose, 7–8×8–9 mm, dehiscing by median ruptures; seeds 0.66×0.68 mm, numerous, flattened-subglobose, pale brown with a thickened paler margin, shiny. $2n=36$ (see Cytology below). Flowering June to July (to October).

Distribution. — The species is known from six pockets of distribution in the Iberian Peninsula, five are in four provinces in Portugal (Beira Litoral-Coimbra area; Ribatejo-Constância; Baixo Alentejo-Odemira; Vila Nova de Milfontes; Algarve-Monchique). The early record from the far northernmost Minho province has to be regarded with much suspicion. The sixth pockets is in Spain in the province of Huelva, at the western limit of the Sierra Morena (Cabezudo 1978; Rivera & Cabezudo 1980).

Habitats are damp, shady places, often besides streams and ditches, and often in iron-rich soil, at altitudes of 130–500 m.

2. *Campanula alata* Desf., Fl. Atlant. 1: 178, t. 50. 1798. – Type: [NW Algeria, "Habitat in Atlante prope Maiane" [=Miliana, SW of Algiers], according to the protologue, sheet without details] (P-Desf., IDC microfiche no. 15, 1. row, 2. fiche from right).

– *Campanula peregrina* sensu Munby (1847)

Icones. — Desfontaines (1798: t. 50).

Biennial or perennial. *Stem* glabrous to densely hispid. *Leaves* narrow obovate, adaxial surface glabrous or almost so, abaxial surface with scattered hairs especially on midrib and margins, 8–20×3.5–6 cm, narrowing into a largely winged small petiole; cauline leaves 3–15×1–3 cm, sessile, attenuate, sometimes auriculate. *Flowers* sessile or shortly pedicellate in a spike-like raceme or sometimes a compound raceme. *Calyx lobes* 15–25 × 4–6.5 mm, hispid on margins only. *Corolla* dark or lilac-blue, glabrous with some hairs at apex; tube 12 mm; lobes 13–21 mm long, 10–15 mm wide at base. *Stamens* 12–15 mm; anthers 5–7 mm; pollen grain 32.9 µm diameter. *Style* 6.5–10 mm; stigma lobes 5–8 mm. *Capsule* ellipsoid, truncate at base, 1–1.5×0.7–1.2 cm, dehiscent by subapical ruptures. Chromosome number unknown. Flowering June–July.

Distribution. — Small populations are widespread in Algeria (Quézel 1954; Quézel & Santa 1963) and rare in Tunisia (Pottier-Alapetite 1981) but are chiefly restricted to coastal regions at altitudes of 900–1000 m. The species grows always near water edges or wet places.

Notes. — Of the three species of *Campanula* sect. *Pterophyllum,* it is the only one with glabrous leaves or almost so. The few specimens examined showed little variation apart from two intergrading types of inflorescence: one with a loose inflorescence with 20–50 flowers, the other with 5–10 flowers only in a terminal cluster, but more field observations are needed.

3. *Campanula peregrina* L., Mant. Pl. 2: 204. 1771. – "Habitat ad C. B. S.? inter semina capensia excrevit ♂ [= biennial]", lectotype (designated by Damboldt 1978: 63): herb Linnaeus no. 221.48 (LINN, IDC microfiche!)

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= *Campanula lanuginosa* Lam., Encycl. 1: 584. 1785. – Type: "on la croît originaire de Tartarie v.v." (P-LA, IDC microfiche 400, no 132!).

Note on the type specimen. — The reason for Linnaeus believing that the specimen so determined by him was possibly of South African ("C. B. S.?" = Caput Bonae Spei) origin was, apparently, because it appeared in the Uppsala Botanic Garden among other plants of Cape of Good Hope origin (Sims 1810). Although it is only supposition, the actual provenance of the specimen may have been Turkish, from one of the very early collectors there. The earliest recognition of the species may be by Tournefort (1700) as "Campanula media foliis inferius candida lanugine vestitis". However, a plant with that epithet grown in the Paris garden, much later at the time of Lamarck was, according to Candolle (1830), *C. peregrina.* Candolle (1830, 1838), cites "L., Syst. 1: 301" as the place of publication of the name, but this is incorrect.

Icones. — Jacquin (1798: t. 337); Sims (1810: t. 1257).

Biennial or perennial, occasionally glaucous. *Basal leaves* 4–10×2–5.5 cm, blades spatulate, clearly narrowing at the petiole, hispid, adaxially with scattered hairs, abaxially densely hispid, petiole 6–10 cm, hispid especially on midrib, narrowly winged; *cauline leaves* 2–4×1–2.5 cm, sessile or subsessile, narrowly obovate, both sides hispid especially along the venation. *Flowers* subsessile or shortly pedicellate in spike-like raceme. *Calyx lobes* 8–12×2–5 mm, lanceolate, acute to acuminate. *Corolla* lilac-blue, usually with darker colouration at interior base, rarely whitish; tube 9–11 mm long; lobes 10–13 mm long, 8–11.5 mm wide a base. *Stamens* 10–12 mm, dilated (to 2–5 mm) at base; anthers 5–7×0.5–0.7 mm; pollen grains 29.4 µm diameter. *Style* 10–15 mm; stigma lobes 4–7 mm. *Capsule* 6–8×5–7 mm, opening by ± median pores; seeds 0.59×0.33 mm ellipsoid. $2n=26$ (see Cytology below). Flowering May–July (–September).

Distribution. — Unlike its W Mediterranean relatives, *Campanula peregrina* is not so rare but, like them, its populations are very disjunct. They occur scattered from SW and W Turkey (Damboldt 1978) and Lebanon (Mouterde 1980) southwards with fewer and fewer populations to Syria (Mouterde 1980), in Israel only in Upper Galilee (Danin 2004), and also in Cyprus (Meikle 1985). Meikle (1985) listed it as growing in Rhodos, but we have no record of it being there. It grows on wet ground at the edge of streams, ditches and canals, also in damp pine woods (Cyprus) and maquis (Israel), at altitudes from near sea level to 1500 m.

Notes. — Many descriptions (e.g. Damboldt 1978) suggest it is a biennial. The species in the region of Antalya (Turkey) can exceed 1 m, especially in very damp gullies (W.M.M.E., pers. obs.). However, it is usually less than 1 m and the seeds are the smallest in the section. While in Turkey the corolla seems always to be dark-coloured, Mouterde (1980) described it with a white throat from Lebanon/Syria. Recent information on Syrian, Lebanon and Israel populations confirmed this (Danin, pers. com.).

General discussion

Cytology. — In *Campanula,* $2n=34$ is by far the predominant chromosome number (Gadella 1964; Bolkhovskikh & al. 1969; Moore 1973–77; Goldblatt 1981–88; Goldblatt & Johnson 1990–2006). The mitotic count of $2n=36$ reported by Trias Blasi (Phylogenetic relationships of *Campanula* sect. *Pterophyllum,* MSc thesis, Univ. Edinburgh, 2005) for *C. primulifolia* is very rare and confirms Gadella's (1963, 1964) counts for $2n=36$ based on five accessions. This diploid number has only been observed in one other species, *Gadellia lactiflora* (Gadella 1963, 1964; Podlech & Damboldt 1963), although counts of $2n=34$ have also been reported for this species (Gadella 1962; Magulaev 1984, 1986). A haploid number of $n=13$ was reported by Marchal (1920) for *C. primulifolia,* whereas Gadella (1964) reported $2n=26$ for three accessions of *C. peregrina* and suggested that the count of $2n=26$ by Marchal resulted from confusing the two species (there is still confusion between these two species in the horticultural trade). Marchal (1920) did not provide locality or voucher information nor did Gadella (1964) provide locality information. *C. alata* has apparently never been investigated cytologically. The diploid number of $2n=36$ is probably correct for *C. primulifolia* and *G. lactiflora.* However, we clearly need counts for *C. alata* and those of *C. peregrina* to be confirmed.

Molecular studies. — Molecular studies have shown that *Campanula primulifolia, C. peregrina* and *G. lactiflora* have affinities with the Madeiran endemic genus *Musschia,* which may be highly significant for our understanding of *Campanulaceae* evolution in the Mediterranean region (Eddie & al. 2003; Haberle & al. 2009; Roquet & al. 2009). Shulkina & al. (2003) have shown that *G. lactiflora* has elongated seedlings and unusual growth patterns compared to other *Campanula* species. All these taxa are relictual in their distribution around the Mediterranean basin and are worthy of further investigation. We still need further cytological sampling and additional molecular investigation to clarify the phylogenetic relationships within this nexus of taxa. It is as yet premature to make taxonomic changes but, from morphological data alone (Trias Blasi, Phylogenetic relationships of *Campanula* sect. *Pterophyllum,* MSc thesis, Univ. Edinburgh, 2005), *C.* sect. *Pterophyllum* (to include all three species) seems to be a homogeneous natural group. Future studies may suggest a merger with *Gadellia* and *Musschia.* However, we suggest that lumping taxa on the basis of monophyly established through molecular analyses alone destroys the natural recognition of distinct and time-honoured

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genera such as *Musschia,* and we would strongly disagree with such a move. Traditionally, *C. primulifolia* and *C. alata* have been treated as separate species. Although the molecular analyses of these species (Trias-Blasi unpubl, l.c.) did not produce clear evidence of specific separateness, the morphometric investigation showed that they can be clearly distinguished. These data together with the unique disjunct distributions indicate that the two species should be recognised as specifically distinct. The differences in morphology and distribution between these two taxa are equivalent to the differences between most sibling and allopatric species throughout *Campanulaceae* (Podlech 1965; see also Eddie, Systematic study of *Musschia,* MSc thesis, Univ. Reading, 1984; Eddie, Global re-assessment of the generic relationships in the Bellflower family *(Campanulaceae)*, unpubl. PhD thesis, Univ. Edinburgh, 1997).

Conservation of *Campanula primulifolia*

The precarious situation of many populations of *Campanula primulifolia* has been recognised in various publications. The 1997 IUCN Red List of Threatened Plants (Walter & Gillett 1998) classified it as "Rare"; a Portuguese unpublished document (Ramos Lopes M. H. & Carvalho M. L. 1990: Lista de espécies botanicas a proteger em Portugal Continental; Ministério do Ambiente e dos Recursos Naturais) indicated it in "Danger of extinction"; the Lista Roja de la flora vascular de Andalucía (Cabezudo & al. 2005 under *C. alata*), refers to it as "In Critical Danger"; the Lista Roja de la Flora Vascular Española 2000 (V.V.A.A. 2000) treated it (as *C. alata*) as "Vunerable" (VU D1+2); and the later version of Lista Roja 2008 de la flora vascular Española (Moreno 2008), regarded the species "Critically Endangered" (CR B1 ab (i,ii,iii,iv,v) + 2ab (i,ii,iii,iv,v)). But in the IUCN Red List of Threatened Plants of 2004 (IUCN 2004), *C. primulifolia* is not listed. We suggest the status of the species should be upgraded to "Critically Endangered" (CR B2 ab (iv,v); C2a (i)).

Campanula primulifolia is very rare in Spain and today, still only known from the Parque Natural de Sierra de Aracena-Picos de Aroche where it was first recorded by Pau (1933) from Cortegana (Huelva, west of Sierra Morena). In Portugal, the species is restricted to five small disjunct areas only (one each in Beira Litoral, Ribatajo and Baixo Alentejo, two in Monchique). The herbarium specimens from the north of Coimbra are old and from a few scattered populations only. These plants grew by small streams, sometimes along cultivated fields and within an area into which the city expanded. In 2005, we searched the locus classicus of Brotero, but only found three plants a few kilometres further north, which disappeared in 2007. The disjunct populations in Monchique (Algarve) were described by Bourgeau in 1853 "as abundant" (Bourgeau in sched., Appendix 1). In 2007, we confirmed the apparently healthy state of the population in the area at Foia, which was almost exclusively formed by large rosettes of seedlings. In SW Alferce in 2006 [*J. Lavranos 32026* (E)], a single population with fairly numerous plants (c. 50), was found. The drying out of many streams and fires that occurred in 2007 in the Monchique area probably reduced the number of suitable humid habitats present in the 19th century.

The particular requirements of the species could also be responsible for the shrinking of the populations, e.g. low competition from other plants, substantial moisture, semi-shade/shade, low altitude and possibly a link to a ferric substrate, at least in both the Coimbra area (Ferreira Soares & al. 1985) and in Spain in the vicinity of iron mines.

Ex situ conservation seems to be a better option because of habitat destruction. *Campanula primulifolia* has a well-established history in gardens and, today, as a result of our recent seed collections, many gardens in Scotland have vigorous plants. It should be stressed, however, that confusion with *C. peregrina* still persists in the horticultural trade.

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Appendix 1. Specimens studied

All specimens were seen unless otherwise stated (n.v.); because of the rarity of specimens, records cited in the literature were also taken into account, these being in [ ].

Campanula primulifolia

Portugal: Beira Litoral: N of Coimbra: Fonte do Gato, *Moller 81* (COI); Coimbra, Fonte do Gato, 7.1886, *Moller s.n.* (BM); Coimbra, 1876, *J. Henriques s.n.* (K); Ribeira de Cozelhas, 7.1877, *A. A. de Carvalho Monteiro s.n.* (BM); Coimbra, near Ribeira de Cozelhas, 6.1883, *Moller 1617* (COI, K, MPU); Coselhas, *J. A. D'Araujo e Castro s.n.* (MPU); near Coimbra, 5.7.1887, *R. P. Murray s.n.* (BM, K); Ribeira de Penedo da Meditação, *J. Matos & A. Matos s.n* (COI); Penedo da Meditação, 30.5.1943, *Francisco de Sousa 8068* (LISE); Eiras, *A. Matos & M. Alves 13680* (COI); road from Casais de Eiras to S. Paulo de Frades by Ribeira do Escarbote, 1.7.2005, *Sales & Hedge 05/188* (E); ["arredores de Coimbra, Fonte do Rangel (Brot.), Fonte do Gato (Brot.)", cited by Coutinho, 1901) – n.v.]. — Ribatejo: Pedrogão Grande, margem direita do rio Zêzere, próximo da Ponte do Cabril, lugares assombreados e húmidos granitos, 17.7.1947, *Fontes & Rainha 2001* (LISE; herb. no 23524); ["dans les sites ombragés et humides sur les rochers au-dessus de Punhete au bord de la rivière du Zezere", cited by Hoffmannsegg & Link, Fl. Portug. (1820–24) and probably based on the record of the misidentified *C. trachelium* by Brotero (1804)]; ["Beira meridional: Constança [Constância], margens do Zêzere, Hoffm. & Link", cited by Coutinho (1901), n.v.]. — Baixo Alentejo: Odemira, ad margines rivulorum umbrosis, "o Bosque" dicto pr. Vila Nova de Milfontes, solo siliceo, 50 m, 7.9.1938, *Rothmaler 14169* (LISE, no. 1829 & 1829a); [Odemira on a slip of paper] Odemira, Ribeira do Sol-Posto, 19.2.1979, *Pinto da Silva* (LISE); S. Salvador, defronte a Vila [Nova de] Milfontes A. 868; [Vila Nova de] Mil-fontes, S*ampaio s.n.* (MPU); Linha de água afluente do rio Mira, subcoberto de *Salix atro-*

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cinerea, hemicriptófito de flores azuis vistosas, 8.9.1988 *José Carlos Costa s.n.* (LISI). — Algarve: In Monchique mountain, Monchique, *Moller s.n.* (COI); Monchique, *Guimarães s.n.* (COI) Serra de Monchique, 7.1891, *José Brandeiro 1381* (COI, LISE, LISI, MPU); Serra de Monchique, 9.1915, *F. Mendes s.n.* (herb. Arthur Ricardo Jorge) (LISE [2 sheets, one with basal rosettes]); Serra de Monchique, *Jahandiez s.n.* (MPU); Monchique, talus très humide de la route pour Alferce, 400 m, 20.6.1979, *Malato-Beliz & Guerra* (LISE, no. 16197); Monchique, Corte, road Grande, Alferce, 1 km from Alferce in wet stream bed, 550 m, 15.6.1978, *coll. illeg.* [E. M. Chaney?] (LISE); SW Alferce, by small permanent stream, in early bud, 30.4.2006*, J. Lavranos 32026* (E); Encortada do pico de Foia, ao longo de uma linha de água, *A. Fernandes, R. Fernandes & J. Matos 7418* (COI); W of Foia, on the slope, 11.11.2007, *Sales & Hedge 07/15;* Foia, 12.8.1964, *E. de Matos Fortuna 11* (LISI); bois de la Serra da Picota, près Monchique, ou il est abondant, 17.6.1853, *Bourgeau 1942* (E, K, MPU); Prov. Algarbia, in montosis ad rivulas N. 2, 1848, *Welwitsch s.n.* (BM). — Sine loc.: Habitat Lusitania, herb. Willdenow no. 3832 (B-W, microfiche! [the earliest record of the species we have located]); 7.1877, *M. Ferreira s.n.* (BM); *Cambessèdes s.n.* (MPU); *Welwitsch 18* (COI); *Welwitsch s.n*. (K); ex. herb. Lambert, *s. coll.*, *s.n.* (K). — Cultivated specimens of known wild, but not precisely designated, Portuguese origin: Cultivated in France, at Montpellier Botanic Garden, *Neyraut* 63 (MPU).

The record cited by Coutinho (1901) from [Minho?]: "Alemdouro litoral: Valença, Choupal, *Ricardo da Cunha* !" is most doubtful. The specimen has not been traced and the record could be a mistake of Coutinho. No Choupal near Valença (in Minho) has been traced, but there is Choupal by Coimbra, near one of the known localities of the species. R. da Cunha collected much material in the Coimbra area.

Spain: Huelva: [Sierra Morena: Cortegana, en el barranco de la calabacilla, *Gros s.n.* (MA, n.v.)]; [Cortelazor, 4.10. 1975, *Cabezudo 3619.75* (SEV 27511, n.v.); id., 29.10.1975, *Cabezudo & Ruiz 3640.75* (SEV 27520, n.v.); id., 18.6.1976, *Cabezudo & García 1404.76* (SEV 27510)]; [Sierra de Arecana, above 600 m, in permanently wet soil, always with *Malva tournefortiana* L. and *Athyrium filix-femina,* cited by Rivera & Cabezudo (1980)].

Campanula alata

Algeria: Tlemcen, *Faure s.n.* (E, MPU); Ourète, near Tlemcen, *Courcière s.n.* (MPU).— Prov. Constantine: Bône, *Dukerley s.n.* (MPU); Bou Merchen near Tunizan, *Maire s.n.* (MPU); Forêt de l'Edrugh près Bône, *Martins s.n.* (MPU); Goubia (Beni-Foughal), *Pomel s.n.* (MPU); Guerrouch, *Pomel s.n.* (MPU); Guerrouch, *Battandier s.n.* (MPU); Babor, river at Tizi n Souk, *Maire s.n.* (MPU); Monts Babor, *Reverchon 135* (MPU); Chabel El Akhra near Bougie, *Gentil s.n.* (MPU). — Prov. Alger: Maison Carrée, *Durando 449* (MPU); Maison Carrée, *E. G. Paris 106* (MPU); near Maison Carrée, *H. de la Perraudière s.n.* (MPU); Maison Carrée, *Roux 1862* (n.v.); ued Reghaïa, *A. Dubuis & L. Faurel 217* (MPU); *Bogres* (MPU); Le Fort de l'Eau, *Battandier s.n.* (MPU). Blida, *Gourget s.n.* (MPU). Nodar de Medes, *Battandier s.n.* (MPU); near Bôue and La Calle, *A. Meyer s.n.* (MPU); c. La Calle, *Clavé s.n.* (MPU); ravin de la maison forestière de Chelia, Massif d'Aurès, *Faurel s.n.* (MPU); Laghouat, *Col. Labrouisse s.n.* (MPU); near Tagmat, close to Yakomen, *Gouthier-? s.n.* (MPU); Milianah, *Pomel s.n.* (MPU).
Tunisia: Aïn Draham, *Robert s.n.* (MPU).

Campanula peregrina

Cyprus: Deep valley in between Kato Akoudaleia and Pano Akoudaleia (3 km in between them), near the remains of a mill (Ayia Paraskevi), *Broderstad s.n.* (E); *Davis 1844* (E).
Turkey: Muğla: Sandras, Dag. near Agla *Davis 13639* (E). — Antalaya: Elmali–Finike road, *Khan & al. 208* (E); Alanya, Gündoğmus to Güzelbahce *E. & G. Sezik 204* (E); Gündoğmus–Guondogmus, Bayirkozagaci yolu, *Ezer 696* (E). — Konya: Goksa deresi between Ermenek to Sarivadi, *Davis 16710* (E). — Içel: Dschennan De. (Cehennam De.) by Cydnus (Tarsus), *Siehe 672* (E). — Adana: near Hasanbeyli, river valley, *Darrah 689* (E). — Hatay: valley above Yesilkent, *Darrah 594* (E); Drtyol gohbel, son. Su. Amonos doplan, *Akman 119* (E); Mont Amanus, Djebel Moussa near Antioche, *Haradjian 3180* (E); Mont Amanus, Kushiji Dagh, *Haradjian 2448* (E); valley of Mont Amanus, *Haradjian 479* (E), *4660* (E); *Heldreich 1845* (E).
Rhodos: [Cited in external distribution of the species in Fl. Cyprus (Meikle 1985) but no specimens have been seen.].
Syria: aquedu du Moulin de chei llali, *Gaillardot s.n.* (MPU); [also in central mountains (Mouterde 1980)].
Lebanon: [Coastal, lower mountains, central mountains, eastern region and Mediterranean side (Mouterde 1980)].
Israel: [Upper Galilee (Danin 2004)].
Cultivated: Hortus Parisiensis, "thermidor" [the 11th month of the French post-revolution calendar, i.e. c. late 1790s or early 1800s] (E, as *Campanula lanuginosa*); Montpellier, Jardin des plantes, *Blanchet s.n.* (MPU); cultivated in France from seeds collected from Lebanon, *Neyraut s.n*. (MPU).

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