

## NEW COMBINATIONS IN *CAMPANULA* SECT. *QUINQUELOCULARES* FROM TURKEY

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### Abstract

*Campanula lyrata* Lam. and *C. sorgerae* Phitos, *C. betonicifolia* Sm. and *C. karadjana* Bocquet are taxonomically problematic. In the present study, their morphology, leaf surface anatomy and palynological characters were thoroughly analysed. Photographs, illustrations, useful differential morphological characters, pollen structure and a distribution map obtained or developed in the course of the study were presented. Problems of nomenclature and synonymy were also discussed. A new combination and status nov. Viz., *C. betonicifolia* subsp. *karadjana* (Bocquet) Alçitepe comb. & stat. nova has been proposed. *C. sorgerae* Phitos was reduced to a synonymy of *C. lyrata* Lam. subsp. *lyrata*.

### Introduction

The species belonging to *Campanula* L., are generally herbaceous and have showy flowers. *Campanula* consists of approximately 300 species and is distributed around the World. Approximately 150 of these are distributed in the Mediterranean Region (Cronquist, 1988; Heywood, 1998). According to Contandriopoulos (1984), the Eastern Mediterranean Region in particular, including Turkey, is considered the greatest diversity region of the *Campanulas*. *Campanula* is represented in the "Flora of Turkey" by 134 taxa of endemism ratios greater than 50% (Damboldt, 1978; Davis *et al.*, 1988; Güner *et al.*, 2000; Özhatay *et al.*, 1999, Özhatay *et al.*, 2006, Özhatay *et al.*, 2009). Section *Quinqueloculares* (Boiss.) Phitos includes 10 species and 11 taxa, and all these members are endemic except *C. crispa*. Some members of the section are taxonomically problematic. For example, *C. lyrata* and *C. sorgerae* are morphologically very similar and can only be distinguished by the lengths of their corolla tubes. If the length of the corolla tube extends up to 10 mm in the identification key of the section, the species is identified as *C. sorgerae*; if the tube length is between 12 and 25 mm, then the species is identified as *C. lyrata*. In the "Flora of Turkey" (Damboldt, 1978), *C. karadjana* is mentioned only in the statement as "species imperfectly known" but is not included in the identification key. This section states that the description of the species is deficient as no material was studied and, therefore, the status of the species cannot be evaluated. The problems relating to the species in the *Quinqueloculares* section defined in "Flora of Turkey" are identified; however, no solution emerges as the material available is insufficient. We undertook the present study to determine the status of *C. lyrata* and *C. sorgerae*, *C. betonicifolia* and *C. karadjana* which are problematic in taxonomy and to eliminate the problems that exist between the species.

### Material and Methods

Field studies were conducted from 2001–2005 and collected specimens of *C. lyrata* and *C. sorgerae*, *C. betonicifolia* and *C. karadjana*. During examination of the specimens found in the ANK, EGE, GAZI, HUB, ISTE, ISTF, IZEF, KNYA and UPA herbaria, we photographed the specimens stored in the B, E, G, LD and OXF herbaria. We could not obtain type material or type photographs of the species from related herbaria. Surface sections from the leaf were examined under a light microscope and fixed them with glycerin-gelatin (İnce 1989).

For recording SEM observations, we mounted the dried mature pollens and seeds on brass stubs and coated them with a thin layer of gold. We used a JEOL JMS 5200 device at the Laboratory of the Faculty of Dentistry, Ege University, Izmir, for examining these mounted specimens and took micrographs. We stored the samples of dried plants, and the anatomical- and palynological preparations in the Biology Department of the Arts and Sciences Faculty of the Celal Bayar University.

### Results and Discussion

In this study we examined the taxonomic status of *C. lyrata* and *C. sorgerae*, *C. betonicifolia* and *C. karadjana* belonging to the *Quinqueloculares* section.

*C. lyrata* subsp. *lyrata* and *C. sorgerae*: *C. lyrata* subsp. *lyrata* is a very widely-distributed species in the *Quinqueloculares* section and is easy to identify by its typical form (Fig. 1). The species has a rich population density in the areas of distribution and is not endangered. Komarov (1965) reports that the *C. lyrata* specimen in the Herbaria of Ledebour, which Nordman collected in the Rize province of Turkey was recorded in Caucasus. He further states that this specimen was initially wrongly identified as *C. stricta* and that Boissier corrected this mistake. Ruprecht suggests that since the Rize province is in Turkey, this species should be excluded from Russian Flora. However, some Russian scientists hope to identify this species in the south and south-west of TransCaucasia and therefore are undecided about following Ruprecht's suggestion. The Flora of Turkey reports that Davitadze was suspicious of the existence of the species distributed in Georgia. However, based on the given photograph, Oganessian (1995) and Phitos (1965) report that this species is not *C. lyrata* and that it is not distributed in Caucasus. In his study on section *Quinqueloculares*, Phitos analyses a typical specimen of *C. lyratella* Feer and suggests that it should be considered a synonym of *C. lyrata* although its leaves are smaller. Furthermore, Phitos suggests that typical forms of *C. lyrata* are distributed only in the islands of Midilli and Samos and in the Kaş district of Antalya province. *C. lyrata* has two subspecies: subsp. *lyrata* (Fig. 2) and subsp. *icarica*. Sorger & Buchner (1983) report that they collected *C. lyrata* subsp. *icarica* in the Marmaris Peninsula. However, Carlström in her article (1986) states that the status of this species is doubtful. In our studies, we did not find this taxon in Turkey. We examined the photograph of holotype LD (Lund University) Herbarium. In addition, we also examined the type specimen of this species in the UPA (University of Patras) Herbaria.

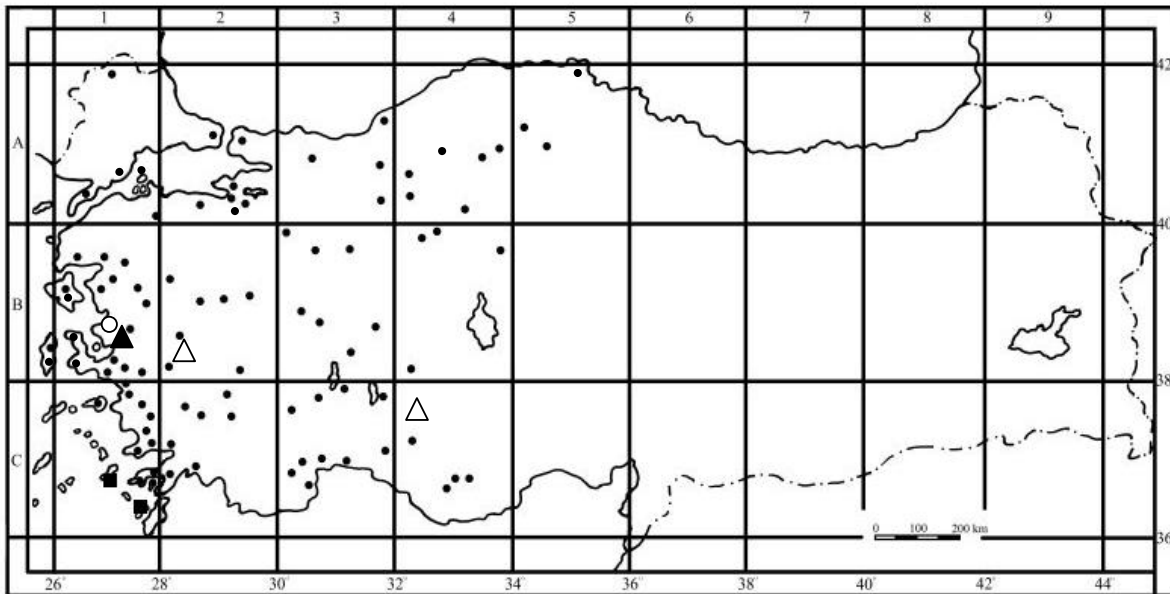


Fig. 1. Distribution area of *C. lyrata* subsp. *lyrata* (●), *C. sorgerae* (△), *C. betonicifolia* (○) and *C. karadjana* (▲)



Fig. 2. *C. lyrata* subsp. *lyrata* A. Habit B. Flower, C. Calyx (scale bars: 1 cm) (Alçitepe 2112).

The “Flora of Turkey”, distinguishes this subspecies based on the erect or rarely ascending stem and pubescent hairs of subsp. *icarica* that differentiate it from subsp. *lyrata*. However, we observed that pubescent and/or subhispid hairs and the erect and/or ascending stem were present also in the specimens of subsp. *lyrata*. Since the type and density of hairs vary depending on the humidity or aridity of the environment and exposure to shade and sun, this is not a reliable character. Additionally, the corolla length of 20 or 25mm used for identification cannot be a distinctive character. In this research, we observed instances of the corolla tube attaining a length of 28mm in some specimens of subsp. of the *lyrata* species (Table 1).

Based on the results of this study, we arranged the identification key as follows:

1. Basal leaves lyrate or oblong-ovate; middle cauline leaves lanceolate to almost linear, margin irregularly crenate; calyx lobes narrowly triangular; 1/2 to 1/3 as long as the lobes narrowly triangular; 1/2 to 1/3 as long as the corolla ..... subsp. *lyrata*
1. Basal leaves cordate; middle cauline leaves broadly lanceolate to almost orbicular; margin dentate or rarely crenate; calyx lobes broadly triangular; 1/3 to 1/4 as long as the corolla ..... subsp. *icarica*

According to the morphological measurements of subsp. *lyrata* noted in the ‘Flora of Turkey’, its stem length varies between 15 and 50 (70) cm and corolla tube length between 12 and 20 mm. In our study, stem length extended up to 88 cm and corolla tube length was found to vary from 5–28 cm (Table 1). *C. sorgerae* is an endemic plant, which is known from a single locality in Turkey (Fig. 1). *C. sorgerae* was described by Phitos on a specimen collected by Sorger 66-38-61 (holo. Hb. Sorger! Photo E) from a single gathering in Konya province in

1978. It is closely related to *C. lyrata* subsp. *lyrata* and differs from it by its shorter corolla tube. These species closely resemble each other, and can only be distinguished from one another by the dimensions of their corolla tubes. The species identification key in 'Flora' describes species with corolla tube lengths measuring up to 10 mm as *C. sorgerae* (Fig. 3), and those with corolla tube lengths between 15 and 25 mm as the *C. lyrata* subsp. *lyrata* species. However, our detailed field studies and measurements of several other herbaria specimens of *C. lyrata* subsp. *lyrata* showed that these differences break down. Our analysis of holotypes and isotypes of *C. sorgerae* indicated that this characteristic does not distinguish it from *C. lyrata* subsp. *lyrata* well enough and the species are interrelated. The difference between the metric values of this species was between the upper- and lower limits in the *C. lyrata* subsp. *lyrata* species. Corolla tube lengths of the subsp. *lyrata* varied between 5 and 28 cm. Furthermore, it is normal for the plant to show such variations depending on the altitude. The seed sizes did not differ significantly. The shapes of the seeds of *C. lyrata* subsp. *lyrata* and *C. sorgerae* were elliptic to ovate with a ribbed surface and were mostly brown in colour. The seed-coat characteristics of the two species were similar, and the areoles, laterally compressed to the extent that the lumen is essentially linear, characterised the seed-coats with a faintly striated appearance. These striations were regular in appearance and the radial walls prominent (Table 1; Fig. 4). We identified amaryllis-type stoma in the surface sections taken from the upper- and lower surfaces of the leaf both in *C. lyrata* subsp. *lyrata* and *C.*

*sorgerae*. The leaves were amphistomatic in character. The cell walls of the lower epidermis cells were significantly undulate while the walls of its upper surface cells were fairly straight. Moreover, the lower surfaces contained more stomata than the upper surfaces. Analyses of upper- and lower layer morphology of the leaf in both species indicated no difference in terms of general cell morphology (Table 1; Fig. 5). We found no significant differences between the two species in palynological analysis. In both species, the pollen was triporate of the *Campanula* type and spheroidal in shape. The exine structure was tectate. Pore edges were mostly significant and appeared as small granules. The operculum generally contained a large columella. Spinal lengths varied in the pollen of the same species (Inceoğlu, 1975). Pollen of *C. sorgerae* and their pore diameter were larger than those of *C. lyrata* subsp. *lyrata*. Exine thickness of *C. lyrata* subsp. *lyrata* was greater; however, on considering microechinate length and the number at 5 µm<sup>2</sup>, no variations were seen (Table 1; Fig. 6).

Consequently, it is not possible to generally distinguish these two species in terms of morphology, seed micro-morphology, leaf upper and lower layer morphology and palynology. Besides, the morphological characters that distinguish the species showed variations between the species. Both species are endemic to Turkey and both are distributed in Konya province (Fig. 1). Considering the actual rule of The Botanical Code, the data generated in this research warrants the reduction of *C. sorgerae* to a synonymy of *C. lyrata* subsp. *lyrata*.

**Table 1. Comparative characters of *C. lyrata* subsp. *lyrata* and *C. sorgerae* (Figs. 2-8).**

		<i>C. lyrata</i> subsp. <i>lyrata</i> M± S (V)	<i>C. sorgerae</i> M± S (V)
Stem length (cm)		37.36 ± 15.07 (15–88)	28.3 ± 13.11 (12–65)
Basal leaf lamina	Width(cm)	2.42 ± 0.50 (1.3–4.0)	1.72 ± 0.42 (1.0–2.5)
	Length(cm)	3.13 ± 0.72 (2.0–4.5)	3.9 ± 0.7 (2.0–4.5)
Petiole length (cm)		7.81 ± 1.70 (2.0–12)	3.9 ± 1.77 (1.5–7.0)
Pedicel length (mm)		12.07 ± 5.43 (2.5–22)	5.26 ± 3.92 (2.0–22.0)
Calyx length (mm)		13.4 ± 3.36 (3.0–21.0)	11.8 ± 2.5 (8.0–16.0)
Calyx lobe length (mm)		9.75 ± 1.50 (3.0–15.0)	4.53 ± 1.41 (3.0–6.0)
Calyx appendages length (mm)		3.89 ± 0.84 (2.0–6.0)	3.40 ± 0.95 (2.0–5.0)
Corolla length (mm)		24.7 ± 4.28 (10.0–36.0)	12.17 ± 2.46 (10.0–13.0)
Corolla tube length (mm)		18.9 ± 2.33 (5.0–28.0)	9.02 ± 1.99 (8.0–10.0)
Stamen	Width (mm)	0.88 ± 0.11 (0.5–1.0)	0.40 ± 0.07 (0.3–0.5)
	Length (mm)	7.76 ± 0.83 (5.5–11.0)	6.0 ± 1.40 (4.0–7.0)
Pistil (mm)	Width	0.87 ± 0.9 (0.5–1.2)	0.49 ± 0.07 (0.4–0.6)
	Length	20.21 ± 2.33(13.0–33.0)	8.70 ± 2.37 (5.0–12.0)
Leaf cell	Cuticle	(3–8)	(6–11)
	Width (µm)		
Upper epidermis		36 ± 2.14 (31–63)	51 ± 1.17 (32–64)
	Lower epidermis	27 ± 1.11 (16–37)	45 ± 0.56 (32–54)
Leaf cell	Upper epidermis	31 ± 1.25 (21–169)	34 ± 0.40 (32–43 )
	Lower epidermis	29 ± 1.13 (19–37)	28 ± 0.49 (21–43 )
Seed (µm)	Width	350 ± 50 (300–400)	320 ± 70 (200–400)
	Length	620 ± 70 (500–700)	600 ± 60 (500–700)
Pollen (µm)	Diameter	21.60 ± 1.63 (15.7–25.2)	23.97 ± 1.08 (22.0–27.3)
	Pore diameter	4.41 ± 0.69 (3.1–5.7)	5.74 ± 0.61 (5.2–7.3)
	Exine thickness	1.02 ± 0.18 (0.7–1.5)	0.98 ± 0.12 (0.7–1.0)
	microechinate length	(0.25–0.50)	(0.25–0.50)
	5 µm <sup>2</sup> microechinate number	(40–45)	(41–45)

M, mean; S, standard deviation; V, variation.



Fig. 3. *C. sorgerae* A. Habit B. Flower (scale bars: 1 cm) (Alçitepe 2268).

With respect to *C. betonicifolia* and *C. karadjana*: In 1806, J. Sibthorp and J. E. Smith reported *C. betonicifolia* (Fig. 7) as a new species in *Florae Graecae Prodrromus*. They collected type specimens from Turkey A2 Bursa Uludağ. In “*Flora of Turkey*”, *C. karadjana* (Fig. 8) is not included in the identification key and the species is mentioned only as the “species imperfectly known” in the section appearing at the end of the account. Bocquet collected *C. karadjana* from Turkey Manisa-Boz Dağ and published it as a new species in “*Compte Rendu des Seances de la Societe de Physique d’Histoire Naturelle de Geneve*” (1968). The “*Flora of Turkey*” only mentions the species as belonging to the *Quinqueloculares* section and “related to *C. lyrata* and *C. betonicifolia*”. In this section, Prof. Dr. D. Phitos states that the description of the species is deficient as no material was supplied and, therefore, its status cannot be evaluated (Damboldt, 1978). The publication (Bocquet, 1968), while reporting *C. karadjana* as a new species, allies it to *C. lyrata* and *C. betonicifolia*, but distinguishes it from the species with flexuous stems having 3 or 5 sessile clustered flowers. It reports that the holotype of the species is kept in the herbaria in ZT (Zurich) and G (Geneve). In our interview with the G Herbaria, they stated that they were not given the isotype specimen. We did not receive any response to our queries on type specimens from the ZT Herbarium. When we took our collection of specimens to Prof. Dr. Phitos, he reiterated his previous views that appear in the ‘*Flora of Turkey*’, and added that they were only based on articles and that he was unable to see the type specimen either. The *C. betonicifolia* species is distributed in A2 Bursa Uludağ, B1 İzmir: Bozdağ, and C2 Muğla: Baba Dağ, while *C. karadjana* is distributed only in B1 İzmir: Bozdağ (Fig. 1). Both species, which are endemic to Turkey, are distributed in close proximity of one another and in similar habitats.

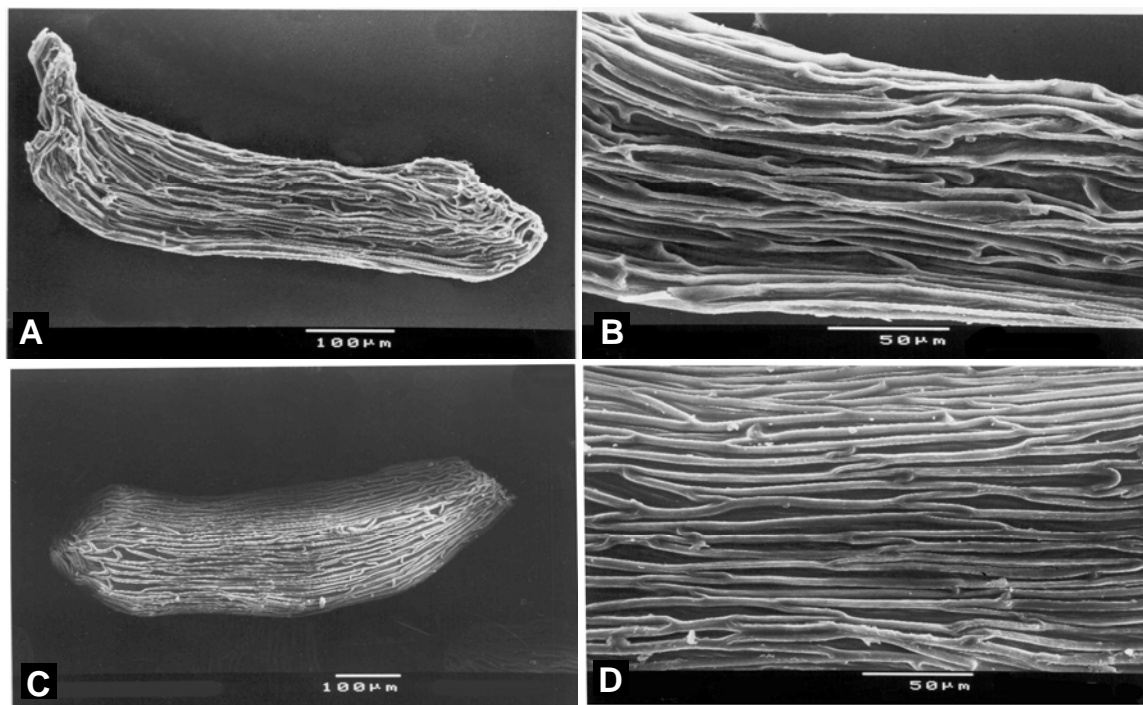


Fig. 4. Seed. A, B: *C. lyrata* subsp. *lyrata* (SEM) A. General view B. Surface view (Alçitepe 2112); C, D: *C. sorgerae* (SEM) C. General view D. Surface view (Alçitepe 2268)

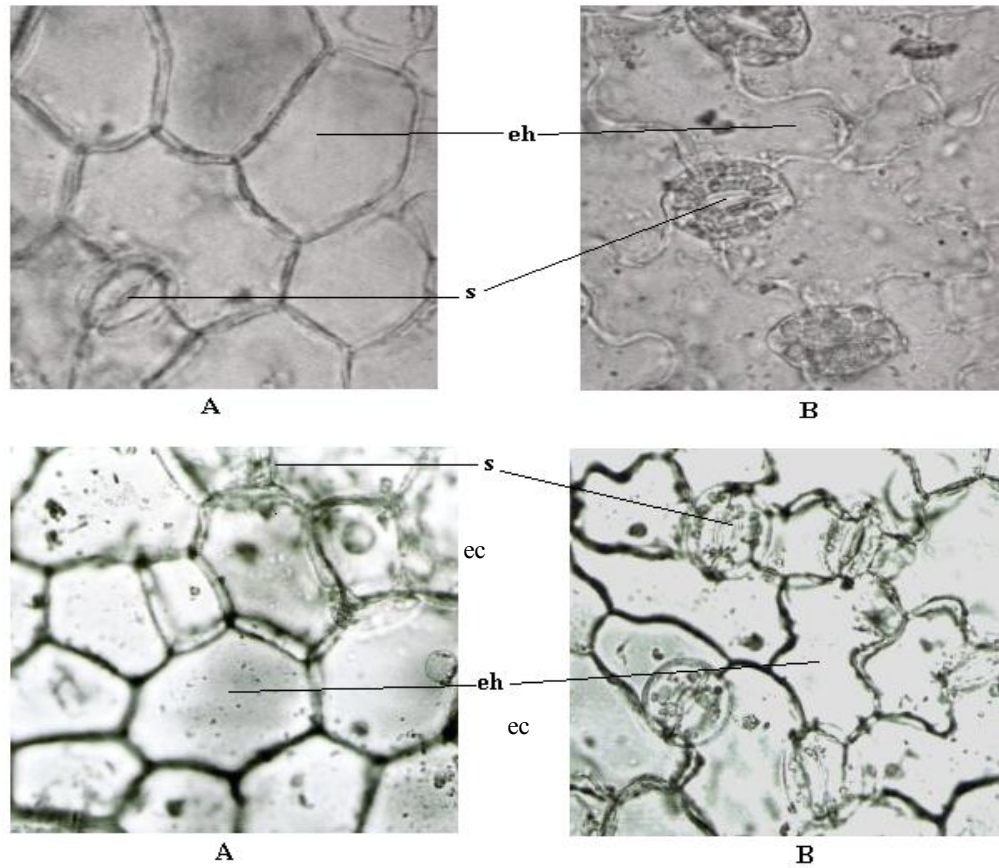


Fig. 5 Leaf surface anatomy, A, B: *C. lyrata* subsp. *lyrata*, A. Leaf upper surface (10x40) B. Leaf below surface (10x40), (Alçitepe 2112); C, D: *C. sorgerae*, A. Leaf upper surface (10x40) B. Leaf below surface (10x40), ec: epiderma cell, s: stoma (Alçitepe 2268).

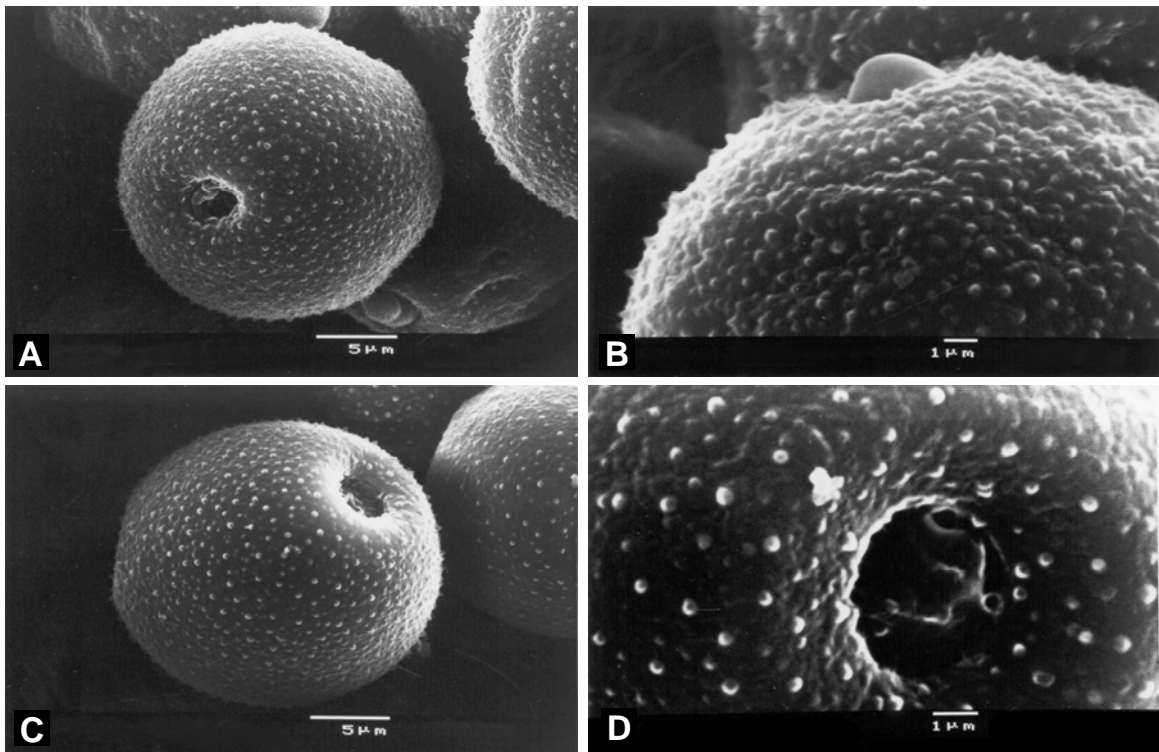


Fig. 6. A, B: Pollen (SEM): *C. lyrata* subsp. *lyrata* A. General view B. Ornamentation and pore (Alçitepe 2112), C, D: *C. sorgerae* C. Genel view D. Ornamentation and pore (Alçitepe 2268).



Fig. 7. *C. betonicifolia* A. Habit B. Flower, C. Calyx (scale bars: 1 cm) (Alçitepe 2121).

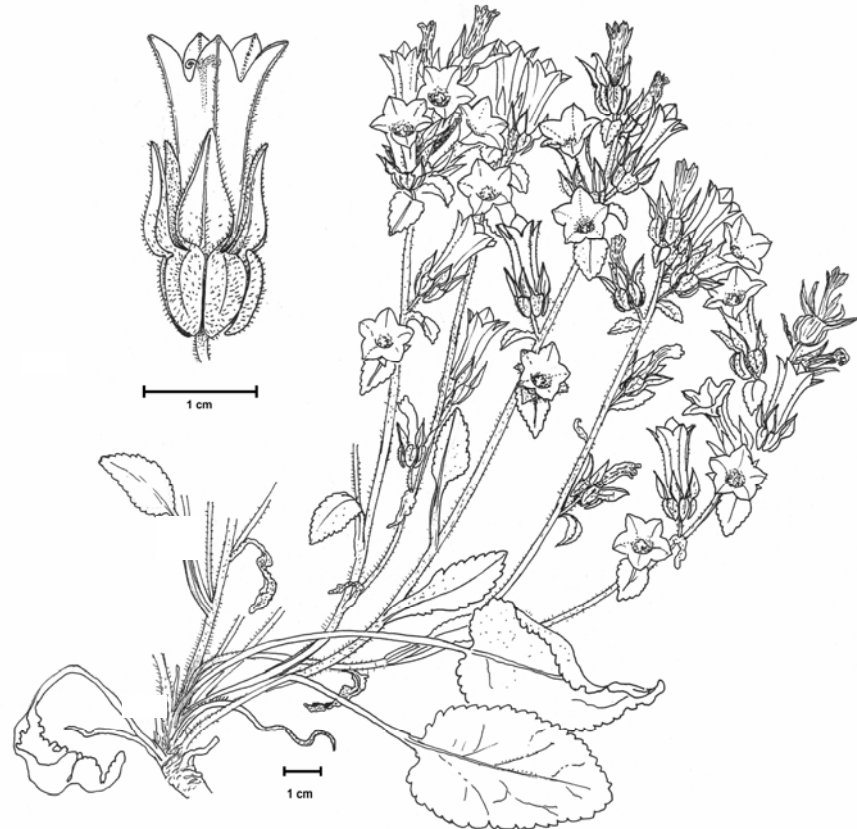


Fig. 8. *C. karadjana* A. Habit B. Flower (scale bars: 1 cm) (Alçitepe 2275).

We carried out a study on a large number of specimens using different characteristics to determine the similarity or differences between these two species and thereby conclude whether they are two separate species or members of the same species growing in different areas. The significant differences we identified in these investigations are given below (Table 3).

We observed from the data that of the two *C. betonicifolia* has the longer stem, calyx length, calyx lob length, calyx appendage length, corolla length, and corolla tube length; and a larger stamen and pistil compared to those of *C. karadjana*. *C. karadjana*, however, has a longer flower stem length (Table 2). We found no significant differences between the seeds of the species. The shapes of the seeds of both *C. betonicifolia* and *C. karadjana* were elliptic to ovate with a ribbed surface and were mostly brown in colour, but the seed width of the former was narrower (Table 2; Fig. 9). In both species, we found significant differences in the general morphology of the cells in the leaf upper and morphology of the lower layer. While the leaf upper layer of *C. betonicifolia* was undulated, in *C. karadjana* it was of a smooth structure. We found that in *C. betonicifolia* the cuticle was thinner and the upper epidermis was larger (Table 2; Fig. 10). In our palynological analysis, we found some differences

between the two taxa. Compared to *C. karadjana*, pollen diameter in *C. betonicifolia* was larger and exine thickness greater, whereas the pore diameter in *C. karadjana* was larger. The number of spines at 5 µm<sup>2</sup> in *C. karadjana* (minimum 50 pcs) was much greater when compared to *C. betonicifolia* (maximum 47 pcs) (Table 2; Fig. 11). Consequently, based on these data, we transferred *C. karadjana* to the *C. betonicifolia* naming it *C. betonicifolia* subsp. *karadjana*.

The species identification key of *C. betonicifolia* that we prepared according to our findings is given below:

1. Stem up to 67 cm, corolla 9–24x13–15 mm, inflorescence mostly solitary or seldom 3–5 together ..... subsp. *betonicifolia*
1. Stem up to 35 cm, corolla 8–21x14–16 mm, inflorescence a raceme or panicle ... subsp. *karadjana*

Our field study observations indicated that the endangered status of subsp. *betonicifolia* was LR (cd), and that of subsp. *karadjana*, which is known to be suspicious or data deficient in ‘‘Flora of Turkey’’, fell into the CR (IUCN 3.1. 2001) category.

**Table 2. Comparative characters of *C. betonicifolia* and *C. karadjana* (Figs. 9–14).**

		<i>C. betonicifolia</i> M ± S (V)	<i>C. karadjana</i> M ± S (V)
Stem Length (cm)		42.6 ± 13.01 (12.5–67.0)	23.7 ± 6.7 (17.0–35.0)
Basal leaf lamina	Width(cm)	2.52 ± 0.57 (1.7– 4.0)	3.13 ± 0.72 (2.0–4.5)
	Length(cm)	5.09 ± 1.60 (1.3– 7.3)	4.3 ± 0.7 (3.5–10.8)
Petiole length (cm)		4.96 ± 2.91 (1.0–9.5)	9.7 ± 2.65 (2.7–13.0)
Pediceal length (mm)		7.07 ± 3.38 (3.0–13.0)	7.23 ± 4.84 (2.0–22.0)
Calyx length (mm)		16.03 ± 2.36 (9.0–19.0)	13.3 ± 2.0 (10.0–17.0)
Calyx lobe length (mm)		10.95 ± 1.64 (9.0–14.0)	6.35 ± 1.44 (3.0–10.0)
Calyx appendages length (mm)		4.14 ± 1.92 (1.0–7.0)	4.20 ± 0.71(3.0–5.0)
Corolla length (mm)		20.0 ± 2.28 (9.0–24.0)	18.0 ± 1.73 (8.0–21.0)
Corolla tube length (mm)		17.41 ± 2.41 (6.0–20.0)	11.42 ± 4.86 (5.0–18.0)
Stamen	Width (mm)	0.8 ± 0.24 (0.5–1.0)	0.52 ± 0.09 (0.4–0.6)
	Length (mm)	7.0 ± 1.0 7.0 ± 1.0 (6.0–8.0)	6.0 ± 1.0 (4.0–7.0)
Pistil	Width (mm)	0.85 ± 0.15 (0.7–1.0)	0.91 ± 0.05 (0.4–0.5)
	Length (mm)	14.25 ± 0.72 (8.0–15.0)	10.6 ± 3.26 (5.0–15.0)
Leaf cell	Cuticle	(5–8)	(5–11)
	Width (µm)		
Upper epidermis		38 ± 2.09 (16–53)	19 ± 0.50 (16–21)
	Lower epidermis	20 ± 1.85 (14–33)	26 ± 1.41 (16–37)
Leaf cell	Upper epidermis	23 ± 1.03 (13–32)	27 ± 0.83 (21–32)
	Lower epidermis	15 ± 1.02 (11–19)	24 ± 1.57 (16–37)
Seed	Width (µm)	290 ± 30 (250–350)	300 ± 50 (250–400)
	Length (µm)	530 ± 40 (500–600)	560 ± 40 (500–600)
Pollen (µm)	Diameter	23.15 ± 2.28 (15.7–29.4)	20.4 ± 1.85 (15.7–24.1)
	Pore diameter	4.57 ± 0.82 (3.1–6.3)	5.33 ± 0.84 (4.2–8.4)
	Exine thickness	0.94 ± 0.10 (0.7–1.2)	0.92 ± 0.18 (0.6–1.2)
	microechinate length	(0.25–0.50)	(0.25–0.50)
	5 µm <sup>2</sup> microechinate number	(35–47)	(50–60)

M, mean; S, standard deviation; V, variation.

**Table 3. Comparative diagnostic characters *C. betonicifolia* and *C. karadjana*.**

	<i>C. betonicifolia</i>	<i>C. karadjana</i>
Stem length	to 67 cm	to 35 cm
Corolla	Corolla 9–24x13–15 mm	Corolla 8–21x14–16 mm
Inflorescence	Most solitary or seldom 3-5 together	Racemes or panicles

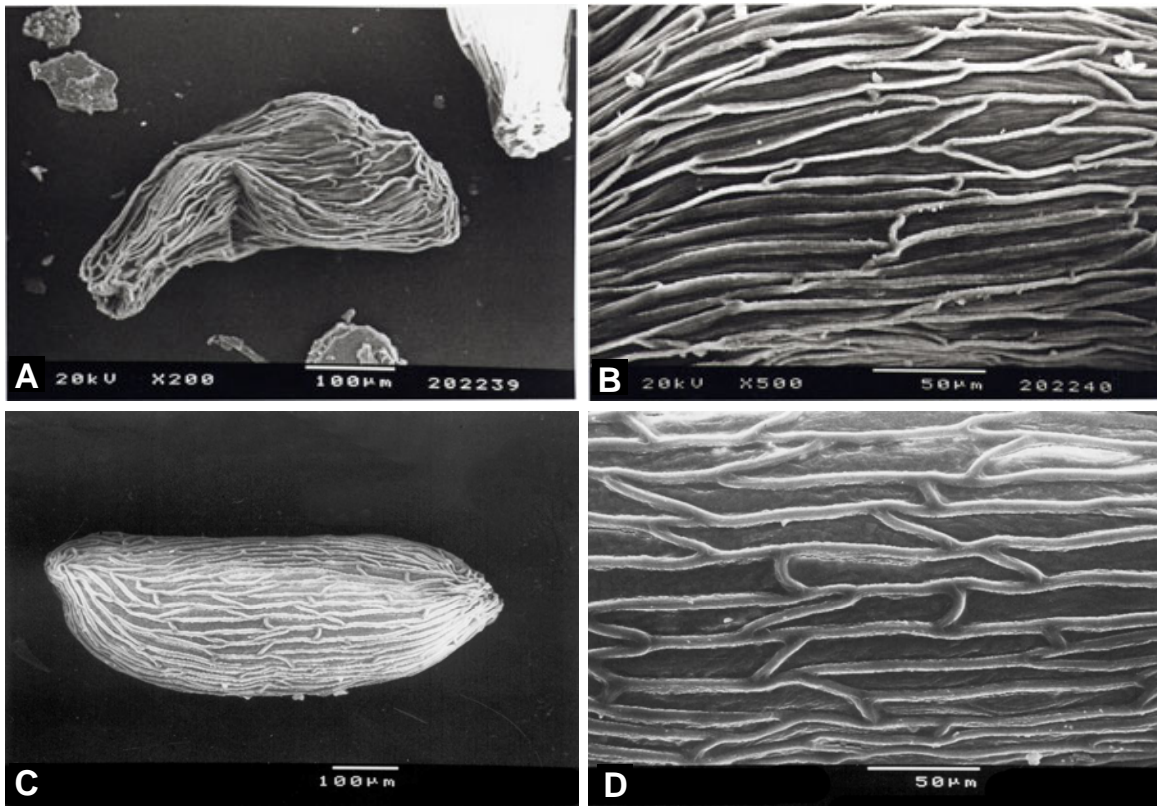


Fig. 9. Seed. A, B: *C. betonicifolia* (SEM) A. General view B. Surface view (Alçitepe 2121); C, D: *C. karadjana* (SEM) C. General view D. Surface view (Alçitepe 2275).

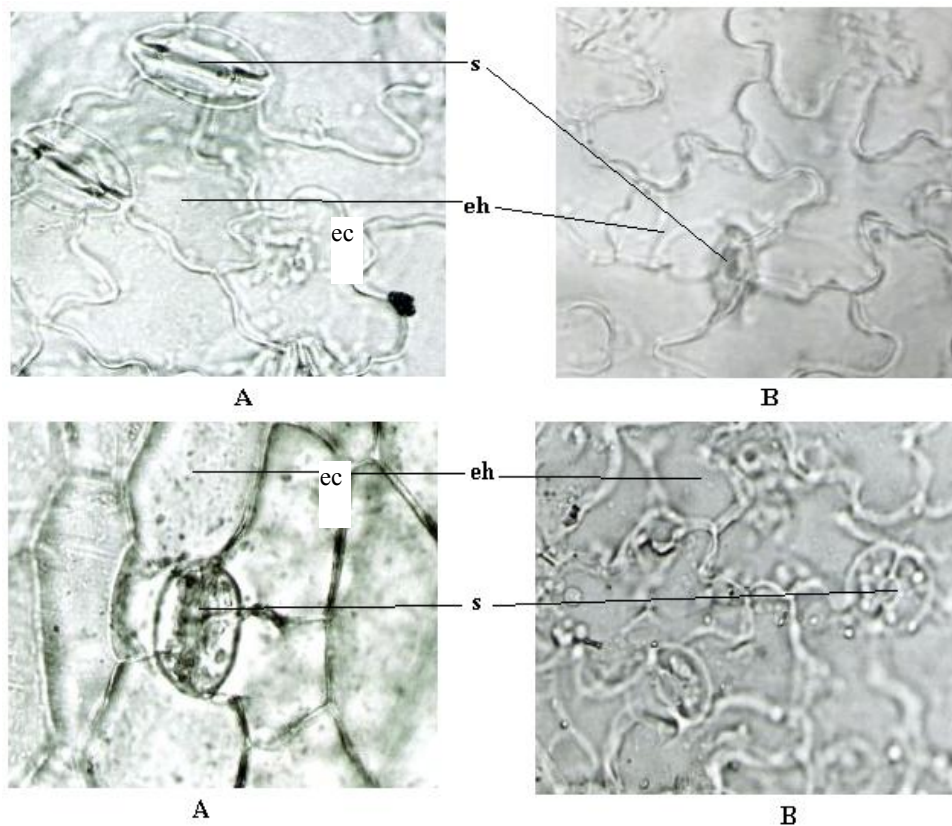


Fig. 10. Leaf surface anatomy, A, B: *C. betonicifolia*, A. Leaf upper surface (10x40) B. Leaf below surface (10x40) (Alçitepe 2121); C, D: *C. karadjana*, A. Leaf upper surface (10x40) B. Leaf below surface (10x40), ec: epiderma cell, s: stoma (Alçitepe 2275).



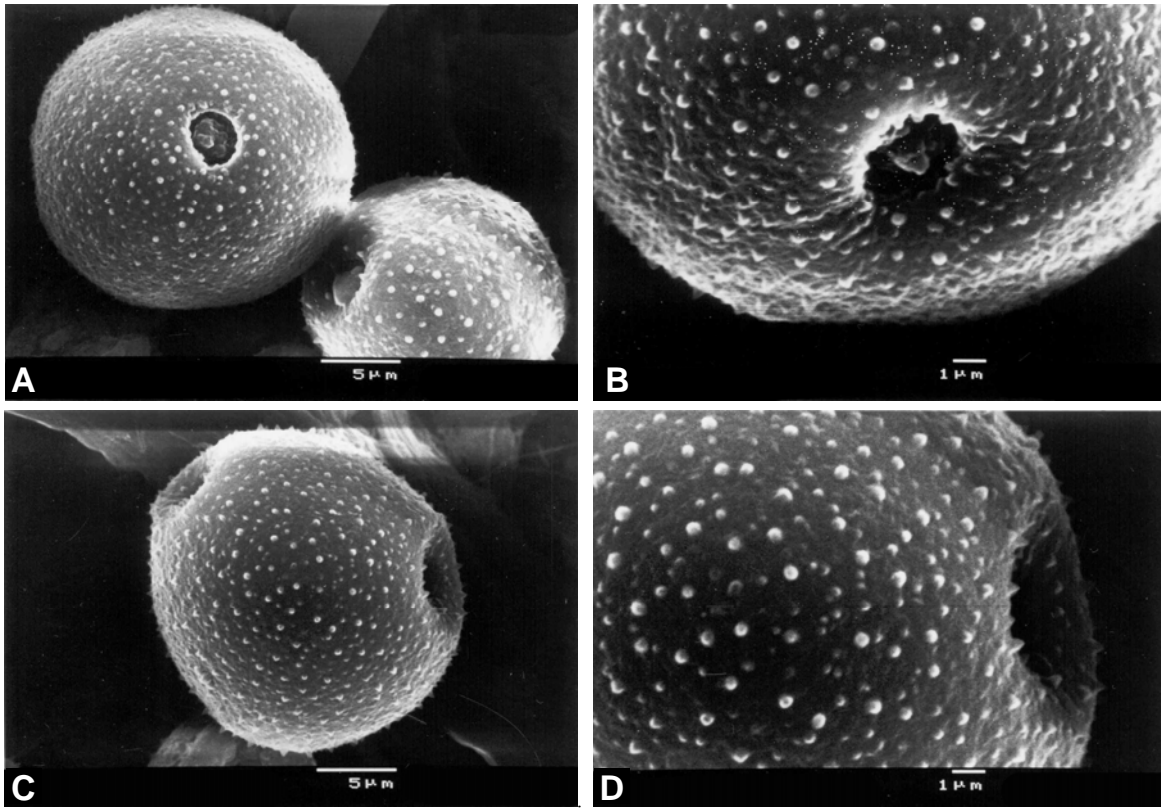


Fig. 11. A, B: Pollen (SEM): *C. betonicifolia* A. General view B. Ornamentation and pore (Alçıtepe 2121); C, D: *C. karadjana* C. General view D. Ornamentation and pore (Alçıtepe 2275)

## Appendix

### Examined specimens

***C. lyrata* subsp. *lyrata*:** Type specimen: Illustration by Aubriet of '*Campanula* foliis profunde incis, fructo duro', *Tournefort*.

**Synonym:** *C. lyratella* Feer in *J. Bot. (London)* 25:269 (1890)! *C. lyrata* Lam. var. *albostrigosa* Rech. Fil. in *Ann. Nat. Hist.* 43:321 (1929), Ic: Crook, *Campanulas*, 122(1953); *Zam. Sist. Geogr. Rast.* 30:34, f.1 (1973). Map 3, p. 11.

**Turkey:** A1 Balıkesir: Balıkesir–Marmara Island, 14.V.1968, *F. Öktem* 1072, ISTE!, ibid. 550 m, 16.VI.1968, *F. Öktem* 13700 ISTE!, ibid. 550m, 17.VI.1968, *F. Öktem* 13736, ISTE!, ibid. 100m, 13.III.1977, *E. Tuzlacı* 39469, ISTE!, ibid. 200 m, 06.V.1978, *E. Tuzlacı* 39203, ISTE!, ibid. 240 m, 12.VII.1978, *E. Tuzlacı* 40298, ISTE!, ibid. *A. Baytop* 13700, ISTE!, Çanakkale: Çanakkale–Eceabat, 350m, *Sorger* 63-73; Kırklareli: Demirköy forest, 21km to Poyralı, under fagus , 06.X.1966, *A. Baytop* 10455, ISTE!, Elmalı–Bulgar Boundary, 22.VI.1969, *G. Oğuz*, *M. Çetindağ* 8657, EGE! A2 Balıkesir: Balıkesir to Susurluk road, toward Varan Foundation, in macchi, c.200m, 10.V.2004, *E. Alçıtepe* 2250; Bursa: in regione inferiore montis Keschischoloh (Olympi), supra Brussa in valle, 200m. Sm., 2.VI.1992, *J. Bornmüller* 5259, B.Foto!; in olivetis et in collibus dumosis maritimis prope Mudania, 12.V.1999, *J. Bornmüller* 5258, B Foto!; 22km W of Bursa, *Sorger* 63-53-10; Uludağ, Aras-Soğuk Pınar road, 16.V.1944, *Heillbornn* 2887, ISTF!, Uludağ, Teferrüç-

Bakacık road, 20.V.1944, *M. Başarman* 3173, ISTF!; Mudanya, Zeytinbağ, 05.V.1974, *A. Baytop* 27855, ISTE! İstanbul: Belgrad forest, Balls 2396; Rumeli Hisarı-Sarıyer, 01.V.1943, *M. Başarman* 2219, ISTF; Burgaz Island, 30.IV.1950, *T. B. Berk* 2924, ISTE! Aydos, 22.VI.1952, *B. A. Berk* 4038, 3459, 3460, ISTE!; Belgrad forest, 19.V.1966, *G. Attila* 10284, ISTE; ibid. 19.VI.1967, *F. Öktem* 11544, ISTE!, ibid. 28.V.1970, *F. Öktem* 18065, ISTE!; ibid. 23.VI.1982, *G. Çakırcı* 48994, ISTE!; Yıldız Park, 06.V.1966, *A. Baytop* 10513, ISTE!; ibid. 02.V.1970, *F. Öktem* 17996, ISTE!; ibid. 17.V.1973, *A. Baytop* 24571, ISTE!; ibid. 17.VII.1981, *A. Baytop* 47488, ISTE!; Çamlıca, 24.V.1966, *G. Attila* 10522, ISTE!; in the top of the Silâhdarağa, 13.V.1967, *A. Baytop* 11207, ISTE!; Şile 30.V.1967 *A. Baytop* 11264, ISTE!; Anadolu Castle, 13.VI.1970, *F. Öktem* 18093, ISTE!; ibid. 20.V.1974, *A. Baytop* 28161, ISTE!; toward Arnavutköy-Kızkoleji, 30.V.1972, *N. Özhatay* 21933, ISTE!; toward Fatih forest, geophysics investigation area, 14.VI.1972, *A. Baytop* 22332, ISTE!; between Kısırmandıra-Kemerburgaz, under dam, 15.V.1973, *A. Baytop* 24545, ISTE!; E of Riva river, 17.V.1975, *A. Baytop* 31611, ISTE!; Rumelihisar am Bosphorus (T-128), 09.V.1983, *K. Faber* 16835 B Foto!; Kocaeli: under Dil, 19.V.1959, *A. Baytop* 5340, ISTE!; Yalova: Termal, S of upper part, 20.VI.1971, *A. Baytop* 20583, ISTE! A3 Ankara: Beypazarı, Aladağ Valley, c.700 m, 26.V.1971, *Y. Akman*, 8482, ANK!; Bolu: Kale, in TKA, in forest, clearer, edge of road, 110 m, 24.VI.1990, *İ. Kılınç* 1169, GAZI!; Yedigöller to Bolu, 10.km , 900 m, *K. Alpınar* 59450, ISTE!; Sakarya: Adapazarı-Izmit road, W of Sapanca Lake, 08.V.1966, *A. Baytop*, 9265, ISTE!; Geyve mountain pass, Bağlarbaşı village, 10.VI.1972, *A. Baytop* 22363, ISTE!; Geyve Mountain Pass, near Doğan kaya,

- Budak Foundation, 04.VI.1973, *A. Baytop*, 25172, ISTE!; Zonguldak: Kozlu, 1-50 m, D.37597; Göbü, Station district, c.50 m, 23.VI.1984, *M. Demirörs 1199*, ANK! A4 Ankara: Hacıkadın River, D. 18798; Çankaya, 28.V.1935, *Balls 2354*; ANK!; ibid. 07.V.1944, *H. Bağda 193*, ISTE!; İdris mountain-Eski Mountain Pasture, c.1400m, 06.VI.1945, *B. Kasaplıgil, 1123*, ANK!; Kızılcahamam, *P.nigra* forest, 7.VII.1953, *Huber-Murath, M. Birand, M. Zohary 3341*, ANK!; Çubuk Dam, c. 1150, 10.VI.1955, *K. H. Haşenbalg*, ANK!; Çubuk Dam, top of the Sera, 25.V.1960, *R. Çetik, 20728*, KNYA!; ibid. *R. Çetik 20387*, KNYA!; Kızılcahamam, Kargasekmez, c.1100m., 9.VI.1974, *O. Ketenoğlu 1111*, ANK!; Ayaş road, Ayaşbeli location, 1200-1350m, 21.V.1989, *Z. Ayaç 2642*, GAZI!; Kızılcahamam, Soğuksu National Park, near Keltepe Hill, stony slopes, 1350-1400m, 29.V.1990, *Ö. Eyuboğlu 1414*, GAZI!; Bolu: Gerede-Aktaş forest, between *Populus tremula*, c. 1600m, 3.VII.1975, *O. Ketenoğlu 419*, ANK! Çankırı: Atakaracalar, Dumanlı Mountain, Abaza River location, in the near of the dry river, 1350-1450 m, 5.VII.1991, *A. Duran 1308*, GAZI; Kastamonu: Ilgaz Mountain, on the Ilgaz center, *Q. pubescens* community, c.1300m, 15.VI.1982, *Y. Akman, E. Yurdakulol, M. Demirörs 12085*, ANK!; Zonguldak: SW of center, between, near road, 80 m, 5.V.1951, *H. Demiriz 10968*, ISTF!; A5 Çorum: Osmancık to Kargı, 500 m, *Tobey 2688*; Kargı, Ada Mountain, near Avşar Village, *P. brutia* forest, c.500-600m, 30.V.1976, *M. Kılınç 27132*, EGE!; Kastamonu : Tosya, Seki Village, Seki River location, c.1000-1200m, 18.VI.1975, *M. Kılınç 1052*, ANK!; B1 Balıkesir : Edremit, in olive grove, clearer of macchi, 08.V.1966, *H. Peşmen 832*, EGE!; ibid. 300m, 29.V.1980, *A. Baytop 44551*, ISTE!; Kazdağı, Bepazarı-Zeytinli, 15 km from Beypınar, 500m, dry sandy roadsides, 20.V.1962, ex. herb. hot. bot. Reg. Edin. 43535, ISTE!; Kazdağı, Koşara-Church, 1100m, 17.X.1970, *F. Öktem 18786*, ISTE!; Çanakkale: Assos, stony slopes, 50-60m, 19.V.2002, *E. Alçitepe 2110*; Truva, clearer, c.50m, 20.V.2002, *E. Alçitepe 2111*; Zeytinli to Kazdağı, 450 m, 30.VII.1974, *A. Baytop 20793*, ISTE!; İzmir: Sinus smyrnaeus, İlidya, in valle, Soghandere, 05.V.1906, 1-200 m, *J. Bornmüller 9745*, B Foto!; Smyrna, supra bunnabad 1906, *J. Bornmüller 9748*, B Foto!; Yamanlar Mountain, 800-900 m, *J. Bornmüller. 1906:9743*; ibid. 15.V.2002, *E. Alçitepe 2109*; Bornova-Potash, limestone rocks, 100-600 m, IV.1932, *O. Schwarz 23257*, EGE!; ibid. *O. Schwarz 2167*, B Foto! Ödemiş, Birgi, 500 m, 17.V.1993, *U. Zeybek 1191*; IZEF!; Bornova, Pınarbaşı, 23.V.1946, *B.Halil, M.Baş 6086*, ISTF!; Kemalpaşa-Karabel, 06.V.1961, *T. Baytop 6466*, ISTE!; Dikili, Çağlayan Village, *P.brutia-macchi*, 24.VI.1965, *H. Peşmen 2881*, EGE!; Kozaklı, Kıran Village-Madran River, clearer, 15.V.1966, *H. Peşmen 2881*, EGE!; Bergama, Acropolis, 19.V.1967, *N. Özocak 11099*, ISTE!; hills N of Bornova, 16-18. IV. 1969, *K. Fitz 7875*, EGE!; Kemalpaşa, Nif Mountain, 3 km to Çine, c.900m, 6.VI.1973, *Ö. Seçmen 23506*, EGE!; Kemalpaşa, Nif Mountain, on road, to fire tower, c.1300m, 16.VII.1975, *Ö. Seçmen 23942*, EGE!; Nif Mountain, Manastır Castle, c.450m, Gümüldür, Kaplan Throat, 22.III.1979, *Ö. Seçmen, E. Leblebici 1876*, EGE! Gümüldür, Sultan Motel, near coast, slopes, 6.IV.1981, *N. Zeybek 1899*, IZEF!; Gümüldür, coast of Özdere Village, c.10-50m, 4.V.1986, *N. Zeybek 647*, IZEF!; Bergama des Asklepeions (T128), 13.V.1983, *K. Faber 16848*, B. Foto!, Bergama, between Kozak-Kıranlı Village, on road, 11.V.1986, *Ö. Seçmen 19745*, EGE!; ibid. 10.VII.2004 *E. Alçitepe 2278*; Bergama, between Kozak-Nabiller-Kaplan, c.400m, 3.VI.1987, *Ç. Yılmaz 19744*, EGE!; ibid. 10.VII.2004, *E. Alçitepe 2279*; Tire, in macchi, c.50-100m, 22.V.2002, *E. Alçitepe 2112*; between Bergama-Ayvalık, Hisarönü Village, separate of road, c.450m, 10.VII.2004, *E. Alçitepe 2280*; Manisa: Monte Sipylus, supra Magnesia, 200-300m, 19-20.V.1906, *J. Bornmüller 9747*, B Foto!, Spil mountain, at location, 1000m, 13.VI.1966 *F. Öktem 9937*, ISTE!; ibid. *24.V.1995, B. Tutel 36506*, ISTF!; ibid. 10.VI.1997, *E. Saver 5385*, IZEF!; *E. Alçitepe 2149*; Sipli Dag bei Manisa (M: Spilacup, Manisa Dağ). 38 ° 36 ' n.Br., 27 ° 29 ' Ö. L. Stra Benrand, offener Boden in macchia. Urpstein (Gneis, Ophiolith) c. 700 m NN. 34.V.1995, *P. Hein 93*, B Foto!, ibid. 25.III.2003, *E. Alçitepe 2148*; Gediz, 4.VI.1955, *H. Ü. E. Walter 58*, B Foto!; 26.V.1978, *I. Akbulut 82*, IZEF! 29.IV.1966, *M. Peşmen 5422*; EGE!; Spil Mountain, Beypınar area, 1200 m, 19.VI.1971, *Ö. İnceoğlu 26136*, HUB!; Ilıca, 27.IV.1975, *Ö. Seçmen 23940*, EGE!; Soma Madenci Foundation, on road, c.600m, 12.V.1977, *Ö. Seçmen, G. Görk 17151*, EGE!; Soma, Coal Mine, 2 km to Daniş Village, *Pinus* and *Q. infectoria*, c.460m, 13.V.1977, *Ö. Seçmen 23638*, Salihli, Sardes, 23.V.1993, *Ş. Şiraneci 65594*, ISTE!; EGE!; B 2 Balıkesir : Sındırgı Mountain, E of Kertil Park, under *P. brutia*, *S. Officinalis*, *Quercus sp.*, c.350m, 5.VI.1972, *S. Oflaz, B. Oğuz, Ö. Seçmen, E. Leblebici 10209*, EGE!; Denizli: Denizli-Buldan, *Hub.-Mor: 5363*; İzmir : Ödemiş-Bozdağ, around Mermeroluk, c.1350m, 16.VI.1972, *S. Ahmet, E. Leblebici 10059*, EGE!; ibid. 27.VI.2004, *E. Alçitepe 2121*; Kütahya: Gediz, Tahtaoluk Mountain Pasture, Murat Mountain, 1300 m, 27.VI.1970, *Föktem 18122*, ISTE!; between Simav-Sındırgı, 47 km to Simav- Sındırgı, Pinnurt location, c. 400 m, 5.VI.1972, *Ö. Seçmen, G. Oğuz, S. Oflaz, E. Leblebici 16885*, EGE!; Gediz, Murat Mountain, 21 km to Gediz, to Karaağaç Village, c.800 m, 3.VI.1972, *S. Oflaz, G. Oğuz, Ö. Seçmen, E. Leblebici 10205*, EGE!; Manisa: muddy spa of Salihli, Pinus-Quercus forest, 17.VI.1965, *H. Peşmen 8651*, EGE!; Yeniköy-Demirci, *P. nigra* forest, 18.VI.1965, *H. Peşmen 8656*, EGE!; 90km of Demirci, on road, 16.V.1978, *Ö. Seçmen, E. Leblebici, G. Görk 17148*, EGE! Salihli-Bozdağ road, near restaurant, 10.V.1975, *Ö. Seçmen, M. Öztürk, T. Kesercioğlu 23941*, EGE! B3 Afyon: Bayat-Köroğlu, between Yongalı Hill, 1450m, 27.VI.1975, *M. Vural 666*, KNYA!; Dazkırı, N of Sarıkavak Village 1030m, 18.VI.1984, *Z. Ayaç 1316*, GAZI!; Bilecik : Küplü, 17.V.1972, *A. Baytop 21643*, ISTE!; between Bozüyük-İnönü, in edge of beta field, 750 m, 01.VI.1973, *A. Baytop 25187*, ISTE!; Eskişehir : Eskişehir-Sivrihisar, 1200-1300m, *Dudley (D. 36033)*; K. Ören, wooded area, 1300m, rock, *M. Karşist 589*, ibid. 1.VII.1970, *T. Ekim 3373*, ANK!; Sündiken Mountain, on Alpagut, c.350m, 3.VI.1971, *T. Ekim 362*, ANK!; 2km of Eskişehir, 01.VI.1973, *A. Baytop 25102*, ISTE!; Sarıca Road, Under Dağhüplü Village, 450 m, 06.III.1973; Türkmen Mountain, Anbar River, Widespread in the mountain, 1000-1500 m, 16.VI.1976, *T. Ekim 2009*, B Foto!, ANK!; around, Gökçekaya dam, On rock, clearer field, 330m, 27.IV.1989, *A. Ocak 33809*, EGE!; Sakarı- Ilıca, on the Sakarya River, 19.V.1991, *A. Baytop 62852*, ISTE!; Isparta: Gelendost, 22.V.1966, *C. Regel, H. Peşmen, G. Oğuz 185*, EGE!; Konya: Akşehir-Sultandağları Mountain, Çobankaya, 1000-1100m, 26.IV.1974, *G. Dökmeci 28462*, ISTE!; Sultandağ Mountain (Kesikbaş, Military Area, 27.V.1974, *G. Dökmeci 28616*, ISTE!; Tekke Village, Ridge of Danasekisi, 29.V.1974, *G. Dökmeci 28768*, ISTE!; Hıdırlık Mountain Motel, 1060m, 25.VI.1974, *G. Dökmeci 28511*, ISTE!; Sultandağ Mountains, Atakent, Nadir Village, in front of Ergenli River, 1160m, 04.VII.1975, *A. Baytop*

32616, ISTE!; Sultandağ Mountain, on the Topyeri, 09.VII.1975, *G. Dökmeci* 32790, ISTE!; Doğanhisar-Sultandağ Mountain, Ridge N of Geçitköprü, c.1850m, 30.VII.1978, *H. Ocakverdi* 665, KNYA!; ibid. *H. Ocakverdi* 662, KNYA!; Sultandağ Mountain, Under the Tekke, 1750m, 13.VIII.1980, *G. Çakırcı* 4539, ISTE ! B4 Ankara: Dikmen River, *Romieu* 5992; ad Angora Galatiae (Elma-dagh), *J. Bommüller* 1892, B. Foto!; Hüseyin Gazi, 4.VI.1932, *W. Kotte* 535, ANK!; Etlik, step, 17.VI.1933, *Krause* 4341, ANK!; Çankaya 24.V.1936, *Gassner* 389, ANK!; Etlik, 14.IV.1944, *S. Kuntay*, *S. Çelebioğlu* 194, ISTE!; Çankaya-İncesu 10.V.1944, *B. Kasaplıgil* 2791, ISTF!; Hacıkadın River, stony slopes, 20.V.1944, *B. Kasaplıgil* 3206, ISTF, ibid. *R. Çetik* 149/1167, ANK!; ibid. *R. Çetik* 672, KNYA!; ibid. *R. Çetik* 673, KNYA!; ibid. *R. Çetik*, *E. Yurdakulol* 675, KNYA!; ibid. *S. Atay* 15243, ISTF! İdris Mountain, , Eski Mountain Pasture, c.1400m, 6.VI.1945, *K. Bilgett* 5202, ISTF!; Beynam forest, clearer of *p.nigra* forest, c. 1350 m, 22.VI.1945, *B. Kasaplıgil* 369, ANK!; ibid. *H. Ü. E. Walter* 3487, B. Foto!; *H. Ü. E. Walter* 4876, B Foto!; *Y. Akman* 8293, ANK!; Konya: Loras Mountain, S of slopes, 1900 m, 12.V.1989, *A. Tatlı*, *B. Eyce*, *M. Serin* 9038, KNYA! C1 Aydın: Kepez, 15.IV.1965, *F. Öktem* 8002, ISTE!; Çakmar Village-Lalelik, 15.IV.1965, *N. Tanker* 8061, ISTE!; Sultanhisar, Malgiçemir Village, village location, c.500 m, 20.V.1968; *S. Oflas* 26981, EGE!; Madran Mountain, Bozdoğan, c. 750 m, *Pinus brutia* forest, 28.IX.1965, *H. Peşmen* 8654, EGE!; Çine, edge of Çine River, 21.IV.1969, *G. Oğuz* 8860, EGE!; Kuşadası, rocky slopes, 09.IV.1971, *F. Öktem* 19134, ISTE!; Priene ruins, between rocks, 9.IV.1971, *F. Öktem* 19134, ISTE!; Didim road, 10.IV.1971, *F.Öktem* 19211, ISTE!; between Bafa and Selimiye, slopes, 10.IV.1971, *F. Öktem* 19228, ISTE!; Davutlar Mountain, *P. brutia* 15.IV.1974, *G. Oğuz*, *A. Yürül* 16880; 2km W to Çakmak Village, in edge of river, c. 200 m, 28.IV.1977, *A. Yürül*, *A. Yayınış* 15001, EGE!; İzmir: Selçuk, Belevi fire tower area, 23.IV.1970, *S. Oflas* 5516, EGE!; Efes Ruins, 31.V.1972, *A. Baytop* 22804, ISTE!, ibid. 05.V. 1984, *N. Zeybek* 2936, ISTE!, Muğla: Bodrum mountain, Güllük 50m, *D. 40926*; Bodrum, mt. E of Karatoprak, garigue, hard schist, 16.IV.1972, *H. Runemark & P. Wendelbo* 72, LD Foto!; Datça Peninsula, 7-8 km NW of the Town of Datça, Limestone 20.IV.1972, *H. Runemark & P. Wendelbo* 146, LD Foto!; Labada Dağ südlich des Bafa Gölü, Ölbaumhaine und Arbutus andrachne-Pinus brutia wald mit steinigen Lichtungen über kalkgestein, 100-500 m. ü NN, 28.IX.1989, *Th. Raus* 14502, B Foto!; Milas, Beçin Kalesi, 275 m, 15.V.2004, *E. Alçitepe* 2260; Milas, in front of Kılıç feed factory, on road, 50-100m, 16.V.2004, *E. Alçitepe* 2251, C2 Denizli : Akçay, Omelle in kiefewald vor Yılanlıdağ, 06.VI.1955, *H. Ü. E. Walter* 226, B Foto!; Honaz Mountain, edge of Baymanlı River, 1400 m, 14.VI.1963, *A. Baytop* 25661, ISTE!; Sarayköy; Babadağ, 5km of Hisarköy to Tekçam, c.950m, 22.V.1972, *G. Oğuz* 16862, EGE!; Honaz Mountain, Babatepe Hill, 1850 m, 30.VI.1972, *E. Tuzlacı* 22831, ISTE!, Honaz Mountain, Çukurköy, in the back wooded area, 750 m, 04.V.1973, *A. Baytop* 24973, ISTE!, between Honaz-Menteş, 16.V.1973, *E. Tuzlacı* 24661, ISTE!; Tavas road, in the Cankurtaran, 30km to Denizli, 1200 m, 07.VI.1973, *A. Baytop* 25530, ISTE!; Honaz Mountain, upper Kozaklı Foundation, 1230m, 10.VI.1973, *A. Baytop* 25660, ISTE!; Honaz Mountain, Kabardıç Mountain Pasture, 10.VI.1973, *A. Baytop* 25727, ISTE!; Honaz Mountain, Pınarbaşı, 650 m, 10.VI.1973, *E. Tuzlacı* 28062, ISTE!; Honaz Mountain, Kayalar location, 800m, 11.VI.1973, *E. Tuzlacı* 25831,

ISTE!; Babadağ Suzek location, c.1250m, 02.VII.1985, *Y. Gemici* 32365, EGE! Muğla: Sildsiluk mach Yatağan in macchie, in vor Çine, 12.VI.1955, *H. Ü. E. Walter* 377, B Foto!; between Marmaris-Gönnücek, 3 km E Marmaris, calcereous rock, *Pinus brutia* forest, c.10m, 9.V.1967, *H. Peşmen*, *G. Oğuz*, *A. Ersoy*, *E. Leblebici* 10569, EGE!; Dereköy-Marmaris, c.10m, 26.III.1956, *Davis et Polunin* 25402, ANK!; Köyceğiz, Fethiye e Göcek, Kalkfels, 14.IV.1985, 50m, *Mak. Nydegger* 40192, B Foto!; Köyceğiz, Yangı Village, Yangı River, calcereous slopes, 40-220m, 22.III.1991, *A. Güner* 8422, GAZI!; ibid. 5.V.2003, *E. Alçitepe* 2142; ibid. 30.VI.2003 *E. Alçitepe* 2161; Köyceğiz, Kaunos ruins, macchi, N of slopes , calcereous fields, 15-200m, 16.IV.1991, *A. Güner* 26128, HUB!; ibid. 8.V.2003 *E. Alçitepe* 2377; between Muğla-Gökova, edge of road, 300-400m, 4.V.2003, *E. Alçitepe* 2146; Muğla-Köyceğiz road, calcereous rocks, c.375m, 16.V.2004, *E. Alçitepe* 2252; C3 Antalya: SW-AN, Kak Felsen und schutt, des TahtalıDag, 15.VI.1967, *R Ulrich* 126/2003-37, B Foto!; Bük forest, research, near water store, *Pinus brutia* forest, 09.V.1972, *R. Çetik* 3843, ANK!; Termessos National Park, Elmalı, Gümüşbucağı location, *C. libani* forest, ground flora, calcereous rock, c. 1300 m, 13.V.1973, *R. Çetik* 2211, ANK!; Kumluca-Kemer road, 15 km to Kumluca, near *S. junceum*, c. 580 m, 14.V.1976, *R. Çetik* 5292, KNYA!; Side, Sorgun, Kumluk, 30.V.1981, *R. Çetik* 320, KNYA!; Gebiz, Bozburun Mountain, Bağazağzı Göğalan Erikli Hill, 1500 m, 17.VI.1983, *G. Çakırcı* 51054, ISTE!; Akseki, Çukurköy area, in macchi, 850m, 14.V.1995, *A. Duran* 1440, Burdur: Burdur-Antalya road, 33km of Antalya, *Arbutus*, *Quercus* sp. community, 25.V.1966, *A. Baytop* 9557, ISTE!, Yakaköy, Cannobis, in field, 110m, 05.VII.1973, *A. Baytop* 26085, ISTE!; Isparta: Dedegöl Mountain, 1400m, *Sorger* 65-43-22; Konya: Beyşehir-Kurucuova, Musallaaltı location, SE slopes, ridge of valley, 1400 m, 15.VI.1980, *M. Serin* 661, KNYA! C4 Karaman: Kazancı Nahiyesi area, 900-1100 m, 19.VI.1983, *R. Sümbül* 26268, HUB! Konya: Bozkır, 11.V.1968, *R. Çetik*, *T. Ekim*, *E. Yurdakulol* 6324, KNYA!; between Bozkır-Çat-Dere, c.1200m, 14.V.1968, *R. Çetik*, *T. Ekim*, *E. Yurdakulol* 6325, KNYA!; Hadım to Taşkent, 1560m, *Hub.-Mor*: 8645; Taşkent, rocky slopes, 1200-1300m, 22.VI.2002, *E. Alçitepe* 2120;

**East aegean islands:** Aios Iorgos: Calcaerous rocks at Aigos Isidarus, c.20, 15.V.1985, *Hauson & Nielson* 1062, B Foto!; Icarica: 100m, *D. 40619*, in declivibus borealibus inter Mileopora et Plumaria substr. Silic., 500m, 1983, *K. H. Rechinger* 54043, B Foto!; Kalimnos: *Gathome-Hardy* 328; Side of rodenear Myrties, 22.4.1963, *E. Athorne-Hardy* 328, B Foto!; in ditone pagi Myrties, ad litoream 12.VI.1976, *D. Phitos* 13347, UPA!, Regio Aegea orientalis, insula Hios, ad sinum milingas litoris orientalis, alt 20-100 m, in scansilibus et fissuris clivorum rupestrium calcareorum 16.IV.1973, *D. Phitos* 10746, UPA!, Khios : Hagies Minar Qorphanides 656; 80m, *Podlech* 26615; Inter papos kalli masia et kataraktis alt 80m, ad moros. 23.IV.1990, *D. Phitos*, *G. Kamari*, *Anapnotopoulos*, *K. Athanasiou*, 21182, UPA!; mons provatas, prope Nea Mori in nanofruticetosis et saxasis calc. 38° 27' N, 26° 03' E, 19.IV.1990, *Phitos*, *Kamari*, *Anagnotopoulos*, *Athanasia* 20956, UPA!; inter papos Marmara et Uraulidia, in satosis colc., alt. 30 m, 21.IV.1990, *Phitos*, *Kamari*, *Anagnotopoulos* 21096, UPA!; ad pogum Pitious, in rupestribus calc. 38° 29' N, 26° 03' E, 26.IV.1990, *Phitos*, *Kamari*, *Anagnotopoulos*,

*Athansiou 21203*, UPA!; nomos chiou, eparchia chiou, adoue mani Agiou Markov, limestone rocks and pinus halepensis woddland, alt 550 m, Lat 38° 22' N, Lang 26° 04' E, 23.07.1989, A. *Anagnostopoulos*, K. *Athansiou 1437*, UPA!, inter Papos Augonyma et Anauatos, in apertis siluae pinus, in staxis calc., alt.400 m, 20.IX.1990, *Phitos*, Kamari, *Anagnostopoulos*, *Athansiov 20921*, UPA! Hansen 306, B Foto! Above iteraink, 20.X.1995, *Hanson & Nielson 5370*, B. Foto!; San Marint an Felsen Baschant herbar 6.1932-1959; Samos: Kerki Mountain, 100-1450 m, *Runemark 18834*; The Waley W of Leka, 200-400 m, 22.V.1962, *Runemark & Snogerup 18856*, LD. Foto!

**C. sorgerae**: Type Specimen: Turkey C4 Konya: c. 16 km N. of Konya, 1200 m, 10.VI.1966, *Sorger 66-38-61* (holo. Hb. Sorger! photo E).

**Turkey**: C4 Konya: c. 16 km N of Konya (N Sille), 1200 m, 10.VI.1966, *Sorger 66-38-61* (holo. Photo E! iso. UPA!) B2 Uşak: between Kula-Uşak, 50 km Uşak, c. 900 m, 28.V.2004, *E. Alçitepe 2268*.

**C. betonicifolia**: Type specimen: [ Turkey A2(A) Bursa ] in monte Olympo bithyno (Ulu Da.) *Sibthorp* (holo. OXF, photo! ).

**Turkey**: A2 Bursa: *A DC. Aucher-Eloy-hebier d'Orient 1841* G!; Uludağ, VII.1917, *E. Leick 189*, ISTF!, ibid. 27.VII.1968, *Pamukçuoğlu & Quezel 25999*, HUB!; ibid. 21.VI.1990, 110m. *A. Baytop 61880*, ISTE! Uludağ, Kestanelik location, Emirsultan, Işıklar, 25.V.1954, *Heilbornn 13032*, ISTF!; Uludağ, Yılanlı kaya location, *P. nigra*, c. 1350m, 5.VII.1978, *E. Yurdakulol*, *M. Kılınç*, *M. Aydoğdu 1121*, ANK! On the road Uludağ hotel, Fagus forest, 800m, 23.VI.1973, *F. Holtz. P. Hänel, Herb. Friedrich Holtz 239*, KNYA! ibid. 27.VII.1968, *Pamukçuoğlu & Quezel 25999*, HUB!; ibid. 25.VII.2003, *E. Alçitepe 2235*; B1 İzmir: Bozdağ, 1525-1675m, *D. 13448*, ibid. *Contandriopoulos*, ibid. c.1800 m, 18.VIII.1994, *Ö. Seçmen 19452*, EGE!, ibid. c.1300m, 23.VI.2004, *E. Alçitepe 2276*, Bozdağ, Küçük Çavdar Pasture, c.1500-1600m, 5.VII.1991, *Y. Gemici 10021* EGE!, ibid. 29.VI.2002, *E. Alçitepe 2121*; C2 Muğla: Babadağ Mountain, 610-1220m, *D. 231*.

**C. karadjana**: **Type specimen**: Turcia, prov. Manisa, in monte Bozdağ (Tmolus vet.), in praeruptis steppo-alpinis sub cacumien, ca. 1900 m supra mare, 11.VII.1966, *Bocquet 3287* (holotypus ZT, iso. G).

**Turkey**: B1 İzmir: in monte Bozdağ (Tmolus Vet.), in praeruptis steppo-alpinis sub cacumien, ca. 1900 m. supra mare, 11.VII.1966, *Bocquet 3287*; ibid. c. 1450-1500 m, on limestone, shady places, 29.VII.2003, *E. Alçitepe 2234*, ibid. 23.VI.2004, *E. Alçitepe 2275*.

## Acknowledgements

This study is based on the Ph.D thesis of Emine Alçitepe submitted to the Celal Bayar University (Project Number: 2002/91). We also thank the curators of the herbaria in ANK, EGE, GAZI, HUB, ISTE, ISTF, IZEF, KNYA. Special thanks to directors of Berlin (B), Edinburgh (E), Genevre (G) and Lund (LD), Oxford (OXF) and Univesity of Patra (UPA) for providing photographs or type specimens.

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