



Campanula teutana, a new isophyllous *Campanula* (Campanulaceae) from the Adriatic region

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Abstract

The Balkan Peninsula and the amphi-Adriatic region are biodiversity centres with a high number of *Campanula* species, some of them with restricted and isolated distributions. Among those is the morphologically, karyologically and genetically well-defined lineage of isophyllous *Campanula* species of the *garganica* clade, taxonomically treated as *Campanula* ser. *Garganicae*. In the central Adriatic, on the Island of Vis (Croatia), an isophyllous *Campanula* was found growing in rocky crevices of calcareous sea cliffs among chasmophytic vegetation with extremely challenging ecological conditions. Based on morphological characters (monopodial growth form, cordate to ovate basal leaves, campanulate corolla, presence of obtuse hairs at the base of filaments, capsule opening by basal pores and brown shiny seeds) the unidentified plant from the Island of Vis falls into ser. *Garganicae*. To establish the phylogenetic position and relationships of the unknown *Campanula* among other species of the *garganica* clade, nuclear ITS and chloroplast *trnL-F* sequences as well as comparative morphology, karyology and scanning electron microscopy of seeds were used. Due to its campanulate corolla the plants from Vis are morphologically close to *C. portenschlagiana* from the eastern Adriatic, from which they differ in several quantitative floral characters. The karyological analysis revealed a diploid chromosome number ($2n = 34$), while SEM analysis showed that seed coat of new taxon has weakly striate testa, thin wavy striped radial walls and slightly marked lumen. Additionally, molecular data show that the Vis taxon is clearly separated as a distinct species from other species of ser. *Garganicae*. Therefore, it is described and illustrated as a new species, *Campanula teutana* Bogdanović & Brullo. Because of the small number of individuals within the single population, *C. teutana* should be included on the Red List of the vascular flora of Croatia as an endangered species (EN).

Key words: *Campanula*, Croatia, narrow endemic species, morphology, phylogeny, taxonomy

Introduction

The genus *Campanula* Linnaeus (1753: 163) (Campanulaceae) is distributed in extra-tropical territories of the northern hemisphere and includes from 420 to 600 species (Shulkina *et al.* 2003, Lammers 2007, Mansion *et al.* 2012). Many species (ca. 250) are localized in the Mediterranean area (Greuter *et al.* 1984), usually linked to rupestrian habitats and characterized by very specialized edaphic or microclimatic conditions. Molecular phylogenetic studies have revealed that *Campanula*, as currently delimited: (1) is not monophyletic, (2) has unresolved phylogenetic relationships with several closely related genera, and (3) that the majority of *Campanula* species constitute two main groups named the *Campanula* s.str. clade and the *Rapunculus* clade (Eddie *et al.* 2003, Park *et al.* 2006, Roquet *et al.* 2008, Mansion *et al.* 2012, Lakušić *et al.* 2013).

The Western Balkan and amphi-Adriatic regions are rich in endemics (Kryštufek & Reed 2004, Park *et al.* 2006, Kučera *et al.* 2008, 2010, Stefanović *et al.* 2008, Frajman & Schneeweiss 2009, Kolarčik *et al.* 2010, Lakušić *et al.* 2013). These include several endemic *Campanula* species from the Apennine and the Balkan Peninsula,

morphologically closely related *C. portenschlagiana*, the seeds are irregular, flattened, showing distinctly striate testa with prominent anastomosed radial walls and distinct linear lumen, giving the seed coat a markedly striate appearance (Fig. 7 A–B). This type of testa is observed in many *Campanula* species (Geslot 1980, Alçitepe 2010). In conclusion, despite recent studies of isophyllous amphi-Adriatic *Campanula*, phylogenetic relationships among taxa still remain largely unresolved. The discovery of the new species belonging to this group indicates that a more complete sampling over the distribution range across the Balkan Peninsula, especially from poorly explored areas such as Albania, Peloponnese, Ionian and Croatian remote islands might reveal new hidden taxa. Further data employing other molecular markers, such as AFLPs, may be necessary to address the unresolved relationships and detailed questions regarding the spatiotemporal diversification of the *garganica* clade.

Key to the Croatian taxa of *Campanula* ser. *Garganicae*

- 1 Corolla campanulate, with tube 1/2–3/4 its length 2
- Corolla rotate, more or less flattened or infundibular, with tube 1/4–1/2 its length 3
- 2 Floral pedicels 5–12 mm long; calyx teeth 5–7 mm long; corolla with tube 1/2 its length; stamen filaments 2–2.5 mm long; anthers white tinged with pale blue, pollen whitish *C. teutana*
- Floral pedicels 12–25 mm long; calyx teeth 3–4 mm long; corolla with tube 2/3–3/4 its length; stamen filaments 0.8–1 mm long; anthers and pollen yellowish *C. portenschlagiana* var. *portenschlagiana*
- 2a. Plant glabrous, habit lax *C. portenschlagiana* var. *pumila*
- 2b. Plant hirsute, habit condensed *C. portenschlagiana* var. *hirsuta*
- 3 Corolla infundibular, 30–40 mm in diameter; calyx teeth 7 mm long and 3 mm wide, twice as long as the capsule *C. poscharskyana*
- Corolla rotate to infundibular, 7–20 mm in diameter; calyx teeth max. 6 mm long and max. 2 mm wide, subequal or shorter than capsule 4
- 4 Plant glabrous, rarely pubescent above, corolla max. 15 mm in diameter; basal leaves with blade max. 4 x 3 cm, 2-serrate or dentate; capsule 2.5 x 3.5 mm *C. fenestrellata* subsp. *fenestrellata*
- Plant densely tomentose-velvety, corolla up to 20 mm in diameter; basal leaves with blade up to 7 x 4 cm, serrate; capsule 4 x 4.5 mm *C. fenestrellata* subsp. *istriaca*

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