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A new subspecies of *Bolanthus creutzburgii* (Caryophyllaceae) from coastal SW Kriti (Greece)

Abstract

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A new subspecies of the dwarf perennial herb *Bolanthus creutzburgii* Greuter (Caryophyllaceae) is described from the coast of SW Kriti (Crete), Greece: *B. creutzburgii* subsp. *zaffranii* Phitos, Turland & Bergmeier. In morphology, flowering period, ecology, and geographic distribution it is compared with *B. creutzburgii* subsp. *creutzburgii*, which is endemic to the high mountains of W and C Kriti. The conservation status of the new subspecies is evaluated as Endangered (EN) according to IUCN criteria.

Key words: Aegean, conservation status, endemic, flora.

Introduction

Greuter (1965: 210–211) described the dwarf caespitose perennial herb *Bolanthus creutzburgii* Greuter as a new species endemic to the South Aegean island of Kriti (Crete), citing gatherings from the two highest mountain massifs, Lefka Ori and Psiloritis, in W and C Kriti, respectively. Later, Greuter (1973: 32) mentioned the existence of plants occurring on the coast of SW Kriti, writing “It was supposed to be endemic to the high mountains of Psiloritis and the Lefka Ori, but surprisingly Zaffran (pers. comm.) found quite similar plants on sandy shores in the Paleochora area (Selinos distr.) whose exact identity has not yet been established”. Later, Zaffran himself mentioned them (1976: 40), as “*Bolanthus* aff. *creutzburgii*”, observing “Alors que l’espèce n’était connue que de la haute montagne crétoise, j’ai pu récolter ces échantillons sur les plages sableuses à l’Est de Paleochora. Le traitement systématique de ces plantes (qui sera fait ultérieurement) permettra de préciser si les représentants du bord de mer ne sont que des écotypes des formes orophiles où si on peut leur attribuer un rang spécifique ou infraspécifique propre.” However, apparently nothing further was published until, in his later treatment, Zaffran (1990: 105–106) treated the plants at Paleochora under *B. creutzburgii*, noting that the chromosome number of the species is $2n = “20”$ (it is actually 30; see Phitos & Kamari 1974), based on material from 1800 m in altitude in the Psiloritis massif, and that it would be very interesting to count the chromosomes of the coastal plants.

Barkoudah & Akeroyd (1993) mentioned that the plants from Paleochora “seem to belong within [*Bolanthus creutzburgii*], but require further investigation.” and Turland & al. (1993: 45) wrote that the record of *B. creutzburgii* from Paleochora “seems unlikely because of its low altitude; it requires confirmation.” Phitos (1997) noted the occurrence of *B. creutzburgii* at Paleochora as well as in the Lefka Ori and Psiloritis massifs and mapped it from all three areas (l.c.: map 632). Turland (in Fielding & Turland 2005: 108) wrote that the population at Paleochora “should be checked to verify whether it is true *B. creutzburgii* or another taxon (perhaps *B. fruticosus*, which occurs in southern Peloponnisos and Kithira; compare this with *Tulipa goulimy*, which is similarly distributed but also occurs in westernmost Crete).” Turland’s speculation about *B. fruticosus* (Bory & Chaub.) Barkoudah was based on geographic distribution only. When the plants from Paleochora are compared with *B. fruticosus*, they are clearly not conspecific. Turland (2009) later noted that, although it seemed unlikely that the report from Paleochora would be *B. creutzburgii*, because of the low altitude, the plants had been confirmed as that species in April 2009 (see below), but more investigation was required.

On 31 March 2009, while conducting field work on the beaches of Kriti and the islands to the south, the second and third authors, together with Th. Constantinidis and R. Lansdown, searched the coast E of Paleochora with the goal of finding the *Bolanthus*. We followed a gravel road running eastward along the coast, branching off from the asphalt road that turns inland to Anidri. After only a short distance we found an open area by the sea with sandy ground among large rocks on the seaward side of the road and a steep rocky slope on the landward side. We found the *Bolanthus* here almost immediately. Some plants had a few flowers open, but most were still in the bud stage. We made a preliminary gathering (one specimen), took detailed macro digital photographs (Fig. 1), recorded ecological data, and determined the precise location by GPS. We deferred collecting further material for a few days, returning on 4 April, when we found more plants with open flowers. We made a second gathering of three herbarium specimens and a DNA sample (leafy stems dried in silica gel, at MO).

Our initial observation was that these coastal plants have laxly dichotomous, cymose inflorescences with a solitary flower at each node. By contrast, the *Bolanthus creutzburgii* we had seen in the high mountains of Kriti has flowers in capitate clusters with at least two flowers per node. We also noticed that the limb of the petals of the coastal plants appeared considerably shorter than that of the high-mountain plants, being \pm semiorbicular rather than oblong-ovate, although this could have been because anthesis was at an early stage, after which the petal limb could have enlarged. Subsequent comparison of our specimens with herbarium material previously collected from the Lefka Ori and Psiloritis massifs revealed another morphological difference: the indumentum of the high-mountain plants is a mixture of eglandular and glandular hairs, whereas the plants from Paleochora have predominantly eglandular hairs, with scattered (sometimes very few) glandular hairs intermixed on the upper part of the plant, especially on the calyces. These observations have convinced us that the coastal plants at Paleochora represent a taxon clearly very similar to, but morphologically, ecologically, and geographically distinct from, typical *B. creutzburgii*. Indeed, Phitos (1997) recognized two subspecies of *B. chelmicus* Phitos based on differences in indumentum that somewhat parallel the case of *B. creutzburgii*, viz. subsp. *meteoricus* Phitos: “pubescent, with a mixture of long glandular and eglandular hairs in upper part” and subsp. *chelmicus*: “puberulent, also with long eglandular and sparse glandular hairs, mainly in upper part”.

Bolanthus creutzburgii* subsp. *zaffranii Phitos, Turland & Bergmeier, **subsp. nov.** – **Fig. 1.**

Type: Greece, Kriti, Nomos Chanion, Eparchia Selinou: coast 2 km ENE of Paleochora, 35°14'23.6"N, 23°42'20.1"E, sea level, semi-consolidated sandy-stony beach, 4 April 2009, *E. Bergmeier, Th. Constantinidis, R. Lansdown, & N. Turland sub N. Turland 1841* (holotype: UPA; isotypes: MO [accession no. 6247480], PAL).

Diagnosis: *Bolanthus creutzburgii* subspeciei typicae similis, differt autem indumento praecipue eglanduloso superne, praesertim in calycibus, pilis glandulosis sparsis vel rarissimis intermixtis (nec glanduloso cum eglanduloso undique pari modo mixto) atque inflorescentia laxe dichotoma, flore in quoque nodo solitario, internodio supra florem infimum 4.5–6 mm longo (nec fasciculata 2–10-flora, floribus in quoque nodo saltem binis, internodiis omnibus brevissimis).

Description of the species and distinguishing features of the two subspecies

Bolanthus creutzburgii. Dwarf caespitose perennial herb, woody at base; stems and leaves when young, bracts, pedicels, and calyces densely and minutely pubescent with patent or slightly recurved eglandular hairs (mostly 0.05–0.2 mm, but to 0.5 mm at leaf and calyx apices) and very few to many glandular hairs (ca. 0.2 mm) intermixed; stems and leaves of previous year almost glabrous. Stems ascending to erect, 1.5–6 cm. Leaves and bracts opposite, oblanceolate or narrowly oblanceolate to spatulate, 2–10.5 × 0.5–3 mm, bases connate. Inflorescence cymose, bracteate, either forming a 2–10-flowered capitate cluster with at least 2 flowers per node (internodes above lowest flower much shortened) or laxly dichotomous with only 1 flower per node (internodes above lowest flower 4.5–6 mm); bracts ± equalling calyx; pedicels 1–2 mm or almost absent. Calyx ellipsoid, 2.5–4 × 1–1.4 mm; tube 5-ribbed, ribs tinged deep purplish, herbaceous, commissures whitish, scarious; teeth narrowly triangular, apex subacute. Petals 5, linear-spatulate, exceeding calyx; limb whitish with transverse deep purple stripe near middle or base, oblong-ovate or ± semiorbicular. Stamens 10. Ovary unilocular; styles 2. Capsule [seen only in subsp. *creutzburgii*] sessile, ovoid-ellipsoid, ± equalling calyx, dehiscing by 4 teeth. Seeds black, comma-shaped, 0.8–1.1 × 0.5–0.7 mm, minutely papillose.

Bolanthus creutzburgii subsp. *creutzburgii*. Indumentum a mixture of eglandular and glandular hairs. Inflorescence forming a 2–10-flowered capitate cluster with at least 2 flowers per node; internodes above lowest flower much shortened.

Bolanthus creutzburgii subsp. *zaffranii*. Indumentum predominantly of eglandular hairs, with scattered (sometimes very few) glandular hairs intermixed on upper part of plant especially on calyces. Inflorescence laxly dichotomous with only 1 flower per node; internodes above lowest flower 4.5–6 mm.

Flowering period

Bolanthus creutzburgii subsp. *zaffranii* flowers from the end of March into April, and possibly later; subsp. *creutzburgii* flowers from May to July.



Fig. 1. Flowering shoots of *Bolanthus creutzburgii* subsp. *zaffranii* photographed at the type locality on 31 March 2009.

Ecology

The environment of *Bolanthus creutzburgii* subsp. *zaffranii* may be characterized as follows: sedimentary rock, screes and boulders, consisting of limestone and sandstone conglomerate with calcareous cementing material. The soil is sandy and skeletal. The vegetation is very open (15% or less) with scattered plants. It is grazed. Co-occurring perennials are: *Anthyllis hermanniae* L., *Aristida caerulea* Desf., *Hyparrhenia hirta* (L.) Stapf, *Phagnalon rupestre* subsp. *graecum* (Boiss. & Heldr.) Batt., *Satureja thymbra* L., and *Thymbra capitata* (L.) Cav. (*Coridothymus capitatus* (L.) Rchb. f.). Co-occurring annuals are, among others, *Anisantha fasciculata* (C. Presl) Nevski (*Bromus fasciculatus* C. Presl), *Chaenorhinum rubrifolium* (Robill. & Castagne ex DC.) Fourr., *Filago aegaea* subsp. *aristata* Wagenitz and *Silene colorata* Poir.

By contrast, the geological and habitat conditions of *Bolanthus creutzburgii* subsp. *creutzburgii* are rocky places, crevices, and screes with metamorphic crystalline limestone and dolomite at altitudes of 750–2100 m. Associated taxa include *Asperula idaea* Halácsy, *Centaurea idaea* Boiss. & Heldr., *Crepis sibthorpiana* Boiss. & Heldr., *Erica manipuliflora* Salisb., *Euphorbia herniariifolia* Willd., *Fumana paphlagonica* subsp. *alpina* (Janch.) Greuter, *Helianthemum hymettium* Boiss. & Heldr., *Hypochaeris tenuiflora* (Boiss.) Boiss., *Lomelosia sphaciotica* (Roem. & Schult.) Greuter & Burdet, *Micromeria hispida* Boiss. & Heldr. ex Benth., *Muscari spreitzenhoferi* (Heldr. ex Osterm.) Vierh., *Pimpinella depressa* (Sieber ex Spreng.) DC., *Prunus prostrata* Labill., *Putoria calabrica* (L. f.) DC., *Satureja spinosa* L., and *Scutellaria hirta* Sm., several of which are also endemic to Kriti.

Distribution

The new species is locally endemic to the coast of SW Kriti; the typical subspecies is endemic to the Lefka Ori and Psiloritis massifs of W and C Kriti (Fig. 2).

Conservation status

The population of *Bolanthus creutzburgii* subsp. *zaffranii* is apparently restricted to a single locality. Precise data on the size of the population are not yet known. Only a few mature individuals were observed at the type locality in 2009, but the surrounding similar habitat was not searched exhaustively. It seems likely that more than 50 mature individuals exist, but perhaps fewer than 250. The known area of occupancy and extent of occurrence are both less than 1 km². We are not aware of a continuing decline or extreme fluctuations in extent of occurrence, area of occupancy, area or extent and/or quality of habitat, number of locations or subpopulations, or numbers of mature individuals. However, the subspecies is potentially threatened by coastal erosion by the sea during storms, widening of the gravel road that runs through the population, over-grazing by sheep, over-collecting by botanists, and tourism-related development along the coast. Based on the currently available data, the category Endangered (EN) is proposed (IUCN 2001), meeting criterion D (population size estimated to number fewer than 250 mature individuals).

Turland (2009) evaluated the conservation status of *Bolanthus creutzburgii* subsp. *creutzburgii* as Vulnerable (VU), meeting criteria D1+2.

Etymology

The subspecific epithet honours French phytosociologist Jacques Zaffran, the original discoverer of the population here described as a new subspecies.

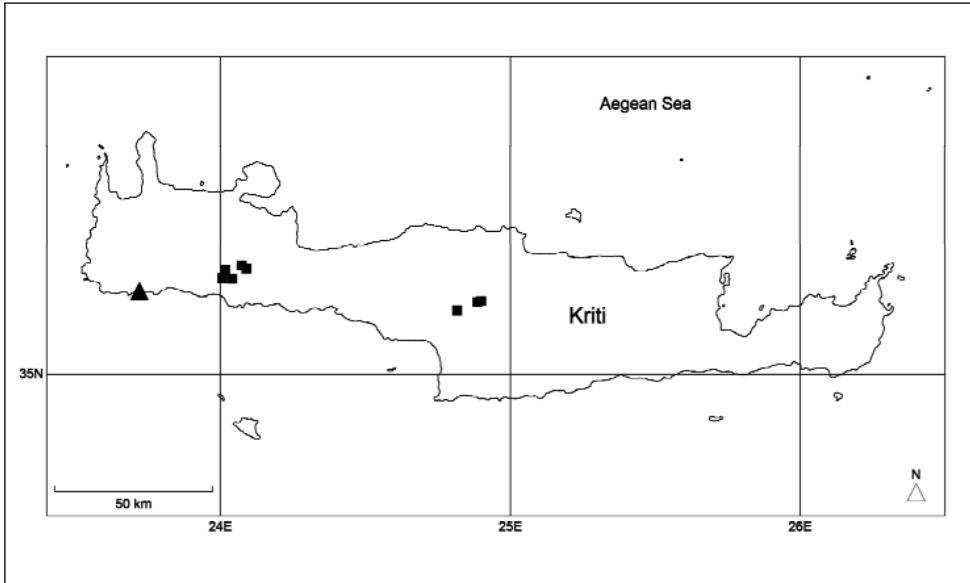


Fig. 2. The South Aegean island of Kriti showing the distributions of *Bolanthus creutzburgii* subsp. *zaffranii* (▲) and *B. creutzburgii* subsp. *creutzburgii* (■).

Additional specimens examined

Bolanthus creutzburgii subsp. *zaffranii*. Same locality as the type gathering, 31 Mar 2009, *E. Bergmeier 09-1* (paratype of subsp. *zaffranii*: herb. Bergmeier [currently at GOET]).

Bolanthus creutzburgii subsp. *creutzburgii*. Greece, Crete, Nomos Chanion, Eparchia Sfakion: Lefka Ori, N end of Amoutsera valley N of Anopoli, “unnamed peak” [Pavlia] 1.25 km SE of Mt Grias Soros, [35°18'26"N, 24°04'23"E], 1950 m, shaded crevice of calcareous rock, 30 Jun 1994, *N. Turland 800* (BM [bar code 98233]); “Talkessel zw. den Bergen Kakòvoli u. Kàstro”, [35°17'30"N, 24°06'00"E], 1750–1800 m, “Tripolitsa-Kalk[, a]uf schwarzen Felsbuckeln u. deren Verwitterungsschutt zerstr. u. selten”, 2 Jul 1962, *W. Greuter 4837* (PAL-Greuter [digital image!]); Nomos Rethimnis, Eparchia Amariou: montes Psiloritis, supra pagum Kouroutes, [c. 35°11'N, 24°45'E], 750–950 m, in saxosis calc. silvae *Quercus coccifera*, 10 Jun 1991, *D. Phitos & G. Kamari 22016* (UPA); Eparchia Milopotamou: massif du Psiloritis, au pied du Mont Skinakas, places nues sableuses au fond de la 2e doline, [35°12'30"N, 24°53'00"E], 1500 m, 8 Jun 2000, *R. Deschatres s.n.* (PAL-Greuter [digital image!]); pass between Mt Piperos and Mt Skinakas, 35°12'19.6"N, 24°53'09.7"E, 1585 m, growing against solid rock on level rocky limestone ground with *Erica manipuliflora*, 5 Jun 2008, *N. Turland 1524* (UPA); Nomos Irakliou, Eparchia Pírgiotissis: “NW-Hang des Berges Mávri ob der Quelle Skarònero” [35°11'N, 24°49'E], 1800–1900 m, “Tripolitsa-Kalk[, a]uf Feinschuttflecken am felsigen Abhang, nicht selten”, 30 Jun 1961, *W. Greuter 3733* (holotype of *B. creutzburgii* Greuter: PAL-Greuter [digital image!]).

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