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## A new subspecies of *Guenthera repanda* (*Brassicaceae*) from Mt Baldo (SE Prealps, Italy)

### Abstract

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*Guenthera repanda* ( $\equiv$  *Brassica repanda*) was discovered on Mt Baldo (SE Prealps, Italy). Comparisons with the known subspecies confirmed that the Mt Baldo populations represents a new taxon, here described as subsp. *baldensis*. The new subspecies has the closest morphological affinities to subspecies of the eastern Iberian Peninsula and not to the three subspecies known from the Alps and NE Italy. Data on the local distribution and ecology of the new taxon are reported.

Key words: *Cruciferae*, *Brassica repanda*, *Guenthera repanda* subsp. *baldensis*, Mt Cimo, xerothermic refuge.

“Cominciando poi ad ascendere si trova la Corona dove è un tempio dedicato alla Madonna di molta devotione, ma non meno raro per il sito che lo rende quasi inaccessibile ... Ma quanto più questo passo è spaueteuole a riguardare e faticoso da uarcare ta[n]to più ci inuita all'ascenderui ... purché su'l detto sentiero nasce copia di seu ouer sette bellissime e rare piante.” Viaggio di Monte Baldo (Calzolari 1566)

### Introduction

Since the 16th century Mt Baldo has been known for its rich and peculiar flora (Calzolari 1566). Due to its fame, many botanists from all over Europe visited this mountain, where many Prealpine endemics are known (Tribusch & Schönswetter 2003). At the beginning of the 19th century there was so much material available of the flora of Mt Baldo that Dalla Torre (1904) was able to write a detailed history of its floristic exploration. Consequently Mt Baldo, and particularly its southern region, is represented as a rather well known area in the map of the floristic knowledge of Italy (Scoppola & Blasi 2005). Nevertheless some parts of Mt Baldo, such as the cliffs of the Adige slope, were neglected by botanists.

Spurred by some interesting floristic findings on the peaks of the Adige slope of northern Mt Baldo (Bertolli & Prosser 2006), we have methodically investigated also the cliffs of central and southern areas on the same side of the mountain ridge. On 7 June 2004 we found on the cliffs of

Mt Cimo several plants of a crucifer with leafless stems. Literature and herbarium studies revealed that the plants represent *Guenthera repanda* (Willd.) Gómez-Campo ( $\equiv$  *Brassica repanda* (Willd.) DC.), a species scattered from Friuli-Venezia Giulia (NE Italy), the SW Alps, Mediterranean France and the Pyrenees to S Spain and the Atlas Mts (Greuter & al. 1986, Akeroyd & Heywood 1993, Gómez-Campo 1999). Gómez-Campo (2003) transferred *Brassica repanda* s.l. to *Guenthera* Besser and distinguished 18 subspecies; 11 subspecies are reported for Spain, four each for France and Morocco, two for Italy and one for Algeria. All investigated European subspecies are diploids with a basic chromosome number of  $x = 10$ ; two African subspecies (subsp. *diplotaxiformis* and subsp. *silenifolia*) are polyploid (Gómez-Campo pers. comm.).

Subsequent field investigations in 2004 and 2005 led to the discovery of further populations scattered on rocky habitats along the eastern slope of Mt Baldo. The undisturbed habitat indicates its occurrence on Mt Baldo as spontaneous.

We compared all 14 collections from Mt Baldo with 38 selected specimens of *Guenthera repanda* from its entire distribution range from the herbaria BM, FI, MA, ROV and TL (Holmgren & Holmgren 1998-) and with the descriptions of the subspecies in the literature. The analysis revealed that the populations of Mt Baldo are very different from the three subspecies already known from the Alps and NE Italy (subsp. *glabrescens* (Poldini) Gómez-Campo, subsp. *repanda* and subsp. *saxatilis* (DC.) Gómez-Campo) and show instead an unexpected morphological similarity with three subspecies endemic to E Spain, viz. subsp. *blancoana* (Boiss.) Gómez-Campo, subsp. *cadevallii* (Font Quer) Gómez-Campo and subsp. *maritima* (Willk.) Gómez-Campo. Nevertheless, the Mt Baldo populations differs also from the latter. Considering that the subspecies of *B. repanda* have been based on minor morphological differences correlated to restricted or even very localised distribution areas (Gómez-Campo 2003) and considering the geographical distance of the populations of Mt Baldo to the morphologically most similar ones, recognition of the Mt Baldo populations as a new subspecies appears inevitably.

***Guenthera repanda* subsp. *baldensis* Prosser & Bertolli, subsp. nov.**

Holotypus: Italia, provincia di Verona, comune di Brentino Belluno, Mt Baldo, pendice 500 m a W di Preabocco (a monte dell'area di sosta) [0331/3], 360 m sottoroccia arido (calcare), 21.6.2004, F. Prosser & A. Bertolli (ROV; isotypi: B, ROV) – Fig. 1.

*Hemikryptophyton* (interdum chamaephyton), caespitosus cum spissa radice lignosum et ramorum caulem ferens (rami usque ad 1-1.5 cm crassi); caulis reliquii foliorum emortuorum priorum annorum tectus, in superiore omnium ramorum parte foliorum rosulam ferens; fere omnium ramorum apex unum aphyllum scapum ferens. *Scapi florentes* erecti 20-40 cm longi, fructiferi procumbentes fructuum pondere 30-60(-80) cm longi, teretes (c. 2 mm crassi), glabri, virides vel lato solibus exposito rubescentes, fragiles. *Folia* omnia rosulis disposita, multa (solite c. 20 vel ultra), carnosula, atroviridia, tenui odore, 5-23 (media ratione 12) cm longae, 0.3-3.5 (media ratione 1.6) cm latae; lamina basi sensim in petiolum attenuata, obovata-lanceolata, pervarie incisa, ab sinuata (solite in umbrosis) usque ad pinnatifidam (solite in apricis), rarissimo integra, saepe in ipso individuo cum dissimilibus incisuris, in ea re laminae inferiores minus incisae quam superiores, margine cum c. 4-6 rotundo apice interdum ad apicem versibus lobis ab utroque latere, sparse ciliato (pili c. 0.4-0.7 mm longi), glabra pagina (rarissime sparse pilosa); petiolus lamina 1-2plo longior. *Racemus* c. 15-30 valde odoratos flores ferens; anthesis ab imo usque ad apicem una cum axis extensione progrediens, ergo inflorescentia initio florendi corymbi forma, deinde racemi forma, inferne remotis superne densis floribus. *Pedunculus* sub anthesi c. 1 cm, sub fructificatione 1.3-3 (media ratione 1.9) cm longus, glabrus. *Flores* 2 externa sepala cucullata, 6-9 mm longa, 2 interiora saccata, paulo breviora, omnia 2-8 pilos (c. 0.5 mm longos) prope apicem ferentia (raro cum aliquibus pilis atque ad dimidiam longitudinem), virida margine pallido; *petala* citrina, 1.2-1.6 cm longa, 0.5-0.9 cm lata, lamina obovata-orbiculata, abrupte in 3-4 mm longo ungue restricta, extra patente, coniuncta ungui sub angulo fere 90°, ad apicem  $\pm$  truncata, integra vel leviter emarginata; *stamina* 6, 2 breviora (c. 6-7 mm longa) et 4

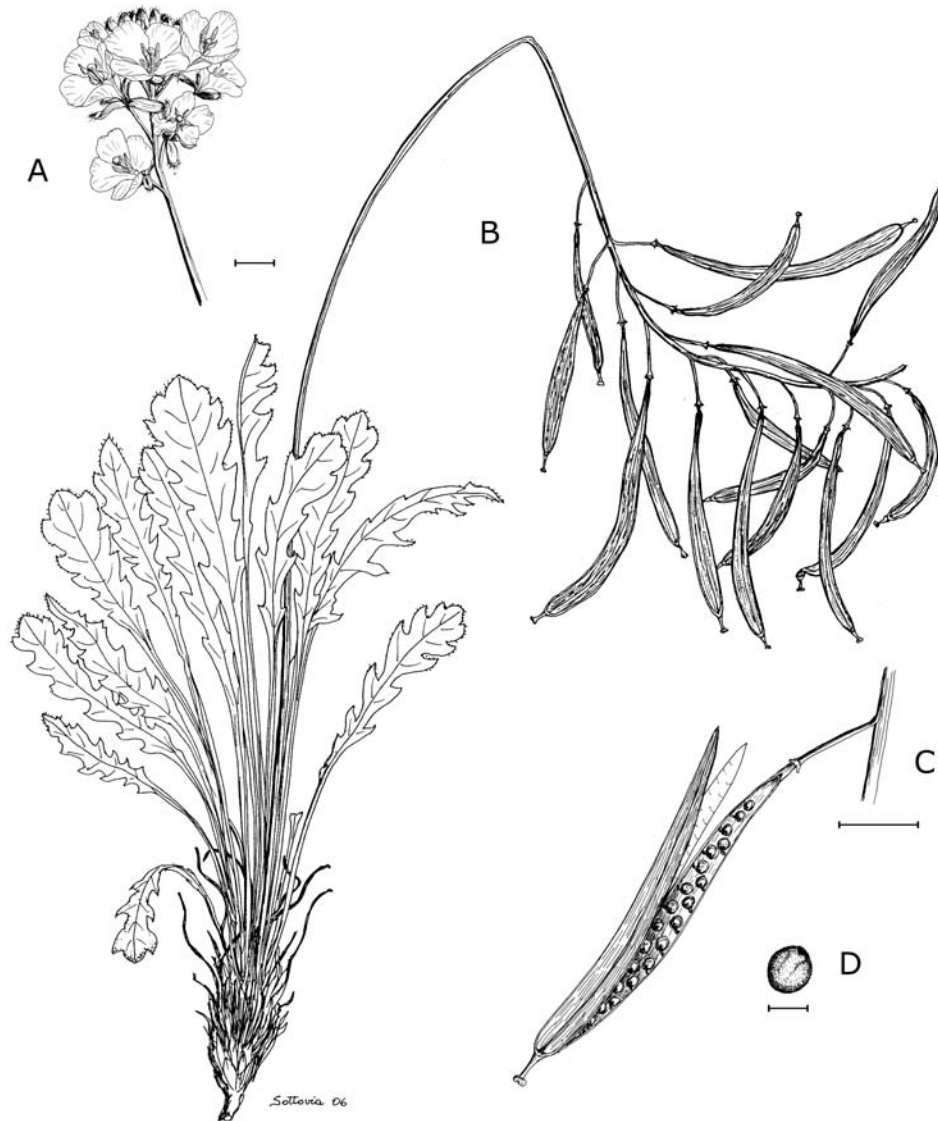


Fig. 1. *Guenthera repanda* subsp. *baldensis* – A: inflorescence; B: fruiting stem with rosette (holotype); C: siliqua; D: seed. – Scale bars: A-C = 1 cm, D = 2 mm; drawings by Lucio Sottovia.

longiora (10-12 mm longa), anthera c. 2-2.5 mm longa; *pistilla* c. 10-12 mm longa, stigmate c. 1 mm lato, stylo c. 3 mm longo; 2 viridia nectaria, c. 0.5 mm longa, ad externorum sepalorum basim inserta, in fructu persistentia. *Siliquae* glabrae, ± pendulae vel horizontales, ad maturitatem 30-70 mm longae et 3-5(-6) mm latae, maxima latitudine in superiore tertia parte, ± clavatae, rostro 3-5 mm longo, leviter ad apicem attenuato, ad basim c. 1 mm et ad apicem c. 0.6 mm crasso, ad dehiscenciam stramineis valvis manifeste prominente medio nervo et reticulata pagina. *Semina* irregulariter 1-2 serialia, brunnea, ± ovata, leviter latere compressa, c. 2.2 × 1.6 × 1 mm.

*Hemicryptophyte* (sometimes chamaephyte), caespitose with a thick root bearing a basal branched woody stem (branches up to 1-1.5 cm thick); stem covered by remains of dry leaves from previous years, carrying a leaf rosette in the distal part of each branch; apex of nearly all branches with one aphyllous scape. *Flowering scapes* erect, 20-40 cm long at flowering, 30-60(-80) cm at fruiting time and procumbent because of the weight of the fruits, terete (c. 2 mm in diameter), glabrous, green or, when sun exposed, reddish, fragile. *Rosette leaves* generally over 20, slightly fleshy, dark green, with weak scent, 5-23 (average 12) × 0.3-3.5 (average 1.6) cm, attenuate into a petiole, obovate-lanceolate, with very variable incision, from sinuate (mainly in shady sites) to pinnatifid (mainly in sun exposed localities), very rarely entire, often with different incisions on the same plant, and in this case the lower blades less incised than the upper ones, margin with about 4-6 lobes rounded at apex on each side, sometimes ± turned to the apex, margin sparsely ciliate (hairs c. 0.4-0.7 mm long), blade surface glabrous (very rare sparsely hairy); petiole 1 to 2 times longer than the blade. *Raceme* with c. 15-30 strongly sweet-scenting flowers; anthesis advancing from the base to the apex together with axis lengthening, therefore inflorescence at the beginning corymbiform, then racemose with lower flowers ± remote and higher close together. *Peduncle* at anthesis c. 1 cm, at fruiting time 1.3-3 (average 1.9) cm long, glabrous. *Flower* with the 2 external *sepals* hooded at apex, 6-9 mm long, the 2 internal saccate at the base and slightly shorter than the external ones, all with 2-8 hairs (c. 0.5 mm long) towards the apex (rarely some hairs also at ½ of the length of sepals), green with pale margin; *petals* lemon yellow, 1.2-1.6 × 0.5-0.9 cm, with obovate-orbicular blade, suddenly attenuate into a 3-4 mm long claw, folded outward with nearly right angle between claw and blade, apex ± truncate and entire to slightly emarginate; *stamens* 6, 2 shorter (c. 6-7 mm long) and 4 longer (10-12 mm long), anther c. 2-2.5 mm long; *pistil* c. 10-12 mm long, stigma c. 1 mm broad, style c. 3 mm long; *nectaries* 2, green, c. 0.5 mm long, inserted at the base of external sepals, persistent in fruit. *Silique* glabrous, ± pendulous or horizontal, ripe 30-70 × 3-5(-6) mm, with largest width in the upper third, ± clavate, beak 3-5 mm long, slightly attenuate into the apex, 1 mm wide at the base and 0.6 mm wide near the apex, valves straw-yellow at dehiscence with clearly prominent middle nerve and reticulate surface. *Seeds* irregularly disposed in 1-2 rows, brown, ± ovate, slightly laterally compressed, c. 2.2 × 1.6 × 1 mm.

*Distribution and ecology.* – *Guenthera repanda* subsp. *baldensis* grows in dry, rocky habitats, on limestone, and particularly on sunny, sometimes bushy (not woody), upper E to SE and NE exposed ledges and in fissure of adjacent cliffs and rocks. The core of the populations is located in rain shelters under projecting cliffs, characterized by aridity, high temperature and sun exposure. Very few plants were found in bushy and disturbed habitats near the cliffs but seem unable there to compete with bushes and herbs. For this reason the Mt Baldo slope between Brentino and Belluno Veronese, where projecting rocks are not common, could be a barrier for the expansion of the plant northwards. The habitat of subsp. *baldensis* is thus quite different from that of subsp. *cadevallii* and subsp. *blancoana* in E Spain (slopes, not necessarily rocky). Only in the localized type population of subsp. *maritima* the plants grow in ledges (Gómez-Campo in litt.).

At the base of projecting rocks the new subspecies is accompanied mainly by *Centaurea deusta* Ten., *Fumana ericoides* (Cav.) Gand., *Kengia serotina* (L.) Packer, *Laserpitium siler* L., *Marrubium vulgare* L., *Piptatherum miliaceum* (L.) Coss., *Scorzonera austriaca* Willd. Bushy vegetation consists of *Amelanchier ovalis* Medik. subsp. *ovalis*, *Crataegus monogyna* Jacq., *Fraxinus ornus* L., *Ostrya carpinifolia* Scop., *Pistacia terebinthus* L., *Quercus ilex* L., etc. On vertical or projecting cliffs it is accompanied in particular by *Campanula petraea* L., *Globularia cordifolia* L., *Leontodon incanus* (L.) Schrank s.l., *Lomelosia graminifolia* (L.) Greuter & Burdet, *Moehringia bavarica* (L.) Gren. subsp. *bavarica*.

The main distribution area is located between the cliffs W of Preabocco village in the south and the cliffs W of Brentino in the north; only few plants were also found on the cliffs 1.2 km NW of Brentino, beyond the Bissole River gorge (“Vaio dell’Orsa”) (Fig. 2). With the exception of the latter, all populations grow on the Adige side of Mt Cimo (956 m), a minor elevation of Mt

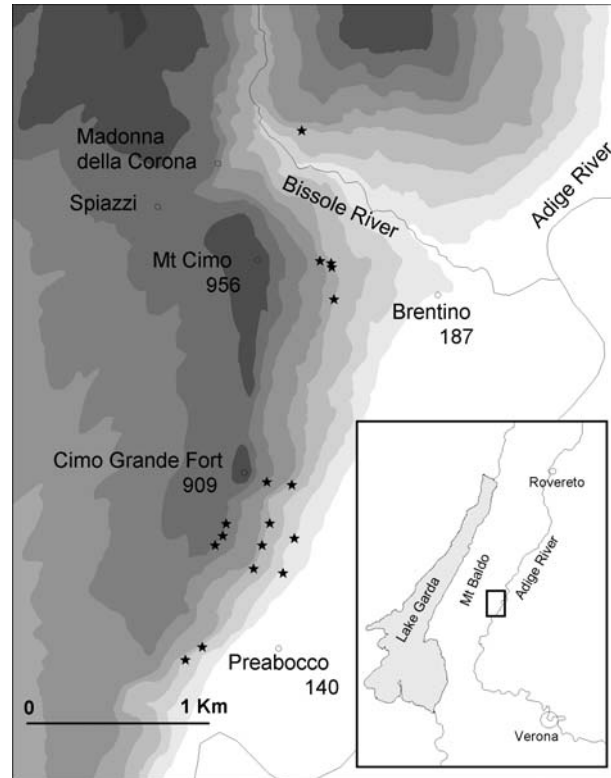


Fig. 2. Distribution of *Guenthera repanda* subsp. *baldensis* (★).

Baldo. The entire distribution area extends over c. 3 km and is situated at an altitude between c. 250 m and c. 820 m (Fig. 2).

The wild western side of Mt Cimo is characterized by three main rock steps, separated by woody slopes. The rocks are stratified limestone of middle and lower Jurassic. The area is nowadays well known by climbers, who have traced several rock routes. Little paths leading to the rock routes allow to reach without climbing several populations of the plant. The only ancient path crossing the western side of Mt Cimo leads to the sanctuary of Madonna della Corona. This path has been well known also by botanists since 1566, when Calzolari published his “Viaggio di Monte Baldo”. By chance no population grows on the cliffs along this path, but one of them is situated only 50-100 m above it. Evidently the surrounding wilderness did not encourage botanists to explore areas beyond the path. It is also possible that *G. repanda* subsp. *baldensis* was mistaken with *Diplotaxis muralis* (L.) DC., common in the area and showing a somewhat similar habit.

Flowering is from April to early May; rarely, fruiting plants bear flowering scapes also in June. Fruiting is at the end of June or in July. Among the insects on the flowers of *Guenthera repanda* subsp. *baldensis*, attracted by their sweet scent and nectar, are *Oxythirea funesta* (Coleoptera Cetonidae), *Cantharis* sp. (Coleoptera Cantharidae) and *Blasticotoma* sp. (Hymenoptera Blasticotomidae) (det. A. Martinelli).

*Additional specimens seen.* – ITALIA: PROVINCIA DI VERONA, BRENTINO BELLUNO, MT BALDO: Versante a NW di Preabocco, 350 m a SSW dell'ex Forte Cimo Grande, sottoroccia arido (calcare), 775 m, 7.6.2004, F. Prosser & A. Bertolli (ROV); ibid., c. 500 m a SSW dell'ex Forte Cimo Grande, rupe arida spiovente (calcare), 775 m, 7.6.2004, F. Prosser & A. Bertolli (ROV);

ibid., c. 600 m a SSW dell'ex Forte Cimo Grande, rupe arida spiovente (calcare), 750 m, 7.6.2004, *F. Prosser & A. Bertolli* (ROV); ibid., id., boscaglia soggetta a caduta sassi al piede della rupe (calcare), 750 m, 7.6.2004, *F. Prosser & A. Bertolli* (ROV); c. 700 m a N di Preabocco, alla rupe con vie di roccia, sottoroccia arido (calcare), 470 m, 21.6.2004, *F. Prosser & A. Bertolli* (ROV); ibid., rupe calcarea, 250 m, 21.4.2005, *F. Prosser, A. Bertolli & F. Zoller* (ROV); pendice 500 m a W di Preabocco (a monte dell'area di sosta), sottoroccia arido (calcare), 360 m, 21.6.2004, *F. Prosser & A. Bertolli* (ROV); a monte del sentiero Brentino-Santuario Madonna della Corona, a S della frana (430 m a E-ESE della cima del M Cimo), sottoroccia arido esp. E (calcare), 520 m, 21.6.2004, *F. Prosser, A. Bertolli* (ROV); ibid., subito a Sud della frana, sottoroccia arido (calcare), rupe e cengia, 500 m, 26.4.2005, *F. Prosser, A. Bertolli & F. Zoller* (ROV); alla "torre gialla" a W di Brentino, c. 300 m a W della croce del dosso panoramico, boscaglia rada al piede della rupe (calcare), 500 m, 26.4.2005, *F. Prosser, A. Bertolli & F. Zoller* (ROV); Brentino, allo sbocco della forra del Rio Bissole, sulla sinistra idrografica, c. 650 m a NW della centrale idroelettrica, rupe calcarea esp. S, 490 m, 29.4.2005, *F. Prosser & A. Bertolli* (ROV).

*Conservation.* – All occurrences of *Guenthera repanda* subsp. *baldensis* are located in the site of community importance "Mt Baldo East" [code IT3210041] designated after the Habitats Directive 92/43/EEC (<http://eurlex.europa.eu>). The habitat of the plant match the "Calcareous rocky slopes with chasmophytic vegetation" [code 8210] after the Annex I of the Directive. Therefore the species habitat should be particularly protected. At the time it is only threatened by the rock climbers, whose favourite climbing walls are projecting rocks where most of the plants are located.

*Relationship and delimitation.* – Seven of the 18 subspecies of *Guenthera repanda* (subsp. *almeriensis*, subsp. *diplotaxiformis*, subsp. *glabrescens*, subsp. *humilis*, subsp. *repanda*, subsp. *silenifolia*, subsp. *turbonis*) are always very low plants, with stems shorter than 15(-25) cm, and cannot therefore be confused with subsp. *baldensis*, with stems longer than 30 cm. The stem length corresponds with several further differences between subsp. *baldensis* and this group of subspecies.

The stem of four other subspecies (subsp. *cantabrica*, subsp. *dertosensis*, subsp. *latisiliqua*, subsp. *saxatilis*) can reach in some cases 35 cm and therefore they match or slightly overlap the range of variability of subsp. *baldensis*. Among others, the different leaf indumentum distinguishes subsp. *baldensis* from these taxa; only subsp. *dertosensis* shows glabrous leaves, the other subspecies have hairy leaves (even on upper surface).

Further four subspecies, with stems up to 50-60 cm (subsp. *africana*, subsp. *confusa*, subsp. *galissieri* subsp. *gypsicola*), can be clearly distinguished by their narrower siliques (up to 3 mm versus wider than 3 mm in subsp. *baldensis*).

Table 1. Characters differentiating *Guenthera repanda* subsp. *baldensis* from the three morphologically nearest subspecies (data from specimens and the literature).

	subsp. <i>baldensis</i>	subsp. <i>blancoana</i>	subsp. <i>cadevallii</i>	subsp. <i>maritima</i>
Ratio petiole length/ blade length	1-2 (average 1.6)	0.7-2.5 (average 1.3)	1-1.5 (average 1.3)	1-1.5 (average 1.3)
Leaf indumentum margin	ciliate	ciliate	ciliate	glabrous to sparsely ciliate
surface	very rarely sparsely hairy	sparsely hairy	rarely sparsely hairy	glabrous to glabrescent
Petal length [mm]	12-16	10-12	c. 10	(12-)15-25(-30)
Silique width [mm]	3-5(-6)	2.5-3.5	3.5-4	4-5
Thickness of beak at the base [mm]	c. 1	c. 1.3	c. 1.4	c. 1.6

Table 2. Characters differentiating *Guenthera repanda* subsp. *baldensis* from the geographically nearest subspecies (data from specimens and the literature).

	subsp. <i>baldensis</i>	subsp. <i>glabrescens</i>	subsp. <i>repanda</i>	subsp. <i>saxatilis</i>
Stems	erect	erect	procumbent	erect
Leaf indumentum	0.4-0.7 mm long hairs at margin, glabrous on the surface	only 1(-2) hairs at apex lobe, glabrous on the surface	margin glabrous or with rare hairs at lobe apex, glabrous on the surface	1-1.5 mm long hairs on the surface
Leaves length [cm]	5-23	2-9	2-6	4-10
Apex of leaf lobes	rounded	acute	rounded	rounded
Leaf incision	pinnatifid to pinnatipartite	pinnatifid	subentire to pinnatifid	deeply pinnatifid to pinnatipartite
Flowers [number]	c. 15-30	c. 2-12	2-10(-15)	2-12
Petal length [mm]	12-16	7-10	9-12	9-12
Nectary length [mm]	c. 0.5	0.6-1	< 0.5	< 0.5
Length of fruiting peduncles [cm]	1.3-3	0.4-1.5	0.6-1.2	1-1.4
Siliques				
seed rows	1-2	1	1(-2)	1(-2)
width [mm]	>3	1.5-3	3-3.5	2-2.5

Three subspecies, all narrow endemics of E Spain, show the closest morphological affinities with subsp. *baldensis*: subsp. *blancoana*, subsp. *cadevallii* and subsp. *maritima*. The main differences are that subsp. *blancoana* and subsp. *cadevallii* have shorter petals ( $\leq 12$  mm) than subsp. *baldensis* ( $\geq 12$  mm) and subsp. *maritima* has leaves without or with a few hairs on the upper side of the lobes, whereas subsp. *baldensis* has leaves with a ciliate margin (Table 1).

A surprising result is the little similarity between subsp. *baldensis* and the geographically nearest subspecies: subsp. *glabrescens* (endemic to Friuli plain and Piedmont hills, NE Italy), subsp. *repanda* (endemic to western Alps) and subsp. *saxatilis* (endemic to southern France). Besides the length of the stem, they differ in several further character (Table 2).

## Discussion

Mt Baldo, as the whole SE side of the Alps, is rich in endemic species. Several species have survived or differentiated during the Pleistocene glaciations on the Nunatak of this area. But some thermophilous endemics may rather be related to xerothermic postglacial periods, as is the case of *Campanula petraea* L., endemic to the thermophilous cliffs of Mt Baldo and Mts Lessini, and *Gypsophila papillosa* Porta, endemic to the sub-Mediterranean southernmost slope of Mt Baldo. Both are not very differentiated, suggesting a relatively short isolation. It could be also the case of *Guenthera repanda* subsp. *baldensis*. The concentration in this area of such postglacial endemics is probably related to the peculiar climate of the southernmost part of the Adige valley, with high temperatures, relatively low rainfall and windiness. Some species may have survived here that were probably more widespread in xerothermic postglacial periods. Several species on Mt Baldo with a disjunct distribution, such as *Astragalus vesicarius* subsp. *pastellianus* (Pollini) Arcang., *Biscutella cichoriifolia* Loisel., *Bulbocodium vernum* L., *Bupleurum praealtum* L., *Jovibarba globifera* subsp. *hirta* (L.) J. Parn., *Linaria angustissima* (Loisel.) Borbás, *Onosma echioides* (L.) L., *Scorzonera hispanica* subsp. *glastifolia* (Willd.) Arcang., *Klasea nudicaulis* (L.) Fourr., *Seseli pallasii* Besser, support the hypothesis of Mt Baldo as a xerothermic refuge.

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