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(*Gentianaceae*) from the Brenta Group, European Alps,
Italy**

Authors: Prosser, Filippo, and Bertolli, Alessio

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FILIPPO PROSSER & ALESSIO BERTOLLI

A new species of *Gentiana* sect. *Calathianae* (*Gentianaceae*) from the Brenta Group, European Alps, Italy

Abstract

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Populations of an unknown taxon of *Gentiana* sect. *Calathianae* have been found in the Brenta Group during floristic surveys. Comparison with morphologically similar taxa (*G. terglouensis*, *G. bavarica*, *G. orbicularis*) revealed that they represent a species new to science, which is described as *G. brentae*. Data on its ecology and local distribution are reported.

Additional key words: *Gentiana brentae*, taxonomy, Dolomiti di Brenta

“... the Brenta group ... a mysterious range utterly unlike anything in the central Alps” (Freshfield 1875)

Introduction

Since the first modern botanical exploration of the Brenta Group (Dolomiti di Brenta) by Caspar Sternberg in the summer 1804 (Sternberg 1806), several botanists visited this mountain range with its rich flora (Festi & Prosser 2008). The Brenta Group represents a well delimited area: it is characterized by basic limestone rocks and high elevation (Cima Tosa: 3173 m), surrounded in the West and North by high siliceous chains (Cima Presanella: 3558 m) and in the South and East by lower basic chains (Cima Cadria: 2254 m).

On 20 September 1997, an unusual population of *Gentiana* sect. *Calathianae* Froel. (= *G.* sect. *Cyclostigma* Griseb. according to Ho & Liu 2001) was observed by the first author near the rifugio Pedrotti-Tosa. It was very similar to *G. bavarica* L., but had papillose leaf margins. The floristic survey of the Adamello-Brenta Natural Park provided an occasion for facing this problem. Several field observations, carried out during 2007 by the present authors, brought them to the surprising conclusion that the deviating *Gentiana* represents a completely overlooked taxon. Several populations of the new taxon were found in the middle part of the Brenta Group. A study of herbarium material revealed that the taxon has been collected several times since 1887 but generally identified as *G. bavarica* subsp. *subacaulis* (Schleich.) G. Mull., or, more rarely, as *G. terglouensis*.

Material and methods

Using fresh material, morphological comparisons of the new species were made with *Gentiana bavarica* and *G. orbicularis* Schur, both occurring in some localities of the Brenta Group in mixed populations with the new taxon, and with *G. terglouensis* Hacq., from Passo Rolle. An extensive morphological comparison was made on the basis of herbarium specimens from the public herbaria BOZ, FI, G, GJO, GZU, IB, M, MSB, PAD, ROV, TR, TSB, W, WU, Z and ZT (abbreviations after Holmgren & Holmgren 1998+) and the personal herbarium of Romano Gabbi (Trento, Italy). The species investigated (in brackets the number of studied specimens) were: *G. bavarica* (483, incl. subsp. *subacaulis*), *G. brachyphylla* Vill. (81), *G. orbicularis* (218), *G. schleicheri* (Vacc.) Kunz (31), *G. terglouensis* (449), *G. verna* L. (87) and the presumed new taxon (28).

Nomenclature of the taxa of *Gentiana* sect. *Calathianae* follows Hämmerli (2007).

The transversal sections of the leaves were made on fresh material for *Gentiana terglouensis*, *G. bavarica* and *G. brentae* with a blade and studied with an optical microscope. Papillae on the leaf margin were studied in all herbarium specimens with a stereo microscope and in the field with a hand lens.

Results

Gentiana brentae Prosser & Bertolli, **sp. nov.**

Holotypus: Italia, provincia di Trento, comune di Ragoli, Gruppo di Brenta, ripiano subito a W del Rif. Alimonta, lastronate dolomitiche scarsamente erbose, 2540 m, 25.7.2007, *F. Prosser & A. Bertolli* (ROV [plant on the left side of the sheet]). – Fig. 1.

Herba perennis, 3-5(-7) cm alta. *Stolones* sympodiales, pauci vel multi, breves et graciles. *Caules* ascendentes vel erecti, graciles, simplices; caules florentes singulariter ab stolonibus orientes, saepe repentes et radicanes ex nodis inferioribus. *Folia* dense congesta sed sine rosula, plerumque imbricata, sessilia; lamina (2-)3-4(-8) × (1-)2.5-3(-4.5) mm, maxima latitudine in media parte, aliquantum rhomboidea, apice rotundato, margine papilloso et cartilagineo, 1-nervata, glauca, opaca, spissa (c. 0.7 mm), transversale sectione V-forma (angulo c. 110°), pagina inferiore carinata; caulis folia 7-10 paribus disposita. *Flores* solitarii, terminales, sessiles vel subsessiles. *Calyx* (7-)10-14(-17) mm, cum angulis peranguste alatis; tubus aliquantum infundibuliformis, c. 3-4 mm latus, atrocaeruleus; lobi 4-6 mm, lanceolati, apice acuminato, suberecti et aliquantum incurvi. *Corolla* hypocrateriformis, 17-20 mm, caerulea; tubus semper atrocaeruleus, calice 1.3-2-plo longior; lobi patentes, 5-10 mm, ovati, apice rotundato, margine integro vel leviter eroso; plicae 1.5-2.5 mm, 2-fissae. *Stamina* $\frac{2}{3}$ supra basim tubo inserta; filamenta 1.5-2.5 mm, linearia; antherae liberae, 1.5-2 mm. *Stylus* c. 4 mm, linearis; stigmatibus lobi contigui, reniformes, 1.5-2 mm diametro, margine lacerulato. *Capsula* 15-25 mm, cylindrica, basi sensim attenuata. *Semina* 0.8-1.1 mm, ellipsoidea, brunnea vel atrobrunnea, reticulata, sine alis.

Perennial herb, 3-5(-7) cm tall. *Stolons* sympodially, few to many, short, slender. *Stems* ascending to erect, slender, simple; flowering stems arising singly from stolons, often creeping and rooting at lower nodes. *Leaves* densely crowded but not rosetted, usually imbricate, sessile; leaf blades (2-)3-4(-8) mm × (1-)2.5-3(-4.5) mm, with maximum width in the middle, somewhat rhomboid, apex rounded, margin papillose and cartilaginous, with a single vein, glaucous, matt, c. 0.7 mm thick, transversal section V-shaped (angle c. 110°), keeled on lower side (see Table 1); cauline leaves in 7-10 pairs. *Flowers* solitary, terminal, sessile to subsessile. *Calyx* (7-)10-14(-17) mm, with very narrow wings on the midrib of the lobes and continued to the tube; tube somewhat funnel-shaped, c. 3-4 mm wide, blackish blue; lobes 4-6 mm, lanceolate, apex acuminate, suberect and somewhat incurved. *Corolla* hypocrateriform, 17-20 mm, dark blue; tube always dark blue, 1.3-2× longer than calyx; lobes spreading, 5-10 mm, ovate, apex rounded, margin entire to slightly erose; plicae 1.5-2.5 mm, 2-cleft. *Stamens* inserted at $\frac{2}{3}$ from the base of the corolla tube; filaments 1.5-2.5 mm, linear; anthers free, 1.5-2 mm. *Style* c. 4 mm, linear; stigma lobes contiguous,



Fig. 1. *Gentiana brentae* – habit, drawn from the holotype at ROV by Lucio Sottovia.

reniform, 1.5–2 mm in diameter, margin lacerulate. *Capsule* 15–25 mm, cylindrical, narrowed to the base. *Seeds* 0.8–1.1 mm, ellipsoid, brown to dark brown, reticulate, unwinged.

Relationships and delimitation. – The new taxon no doubt belongs to *Gentiana* sect. *Calathianae* Froel. as it has a hypocrateriform (salver form) corolla, contiguous stigma lobes expanded into a discoid structure and wingless seeds with reticulate surface. Among the 12 species of *G.* sect. *Calathianae* (Hämmerli 2007), the new taxon is similar to *G. bavarica* and *G. terglouensis* for its perennial habit, the non-linear leaves and the stem with $\pm$ equally spaced (non-rosetted) leaves. Main differential characters between these two species and the newly described species are given in Table 1.

Gentiana bavarica has a very variable habit: plants of humid, fertile and lower altitude habitats correspond to var. *bavarica* with distantly leafy stems up to 15 cm tall; plants of rocky and higher altitude habitats correspond to subsp. *subacaulis* with very short stems and imbricate leaves. The habit of *G. brentae* generally resembles the latter subspecies. Distinction between *G. bavarica*, including its subsp. *subacaulis*, and *G. brentae* is quite obvious on living material: leaves in frontal view are clearly thick in *G. brentae*, V-shaped (with broad angle: 110°), glaucous and matt, whereas in *G. bavarica* they are thinner, U-shaped, green and shiny (see Table 1); also the presence of papillae (lens!) at the leaf margin is important. In some localities of the Brenta Group both taxa co-occur and no intermediates were found. In such mixed populations a clearly different phenology was observed: e.g., on Sella del Montoz on 31 July 2007, *G. bavarica* was at the beginning of fruiting while *G. brentae* was still flowering. On herbarium material the distinction is more difficult because the thickness and colour of the leaves generally are not preserved. In this case the distinction between *G. bavarica* subsp. *subacaulis* and *G. brentae* relies only on the presence/absence of papillae. We have checked this character in nearly 500 herbarium specimens of *G. bavarica* s.l. from the Alps and we never found papillae; very rarely the cartilaginous margin was somewhat erose only.

Table 1. Main differential characters between *Gentiana bavarica* (incl. subsp. *subacaulis*), *G. terglouensis* and *G. brentae*. – Scale bar = 1 mm; * = characters visible only in fresh material.

	<i>G. bavarica</i>	<i>G. terglouensis</i>	<i>G. brentae</i>
Leaf apex	rounded	acute to obtuse	rounded
Leaf transversal section (in the middle)*			
Leaf thickness*	0.3-0.4 mm	0.6-0.8 mm	0.6-0.8 mm
Leaf margin	smooth	strongly papillose (Fig. 2C)	papillose (Fig. 2B)
Leaf colour*	green, shining	glaucous, mat	glaucous, mat
Calyx lobes	suberect, ± incurved	appressed to corolla tube, straight	suberect, ± incurved

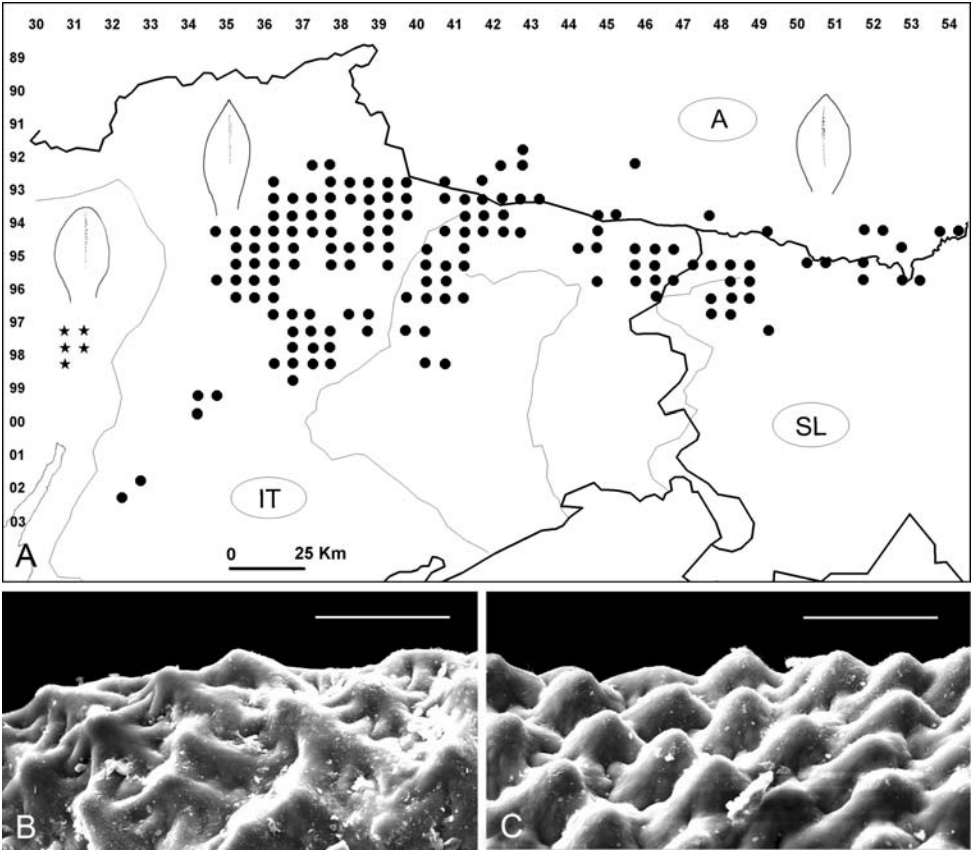


Fig. 2A: Distribution of *Gentiana brentae* (stars) and *G. terglouensis* (dots); distribution data of *G. terglouensis* according to Pertot & Poldini (1979), Hartl & al. (1992), Jogan (2001), T. Wilhalm, C. Argenti and S. Scortegagna (in litt.); leaf shapes from left to right: *G. brentae*, *G. terglouensis* western and eastern variant – B-C: SEM photograph of the papillose leaf margin of *G. brentae* (B; Busa dei Armi, 2500 m, 15.8.2001, F. Prosser, ROV) and *G. terglouensis* eastern variant (C; Krein, auf der Vertatscha in den Karawanken bei 1900-2000 m, 22.7.1913, F. Widder, GZU); scale bars B-C = 100 µm.

Gentiana terglouensis is a very variable species too. In the eastern part of its distribution area (Alps of Slovenia) plants have obtuse and $\pm$ spreading leaves, in the western part (Dolomites) plants have acute and suberect leaves (Fig. 2A), whereas in the centre of its distribution area the populations are intermediate (Müller 1982). The eastern variant corresponds to the type of the name, the western variant was treated by some authors as *G. imbricata* Froel. According to Hayek (1911), the eastern variant (*G. terglouensis* s.str.) grows in the Sanntaler and Julischen Alpen, the western variant (*G. imbricata*) in the Südtiroler Dolomiten. *G. brentae* is clearly distinct from both the western and eastern variant because of its rounded leaf apex (Fig. 2A). Transverse sections of the leaves (fresh material) are not useful to distinguish the two species, since the differences are rather minor (Table 1). Only on 2 out of c. 450 *G. terglouensis* specimens studied we found single individuals of the eastern variant with approximately rounded leaves among plants with normally obtuse leaves, these are: Karawanken, Hochstuhl, 2000–2100 m, 22.7.1930, F. Widder, with the note by Widder (translation from German): “one plant with very obtuse leaves” (GZU); Krein, auf der Vertatscha in den Karawanken bei 1900–2000 m, 22.7.1913, F. Widder (GZU). In such rare cases *G. terglouensis* and *G. brentae* can be separated on the base of the $\pm$ different papillae (Fig. 2B–C) and the $\pm$ different calyx lobes (Table 1). Moreover, it should be kept in mind that the eastern variant, which is more similar to *G. brentae* in leaf characters than the western variant, is the one that is more distant geographically from the Brenta Group (Fig. 2A).

According to Dalla Torre & Sarnthein (1912) and repeated by, e.g., Pignatti (1982), *Gentiana terglouensis* occurs in the Brenta Group, too. These reports are exclusively based on a single specimen by G. Loss (“Tosa, dolomia, ghiaia della vedretta, s.d.”, IBF!, sub *G. imbricata* Froel.) and has never since been confirmed by any further collection. The specimen includes two plants of *G. terglouensis* (the determination was confirmed also by G. Müller, 1979), and surprisingly they show the obtuse leaves characteristic for the eastern variant. Therefore it is most likely that the locality on the label is wrong. This assumption is also supported by the fact that wrong or very doubtful reports by different authors of further 11 species from the Brenta Group are exclusively based on specimens of G. Loss in IBF (Festi & Prosser 2008). It seems also strange, that Loss did not mention the interesting finding of *G. terglouensis* in his own publication comprising the flora of the Brenta Group (Loss 1873). It is thus safe to conclude that *G. terglouensis* is lacking in the Brenta Group and its western limit is the Adige river (Piccole Dolomiti, Pasubio, Cima Dodici and Dolomiti).

Gentiana brentae can also be mistaken for *G. orbicularis* because both have papillae at the leaf margin and a somewhat similar habit. Nevertheless, the presence of a leaf rosette, generally wider calyx wings, a green calyx, thinner and generally larger leaves clearly differentiate these two species. In the Brenta Group *G. orbicularis* occurs mainly on limestone, but we never had problems to distinguish the two species. Near rifugio Agostini, on a moraine with both limestone and dolomite, we found a mixed population of both species, but it was not possible to find intermediate plants.

Ecology and distribution. – We found *Gentiana brentae* exclusively in the Brenta Group and only on dolomite. Faults separating dolomite and limestone in different localities of the Brenta Group show a strict correlation between the occurrence of *G. brentae* and dolomite. In the little valley on the western side of Turrion Alto or ascending Val Noghera, e.g., it is possible to find *G. brentae* only after crossing the fault separating limestone and dolomite, even if all other habitat conditions are the same. *G. brentae* also occurs on dolomite debris covering limestone, as on the limestone plateau near rifugio Agostini, on a consolidated part of the moraine of Ambiez glacier.

Gentiana brentae grows on consolidated scree, in small depressions (“snow beds”) and in clefts of subhorizontal layers. The soil is generally stony but with a high fraction of fine particles and generally moist. The presence of *G. brentae* seems to be correlated to long snow persistence, such as in depressions at lower altitudes and on plateau habitats at higher altitudes. These habitats phytosociologically mainly belong to stony aspects of the Arabidion caeruleae and humid aspects of the Caricion firmae. Table 2 shows three phytosociological relevés.

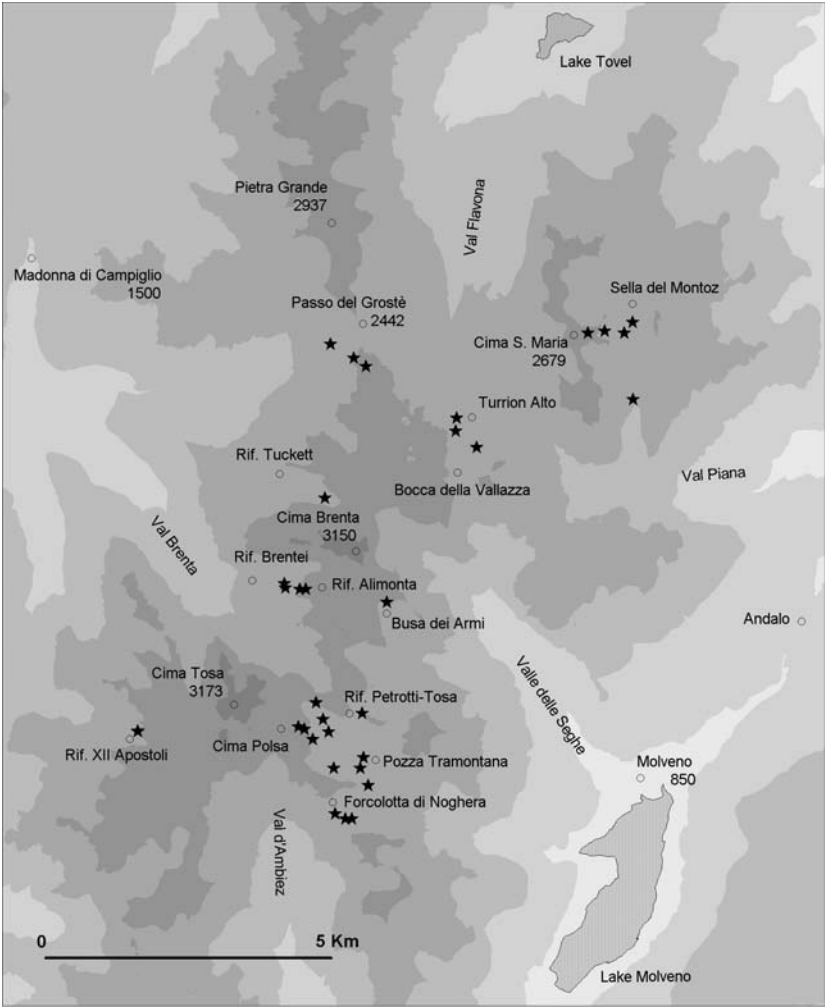


Fig. 3. Geographical distribution of *Gentiana brentae*. – The stars represent different populations.

Gentiana bavarica in contrast occurs on both acid and basic (limestone, dolomite) bedrock and compared to *G. brentae* has a more pronounced preference for “snow beds” and humid, grassy depressions in the Brenta Group. *G. terglouensis* prefers somewhat more xeric habitats than *G. brentae*, being strictly bounded to typical aspects of the Caricion firmae, including also its xeric variants. Besides, it grows on both limestone and dolomite.

At present, we have found *Gentiana brentae* only in the central part of the Brenta Group between 2040 and 2640 m (Fig. 3). In North-South direction the distribution area measures 8.7 km, in West-East direction 8.6 km, and it includes c. 40 km².

Flowering is from July to September, fruiting from August to September/October.

Specimens seen. – ITALY: TRENTO: BRENTA GROUP: Pozza Tramontana, 7.8.1887, *E. Gelmi* (TR); Passo di Grostè, 2250 m, 6.8.1966, *F. Rasetti* (FI); Passo Grostè, 2500 m, 12.8.1970, *L. Chiapella* (TSB); tra i rifugi Brente e Alimonta, 2500 m, 10.8.1973, *R. Gabbi* (ROV); morena della vedretta di Brenta inferiore, 2400 m, 15.8.1985, *R. Gabbi* (herb. Gabbi); ibid., alture lastronate del Passo del Grostè, 2500 m, 16.8.1988, *R. Gabbi* (ROV); id., 19.8.1989, *R. Gabbi* (ROV); tra Pozza Tramon-

Table 2. Three phytosociological relevés of *Gentiana brentae* populations using Braun-Blanquet scale. – Nomenclature after Conti & al. (2005); relevé 1 = SW Passo Grostè, 2480 m; 2 = WSW Rif. Alimonta, 2500 m; 3 = Cima Polsa, 2620 m.

Relevé	1	2	3
Vegetation cover [%]	10	5	5
<i>Gentiana brentae</i>	+	+	+
<i>Achillea atrata</i> L.		+	+
<i>Anthyllis vulneraria</i> subsp. <i>alpestris</i> (Schult.) Asch. & Graebn.	+	+	
<i>Arabis bellidifolia</i> subsp. <i>stellulata</i> (Bertol.) Greuter & Burdet	+	+	+
<i>Bistorta vivipara</i> (L.) Delarbre	+	+	
<i>Carex firma</i> Host	2	+	+
<i>Carex ornithopodioides</i> Hausm.		+	
<i>Carex rupestris</i> All.		+	
<i>Crepis jacquinii</i> subsp. <i>kernerii</i> (Rech. f.) Merxm.	+		+
<i>Dryas octopetala</i> L.	1		
<i>Festuca quadriflora</i> Honck.	+	+	
<i>Minuartia sedoides</i> (L.) Hiern	+		+
<i>Moehringia ciliata</i> (Scop.) Dalla Torre			+
<i>Poa minor</i> Gaudin			+
<i>Salix retusa</i> L.		1	+
<i>Saxifraga caesia</i> L.	+	+	
<i>Saxifraga sedoides</i> L.			+
<i>Sesleriella sphaerocephala</i> (Ard.) Deyl	1		
<i>Silene acaulis</i> (L.) Jacq. subsp. <i>acaulis</i>	+		
<i>Taraxacum</i> sect. <i>Alpina</i> G. E. Haglund			+
<i>Thlaspi rotundifolium</i> (L.) Gaudin subsp. <i>rotundifolium</i>			+

tana e il Rif. Pedrotti, sfasciume dolomitico, 2300 m, 17.8.1993, *F. Prosser & G. Pils* (ROV); alla Sella del Rifugio presso il Rif. Pedrotti-Tosa, valletta nivale su dolomia, 2460 m, 20.9.1997, *F. Prosser* (ROV); ibid., sopra il Rif. Graffer lungo il sentiero per il Rif. Tuckett prima del bivio con il sent. Benini, valletta nivale su dolomia, 2395 m, 4.10.1997, *F. Prosser* (ROV); sentiero Orsi, Busa dei Armi, pendio sassoso (dolomia), 2500 m, 15.8.2001, *F. Prosser* (ROV); c. 600 m a WSW del Passo Grostè, lastronate dolomitiche, 2400 m, 11.7.2007, *F. Prosser & A. Bertolli* (ROV); gradonate a W del Rif. Alimonta, lastronate dolomitiche scarsamente erbose, 2370 m, 25.7.2007, *F. Prosser & A. Bertolli* (ROV); dolina 650 m a W del Rif. Alimonta, detrito dolomitico a lungo innevamento, 2337 m, 25.7.2007, *F. Prosser & A. Bertolli* (ROV); Val dei Cavai a N di Malga Cavedago, nell'impluvio, detrito dolomitico in fase di consolidamento, 2040 m, 31.7.2007, *F. Prosser & A. Bertolli* (ROV); pendice E di Cima S. Maria, lastronate e detriti dolomitici a scarsa copertura vegetale, 2550-2570 m, 31.7.2007, *F. Prosser & A. Bertolli* (ROV); pianori subito a SW della Sella del Montoz, conche nivali su substrato basico (dolomia), 2360 m, 31.7.2007, *F. Prosser & A. Bertolli* (ROV); alla Sella del Montoz, impluvio limoso leggermente nitrofilo (dolomia), 2325 m, 31.7.2007, *F. Prosser & A. Bertolli* (ROV); c. 200 m a NE del Rif. XII Apostoli, lungo la "Via delle Bocchette", detrito morenico (calcare e dolomia), 2500 m, 7.8.2007, *F. Prosser & A. Bertolli* (ROV); 350 m a SW della cima del Turrion Alto, al lato W della selletta, detrito consolidato (dolomia), 2360 m, 9.8.2007, *F. Prosser & A. Bertolli* (ROV); 250 m a W della cima del Turrion Alto, detrito consolidato (dolomia), 2300 m, 9.8.2007, *F. Prosser & A. Bertolli* (ROV); pendice subito a SE della Forcolotta di Noghera, pendio sassoso a lungo innevamento (dolomia), 2300 m, 16.8.2007, *F. Prosser & A. Bertolli* (ROV); pendice subito a SE della Forcolotta di Noghera, pendio sassoso a lungo innevamento (dolomia), 2330 m, 16.8.2007, *F. Prosser & A. Bertolli* (ROV); lungo il Sent. Palmieri a SW della Pozza Tramontana, pendio sassoso a lungo innevamento (dolomia), 2350 m, 16.8.2007, *F. Prosser & A. Bertolli* (ROV); pendice a S della Pozza Tramontana (a S di q. 2184.0), detrito dolomitico sulla faglia che mette in contatto dolomia e calcare, 2210 m, 16.8.2007,

F. Prosser & A. Bertolli (ROV); lato S del fondo della Pozza Tramontana, detrito dolomitico, 2100-2120 m, 16.8.2007, *F. Prosser & A. Bertolli* (ROV); a NE delle Cime di Ceda, 600 m a E del Passo dei Cacciatori, su terreno sassoso piano (dolomia), 2390 m, 12.9.2007, *F. Prosser & A. Bertolli* (ROV); subito a S della Vedretta della Tosa Inferiore, pendice SE di Cima Polsa, detrito dolomitico, c. 2450 m, 12.9.2007, *F. Prosser & A. Bertolli* (ROV).

Conservation. – All occurrences of *Gentiana brentae* are located in the Adamello-Brenta Natural Park, in the sites of community importance “Dolomiti di Brenta” [code IT3120009] and “Val di Tovel” [code IT3120008], designated according to the Habitats Directive 92/43/EEC (Council European Communities 1992). Its extent of occurrence is c. 40 km². It grows in “Alpine and subalpine calcareous grasslands” [code 6170] and “Calcareous and calcschist scree of the montane to alpine levels (*Thlaspietea rotundifolii*)” [code 8120], according to the Annex I of the Directive. Therefore the habitat of the species should be legally protected. The species seems to be not directly threatened, but some populations are exposed to the risk of damage, such as by ski runs in the Grostè area, trampling near refuges, and climate warming at lower altitudes.

Phytogeographical considerations. – *Gentiana brentae* is a local endemic and among the species of *G.* sect. *Calathianae* the one with the smallest distribution area. Another endemic species of the Brenta Group, *Nigritella buschmanniae* Teppner & Ster, shows a very similar distribution (Perazza & Decarli Perazza 2005): both species occur only on dolomite of the higher part of the Brenta Group.

We can suppose a postglacial origin of *G. brentae*, since Würm glaciation completely covered all suitable habitats of the Brenta Group. Nunataks occurred only in the lower chains located south of the Brenta Group (e.g., Tremalzo-Tomba chain). Morphological features and the distribution data suggest that *G. brentae* could have been originated from *G. bavarica* and *G. terglouensis* as a result of hybridisation, or from *G. terglouensis* by geographical isolation.

Further strictly endemic taxa growing in the Brenta Group and neighbouring areas are (nomenclature after Conti & al. 2005): *Erysimum sylvestre* subsp. *aurantiacum* (Leyb.) P.W. Ball (probably only on the south slopes of the Brenta Group and on the neighbouring Mt Gazza) and *Hypochaeris facchiniana* Ambrosi (only on the southern slopes of the Brenta Group and the neighbouring Catria Group, with a little disjunction in Mt Castello in the western part of province Belluno). The phytogeographical significance of the Brenta Group as a refugium is also indicated by some remarkable disjunctions: with the next occurrence c. 100 km distant from the Brenta Group: *Scutellaria alpina* L. subsp. *alpina*; c. 50 km distant: *Androsace hausmannii* Leyb., *Callianthemum coriandrifolium* Rchb., *Carex bicolor* All., *Nigritella austriaca* (Teppner & E. Klein) P. Delforge.

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Addresses of the authors:

Filippo Prosser, Alessio Bertolli, Museo Civico, Borgo S. Caterina 41, I-38068 Rovereto; e-mail: prosserfilippo@museocivico.rovereto.tn.it; bertollia@yahoo.com