Ann. Bot. Fennici 42: 35–39 ISSN 0003-3847
Helsinki 16 February 2005 © Finnish Zoological and Botanical Publishing Board 2005

Androsace septentrionalis (Primulaceae), a new species for the Balkan flora

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Received 28 Mar. 2004, revised version received 30 Sep. 2004, accepted 20 Oct. 2004

Stevanović, V., Vukojičić, S. & Tan, K. 2005: *Androsace septentrionalis* (Primulaceae), a new species for the Balkan flora. — *Ann. Bot. Fennici* 42: 35–39.

Androsace septentrionalis L. (Primulaceae) is recorded as a new species for the Balkan flora on the basis of herbarium material collected several times from Mt. Prokletije, situated near the borders of Serbia (Metochia and Kosovo province), Montenegro and Albania. The locality marks the southernmost limit of the species' range in Europe. The existence of *A. septentrionalis* in the Balkans may be the result of migration of the tundra-steppe flora from central and East Europe towards the mountains of the peninsula during the Ice Age.

Key words: *Androsace septentrionalis*, Balkans (Mt. Prokletije), glacial mountain flora, Primulaceae

Androsace sect. *Andraspis* (syn. sect. *Androsace*) comprises ca. 20 species, mostly annuals and biennials or, rarely, short-lived perennials distributed over the whole of the Holarctic, from the Arctic regions of Eurasia and N America extending towards the warm and arid regions of the Mediterranean, Asia Minor, Iran and Afghanistan (Pax & Knuth 1905). The centre of diversity is the Caucasus, mainly in Armenia (Shishkin & Bobrov 1952, Grossheim 1967). Only two species of sect. *Andraspis* (*A. maxima* and *A. elongata*) have so far been reported from the Balkans (Hayek 1927, Ferguson 1972, Greuter *et al*. 1989).

During revision of herbarium material kept at BEOU (Herbarium of Institute of Botany and Botanical Garden "Jevremovac", University of Belgrade) several specimens of *A. septentrionalis*, collected on Mt. Prokletije, attracted our attention, particularly as this species, otherwise widespread in the Holarctic, has not previously been recorded in the Balkans.

Distribution of *Androsace septentrionalis*

The range of *A. septentrionalis* extends over a wide area of Eurasia and N America, covering several climatic zones ranging from Arctic to temperate (Fig. 1A). It belongs to the boreal (Walter & Straka 1970), or Euro-Siberian-N American (Hess *et al*. 1970) or more appropriately, Euro-Asian-Eastern N American temperate-Arctic montane floristic element (Meusel *et al*. 1978).

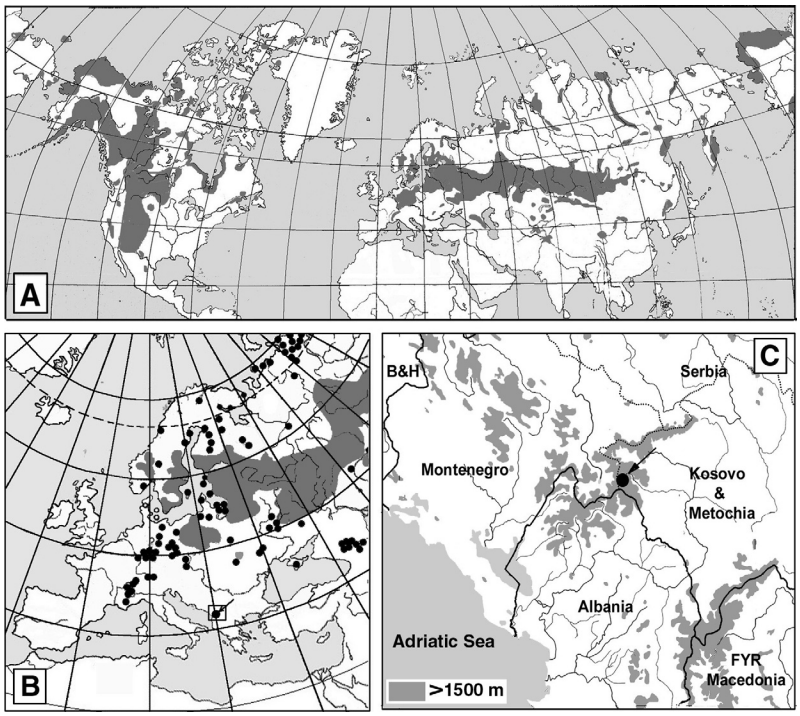

Fig. 1. — **A**: General distribution of *Androsace septentrionalis* aggregate (according to Meusel *et al.* 1978, slightly modified). — **B**: Distribution of *A. septentrionalis* in Europe (according to Meusel *et al.* (1978), slightly modified); the new locality of *A. septentrionalis* in the Balkans is indicated by an arrow. — **C**: Locality of *A. septentrionalis* on Mt. Prokletije.

In Europe *A. septentrionalis* is distributed from the Kola Peninsula on the Arctic Circle, N Norway and Sweden southwards throughout Fennoscandia, temperate W Siberia, central and East Europe (Germany, Poland, Czech Republic, Hungary, Ukraine, Belarus, Russia) to the mountains of central Europe (Alps, Mts. Sudety, Tatra, Carpathians). It also occurs in the Crimea and Caucasus (Fig. 1B).

In the Balkans, *A. septentrionalis* is restricted to the slopes of the peak Maja Rops above the village of Dečani, very close to the border between Montenegro, Albania and Metochia (Fig. 1C). The following material exists in the herbarium of the Institute of Botany and Botanical Garden, University of Belgrade (BEOU): Serbia & Montenegro. Metochia & Kosovo province: Mt. Prokletije, Dečanske forests, 1957, *B. Lazarević*; Mt. Prokletije, pascuis et dumetis regionis subalpinae, in declivibus Maja Rops, 10.IX.1958 *M. Janković*; Mt. Prokletije, Maja Rops, *Pinus peuce* forest, 14.VII.1964 *M. Janković*; Mt. Prokletije, Maja Rops, *Pinus peuce* forest, 14.X.1964 *M. Janković*.

It is assumed that the species also occurs on other parts of Mt. Prokletije. This isolated and very restricted distribution of *A. septentrionalis* is ca. 400 km distant from the nearest known localities in central Europe and marks the southernmost limit of the species in Europe (Fig. 1B).

The origin of the isolated mountain distribution in the Balkans may be attributed to the migration of a northern tundra-steppe flora towards the Balkans during the Ice Age.

Habitat and ecology

Androsace septentrionalis inhabits subalpine and alpine zones between 1700 and 2100 m in the vicinity of the peak Maja Rops (2501 m) of Mt. Prokletije. The geological substrate comprises siliceous granite, agloschists and philite rocks. The subalpine zone is covered by Balkan pine forest (*Pinetum peucisi*) while the upper timberline consists of mixed Balkan and dwarf pine forest (*Pinetum mughi-peucis*) as well as dwarf pine shrubs (*Pinetum mughi silicicolum*). The subalpine grassland belongs to the Alliance *Bruckenthalion spiculifoliae*, in particular the community *Empetro-Vaccinietum balcanicum*. Many boreal and alpine species have been recorded in these

communities and on this part of Mt. Prokletije (peak Maja Rops), including *Empetrum hermaphroditum* (one specimen of *A. septentrionalis* was found with a dried herbarium specimen of *E. hermaphroditum*), *Vaccinium uliginosum*, *Primula minima*, *Saxifraga exarata*, *S. moschata*, *Homogyne alpina*, *Senecio carpathicus*, *Juncus trifidus*, etc. The whole mountain region is a special refuge for a glacial flora, boreal and alpine in origin, existing at one of the southernmost limits of its distribution in the Balkans.

Unlike the habitats of *A. septentrionalis* on Mt. Prokletije, those in the Alps are thermophilous, steppe-like, stony grasslands at altitudes of 500 and 1950 m (Hess *et al*. 1970, Pignatti 1982, Käsermann 1999). In the Alps *A. septentrionalis* is the characteristic species of class *Sedo-Scleranthetea*, alliance *Stipeto-Poion carniolicae* and community *Sclerantho-Sempervivetum arachnoidei*. In northern Bohemia, Mts. Sudety, Galicia and Bukowina, this species inhabits steppe and steppe-like grasslands (Hayek 1916), whilst Kovanda (1992) states that in the Czech Republic *A. septentrionalis* grows in the sandy steppe form of the alliance *Koelerion glaucae*. The species inhabits steppe communities in S Siberia and central Asia (Walter 1974).

Should *Androsace septentrionalis* be treated as an aggregate species?

A relatively large number of taxa from varietal to species rank have been described (Pax & Knuth 1905): var. *typica* R. Knuth; var. *pinetorum* (Greene) R. Knuth (*A. pinetorum* Greene); var. *subumbellata* Nelson (*A. septentrionalis* var. *subintegra* Nelson, *A. subumbellata* (A. Nelson) Small); var. *puberulenta* (Rydberg) R. Knuth (*A. puberulenta* Rydberg); subsp. *glandulosa* (Woot. & Standl.) G. T. Robinson (*A. glandulosa* Woot. & Standl., *A. septentrionalis* var. *glandulosa* (Woot. & Standl.) St. John); subsp. *subulifera* (A. Gray) G. T. Robbins (*A. diffusa* Small, *A. septentrionalis* var. *subulifera* A. Gray, *A. septentrionalis* var. *diffusa* (Small) R. Knuth); *A. lactiflora* Pallas (*A. septentrionalis* L. var. *lactiflora* Trautv.). In taxonomic accounts or revisions most of these taxa, particularly those at subspecies and species rank, were included into synonymy of *A. septentrionalis*. Consequently, the infraspecific taxonomy of *A. septentrionalis* is based on some very variable characters such as length of scape, length ratio between scape and pedicels, arrangement of leaf rosette, ratio of petal-sepal length, general habit, etc. Great variation in the species is expected since the distributional range is extremely wide and covers several climatic zones. Another reason for the variability lies in the fact that *A. septentrionalis* has the life form of monocarpic annuals or biennials, which can for short periods adapt to a variety of habitat conditions. It is thus quite reasonable to suppose that variation within the populations of *A. septentrionalis* is the response to various environmental factors; they might therefore be treated as ecotypes, rather than as species or subspecies. In addition, there is no chorological proof that a particular population has "speciated" into species or subspecies. The infraspecific taxonomy of *A. septentrionalis* clearly needs further investigation.

When specimens from Mt. Prokletije were compared with those from northern and central Europe (Finland, Sweden, Poland, Czech Republic, Russia; herbarium abbreviations according to *Index Herbariorum* ed. 8 — H, BR, KPABG, PRC, PR, BEOU) and N America (Canada, USA), significant and constant differences in the shape of inflorescence, length of pedicels, number of flowers, size and shape of sepals and petals and indumentum type were observed. All specimens from Mt. Prokletije have short, umbelliform, condensed inflorescences composed of a small number of flowers, whose pedicels are almost 2–4 times longer than the calyx tube. The inflorescence is 6–16 times shorter than the scape. However, these characteristics were also observed in several specimens from Europe, Canada and USA (Fig. 2). Despite morphological uniformity and chorological isolation, the above-mentioned characters appear insufficient to distinguish the population from Mt. Prokletije as a new species closely related to *A. septentrionalis*; it had however, been previously reported as such (*sub nom. A. gracilis sp. nova*, *see* Stevanović & Vukojičić 2003).

As numerous standard floras and monographs (Pax & Knuth 1905, Robbins 1944, Shishkin &

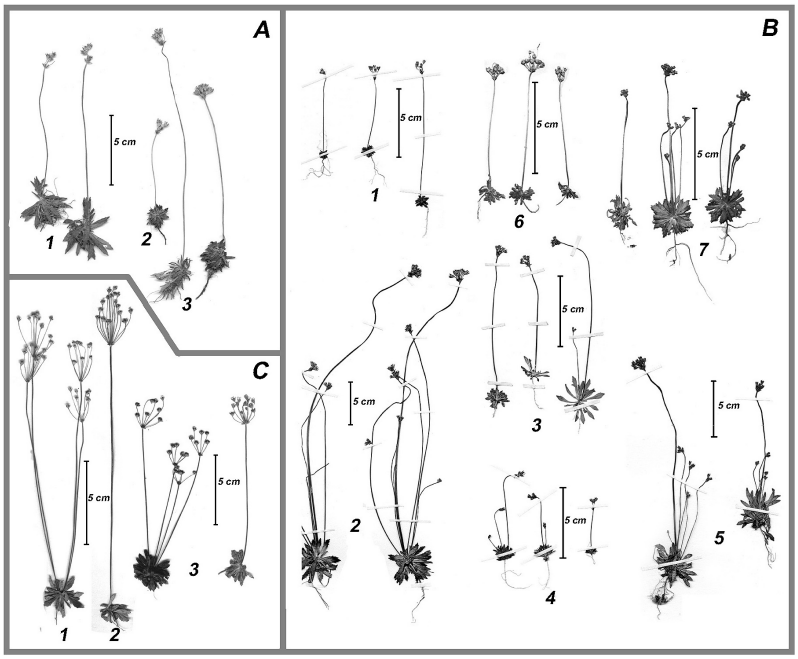

Fig. 2. Specimens of *Androsace septentrionalis* with short and compact (**A** and **B**) or elongated and lax inflorescences (**C**). — **A**: Specimens from Mt. Prokletije. 1: Dečanske Mts.; 2 and 3: Mt. Maja Rops. — **B**: Specimens from different parts of the species' range. 1–6: NW Canada; 7: Bohemia (Czech). — **C**: Typical specimens 1–3, from different parts of the species' range.

Bobrov 1952, Hess *et al*. 1970, Ferguson 1972, Pignatti 1982, Suttill 1991, Käsermann 1999, etc.) provide no description of *A. septentrionalis* covering its entire range of variation, we submit the following amended description.

Annual or biennial. Scape (4–)8–25(–30) cm; lower part sparsely stellate-pilose or with simple papillae, upper part sparsely or densely stellate-pilose especially near inflorescence. Leaves 4–35 × 1–10 mm, lanceolate, oblong-lanceolate or elliptical, irregularly dentate, sessile or very shortly petiolate; lamina glabrous or sparsely short-ciliate with ± dense, very short, forked or stellate cilia. Involucral bracts 2–6 × 1–3 mm, narrowly ovate, oblong or lanceolate, glabrous or sparsely short-ciliate. Petiole 1.5–30 mm, erect, slender, sparsely to densely stellate-pubescent or glabrous. Inflorescence lax to compact, 5–30-flowered. Calyx 3–5 × 2–3.5 mm, campanulate to broadly campanulate or turbinate, glabrous or sparsely papillose in lower part of tube; teeth 1–2 × 0.5–1 mm, narrowly triangular or ± apiculate, glabrous. Petals white or pink, 2–5(–6) × 0.5–2 mm, obovate to narrowly obovate. Capsule equalling or slightly exceeding calyx; teeth erect or slightly recurved. Seeds ca. 0.5–1.5 × 0.2–0.7 mm, orbicular or elliptical, smooth, brown.

Bearing in mind the wide geographical range it is reasonable to assume that *A. septentrionalis* is a complex species comprising several infraspecific taxa. The separation of infraspecific taxonomic levels and existing ecotypes needs molecular and biosystematic study.

Conclusions

The occurrence of *A. septentrionalis* in the Balkans on Mt. Prokletije marks the southernmost limit of the species in the whole of Eurasia. This isolated, disjunct locality is more than 400 km from the nearest areas of occurrence in the Alps, Sudety and Tatra mountains. The restricted distribution of *A. septentrionalis* in the Balkans could be explained by the migration of the glacial flora during the Pleistocene. We assume that movement of a population of *A. septentrionalis* to Mt. Prokletije from the north occurred during the maximal spread of tundra-steppe and steppe towards the Balkan Peninsula during the Wurm and Riss glacial periods. During those periods, the greater part of the Balkan lowlands southwards to the Mediterranean was covered by this type of vegetation (van der Hammen *et al.* 1971). In addition, during the glacial-interglacial periods "pulsate" migration of the glacial flora from

southern to northern Europe as well as from the foothill (montane) zone to the alpine/subalpine zone of mountains in central and S Europe took place. This is a very simplified explanation of the two main trends in the formation of the Arctic–Alpine disjunction and the isolation of populations of glacial plants (species or aggregate) on the mountains of central and S Europe. However, there is no doubt that the occurrence of glacial relicts in the mountains of the Balkans is the result of complex migration and/or immigration from the Alps or more or less directly from central Europe during the Pleistocene, e.g., the Dryas flora of central Europe, which is mainly of Arctic origin. Among numerous glacial plants, *A. septentrionalis* provides an additional example of this migration of the glacial flora, which has originated from northern glacial tundra–steppe flora. The alpine flora of Mt. Prokletije also contains a high percentage of glacial relicts, e.g., *Empetrum hermaphroditum*, *Elyna myosuroides*, *Saxifraga aizoides*, *Dryas octopetala*, *Salix retusa*, *Polygonum viviparum*, *Arctostaphylos alpinus*, *Bartsia alpina*, *Viola biflora*, *Carex rupestris*, *Pulsatilla vernalis*, *Selaginella selaginoides*, *Cerastium cerastioides*, *Oxyria digyna*, *Sedum rosea*, *Saxifraga oppositifolia*, *Pedicularis oederi*, *P. verticillata*, *Silene acaulis*, *Gentiana nivalis*, etc., making this mountain of the SW Dinaric Alps one of the most important refugial centres of the glacial flora in the Balkans.

Acknowledgements

The research was supported in part by the Ministry of Science, Technology and Development, Republic of Serbia (Grant no. 1505).

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