Ann. Bot. Fennici 42: 143–149 ISSN 0003-3847
Helsinki 27 April 2005

A new subspecies of *Silene acaulis* (Caryophyllaceae) from East Anatolia, Turkey

Fevzi Özgökçe[1], Kit Tan[2]* & Vladimir Stevanović[3]

[1)] *Yüzüncü Yıl University, Faculty of Science and Arts, Department of Biology, 65080 Van, Turkey*
[2)] *Institute of Biology, University of Copenhagen, Øster Farimagsgade 2D, DK-1353 Copenhagen K, Denmark (*corresponding author's e-mail: kitt@bi.ku.dk)*
[3)] *Institute of Botany and Botanical Garden, Faculty of Biology, University of Belgrade, Takovska 43, Belgrade 11000, Serbia and Montenegro*

Received 21 Oct. 2004, revised version received 27 Dec. 2004, accepted 28 Dec. 2004

Özgökçe, F., Tan, K. & Stevanović, V. 2005: A new subspecies of *Silene acaulis* (Caryophyllaceae) from East Anatolia, Turkey. — *Ann. Bot. Fennici* 42: 143–149.

Silene acaulis (L.) Jacq. subsp. *vanensis* Özgökçe & Kit Tan (Caryophyllaceae), a new taxon occurring in the province of Van in East Anatolia, Turkey, is described and illustrated. Its closest affinities are with *S. acaulis* subsp. *bryoides*, a plant occurring more than 2000 km away in the mountains of central and southern Europe. The existence of a new subspecies of *S. acaulis* in the extremely disjunct locality is interesting from a phytogeographical viewpoint. It is possible that during the post-glacial period the present-day Arctic-Alpine flora migrated not only southwards to the mountains of central and southern Europe but also to the highlands of eastern Turkey.

Key words: Caryophyllaceae, new subspecies, phytogeography, *Silene*, taxonomy

Silene is one of the larger genera of flowering plants in the world, comprising ca. 750 species, of which approximately half occur in the Mediterranean area. The southern part of the Balkan Peninsula and SW Asia are two main centres of diversity (Greuter 1995). Fourteen new species from Turkey have been described and three species new for Turkey have been recorded since the publication of the second volume of *Flora of Turkey and the East Aegean Islands* (Davis 1967). They indicate the country as still a rich source of *Silene* taxa. The genus is a complex one and a revision of the Turkish taxa would some day be necessary. Besides the addition of new taxa, several names must be relegated to synonymy.

During field work in spring 1997 to early summer 1999, one of us (F.Ö.) collected much material from Ahta Dağ, a rarely botanized mountain situated to the northwest of the small town of Özalp in the province of Van in East Anatolia. One species of *Silene* was extremely puzzling as it could not be fitted into any of the taxonomic groupings of *Silene* in Davis (1967). However, using *Flora Europaea* (Chater *et al.* 1993), the species keyed out as *Silene acaulis* (L.) Jacq. subsp. *bryoides* (Jordan) Nyman (= subsp. *exscapa* (All.) J. Braun *sec. Flora Europaea*). The latter is a taxon occurring in the mountains of central and southern Europe. Populations closest to the Turkish locality are in the Balkans, ca. 2000 km away, on Mt. Pirin (main

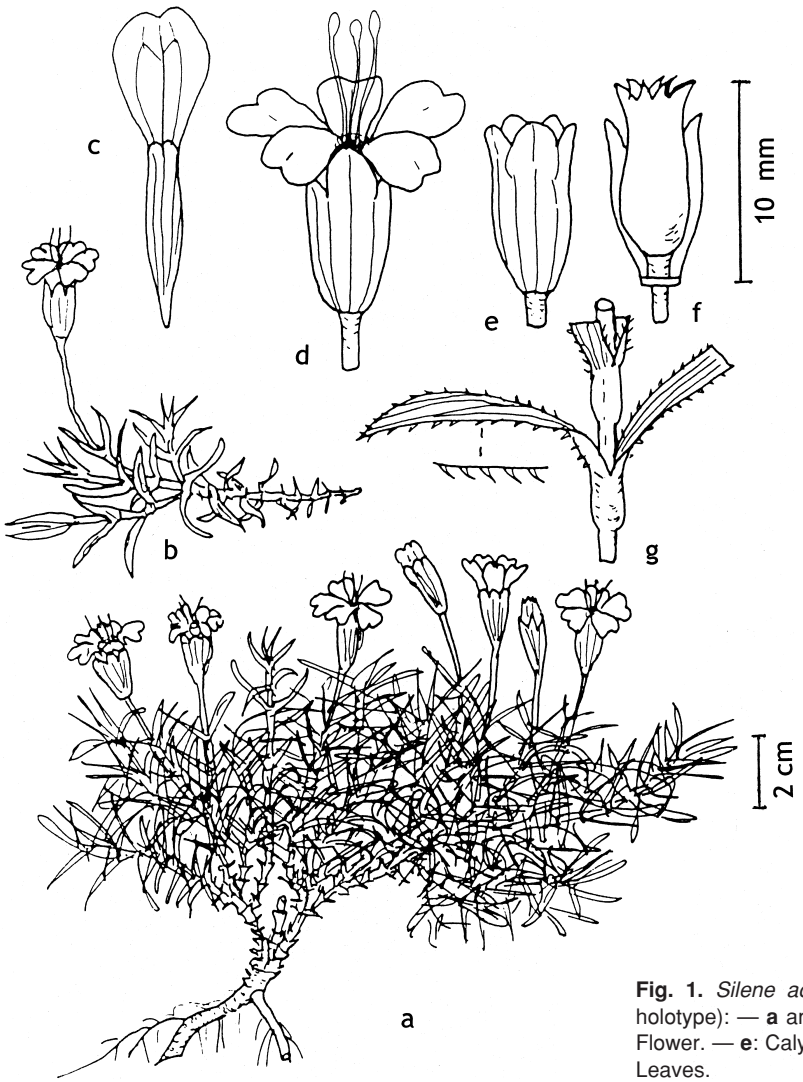

Fig. 1. *Silene acaulis* subsp. *vanensis* (from holotype): — **a** and **b**: Habit. — **c**: Petal. — **d**: Flower. — **e**: Calyx. — **f**: Mature capsule. — **g**: Leaves.

summit Vihren) in Bulgaria. A critical comparison of the Turkish and European material revealed some differences. The differences may be considered by some as slight but taking into consideration the period of maximum glaciation, the post-glacial history of the Balkan flora with various stages of advance and retreat following the ice sheets and glaciers, together with the great disjunction, we then realise the differences have some taxonomic and phytogeographical importance. We conclude the Turkish plant is a new taxon within the polymorphic *S. acaulis*.

Silene acaulis subsp. ***vanensis*** Özgökçe & Kit Tan, *subsp. nova* (Fig. 1)

Silene acaulis subsp. vanensis persimilis subspeciei bryoidis (= subsp. exscapa) quae autem procul disjunctim in montibus Europae centralis meridionalisque distributa. Subsp. vanensis vero differt characteribus nonnullis minutis sed constantibus: caulibus 2–5 cm tantum longis, foliis 5–10 mm tantum longis; floribus diametro maxime 10 mm, capsulis cylindricis 4–9 mm longis. Ab subsp. bryoides differt floribus

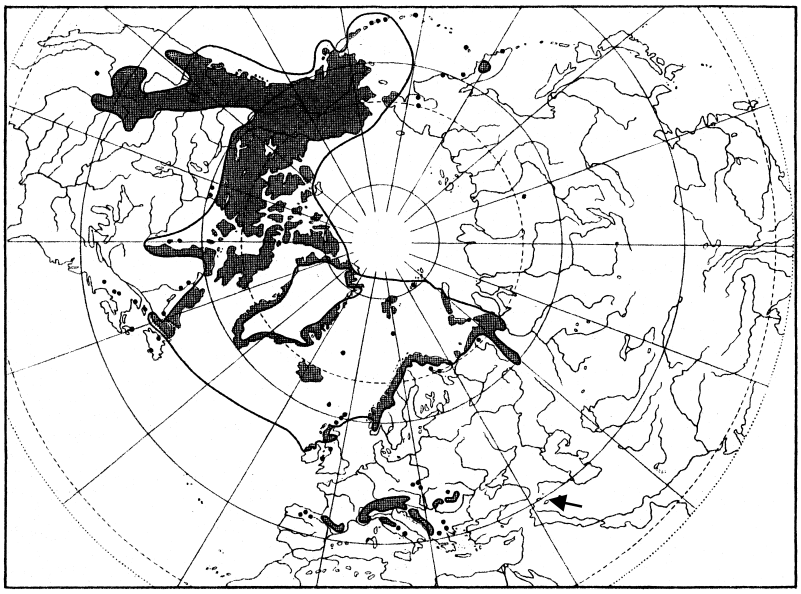

Fig. 2. Distribution map of *Silene acaulis* and *S. acaulis* subsp. *vanensis* (arrow). Reproduced from Meusel *et al.* (1965: p. 137).

hermaphroditis maxime 10 mm (nec 14 mm) diametro, capsula cylindrica, 4–9 mm longa, longitudine fere 1.5 × calycis (nec subglobosa, 3–5 mm longa, calyce brevior usque subsuperans). Differt ab subsp. acaulis caulibus brevissimis, maxime 2–5 cm longis (nec 5–15 cm longis), floribus minoribus maxime 10 mm diam. (nec usque 15 mm diam.), capsulis 4–9 mm longis, 1.5 × calycis longitudine (nec 6–15 mm longis, 1.5–2 ×).

TYPE: Turkey B9 Van: Ahta Dağ, southeast of Kalecik village near Özalp, 2500–2700 m, 15.V.1998 *F. Özgökçe 5911* (holotype VANF; isotype BEOU, herb. Kit). — PARATYPE: Same locality, 27.V.1999 *F. Özgökçe 7555* (VANF).

Perennial, dwarf, laxly caespitose herb, forming small mats 2–5 cm high at most. Stems numerous, erect, very short, mostly 2 cm in length (rarely to 5 cm), terete, glabrous, leafy to base of inflorescence, 1-flowered; nodes slightly swollen. Lower leaves not persistent, only brownish sheaths and midribs remaining. Middle and upper leaves linear-lanceolate to almost subulate, 5–10 × 0.5–1 mm, keeled below, acuminate, suberect to patent, mid-green, ciliate-denticulate. Inflorescence axis smooth, glabrous, not glandular-viscid. Calyx narrowly campanulate, 5–7 mm, inconspicuously 10-veined, glabrous, deep pinkish-violet, narrowed at base and not inflated in fruit; teeth broadly ovate-triangular, 1–1.5 × 1.5 mm, obtuse, ciliolate. Flowers conspicuous, terminal, hermaphrodite ones to 10 mm diam. at most. Petals deep pink but paler than calyx; limb obovate, 4–6 mm, shallowly retuse-emarginate; claw exauriculate; coronal scales small. Filaments slender, glabrous, pale pink; anthers oblong, to 1 mm, exserted from calyx. Anthophore 6–8 mm, sparsely pubescent. Styles 3, 8–10 mm, pink. Capsule cylindrical, 4–9 mm, shorter than or shortly overtopping calyx, pale brown, smooth, opening by 6 erect teeth. Seeds reniform, 1–1.5 mm, pale brown, tuberculate.

Ledges and crevices of limestone cliffs and scree in alpine zone, 2500–2700 m. Flowering and fruiting mid-May to June.

DISTRIBUTION: So far known only from Ahta Dağ in East Anatolia, Turkey (Figs. 2–3).

Silene acaulis subsp. *vanensis* morphologically resembles subsp. *bryoides*, differing from this taxon in a number of small but constant features: leaves ciliate-denticulate, 5–10 mm; hermaphrodite flowers to 10 mm diam. at most, calyx 5–7 mm, capsules cylindrical, 4–9 mm. *Silene acaulis* subsp. *bryoides* has scabrid to stiffly ciliate leaves 4–8 mm long, larger flowers to 14 mm diam., calyx 3.5–5 mm and subglo-

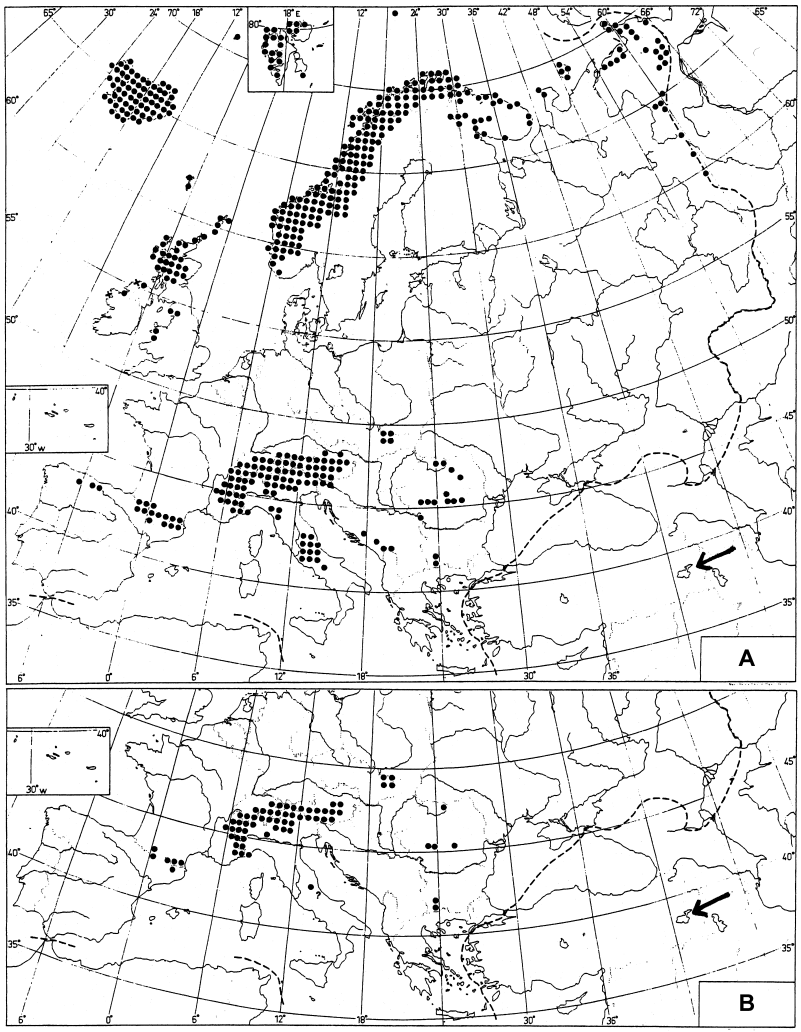

Fig. 3. — **A**: Distribution map of *Silene acaulis* in Europe and *S. acaulis* subsp. *vanensis* (arrow) in Turkey. Reproduced with permission from Jalas and Suominen (1986). — **B**: Distribution map of *Silene acaulis* subsp. *bryoides* and *S. acaulis* subsp. *vanensis* (arrow). Reproduced with permission from Jalas and Suominen (1986).

bose, 3–5 mm capsules which are shorter than or scarcely exceeding the calyx. The extreme shortness of the stems (mostly 2 cm and glabrous), smaller flowers (maximum to 10 mm diam.) and shorter, 4–9 mm capsules separate it from subsp. *acaulis s. stricto*. The latter has much longer (5–15 cm and often sparsely pubescent) stems, larger hermaphrodite flowers (to 15 mm diam.) and cylindrical capsules 6–15 mm, which are 1.5–2 times longer than the calyx and distinctly overtopping it. The most obvious character separating subsp. *vanensis* from the other subspecies of *S. acaulis* is the more lax, mat-forming, not rounded, cushion habit. *Silene acaulis*, familiar to rock gardeners as the Moss Campion or *Polsternelke*, is usually densely caespitose-pulvinate, forming small, ± rounded and sometimes rather hard cushions.

Silene acaulis is distributed in the Holarctic, from the arctic regions of Eurasia (including Greenland), and North America to the mountains of central and southern Europe (Fig. 2; Jalas & Suominen 1986: maps 1167, 1168). In Jalas and Suominen (1986: pp. 82–83), it is divided into two subspecies, subsp. *acaulis* [*s. lato*] and subsp. *bryoides*. The north European and arctic plants can be referred to subsp. *acaulis s. stricto* while the plants occurring in the siliceous Alps are treated as subsp. *bryoides* (including subsp. *exscapa* and subsp. *norica* Vierh.) and those from the calcareous Alps referred to a third subspecies, subsp. *longiscapa* (Kerner *ex* Vierh.) Vierh. (*see* Fischer 2005[1]).

[1] following W. Gutermann (ined).

Plants from South Tyrol, French and Spanish Pyrenees, and Swiss Alps appear to be more variable than the populations in North America or the arctic, although so far only material from Canada, Newfoundland, West Spitzbergen (Svalbard), Novaya Zemlya and Arctic East Siberia have been examined. Plants from the Dinaric Alps in Montenegro have been called var. *balcanica* Hayek & Vierh.; as usual with relict taxa, they are more uniform and show some resemblance to subsp. *vanensis*. The existence of a member of the very polymorphic *S. acaulis* in East Anatolia, ca. 2000 km from the Balkans, without any occurrence of *S. acaulis* in the area between, is phytogeographically remarkable and can be interpreted in various ways, commented below.

1. Subsp. *vanensis* is part of *S. acaulis* but there is no documented evidence as to how it had reached the highlands of East Anatolia and persisted there, hanging on, in small populations. It may be noted in passing that *S. acaulis* does not occur at all in the Caucasus. — COMMENT: Given the continentality of climate in the Van area with long hard winters, *S. acaulis* would probably survive there better than in mountain areas with proximity to the sea as in the north and west of Turkey. We doubt that populations of *S. acaulis* in their current southern refuges are under any threat because of climatic change; short-term observations during the past 100 years or more are insufficient to conclude that rapid climatic changes have occurred. The characteristic habitats of many glacial relicts in the southern mountains of Europe (in the Balkan, Iberian and Apennine Peninsulas) are small, local refugia often exposed to strong wind, cold conditions and with a long-persisting snow blanket. These refugia originated from climatic change following the disappearance of glaciers on the mountains in southern Europe after the last Ice Age. A predominantly limestone habitat is typical for *S. acaulis* in the Balkans, as on Ahta Dağ in East Anatolia. In the Alps the more favoured habitats for glacial relicts are those at the glacier and periglacier areas above 2500 m.

2. If *S. acaulis* had colonised highlands in East Anatolia, the disparate climate and isolation from other populations would finance some evolutionary divergence, partly adaptive, partly by genetic drift, thus creating a new taxon. Should isolated populations of glacial relicts be regarded as new taxa? — COMMENT: This depends to a large extent on the duration of isolation. Populations of glacial relicts are often rather uniform and express no obvious morphological differentiation at species or subspecies level. However, analysis at the molecular level must surely reveal some fine genetic differences. Some botanists would consider that each isolated population of Alpine plants would represent a separate species, e.g., *Hedysarum silicii*, *Wulfenia blecicii*, *Centranthus silicii* while others would prefer to treat these taxa as belonging to the variable and wider-ranging species *Hedysarum hedysaroides*, *Wulfenia carinthiaca* and *Centranthus longiflorus* respectively.

3. The existence of subsp. *vanensis* in East Anatolia may be attributed to the impact of Pleistocene glaciation. Had there been a migration of glacial flora arctic or boreal in origin to the highlands of East Anatolia in addition to mountain refuges in southern Europe? — COMMENT: In Europe, the main routes of migration of glacial flora towards the Balkan mountains are well known; the first across the Dinaric Alps, and the second, from the Carpathians towards the Bulgarian mountains. However, the route towards the Anatolian mountains has not been constructed and is still unknown.

Glacial flora was widely distributed along the mountain systems of the Balkans during the Ice Age and the rise in snow line of several hundred metres at that time helped to establish closer contact between plant populations. After the glaciers retreated to the north and to mountain tops, many populations of glacial flora disappeared except those which sought refuge in high alpine refugia. The Dinaric Alps, Mt. Pirin and Mt. Rila, have an Alpine type of climate and harbour many such refugia. On the other hand, mountains under a strong Mediterranean climatic influence, e.g., the inner chain of the Dinaric Alps, have few true glacial relicts although there is clear evidence that glaciers existed on those mountains during the Ice Age. We can assume that the Balkan

mountains once had a glacial flora which became extinct during the past 10 000 years.

Mountain glaciers are known to have existed in Anatolia during the Würm and Riss glaciations (*see* map of Ice Age distribution in western Palearctic, Walter & Straka 1970). These island glaciers reached the Cilician and Taurus mountains in South Anatolia and also eastwards to Mt. Ararat and the adjacent high mountains. In fact the tops of all mountains above 2200 m in Anatolia were once under glaciation and Ararat, the highest of them all, is still glaciated. One would thus expect that *S. acaulis* existed on Anatolian mountains during the Ice Age. However, except for the present discovery, it was not known to occur on the high mountains of North and East Anatolia. Equally puzzling is its absence from the Caucasus. The nearest localities to Ahta Dağ are the Rila and Pirin mountains in Bulgaria, ca. 2000 km away. The discovery or existence of some glacial relicts on Ahta Dağ or on mountains systems of Central and East Anatolia along a supposed route of migration will be all important to support a hypothesis that migration of glacial flora from the Balkans to Anatolia during the Ice Age had occurred.

A few plants occur which may prove this. *Cerastium cerastioides*, *Carex atrata*, *Saxifraga adscendens* and *Sedum annuum* all are found on Ahta Dağ, supporting a Balkan connection. These species, however, also occur in the Caucasus, indicating an alternative route of migration from the west (the Caucasus is presently, and during the Pleistocene, a strong centre of glacial flora). An attempt to discover a possible route of migration of *S. acaulis* populations from Pleistocene European or Alpine tundra towards Anatolia is presently under investigation by Stevanović and co-workers. It could be from the East Balkans or it may follow quite an independent route. Arctic-Alpine species on Ulu Dağ in NW Anatolia and the high mountains of NE Anatolia but not discovered on Ahta Dağ are *Saxifraga paniculata*, *Gnaphalium supinum*, *Epilobium anagallidifolium* and *Androsace chamaejasme*.

4. Is *S. acaulis* arctic or alpine in origin? A careful study of the North American populations would be necessary to find how different they are, even if they are not taxonomically recognised as such. — Comment: It is our opinion that *S. acaulis* is arctic in origin.

5. What happens *Silene*-wise up the Himalayas? — Comment: For *S. acaulis* to reach the Himalaya is almost impossible as the closest distribution in the Eurasian Arctic is an arc several 1000 km distant.

Özalp is situated between the towns of Erçek and Saray, on the main road running eastwards of Van to the Iranian border. Ahta Dağ (peak 2800 m) lies in a region of high mountains to the north of Özalp. The two highest mountains in Anatolia, Süphan Dağ (4058 m) and Ararat (5123 m) are to the northwest and north-northeast of Ahta Dağ respectively. It is possible subsp. *vanensis* occurs on other high mountains in East Anatolia. The limestone mountain cliffs where it was collected are 2500–2700 m above sea level. Metamorphic and sedimentary rocks of different geological ages, mostly Lower Palaeozoic to Quaternary, cover the area. The other plants in the immediate vicinity are not particularly unusual for the area. They include *Parietaria judaica*, *Campanula coriacea*, *Arabis caucasica*, *Dianthus crinitus*, *Rosularia radiciflora*, *Kochia prostrata*, *Melica persica*, *Sedum gracile* and *Ephedra major*. The steppe vegetation is dominated by *Astragalus microcephalus*, *A. lagurus* and *A. gummifer.* The extremely dwarf habit of the plants is obviously influenced by the steep eroded and exposed scree slopes with calcareous frost-shattered rock debris and melt water, the high altitude and the short growing season. Subsp. *vanensis* appears to be very rare and has so far been found on one mountain which is fairly close to the Iranian border. This is one reason why we have not listed it as a Turkish endemic at present. By virtue of the location and relative inaccessibility it is not considered under any anthropogenic threat. Both *S. acaulis* subsp. *acaulis s. lato* and subsp. *bryoides* are diploid with 2n = 24. The chromosome number of subsp. *vanensis* is unknown.

Acknowledgements

We thank Prof. Manfred A. Fischer (University of Vienna) for kindly providing the Latin diagnosis and for most useful suggestions. Drs. Lütfi Behçet and Nezaket Adigüzel (Yüzüncü

Yıl University), Prof. Drs. Mecit Vural, Zeki Aytaç and Hayri Duman (Gazi University) are thanked for their interest.

References

Chater, A. O., Walters, S. M. & Akeroyd, J. R. 1993: *Silene*. — In: Tutin, T. G. *et al*. (eds.), *Flora Europaea*, 2nd ed., 1: 191–218. Cambridge Univ. Press, Cambridge.

Davis, P. H. (ed.) 1967: *Flora of Turkey and the East Aegean Islands*, 2. — Edinburgh Univ. Press, Edinburgh.

Fischer, M. A. (ed.) 2005: *Exkursionsflora von Österreich, Liechtenstein und Südtirol*. — O.Ö. Landesmuseum, Linz. [In press].

Greuter, W. 1995: *Silene* (Caryophyllaceae) in Greece: a subgeneric and sectional classification. — *Taxon* 44: 543–581.

Jalas, J. & Suominen, J. (eds.) 1986: *Atlas Florae Europaeae* 7 (Caryophyllaceae–Silenoideae). — The Committee for mapping the Flora of Europe & Soc. Biologica Fennica Vanamo, Helsinki.

Meusel, H., Jäger, E. & Weinert, E. 1965: *Vergleichende Chorologie der zentraleuropäischen Flora*. Band 1(Karten). — G. Fischer, Jena & Stuttgart.

Walter, H. & Straka, H. 1970: *Arealkunde, Floristisch-historische Geobotanik, Einführung in die Phytologie* III/2. — Verlag Eugen Ulmer, Stuttgart.