

## One more *Allium* species for the Turkish flora: *Allium saxatile*

Fatma Neriman ÖZHATAY, Mine KOÇYİĞİT\*, Emine AKALIN URUŞAK

Department of Pharmaceutical Botany, Faculty of Pharmacy, İstanbul University, 34116 Beyazıt, İstanbul – TURKEY

Received: 28.04.2011 • Accepted: 05.06.2012

**Abstract:** *Allium saxatile* M.Bieb. was collected from the north-western corner of European Turkey (Demirköy, Kırklareli) during the field survey of the “Yıldız Mountain Biosphere Project”. It has been reported as a new record for the Turkish flora. A description based on the collected specimens, photographs of its habitat and flowering plants, map of the distribution area, and its karyotype are given.

**Key words:** *Allium*, new record, karyotype, Yıldız Mountains, Kırklareli, Turkey

### Introduction

The genus *Allium* L. is represented by 187 wild taxa (165 species, 19 subspecies, and 3 varieties) in Turkey (Kollmann, 1984; Davis et al., 1988; Güner et al., 2000; Özhatay & Kültür, 2006, Özhatay et al., 2009, 2011; Koçyigit & Özhatay, 2010). They are grouped into 13 sections: *Rhizirideum* (5 spp.), *Schoenoprasum* (2 spp.), *Molium* (10 spp.), *Briseis* (1 sp.), *Chamaeprason* (1 sp.), *Porphyroprason* (1 sp.), *Brevispatha* (5 spp.), *Scorodon* (14 spp.), *Codonoprasum* (47 spp.), *Allium* (56 spp.), *Acanthoprasum* (2 spp.), *Melanocrommyum* (26 spp.), and *Kaloprasum* (1 sp.). Turkish *Allium* species have been examined by N. Özhatay and M. Koyuncu since 1977, and they have made a valuable contribution and published several papers and carried out projects (Koyuncu, 1979a, 1979b; Özhatay, 1984), and recently 2 sections “Sect. *Codonoprasum* and Sect. *Melanocrommyum*” have been reviewed in a doctorate thesis supervised by N. Özhatay.

Taxonomical treatments have revealed a lot of new species and new records for the Turkish flora

recently (Hamzaoğlu, 2012; Koyuncu, 2012; Vural & Şapçı, 2012, Behçet et al., 2012). As part of the Yıldız Mountains Biosphere Project, a vascular plant diversity survey was carried out between May and October 2009. Biosphere reserves are areas of terrestrial and coastal/marine ecosystems, or a combination thereof, which are internationally recognised within the framework of UNESCO’s Programme on Man and the Biosphere (MAB). The importance of the Yıldız Mountains (Istranca Mountains) was recognised when in 1992 at a conference of European Ministers for the environment, held in Lucerne (Switzerland), the Yıldız Mountains were identified as 1 of the 5 most important areas in Central and Eastern Europe for conservation of European natural heritage. The Yıldız Mountains Biosphere Project is the abbreviated name for Service Contract TR 0602.16-01/001 *Technical Assistance for Protection and Sustainable Development of Natural Resources and Biodiversity in the Yıldız Mountains in Turkey*. A thorough review of the literature and available herbarium records (ISTE and EDTU) indicated that a total of 1369 vascular

\* E-mail: minekocycigit@hotmail.com

plant taxa were found in the project area, based on the results of the project survey and previous studies (Turrill, 1924; Webb, 1966; Kurter, 1983; Seçmen & Leblebici, 1991; Yarcı, 1997, 1999; Özhatay et al., 2003; Başak & Kıyıcı, 2004; Kavgacı, 2007; Kavgacı et al., 2007). During an expedition to around the Dupnisa hot spot, which is one of the most important sites, unusual *Allium* specimens were collected. They belong to the sect. *Rhizirideum*, having clustered, ovoid-cylindrical bulbs, and were quite easy to identify, after detailed studies revealed that the specimens belonged to *Allium saxatile* M.Bieb. (Figures 1, 2).

**Materials and methods**

*Morphology:* During the morphological studies the features of the species including habit, rhizome, stem, leaves, perigon, filament, ovary, capsule, and seed were examined and evaluated. These features were compared with the specimens of *A. saxatile* kept in the herbaria Kew, Geneva, and Berlin. Collected specimens were housed in ISTE.



Figure 1. Habitat and young plant.



Figure 2. *Allium saxatile*; upper part of the plant (A), umbel (B), underground part of the plant (C) (scale bar 1 cm).

**Karyology:** Living bulbs were collected and potted for the karyological studies. Root tips were pretreated with 0.05% 1-bromonaphthalene solution at 4°C for 24 h and then fixed in fresh Carnoy's solution overnight. Root tips were hydrolysed for 10–12 min in 1 N HCl at 60 °C, washed and stained in Feulgen solution for 1–2 h. Stained meristems were squashed in a drop of 2% aceto-orcein and permanent preparations were made by the liquid CO<sub>2</sub> method. The image analysis systems KAMERAM® and a Canon A 640 camera were used for metaphase handling and chromosome measurements. The chromosome types were named according to the position of the centromere: r = 1–1.3 (m) median, median-submedian, r = 1.7–3 (sm), r = 3–7 (st) subterminal (Tzanoudakis, 1983). Ideograms were prepared with measurements made on enlarged microphotographs of 5 well-spread metaphase plates of different individuals. For each chromosome, the relative length (percentage of total autosomal length) and centromeric index (length of short arm as a percentage of the whole chromosome length) were calculated (Table).

**Description of the species**

*Allium saxatile* M.Bieb. Tabl. Prov. Casp. 114 (1798).  
(incl. *A. globosum* Bieb. ex Redouté, *A. marschallianum* Vved).

**Bulbs** usually clustered, ovoid–cylindrical, 0.5–1.5 cm in diameter; outer tunics brown to red–

brown coriaceous, splitting lengthwise into strips; inner tunics light brown, membranous. **Stem** 20–60 cm, cylindrical, solid and smooth. **Leaves** 3–7, 5–20 cm × 0.5–1 mm, longer than scape, filiform, semicylindrical, solid, lower leaves scabrous at margins; sheathing the lower 1/3 or less of the scape, outermost leaf sheath usually scabrous. **Spathe** 2 valved, valves unequal, one long-beaked, up to 3 cm and distinctly longer than the umbel, persistent, 3–5 veined. **Umbel** 1.5–2 cm in diameter, subglobose or hemispherical, 15–35 flowered; pedicels 5–15 mm, almost equal, 1.5–2 (3)× as long as perianth, elongate in fruit, bracteolate. **Perianth** campanulate; segments 3.5–4 × 1.5–2 mm, white with light green midvein, elliptic-ovate, acute; inner ones slightly longer than outer ones. **Stamens** exerted, equal; filaments 5–6 mm, simple, white, 1.5–2× as long as tepals, connate at base and adnate to tepals; anthers yellow, oblong, rounded at apex. **Ovary** subglobose–oblong, yellowish green, 0.8–1 × 1–1.5 mm. **Style** exerted, almost as long as stamens, white. **Stigma** papillose. **Capsule** globose–rhomboid, 3–4 × 3.5–4.5 mm. Valves of capsule rhomboid–ovate. **Seed** black, 1–1.5 × 1.5–2 mm.

**Flowering time:** September–October.

**Habitat:** Rocks, stony slopes, 225–460 m.

**Distribution:** SE Europe, extending westwards to N & C Italy and northwards to N in C Russia (Figure 3).

Table. Morphometric data on the haploid chromosomes of *Allium saxatile*.

Chromosome pair	Long arm (µm)	Short arm (µm)	Total length (µm)	Arm ratio R = l/s	Centromeric index	Relative length	Centromeric position
1	5.32 ± 0.43	4.89 ± 0.28	10.21 ± 0.27	1.09	47.89	15.93	m
2	4.89 ± 0.25	4.26 ± 0.35	9.15 ± 0.32	1.15	46.56	14.27	m
3	4.04 ± 0.36	3.70 ± 0.23	7.74 ± 0.39	1.09	47.80	12.07	m
4	4.26 ± 0.31	4.04 ± 0.29	8.30 ± 0.42	1.05	48.67	12.95	m
5	3.19 ± 0.28	3.19 ± 0.51	6.38 ± 0.38	1	50	9.95	m
6	3.81 ± 0.67	2.98 ± 0.49	6.79 ± 0.45	1.28	43.89	10.59	m
7	5.11 ± 0.56	2.34 ± 0.48	7.45 ± 0.53	2.18	31.41	11.62	sm
8	5.96 ± 0.42	2.13 ± 0.55	8.09 ± 0.37	2.80	26.33	12.62	sm

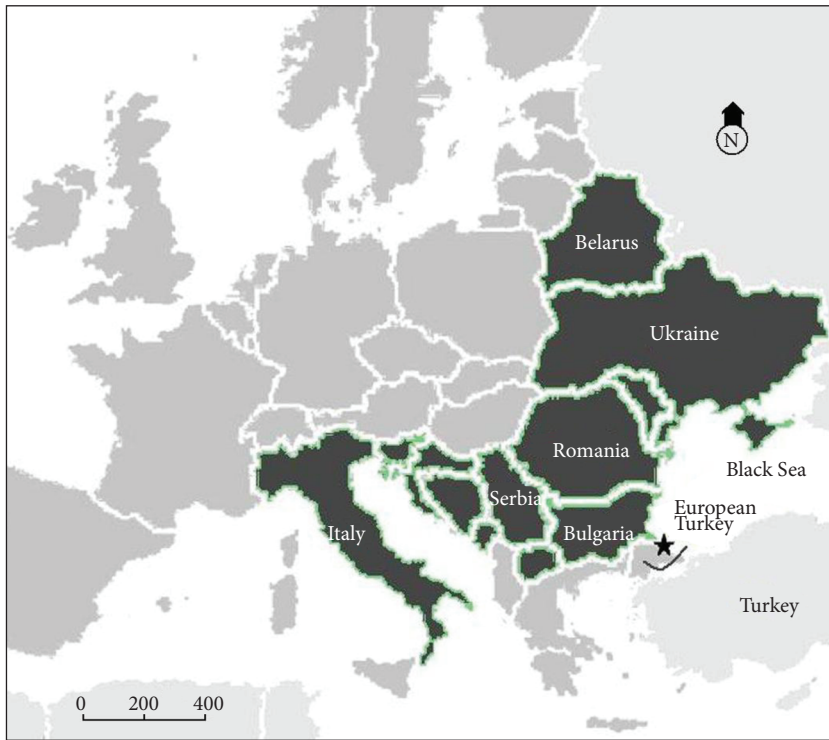


Figure 3. Distribution of *Allium saxatile* in Europe. ★ Locality of *Allium saxatile* in Turkey.

### Specimens examined:

**Turkey:** A1 (E): Kırklareli: Demirköy, Mahya Mount., Sarpdere village, 358 m, 3.10.2009, *E.Akalın, Y.Yeşil s.n.* (ISTE 92497); Dupnisa Cave, 458 m, 26.10.2009, *E.Akalın, Y.Yeşil, M.Koçyiğit s.n.* (ISTE 93421); 20.07.2010, *N. & E.Özhatay, E.Akalın, M.Koçyiğit s.n.* (ISTE 93422).

**Europe:** Russia, Petigorsk, 1839, *R.F.Hohenacker s.n.* (*A. globosum*) (K); Italy, Trieste, 20.09.1855 (B); Turkestanicum, 23.07.1877 (K); Turkestanicum, 03.07.1879, *Karel s.n.* (G); Italy, Trieste, 20.09.1884 (B); Transcaucasia, Tiflis, 11.10.1923, *B. Schischkin* (*A. globosum*) (K); Azerbaijan, 1600-1800 m, 24.08.1935, *I.Karjagin*, 4382 (K).

### Karyological results

**Chromosome number:**  $2n = 16$

**Examined specimen:** A1 (E): Kırklareli: Demirköy, Dupnisa Cave, 458 m, 26.10.2009, *E.Akalın, Y.Yeşil, M.Koçyiğit s.n.* (ISTE 93421).

**Karyotype formula:**  $12m + 4sm$  (Figures 4, 5).

**Metaphase chromosome size:**  $6.38\text{--}10.21\ \mu\text{m}$  (Figure 5).

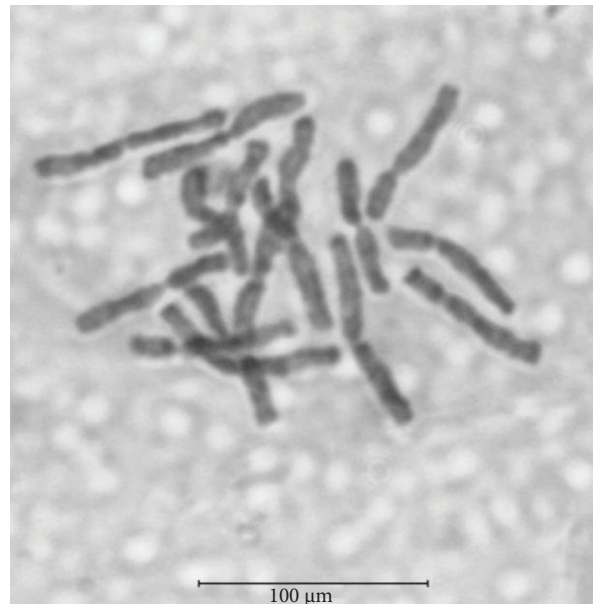


Figure 4. The metaphase chromosomes of *A. saxatile* ( $2n = 16$ ) (ISTE 93421) (scale bar  $10\ \mu\text{m}$ ).

**Total length of the haploid set:**  $64.11\ \mu\text{m}$  (Figure 6).

The chromosome number and morphology of *A. saxatile* were reported by Levan (1935), Kudryashova

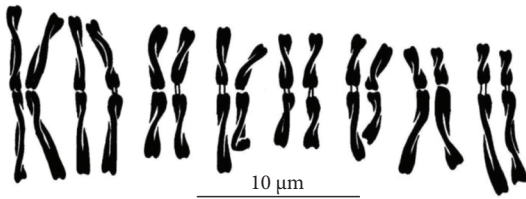


Figure 5. Diploid karyogram ( $2n = 16$ ) of *Allium saxatile* (scale bar  $10 \mu\text{m}$ ).

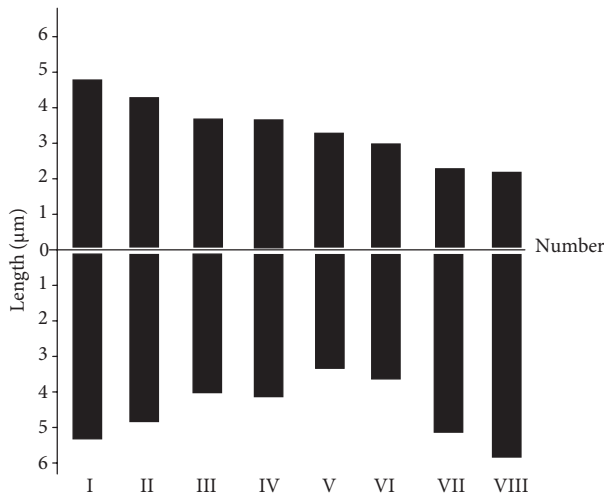


Figure 6. Haploid ideogram ( $n = 8$ ) of *Allium saxatile*.

(1988), Pogolian (1983, 1997), Van Loon and Kieft (1980), Vosa (1977), and Magulaev (1976); their results indicated that the chromosome number of *A. saxatile* was  $2n = 16$ . The chromosome morphology of *A. saxatile* was investigated on specimens from Lund, Sweden (Levan, 1935). The haploid ( $n = 8$ ) karyotype formula of the Swedish *A. saxatile* is  $7m + 1st^{SAT}$  and chromosome size is  $5-7 \mu\text{m}$ .

## References

- Başak N & Kıyıcı S (2004). Two new records for the flora of Turkey: *Campanula patula* L. subsp. *patula*, *Campanula cervicaria* L. *Journal of Faculty of Pharmacy of Ankara University* 37: 55–60.
- Behçet L, Kaval İ & Rüstemoğlu M (2012). Three new records for Turkey: *Allium giganteum* (Liliaceae), *Grammosciadium scabridum*, and *Ferulago angulata* subsp. *carduchorum* (Apiaceae). *Turkish Journal of Botany* 28: 637–643.

## Concluding remarks

*A. saxatile* is a new record for the Turkish flora and the total number of taxa *this* genus known from Turkey rises to 187. Flora Europaea states that “Although few collections are annotated as to the flower-colour in a living state, there would appear to be regional colour-differentiation. Plants with pink perianth and purple anthers (typical *A. saxatile*) occur from the Eastern Alps eastwards, while plants with yellowish-white perianth and yellow anthers (*A. marschallianum* Vved.) occur in North Italy, the North part of the Balkan Peninsula and Krym” (Stearn, 1980). The specimens from European Turkey with yellowish-white perigon and yellow anthers are similar with specimens from North Italy, the North part of Balkan Peninsula, and Krym.

Additionally, there are karyological differences as follows: the Swedish *A. saxatile* haploid karyotype formula and chromosome size are different from those of the Turkish *A. saxatile* (as mentioned in the karyology part of this paper).

Finally, further study of these variants *A. saxatile*, *A. marschallianum*, and *A. globosum* should be conducted to ascertain their status.

## Acknowledgements

We thank the curators of the Berlin, Geneva, and Kew herbaria for giving us permission to examine specimens. Financial support was provided through “Protection and Sustainable Development of Natural Resources and Biodiversity in the Yıldız Mountains, Turkey” (project no: EuropeAid/125289/D/SER/TR). Also, thanks are due to Prof Dr Engin Özhatay and Dr Uğur Uruşak for accompanying the field study and helping to collect plant specimens and to Adil Önder Erdem for taking the photographs.

- Davis PH, Mill RR & Tan K (1988). *Flora of Turkey and the East Aegean Islands* (suppl. 1). Vol 10, Edinburgh: Edinburgh University Press.

- Güner A, Özhatay N, Ekim T & Başer KHC (2000). *Flora of Turkey and the East Aegean Islands* (suppl. 2). Vol. 11, Edinburgh: Edinburgh University Press.

- Hamzaoğlu E (2012). A new species of *Gypsophila* and a new name for *Silene* (Caryophyllaceae) from Turkey. *Turkish Journal of Botany* 36: 135–139.
- Kavgacı A (2007). Sand-dune vegetation of Igneada coast in the Thracian part of Turkey. *Hacquetia* 6 (2): 65–76.
- Kavgacı A, Özalp G & Özhatay N (2007). Flora of Igneada floodplain forests (longozes) and their surroundings. *İstanbul Üniversitesi Orman Fakültesi Dergisi A-57* (2): 61–90 (in Turkish).
- Koçyiğit M & Özhatay N (2010). A contribution to the genus *Allium* L. (Sect. *Codonoprasum*) in Turkey. *Turkish Journal of Botany* 30: 391–395.
- Kollmann F (1984) *Allium*. In: Davis PH (ed.), *Flora of Turkey and the east Aegean Islands*. Vol. 8, Edinburgh: Edinburgh University Press.
- Koyuncu M (1979a). Species of *Allium* newly recorded from Turkey I, sect. *Allium*. *Journal of Faculty of Pharmacy of Ankara University* 9: 45–53.
- Koyuncu M (1979b). Species of *Allium* newly recorded from Turkey II, sect. *Codonoprasum*. *Journal of Faculty of Pharmacy of Ankara University* 9: 54–59
- Koyuncu M (2012). A new species of *Vinca* (Apocynaceae) from eastern Anatolia, Turkey. *Turkish Journal of Botany* 36: 247–251.
- Kudryashova GL (1988). Cytotaxonomical study of *Allium saxatile* (Alliaceae) and closely-related species from the Caucasus and the European part of the USSR. *Botanicheskii Zhurnal SSSR* 73: 665–669.
- Kurter A (1983). Istranca (Yıldız) dağlarının temel yapısal ve jeomorfolojik özellikleri (Yeni Görüşlerin Işığı Altında II). *Güney-Doğu Avrupa Araştırmaları Dergisi* 10 (11): 1–19 (in Turkish).
- Levan A (1935). Cytological studies in *Allium*, IV: the chromosome morphology of some diploid species of *Allium*. *Hereditas* 20 (3): 289–330.
- Magulaev AJ (1976). The chromosome numbers of flowering plants of the northern Caucasus. *Flora of the Northern Caucasus* 2: 51–62.
- Özhatay N & Kültür Ş (2006). Check-list of additional taxa to the Supplement Flora of Turkey III. *Turkish Journal of Botany* 30: 281–316.
- Özhatay N (1984). Cytotaxonomic studies on the genus *Allium* in European Turkey and around Istanbul II. sect. *Codonoprasum*. *Journal of Faculty of Pharmacy of Istanbul University* 20: 29–41.
- Özhatay N, Byfield A & Atay S (2003). *Important Plant Areas in Turkey*, Doğal Hayatı Koruma Vakfı (WWF Türkiye) yayını, İstanbul (in Turkish).
- Özhatay N, Kültür Ş & Aslan S (2009). Check-list of additional taxa to the Supplement Flora of Turkey IV. *Turkish Journal of Botany* 33: 191–226.
- Özhatay N, Kültür Ş & Gürdal B (2011). Checklist of additional taxa to the Supplement Flora of Turkey V. *Turkish Journal of Botany* 35: 589–624.
- Pogosian AI (1983). Chromosome numbers of some species of the genus *Allium* (Alliaceae) distributed in Armenia and Iran. *Botanicheskii Zhurnal SSSR* 68: 652–660.
- Pogosian AI (1997). Chromosome numbers in some species of monocotyledones from the Transcaucasia. *Botanicheskii Zhurnal SSSR* 82 (6): 117–118.
- Seçmen Ö & Leblebici E (1991). Aquatic flora of Thrace. *Willdenowia* 20: 53–66.
- Stearn WT (1980). *Allium*. In: Tutin TG, Heywood VH, Burges NA, Moore DM, Valentine DH, Walters SM & Webb DA (eds.). *Flora Europaea*, pp. 54. Cambridge, Cambridge University Press.
- Turrill WB (1924). On the Flora of the Gallipoli Peninsula. *Kew Bulletin* 20: 53–66.
- Tzanoudakis (1983). Karyotypes of ten taxa of *Allium* section *Scorodon* from Greece. *Caryologia* 36 (3): 259–284.
- Van Loon JC & Kieft B (1980). In Chromosome number reports LXVIII. *Taxon* 29: 538–542.
- Vosa CG (1977). Heterochromatic patterns and species relationship. *Nucleus* 20: 33–41.
- Vural C & Şapçı H (2012). Five new records of the genus *Echinops* (Asteraceae) from Turkey. *Turkish Journal of Botany* 36: 151–160.
- Webb DA (1966). The flora of European Turkey, *Proceedings of the Royal Irish Academy* 65(1): 1–100.
- Yarıç C (1997). Flora of Demirköy (Istranca Mountains/Kırklareli European Turkey). *Flora Mediterranean* 7: 55–99.
- Yarıç C (1999). Contributions to the flora of the western part of Istranca Mountains (Kırklareli/Thrace Region) *Turkish Journal of Botany* 23: 211–228.