Allium dumanii (A. sect. Codonoprasum, Amaryllidaceae), a new species from E Turkey

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Abstract: Allium dumanii Koyuncu & Koçyiğit, a new species in A. sect. Codonoprasum (Rchb.) Endl. from Kahramanmaraş and Malatya, Anatolia, is described and illustrated. It is compared with the possibly related A. armenum Boiss. & Kotschy. The karyomorphology of A. dumanii and A. armenum is also presented and discussed. The chromosome number of the new species is 2n = 16.

Key words: Allium, Allium sect. Codonoprasum, Amaryllidaceae, new species, taxonomy, chromosome number, Anatolia, Turkey

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Introduction

The genus Allium L. is the largest genus in Turkey, comprising about 220 taxa grouped into 14 sections; 86 taxa are endemic to the country (endemism rate 39.1%) (Kaya 2014; Özhatay & al. 2014). Allium has been treated in the family Liliceae (s.l.) by Kollmann (1984). However, it is included in the family Amaryllidaceae according to The Angiosperm Phylogeny Group (2009). Allium sect. Codonoprasum (Rchb.) Endl., the second largest and the most taxonomically complicated section in Turkey, includes 55 taxa, of which 25 are endemic to the country (Koyuncu 2012; Koçyiğit & al. 2014). Recent taxonomic research in the genus has been mainly focused in the Mediterranean area, SW Asia and parts of C Asia and has resulted in the description of several new species and subspecies, increasing the number of Allium taxa to more than 900 worldwide (Brullo & Tzanoudakis 1994; Brullo & al. 2001; Brullo & al. 2008; Friesen 2008; Khassanov & al. 2011; Koçyiğit & Özhatay 2012; Khassanov & al. 2013; Tojibaev & al. 2014; Galdo & al. 2015; Seregin 2015; Tzanoudakis & Trigas 2015). The above mentioned areas have been considered as the gene centre of the genus (Friesen 2008).

The new species was first collected in 1986 from Kahramanmaraş Province by Prof. H. Duman and was already mentioned by M. Koyuncu in an unpublished report of the project “Endemic Allium in Turkey” in 1994 (Koyuncu & Güvenç 1994). Later, in the Ph.D. thesis project by M. Koçyiğit “Taxonomic studies on the genus Allium (sect. Codonoprasum) in Turkey” performed in 2007–2010 under the supervision of Prof. N. Özhatay, some specimens were collected from Malatya Province and they were compared with the Kahramanmaraş specimens and other herbarium material. They were examined

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in detail morphologically and karyologically. Because of the simple filaments and absence of conspicuous nectar-ies on the ovary, they were determined as belonging to A. sect. Codonoprasum. The new species shows similarities with the Turkish endemic A. armenum Boiss. & Kots-chy because it has persistent spathe valves shorter than or equalling the umbel, lax and globose inflorescence, campanulate perigon, and ovoid-globose ovary. A careful examination of herbarium specimens, however, revealed that the populations in fact differ from A. armenum in several morphological characters, particularly in the capsule and flower features. The material is described in the present paper as a species new to science, A. dumanii Koyuncu & Koçyiğit.

Material and methods

The comparison of Allium dumanii with A. armenum was based on living material, herbarium specimens kept at AEF, E, G, ISTE and K (herbarium codes according to Thiers [continuously updated]) and on data derived from the available literature. Ten different bulbs of each species were investigated karyologically and 10–15 metaphase plates were studied. Chromosome counts were obtained from somatic metaphases using a standard squash tech-
nique (Koçyiğit & Bona 2013; Demirci & al. 2013). The karyomorphology of the new species was described and compared with that of A. armenum. The classification of chromosomes follows Levan & al. (1964).

Results and Discussion

Allium dumanii Koyuncu & Koçyiğit, sp. nov. – Fig. 1 & 2.

Holotype: Turkey, C6 Kahramanmaraş, Engizek Mountain, Küçükışıl area, 2300 m, 19 Jul 1986, H. Duman 1987 (AEF; isotypes: GAZI, ISTE).

Description — Bulb ovoid, 1–1.5 × 0.4–0.8 cm; outer tunic greyish brown, papyraceous, without collar; inner tunic yellowish to dirty white, membranous; bulblets absent. Leaves 1 or 2(or 3), semicylindric, fistulose, cal-
aliculate, 5–8 cm × 1–1.5 mm, longer than scape, gla-
brous. Leaf sheaths yellow, glabrous. Scape cylindrical, curved in upper part, 3–5(–10) cm × 0.8–1 mm, glabrous, not pruinose, covered for ½—¾ its length by leaf sheaths. Spathe valves 2, persistent, acuminate from a broader and connected base, slightly unequal, shorter than or equalling umbel, longer valve 6–10 mm long, shorter valve 5–8 mm long, both valves 3– or 4-nerved, margin entire. Inflorescence lax, globose, 1–1.5 cm in diam., 14–20-flowered; pedicels slender, filiform, almost equal, 3–6 mm long in flower, 8–10 mm long in fruit, pruinose. Perigon shortly campanulate; tepals

Fig. 1. Allium dumanii – A: habit; B: inflorescence. – Turkey, B6 Malatya, Akçadağ, Kürecik, Harunuşağı Köyü, Kavurma Yaylası altı, 2200 m, 2 Aug 2008, photographed by Y. Yeşil (ISTE 87025).
Fig. 2. Flower details of *Allium dumanii* (A) and *A. armenum* (B) – a: tepals and filaments; b: ovary; c: capsule; d: capsule valve; e: seed; f: spathe valves; g: anther. – Drawn by M. Koçyiğit: A from Y. Yeşil (ISTE 87025); B from M. Koçyiğit 108 (ISTE 87033).

Fig. 3. Distribution of *Allium dumanii* (★) and *A. armenum* (*) in Turkey.
purple-mauve, elliptic, equal, 2.5–3 × 0.8–1 mm, apex obtuse. **Stamens** exserted; **filaments** white, subulate, 3–3.5 mm long, c. 1.25 × perigon, coniate with tepals at base in an annulus 0.4–0.5 mm high; **anthers** purple, ovate, 0.7–0.8 × 0.3–0.4 mm, apex rounded. **Ovary** ovoid-globose, shortly stipitate, 0.9–1 × 0.5–0.6 mm; **style** white, 3–3.2 mm long, c. 1.25 × stamens, c. 2 × perigon; **stigma** globose. **Capsule** globose-oblong, 2–2.5 × 1.5–2 mm. **Seeds** black, narrowly obovate, 1.9–2.4 × 0.4–0.6 mm, wrinkled.

**Phenology** — Flowering in August and September.

**Distribution and ecology** — *Allium dumanii* is endemic to Turkey and distributed in the Irano-Turanian phytogeographical region. It grows on rocky slopes at altitudes of 1545–2300 m and is known from Kahramanmaraş (the type locality) and Malatya (Fig. 3).

**Etymology** — The new species is named after Hayri Duman, collector of the new species and Professor of Botany in the Department of Biology, Faculty of Science, Gazi University.

**Karyology** — The members of *Allium sect. Codonoprasum* are generally characterized by a uniform haploid chromosome complement consisting of eight ± median and submedian chromosomes (Özhatay 1984; Tzanoudakis 1986; Koçyiğit & Özhatay 2012). The results of the present study are more or less in agreement with the above statement: the diploid chromosome number was found to be the same (2n = 16) and only small morphological differences were observed on the karyotypes (Table 2). *Allium dumanii* resulted diploid with 2n = 16 chromosomes, showing a karyotype similar to that of *A. armenum*, as follows:

*Allium dumanii*: karyotype formula 2n = 2x = 16 = 14m+2mSAT. Metaphase chromosome length 40.151–27.904 μm; total haploid chromosome length 134.856 μm ±0.92 (Fig. 4).

*Allium armenum*: karyotype formula 2n = 2x = 16 = 14m+2s. Metaphase chromosome length from 35.972–26.272 μm; total haploid chromosome length 118.836 μm ±0.90 (Fig. 4).

**Taxonomic remarks** — *Allium dumanii* clearly belongs to *A. sect. Codonoprasum* because it has simple filaments, absence of conspicuous nectaries on the ovary, and two
opposite spathe valves, which are unequal with at least one shorter than the umbel or at most as long as the umbel. In some morphological features and in karyotype the new species is well differentiated from other similar taxa of this section. On the basis of the morphology of the spathe valves, perigon and ovary A. armenum shows similarities with A. dumanii, but differs in having yellowish to dirty-white inner bulb tunics, glabrous leaves, yellow and glabrous leaf sheaths, shorter scape, and purple-mauve and equal tepals. Also the flowering time of A. dumanii (August-September) is later than that of A. armenum (July-August). Despite both examined species sharing the same diploid chromosome number, A. dumanii differs from A. armenum in having 16 metacentric (m), one of which has a SAT chromosome. The morphological and karyological differences between the new species and A. armenum are summarized in Tables 1 and 2.

### Table 1. Comparison of the morphological characteristics of Allium dumanii and A. armenum.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Allium dumanii</th>
<th>Allium armenum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulb</td>
<td>1–1.5 cm × 0.4–0.8 cm</td>
<td>1–1.2 cm × 0.8–1 cm</td>
</tr>
<tr>
<td>Tunic</td>
<td>outer tunics greyish-brown, without collar; inner tunics yellowish to dirty white</td>
<td>outer tunics greyish black, prolonged into a collar 1.5–2 cm long; inner tunics white</td>
</tr>
<tr>
<td>Leaves</td>
<td>1 or 2(3), 5–8 cm × 1–1.5 mm, longer than scape, glabrous</td>
<td>2 or 3(4), 6–10 cm × 0.8–1 mm, longer than or sometimes equaling scape, scabrid</td>
</tr>
<tr>
<td>Leaf sheaths</td>
<td>yellow, glabrous</td>
<td>greenish purple, pruinose</td>
</tr>
<tr>
<td>Scape</td>
<td>curved in upper part, 3–5 cm × 0.8–1 mm, not pruinose, covered for ½–⅔ its length by leaf sheaths</td>
<td>curved, (6–)8–25 cm × 0.8–1(1–1.5) mm, pruinose, covered for ⅓ its length by leaf sheaths</td>
</tr>
<tr>
<td>Spathalaria</td>
<td>longer valve 6–10 mm long; shorter valve 5–8 mm long</td>
<td>longer valve 10–20 mm long; shorter valve 5–15 mm long</td>
</tr>
<tr>
<td>Inflorescence</td>
<td>globose, 1–1.5 cm in diam., 14–20-flowered</td>
<td>almost globose, 2–3 cm in diam., 5–20-flowered</td>
</tr>
<tr>
<td>Pedicels</td>
<td>almost equal, 3–6 mm long in flower</td>
<td>equal, 10–20 mm long in flower</td>
</tr>
<tr>
<td>Perigon</td>
<td>shortly campanulate; tepals purple-mauve, equal, 2.5–3 × 0.8–1 mm</td>
<td>campanulate; tepals pinkish purple, unequal; inner ones 4–4.5 × 0.8–1 mm, outer ones 4–4.5 × 1.7–2 mm</td>
</tr>
<tr>
<td>Stamens</td>
<td>filaments 3–3.5 mm long, coniate with tepals at base in an annulus 0.4–0.5 mm high; anthers purple, 0.7–0.8 × 0.3–0.4 mm, apex rounded</td>
<td>filaments 4–4.5 mm long, coniate with tepals at base in an annulus 0.8–1 mm high; anthers yellow when young, purple when mature, 0.9–1 × 0.4–0.6 mm, apex obtuse</td>
</tr>
<tr>
<td>Ovary and style</td>
<td>ovary ovoid-globose, 0.9–1 × 0.5–0.6 mm; style 3–3.2 mm long</td>
<td>ovary almost globose, 2.4–2.6 × 2–2.5 mm; style 4–4.5 mm long</td>
</tr>
<tr>
<td>Capsule</td>
<td>globose-oblong, 2–2.5 × 1.5–2 mm</td>
<td>almost globose, 3.8–4.5 × 3.5–4 mm</td>
</tr>
<tr>
<td>Seeds</td>
<td>narrowly obovate, 1.9–2.4 × 0.4–0.6 mm</td>
<td>oblong, 1.7–2 × 0.7–0.9 mm</td>
</tr>
</tbody>
</table>

### Table 2. Measurements of somatic chromosomes of Allium dumanii and A. armenum.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Allium dumanii</th>
<th>Allium armenum</th>
</tr>
</thead>
<tbody>
<tr>
<td>A₁</td>
<td>0.186</td>
<td>0.308</td>
</tr>
<tr>
<td>A₂</td>
<td>0.123</td>
<td>0.108</td>
</tr>
<tr>
<td>CV CLI</td>
<td>5.393</td>
<td>8.725</td>
</tr>
<tr>
<td>CV CL</td>
<td>12.272</td>
<td>10.849</td>
</tr>
<tr>
<td>A1</td>
<td>0.662</td>
<td>0.947</td>
</tr>
<tr>
<td>Ratio of LC/SC</td>
<td>1.439</td>
<td>1.421</td>
</tr>
<tr>
<td>Short arm length [μm]</td>
<td>7.51±0.83</td>
<td>6.02±0.95</td>
</tr>
<tr>
<td>Long arm length [μm]</td>
<td>9.35±1.37</td>
<td>8.84±0.90</td>
</tr>
<tr>
<td>CI</td>
<td>0.45 (±0.02)</td>
<td>0.40 (±0.04)</td>
</tr>
</tbody>
</table>

A₁ = intrachromosomal asymmetry index; A₂ = interchromosomal asymmetry index; CV CLI = coefficient of variation of centromeric index; CV CL = coefficient of variation of chromosome lengths; AI = karyotype asymmetry index; SC = shortest chromosome length; CI = mean centromeric index; ± = standard deviation (for definitions see Paszko 2006).

58027); Erzurum’dan Tortum’a 25 km, 1950 m, 14 Jul 1982, N. & E. Özhatay (ISTE 49501); Yeşıldere köyü yol ayrıncı 500 m sonra, 1940 m, 5 Jul 2007, M. Koçyiğit 225 (ISTE 87587); Erzurum-Tortum arası, 1500 m, 17 Jul 1990, M. Koyuncu (AEF 15404); İkizdere-İspir arası, Erzurum’a 120 km kala, 2200 m, 7 Aug 1983, N. & E. Özhatay & G. Sarıyar (ISTE 52093); İspir-Erzurum yolu, Gökyurt geçidi, 2285 m, 27 Jul 1987, M. Koyuncu & al. (AEF 17882); İspir, Çapa köyü 150 m, 27 Jul 1991, M. Koyuncu & al. (AEF 17881); Erzurum-Pasinler yolu, 5–10 km’ler arası, 2200 m, 18 Jul 1990, M. Koyuncu (AEF 15636); Erzurum-İspir arası, Ağaoğlu köyünün batısı, 1800 m, 4 Jul 2007, M. Koçyiğit 227 (ISTE 87589); Tortum’un 7 km üstüleri, 2000 m, Ehrendorfer & Fischer 787-119-3 (K). — B8 Erzurum: Ömertepe köyü, Ilıca N. & E. Özhatay 1700 47334 N. Koyuncu arasından 500 m sonra, 1120 m, 8 Jun 1979, F. Özgökçe 5866; Van: Özalp, Yukarı Tulgalı Köyü, 2170 m, 10 Jun 1997, G. Koçyiğit & al. (AEF 15511); Palandöken Da., 2350 m, 1 Aug 1983, N. & E. Özhatay & G. Sarıyar (ISTE 51960); Erzurum-Aşkale arası, 20 km, 1800 m, 18 Jul 1990, M. Koyuncu (AEF 16567); Palandöken Da., 2350 m, 1 Aug 1983, N. & E. Özhatay & G. Sarıyar (ISTE 51960); Erzurum-Aşkale arası, 20 km, 1800 m, 18 Jul 1990, M. Koyuncu (AEF 16562); Pasinler, Otlukkapı Köyü, 1750–1870 m, 19 Aug 1988, Y. Kaya 9187 (ATA); Palandöken Dağı, Çat’a güneye giderken 20–23 km, 2300–2500 m, Davis 47334 (E). — İdür: Tüzluca, E. Altundag 850 m, 27 Jul 1991, B6 Kahramanmaresa Göksun, Berit dağı etekleri, Karadut-Ericak köyleri arası, 1430 m, 20 Jun 1979, E. Tuzlacı & M. Saraçoğlu (ISTE 42362). — Sivas: Şarkışla-Kale Köyü, Ebru Kalesi, 1450 m, 6 Jul 1979, T. Ekim 4408 (ISTF). — B7 ERZURUM: Ovacık, Munzur Süyu Barajı, 1200 m, 18 Jun 1979, Ş. Yıldırım 2034 (herb. Yıldırım); Egin (Kemaliye), 1890, Sintenis 2798 [as a stamineum Boiss. f. brachyantha Hausskn.] (K). — B8 ERZURUM: Ömertepe köyü, İlca yaktın, 1750 m, 15 Jul 1988, T. Baytop 9594 (ISTE 59414); Erzurum’dan Çat’a güderken 22 km, 2000 m, 13 Jul 1982, N. & E. Özhatay (ISTE 49454); 19 Jul 1990, M. Koyuncu (AEF 16567); Palandöken Da., 2350 m, 1 Aug 1983, N. & E. Özhatay & G. Sarıyar (ISTE 51960); Erzurum-Aşkale arası, 20 km, 1800 m, 18 Jul 1990, M. Koyuncu (AEF 16562); Pasinler, Otlukkapı Köyü, 1750–1870 m, 19 Aug 1988, Y. Kaya 9187 (ATA); Palandöken Dağı, Çat’tan Erzurum’a giderken 20–23 km, 2300–2500 m, Davis 47334 (E). — Bingöl: Bingöl Dağı’nın güney etekleri, 1700–1800 m, Engin 936 (K). — B9 Van: Pirreşit Dağı, Adakı Köyü-Sultan Gölü arasında, 2500 m, 1983, M. Ünal 4229 (ISTF). — B10 İdird: Aralık, Küçük Ağrı eteği, 1200 m, 5 Jul 1984, M. Koyuncu (AEF 15511). — Van: Özalp, Yukarı Tulgalı Köyü, 2170 m, 10 Jun 1997, F. Özgökçe 5866 (VPH). — C8 MARDİN: Gercüş-Midyat arası, Gercüş’ten 1 km, 1120 m, 8 Jun 1979, E. Tuzlacı & M. Saraçoğlu (ISTE 42096); Diyarbakır-Mardin Yolu, Sultankoy, 950 m, 22 May 2008, M. Koçyiğit 108 (ISTE 87033). — C9 SİIR: Herakol Dağı, Mila Mergi Yayaşısı, 1900 m, Frödin 1936 (K).

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