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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 *Liliaceae* (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 H. Duman and was already mentioned by M. Koyuncu in an unpublished report of the project "Endemic *Allium* in Turkey" in 1994 (Koyuncu & Güvenç 1994).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 nectaries on the ovary, they were determined as belonging to *A.* sect. *Codonoprasum*. The new species shows similarities with the Turkish endemic *A. armenum* Boiss. & Kotschy 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 technique (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, Küçükyeşil 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 tunics* greyish brown, papyraceous, without collar; *inner tunics* yellowish to dirty white, membranous; *bulblets* absent. *Leaves* 1 or 2(or 3), semicylindric, fistulose, canaliculate, 5–8 cm × 1–1.5 mm, longer than scape, glabrous. *Leaf sheaths* yellow, glabrous. *Scape* cylindrical, curved in upper part, 3–5(–10) cm × 0.8–1 mm, glabrous, not pruinose, covered for ½–⅔ 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).

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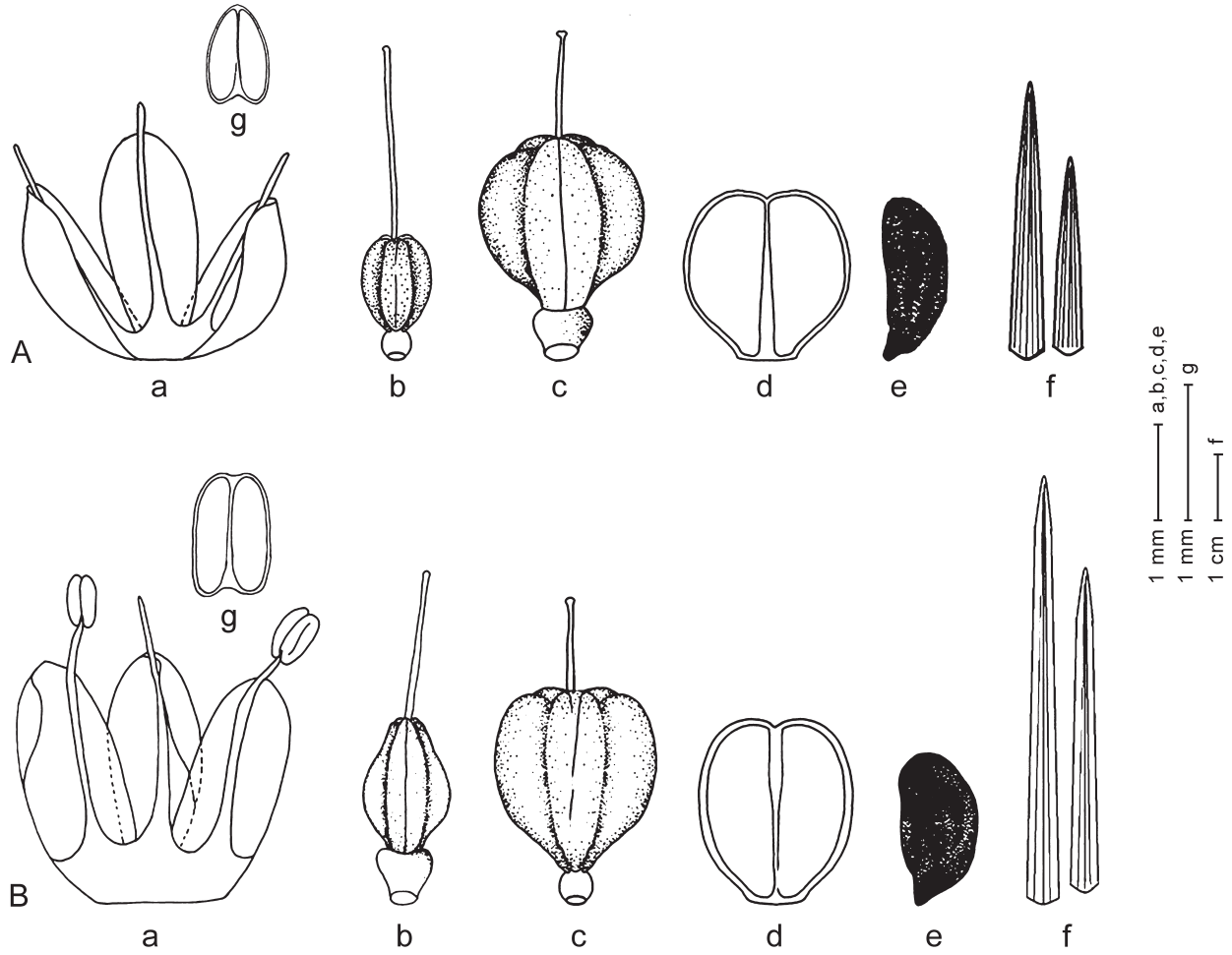


Fig. 2. Flower details of *Allium dumanii* (A) and *A. armenum* (B) – a: tepals and filaments; b: ovary; c: capsule; d: capsule valve; e: seed; f: spathe valves; g: anther. – Drawn by M. Koçyiğit: A from *Y. Yeşil* (ISTE 87025); B from *M. Koçyiğit 108* (ISTE 87033).

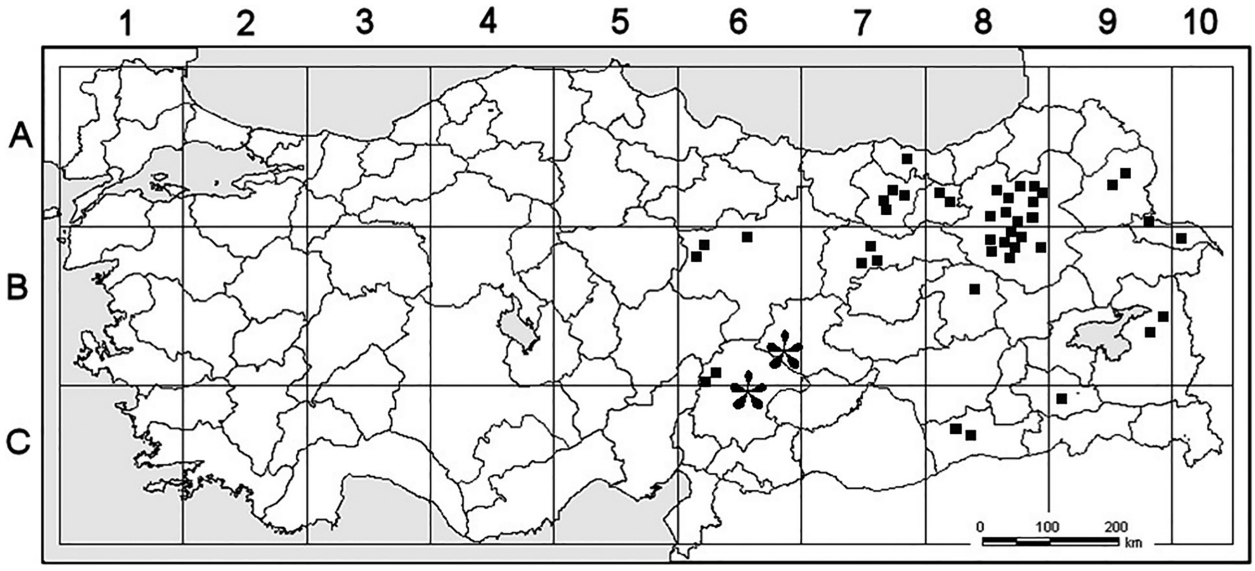


Fig. 3. Distribution of *Allium dumanii* (★) and *A. armenum* (■) in Turkey.

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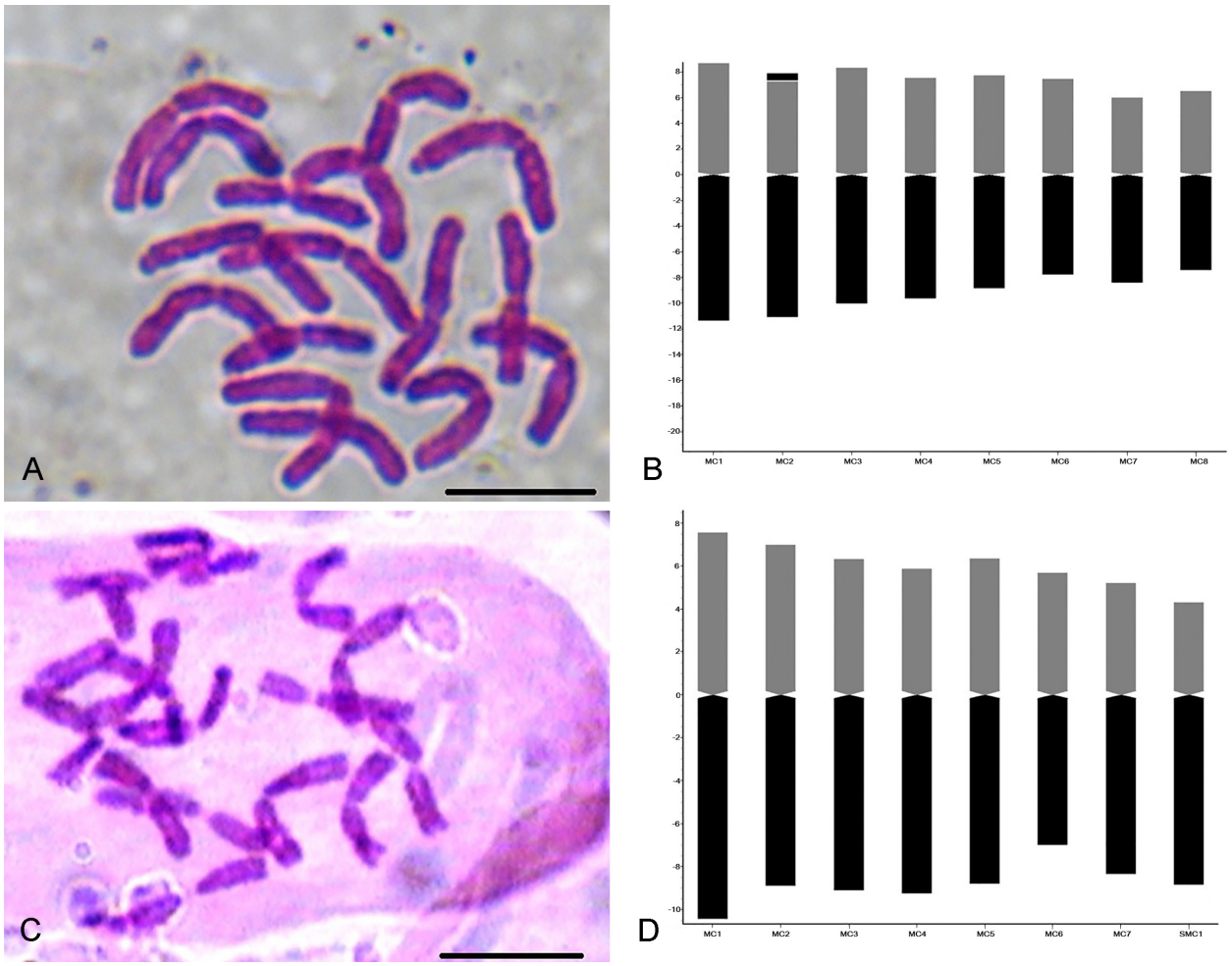


Fig. 4. *Allium dumanii* (A, B) and *A. armenum* (C, D) – A, C: somatic chromosomes; B, D: idiogram. – Scale bar = 10 µm. – A, B from *Y. Yeşil* (ISTE 87025); C, D from *M. Koçyiğit 227* (ISTE 87589).

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, connate 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 $2n = 2x = 16 = 14m+2m^{SAT}$. Metaphase chromosome length 40.151–27.904 µm; total haploid chromosome length 134.856 µm ±0.92 (Fig. 4).

Allium armenum: karyotype formula $2n = 2x = 16 = 14m+2sm$. 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

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

	Allium dumanii	***Allium armenum***
Bulb	1–1.5 × 0.4–0.8 cm	1–1.2 × 0.8–1 cm
Tunics	outer tunics greyish-brown, without collar; inner tunics yellowish to dirty white	outer tunics greyish black, prolonged into a collar 1.5–2 cm long; inner tunics white
Leaves	1 or 2(or 3), 5–8 cm × 1–1.5 mm, longer than scape, glabrous	2 or 3(or 4), 6–10(–15) cm × 0.8–1 mm, longer than or sometimes equalling scape, scabrid
Leaf sheaths	yellow, glabrous	greenish purple, pruinose
Scape	curved in upper part, 3–5(–10) cm × 0.8–1 mm, not pruinose, covered for ½–⅔ its length by leaf sheaths	curved, (6–)8–25 cm × 0.8–1(–1.5) mm, pruinose, covered for c. ⅓ its length by leaf sheaths
Spathe valves	longer valve 6–10 mm long; shorter valve 5–8 mm long	longer valve 10–20 mm long; shorter valve 5–15 mm long
Inflorescence	globose, 1–1.5 cm in diam., 14–20-flowered	almost globose, 2–3 cm in diam., 5–20-flowered
Pedicels	almost equal, 3–6 mm long in flower	equal, 10–20 mm long in flower
Perigon	shortly campanulate; tepals purple-mauve, equal, 2.5–3 × 0.8–1 mm	campanulate; tepals pinkish purple, unequal; inner ones 4–4.5 × 0.8–1 mm, outer ones 4–4.5 × 1.7–2 mm
Stamens	filaments 3–3.5 mm long, connate 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	filaments 4–4.5 mm long, connate 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
Ovary and style	ovary ovoid-globose, 0.9–1 × 0.5–0.6 mm; style 3–3.2 mm long	ovary almost globose, 2.4–2.6 × 2–2.5 mm; style 4–4.5 mm long
Capsule	globose-oblong, 2–2.5 × 1.5–2 mm	almost globose, 3.8–4.5 × 3.5–4 mm
Seeds	narrowly obovate, 1.9–2.4 × 0.4–0.6 mm	oblong, 1.7–2 × 0.7–0.9 mm

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

	A_1	**A_2**	**CV_{CI}**	**CV_{CL}**	**AI**	**Range of SC–LC** [µm]	**Ratio of LC/SC**	**Short arm length** [µm]	**Long arm length** [µm]	**CI**
A. dumanii	0.186	0.123	5.393	12.272	0.662	13.95–20.08	1.439	7.51 (± 0.83)	9.35 (± 1.37)	0.45 (± 0.02)
A. armenum	0.308	0.108	8.725	10.849	0.947	12.66–17.99	1.421	6.02 (± 0.95)	8.84 (± 0.90)	0.40 (± 0.04)

A_1 = intrachromosomal asymmetry index; A_2 = interchromosomal asymmetry index; CV_{CI} = coefficient of variation of centromeric index; CV_{CL} = coefficient of variation of chromosome lengths; AI = karyotype asymmetry index; SC = shortest chromosome length; LC = longest chromosome length; CI = mean centromeric index; ± = standard deviation (for definitions see Paszko 2006).

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. dumanii* shows similarities with *A. armenum*, 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.

Additional specimens examined — ***Allium dumanii*:** Turkey: B6 Malatya: Akçadağ, Kürecik, Harunuşağı Köyü, Kavurma Yaylası altı, 2200 m, 2 Aug 2008, *Y. Yeşil* (ISTE 87025); ibid., 2 Sep 2010, *Y. Yeşil* (ISTE). — ***Allium armenum*:** Turkey: A7 Gümüşhane: 1200 m, 23 Jul 1981, *T. Gözler & M. A.* Önür (ISTE 55216); 1370 m, *Balls 1714* (E); Aşkale-Bayburt arası, Kop geçidi, 2430 m, 7 Aug 1983, *N. & E.* Özhatay *& G. Sarıyar* (ISTE 52104). — Trabzon: Stavri, 1280 m, *Balls 5081* (E). — A8 Erzurum: Yiğitpınar köyü, 8 Jul 1987, *A & T. Baytop* (ISTE

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58027); Erzurum'dan Tortum'a 25 km, 1950 m, 14 Jul 1982, *N. & E.* Özhatay (ISTE 49501); Yeşildere köyü yol ayrımından 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 altı, 1850 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-Ilıca arası, Ağaören köyünün batısı, 1800 m, 4 Jul 2007, *M. Koçyiğit 227* (ISTE 87589); Tortum'un 7 km üstleri, 1900 m, *Ehrendorfer & Fischer 787-119-3* (K). — Bayburt: Çoruh vadisi, Çakırbağ-Darıca arası, 1550 m, 26 Jul 1991, *M. Koyuncu & al.* (AEF 17866); Darıca köyü, 1750–1850 m, 27 Jul 1991, *M. Koyuncu & al.* (AEF 17880). — A9 Kars: Susuz-Ardahan yolu, Susuz'u geçince, 1600 m, 15 Jul 1986, *M. Koyuncu* (AEF 18559); Kuyucuk, 1800 m, 29 Aug 2007, *N.* Özhatay *206* (ISTE 87706). — Iğdır: Tuzluca, *E. Altundağ* (ISTE 85600). — B6 Kahramanmaraş: Göksun, Berit dağı etekleri, Karadut-Ericak köyleri arası, 1430 m, 20 Jun 1979, *E. Tuzlacı & M. Saraçoğlu* (ISTE 42362). — Sivas: Şarkışla-Kale Köyü, Ebruz Kalesi, 1450 m, 6 Jul 1979, *T. Ekim 4408* (ISTF). — B7 Erzincan: Ovacık, Munzur Suyu Barajı, 1200 m, 18 Jun 1979, Ş. *Yıldırımlı 2034* (herb. Yıldırımlı); Eğin (Kemaliye), 1890, *Sintenis 2978* [as *A. stamineum* Boiss. f. *brachyantha* Hausskn.] (K). — B8 Erzurum: Ömertepe köyü, Ilıca yakını, 1750 m, 15 Jul 1988, *T. Baytop* (ISTE 59414); Erzurum'da Çat'a giderken 22 km, 2000 m, 13 Jul 1982, *N. & E. Özhatay* (ISTE 49454); 19 Jul 1990, *M. Koyuncu* (AEF 15667); 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 15622); Pasinler, Otlukkapı Köyü, 1750–1870 m, 19 Aug 1988, *Y. Kaya 9187* (ATA); Palandöken Dağı, Çat'tan Erzurum'a giderken 20–23 km, 2300–2350 m, *Davis 47334* (E). — Bingöl: Bingöl Dağı'nın güney etekleri, 1700–1800 m, *Engin 936* (K). — B9 Van: Pirreşit Dağı, Adaklı Köyü-Sultan Gölü arasında, 2500 m, 28 Jun 1998, *M. Ünal 4229* (ISTF). — B10 Iğdır: 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 Mardin: Gercüş-Midyat arası, Gercüş'ten 1 km, 1120 m, 8 Jun 1979, *E. Tuzlacı & M. Saraçoğlu* (ISTE 42096); Diyarbakır-Mardin Yolu, Sultanköy, 950 m, 22 May 2008, *M. Koçyiğit 108* (ISTE 87033). — C9 Siirt: Herakol Dağı, Mila Mergi Yaylası, 1900 m, *Frödin 1936* (K).

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