

## *Arenaria microcalyx* (Caryophyllaceae), a new species from Turkey

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**Abstract:** *Arenaria microcalyx* M.Koç & Hamzaoğlu (Caryophyllaceae) is described as a new species of subgen. *Arenaria* L. in Turkey. The specimens were collected from Kaş (Antalya). The new species is related to *Arenaria leptoclados* (Rchb.) Guss. and is an endemic species that has a distribution in the Mediterranean region. The differences between the species are discussed. Description, distribution, illustration, and conservation status of the new species are given. Seeds structures were examined by scanning electron microscopy.

**Key words:** Alsinoideae, *Arenaria*, taxonomy, Anatolia

### 1. Introduction

The family Caryophyllaceae has approximately 80 genera and 2100 species, a great portion of which are found in the northern temperate regions, while the remainder are found in the southern temperate regions. The main distribution area of the family is the Mediterranean region (Lawrence, 1951). The family Caryophyllaceae is divided into 3 subfamilies, including Alsinoideae Burnett, Caryophylloideae Arn., and Paronychioideae A.St. The subfamily Alsinoideae has 5 tribes, while tribe Alsineae has 23 genera, including *Arenaria* L. (Bittrich, 1993). In their study in 2010, Harbaugh et al. proposed the division of Caryophyllaceae into 11 tribes on the basis of the monophyletic groups and published a new tribe called Eremogoneae Rabeler & W.L.Wagner (Harbaugh et al., 2010).

Based on *Flora of Turkey and the East Aegean Islands*, the genus *Arenaria* has 2 subgenera and 49 species (McNeill, 1967; Davis et al., 1988; Tan and Vural, 2000). Due to recent studies, 2 species were added (Aytaç & Duman, 2004). However, 17 of these species were transferred to the genus *Eremogone* Fenzl (Dinç, 2012). As a result, the total number is now 34. Seed characteristics of the genus *Arenaria* have great contributions in taxonomic studies (Wofford, 1981). In particular, the different patterns formed by folds on the seed surface can be used to distinguish one taxon from another (Koç et al., 2011, 2012; Koç & Aksoy, 2013; Khalik, 2013).

While analyzing the samples of Caryophyllaceae found in the ISTE herbarium, the authors recognized that the *Arenaria* species collected in Kaş (Antalya) was interesting.

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The specimens were compared with related species in the herbaria of ANK, GAZI, and Bozok University and with records in the literature (Rechinger, 1964, 1988; Zohary, 1966; McNeill, 1967; Chater & Halliday, 1976; Davis et al., 1988; Shishkin, 1995; Tan & Vural, 2000; Abuhadra, 2000; Bojňanský & Fargašová, 2007). The studies showed that these specimens were representatives of a species new to science.

### 2. Materials and methods

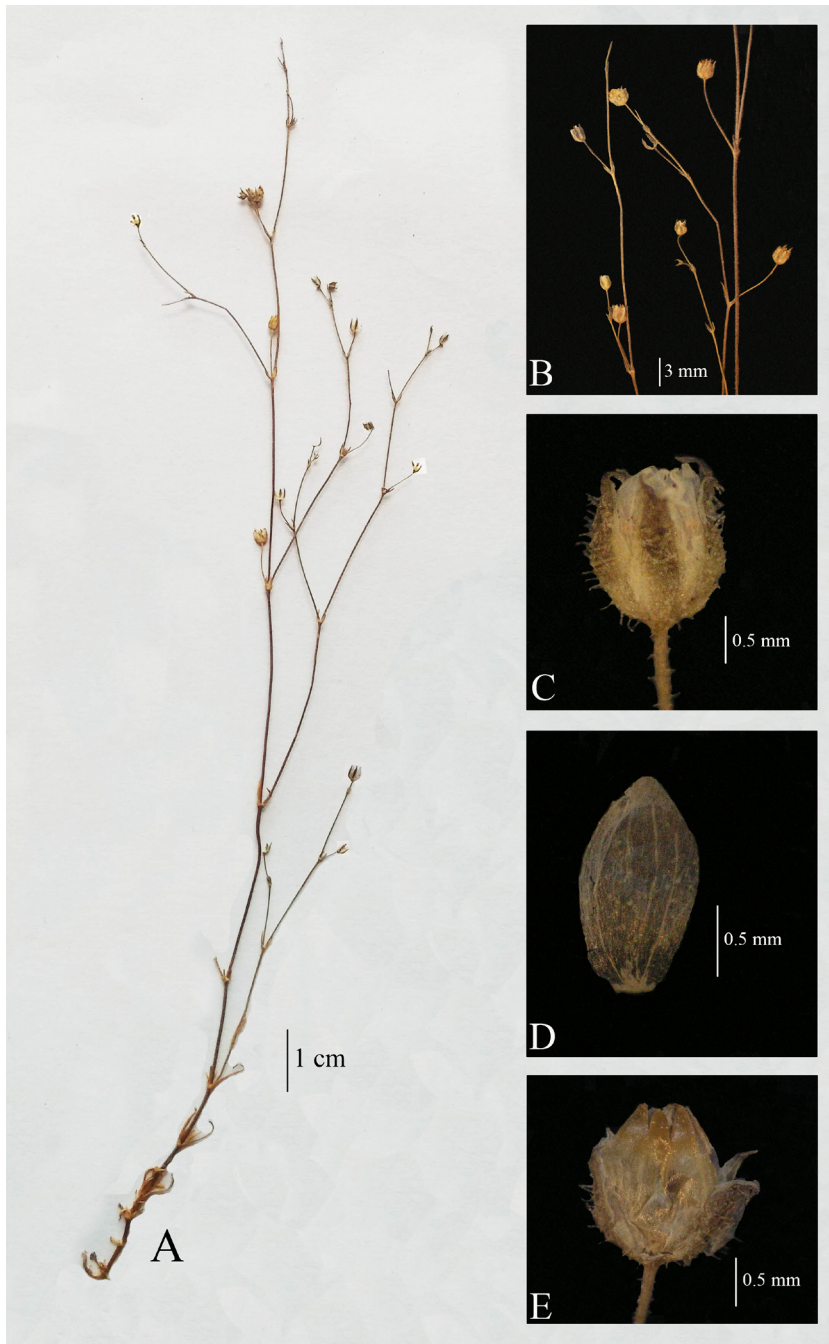
This study is based on the literature, field observations of living plants, and herbarium specimens in the ISTE and Bozok University herbaria. The materials were examined using an Olympus SZ61 microscope. Mature seeds were collected from capsules of the holotype. Thirty randomly chosen seeds were measured using light microscopy. Seeds were examined and photographed with a LEO 440 scanning electron microscope (SEM). Measurements of vegetative characters were made with a ruler accurate to 1 mm and floral characters were measured with an ocular micrometer.

### 3. Results

*Arenaria microcalyx* M.Koç & Hamzaoğlu sp. nov. (Figures 1–3)

**Subgen:** *Arenaria*

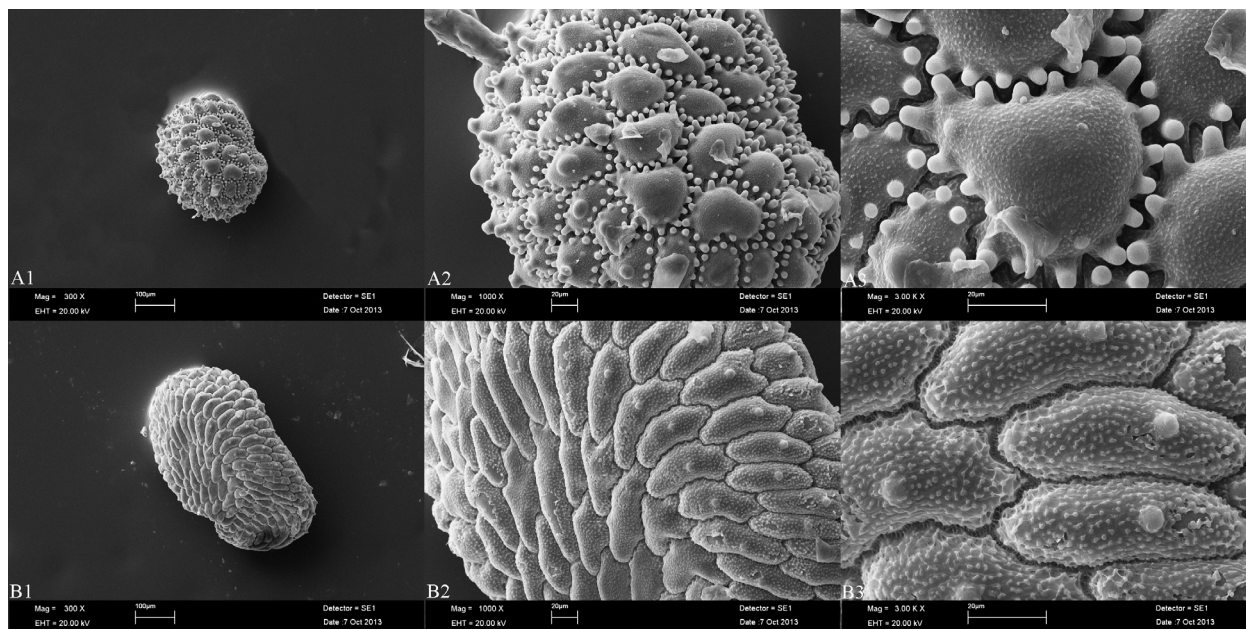
**Type:** Turkey C2 Antalya: Between Kaş and Finike, 32nd km, rocky, open field, under *Quercus* sp. and *Arbutus* sp., 620 m, 30.5.1988, N. & E.Özhatay s.n. (holotype: ISTE-58673, isotypes: Bozok Univ. Herb., ANK, GAZI).



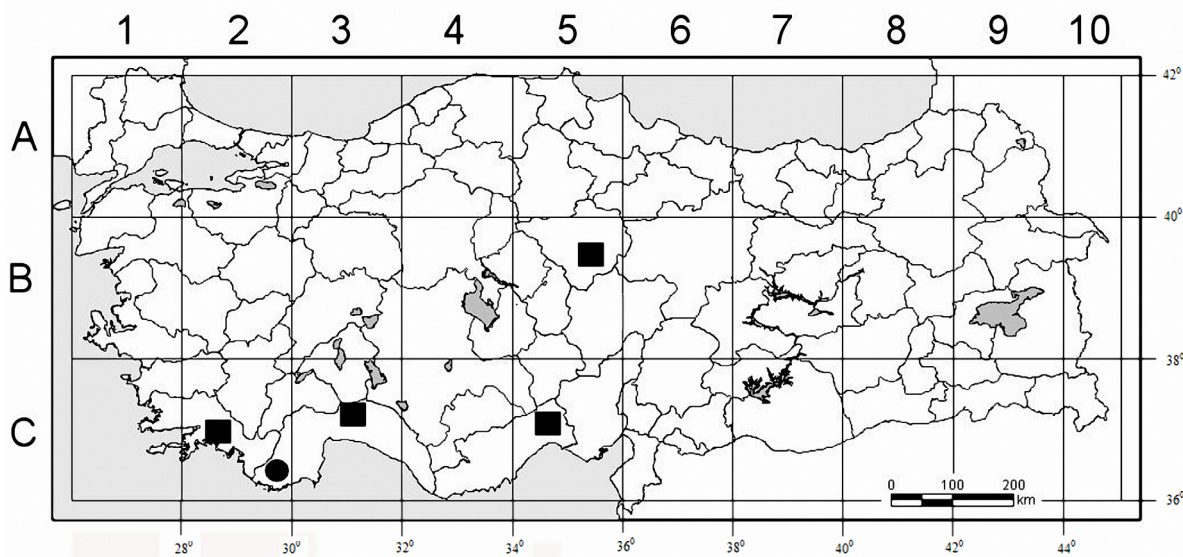
**Figure 1.** *Arenaria microcalyx*. A- habit, B- inflorescence, C- calyx, D- petal, E- capsule.

**Diagnosis:** *Arenaria microcalyx* is related to *Arenaria leptoclados* (Rchb.) Guss. It mainly differs from *Arenaria leptoclados* because it has monomorphic leaves, linear-lanceolate (not dimorphic leaves, basal spatulate, cauline ovate-triangular), sepals length 1.5-2.5 mm (not 2.5-3 mm), petals shape elliptic (not ovate), capsule shape subglobose (not conical), and seed surface cell margins ribbed fingerless (not cell margins not ribbed fingerless).

**Description:** Annual herb, whole plant glandular hairy. Stems erect or ascending, 8.5-13 cm long and 0.5-0.7 mm in diameter, fragile, single or branched from base. Leaves monomorphic, linear-lanceolate, 5-12 × 0.6-0.9 mm, smooth, 3-nerved, greenish; apex acute to acuminate; leaf sheath membranous, 0.1-0.2 mm. Bracts broadly subglobose (not conical), and seed surface cell margins ribbed fingerless (not cell margins not ribbed fingerless). Pedicels 2-10 mm, erect, dense, very



**Figure 2.** SEM photographs of the seed coat. A1–A3- *Arenaria microcalyx*; B1–B3- *A. leptoclados*. Scale bars: A1 and B1, 100  $\mu$ m; A2, A3, B2, and B3, 20  $\mu$ m.



**Figure 3.** Distribution of *Arenaria microcalyx* (●) and *A. leptoclados* (■) in Turkey.

thin. Inflorescence very lax clusters; flowers pedicellate, per cyme 1-10-flowered. Sepals broadly lanceolate, 1.5-2.5  $\times$  1-1.6 mm, 3-nerved; apex acute to acuminate; margin membranous and glabrous, membranous margin 0.1-0.2 mm wide, carinate. Petals elliptic, 1.4-2.5  $\times$  1.2-2 mm,  $\pm$  as long as sepals, white; apex widely acute; cuneate at the base; persistent at maturity. Stamens 10; filaments 1-2 mm, not

exceeding corolla. Styles 0.8-1.2 mm. Capsule subglobose, 1.4-2.5  $\times$  1.2-2 mm, 6-9-seeded, as long as sepals.

**Seed micromorphology:** Seeds reniform; 0.4-0.7  $\times$  0.2-0.5 mm; blackish; lateral and dorsal surfaces papillate; cells irregular, margins ribbed fingerless; anticlinal cell walls uncertain V-undulate; periclinal cell walls convex, wrinkled.

**Table.** Diagnostic characters of *Arenaria microcalyx* and *Arenaria leptoclados*.

Characters	<i>Arenaria microcalyx</i>	<i>Arenaria leptoclados</i>
Basal leaves	linear-lanceolate	spathulate
Cauline leaves	linear-lanceolate	ovate-triangular
Petal shape	elliptic	ovate
Sepal length	1.5-2.5 mm	2.5-3 mm
Capsule shape	subglobose	conical
Seed surface	cell margins ribbed fingerless	cell margins not ribbed fingerless

**Specimens examined.** - *Arenaria leptoclados*: B5 Yozgat: Çekerek, between Çakırlar and Çakırköy, 1000 m, 23.4.2013, M.Koç 849 & Hamzaoğlu (Bozok Univ. Herb.); C2 Muğla: Köyceğiz, Yangı village, 70 m, 2.4.1991, A.Güner 8949 et al. (GAZI); C3 Antalya: Akseki, Taşlıca village, Tuzaklı mountain, 800–850 m, 4.5.1996, A.Duran 3547 (GAZI); C5 Mersin: between Tekir and Gülek, 1360 m, 25.5.2010, M.Koç 979 & Hamzaoğlu (Bozok Univ. Herb.).

**Conservation status:** *Arenaria microcalyx* is an endemic species known only from the type gathered in the Mediterranean region (Kaş, Antalya). This species must be classified as “Critically Endangered” (CR-B1a) according to the World Conservation Union categories (IUCN, 2011).

**Ecology:** *Arenaria microcalyx* is found in limestone areas at an altitude of 620 m, under *Quercus* sp. and *Arbutus* sp. The species' bloom period is in June.

#### 4. Discussion

*Arenaria microcalyx* is included in subgen. *Arenaria* as its leaves are linear-lanceolate, sepals are fully herbaceous, and seeds are reniform. This species is similar to *Arenaria leptoclados* in terms of hairs, pedicel length, sepal shape, petal/sepal rate, and seed size. However, the differences

in leaf shapes, sepal lengths, petal shapes, capsule shapes, and seed surfaces indicate differentiation from the above-mentioned taxon. Furthermore, *Arenaria microcalyx* is different from other annual *Arenaria* taxa in Turkey in terms of sepal length and seed tubercle cell margins ribbed fingerless (Table).

**Key to *Arenaria microcalyx* and its related species in Turkey**

1. Leaves monomorphic, linear-lanceolate; sepals 1.5-2.5 mm long; petals  $\pm$  as long as sepals ..... **A. microcalyx**

1. Leaves dimorphic, basal spathulate, cauline ovate-triangular; sepals 2.5-4 mm long; petals less than 3/4 as long as sepals

2. Sepals 3-4 mm long, ovate-lanceolate; capsule flask-shaped with a rather hard and brittle wall; seeds 0.55-0.7  $\times$  (0.5-)0.55-0.65 mm ..... **A. serpyllifolia**

2. Sepals 2.5-3 mm long, lanceolate; capsule conical with a thin and flexible wall; seeds 0.4-0.55  $\times$  0.35-0.5 mm ..  
..... **A. leptoclados**

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