

Salicornia freitagii (Chenopodiaceae), a new species from Turkey

Ahmet Emre Yaprak* & Ender Yurdakulol

Ankara University, Faculty of Science, Department of Biology, 06100 Tandogan Ankara, Turkey
(*corresponding author's e-mail: eyaprak@science.ankara.edu.tr)

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Salicornia freitagii Yaprak & Yurdakulol *sp. nova* (Chenopodiaceae) is described as a new species from Central Anatolia, Turkey. It is characterised by having a fastigiate habit, an acuminate leaf apex and short terminal spikes. It is considered to belong to section *Dolichostachyae*. Contrary to other members of the section, it is distributed in inland salt lake shores at relatively high altitudes.

Key words: Chenopodiaceae, halophyte, new species, *Salicornia*, taxonomy

Salicornia (Chenopodiaceae) is a genus of annual, apparently leafless, hygrophilous herbs that have articulated, succulent stems. Combination of inbreeding — which allows the development of locally differentiated populations, considerable phenotypic plasticity, a much simplified morphology with reduced leaves and simple, often cleistogamous flowers — with the inadequacy of herbarium material in representing the succulent growth form has resulted in great taxonomic difficulties in the genus (Ball 1964, Davy *et al.* 2001).

In Europe and North America, several detailed taxonomical studies have been carried out on *Salicornia* (Ball & Tutin 1959, König 1960, Ball 1964, Castroviejo & Coello 1980, Wolff & Jefferies 1987a, 1987b, Piirainen 1991, Géhu, 1992, Ball & Akeroyd 1993, Iberite 1996, Martines & Herrera 1996, Davy *et al.* 2001, Ball 2003, Lahondère 2004). A few local taxonomical studies exist on the Asian and Middle Eastern taxa (Freitag *et al.* 2001, Akhani 2003).

Little is known about *Salicornia* in Turkey. The specimens cited in *Flora of Turkey* (Ball 1967) were identified and compared with dried European specimens of known identity, but it was not possible to be absolutely certain that the determination is correct (Ball 1967). In *Flora of Turkey*, *S. europaea*, *S. prostrata*, and *S. fragilis* are species that have been cited without certainty and it is noted that some specimens given under the name *S. fragilis* could actually be *S. dolichostachya* (Ball 1967). Géhu and Uslu (1989) reported a *Suaedo-Salicornietum patulae* (Bruno & Furnari 1976) plant association from Turkey and cited *Salicornia patula* as the characteristic species for the association. However, they did not provide a description of the species nor mention that it was a new record for Turkey. For these reasons, information about *Salicornia* in Turkey is poor.

During our study on Turkish *Salicornia* we confirmed the presence of *S. dolichostachya*, *S. perennans* (syn. *S. prostrata*) and *S. patula* and

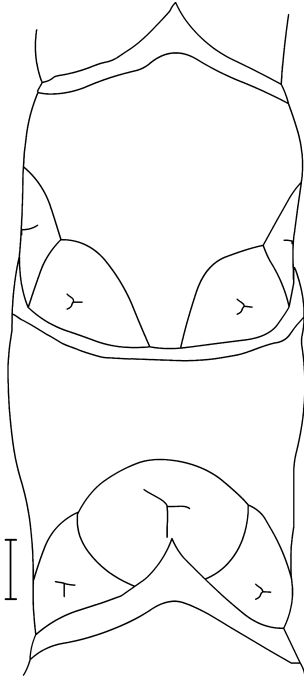


Fig. 1. Fertile segment shape of *Salicornia freitagii* (from the holotype). Scale bar = 0.5 mm.

recorded *S. emerici* as new for Turkey (A. E. Yaprak unpubl. data).

The first global molecular study on *Salicornia* was done recently by Kadereit *et al.* (2007). In the phylogenetic analysis based on External Transcribed Spacer (ETS) sequences, *S. freitagii* grouped together with almost all known Eurasian tetraploids (*S. dolichostachya*, *S. emerici*, *S. fragilis*, *S. pojarkovae*, *S. procumbens* and *S. veneta*) and a few species of unknown ploidy levels (*S. borysthenica*, *S. heterantha*). These species form a well-supported, monophyletic group with very little variation among the 30 accessions included (Kadereit *et al.* 2007). An ongoing AFLP analysis of this clade may result in better phylogenetic resolution for *S. freitagii* and the other members of the clade (S. S. Beer unpubl. data).

The specimens described here as a new species were discovered during field studies on Turkish Salicornioideae in Central Anatolia. Due to inadequacy of herbarium material in representing the succulent growth forms, the study was based on both 70% alcohol-preserved and herbarium material, both collected by the first author. Measurements of floral characters and



Fig. 2. A close-up picture of terminal spike of *Salicornia freitagii* (from the holotype). Scale bar = 1 mm.

drawing of the fertile segment were done from alcohol preserved material. The type specimen consists of an herbarium sheet and an alcohol-preserved terminal spike.

Salicornia freitagii Yaprak & Yurdakulol, *sp. nova* (Figs. 1–5)

Planta annua. Caulis erectus pyramidatus ramosus 20–35 cm altus, viridis vel purpureus. Apex folii acuminatus. Spica terminalis 15–30 mm longa, cum 6–13 articulis. Antherae 0.6–0.7 mm longae. Semina pilosa.

TYPE: Turkey. A5: Corum, Sungurlu, Bahsili village, Edge of small salt lake, 675 m, 29.VIII.2004 A.E. Yaprak 2004-05 (holotype ANK; isotypes GAZI, KAS, MJG).

ETYMOLOGY: The species is named in honour of the eminent German botanist Prof. Dr. Helmut Freitag.

Root type fibrous. Plants erect, 20–35 cm

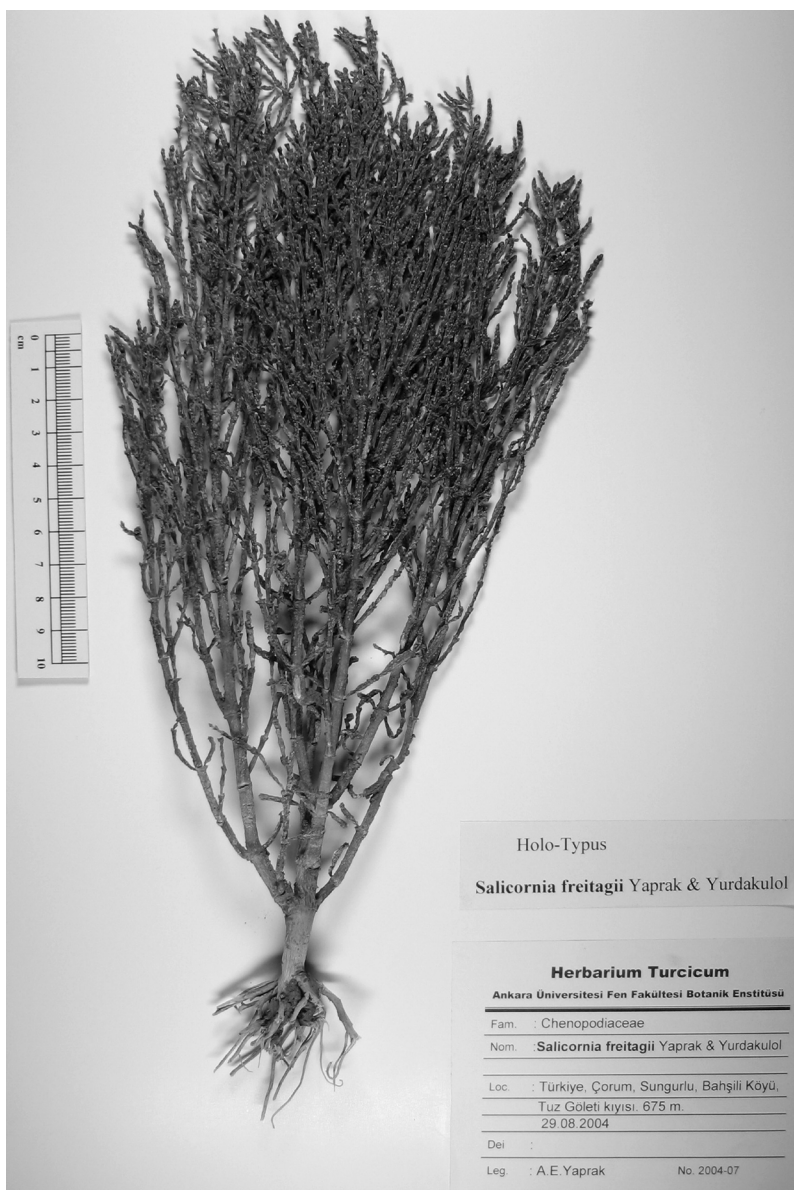


Fig. 3. Holotype of *Salicornia freitagii*.

high, dark green, becoming purple, richly branched, lowest branches about as long as main stem, almost fastigiate. Free part of leaf 0.5–0.75 mm long, acuminate, with a conspicuous scarious border. Terminal spike 15–30 mm long, with 6–13 fertile segments. Lower fertile segments more or less cylindrical, 3–3.5 mm long and 2.5–3.5 mm wide. Stamens 2, Anthers 0.6–0.7 mm long, always exserted. Seeds of central flowers oblong, ca. 1.3 × 0.8 mm, testa brown and covered with hooked hairs; seeds of lateral flowers ovate, ca.

0.9 × 0.5 mm, testa dark brown and covered with hooked hairs. Flowering late August to September, fruiting late September to October.

The species occurs in Central Anatolia at 675–900 m along salty lakeshores (Fig. 5). It usually forms pure stands in the lower marsh and sometimes it occurs with *Halocnemum strobilaceum*, *Halimione verucifera*, *Salsola kali* and *Salicornia* aff. *perennans* in the middle marsh.

Salicornia freitagii can be placed in the section *Dolichostachyae* due to its 3-flowered



Fig. 4. Habit of *Salicornia freitagii* (from the holotype locality).

cymes, not disarticulated inflorescence, central flowers not much exceeding the laterals, and 0.7 mm long anthers. The ETS-based phylogeny of *Salicornia* supports this placement (Kadereit *et al.* 2007). So far we were not able to count the chromosome number of *S. freitagii*, but it is probably a tetraploid species.

All other members of section *Dolichostachyae* occur in coastal habitats. According to Ball and Akeroyd (1993) *S. procumbens* must be identical with either *S. fragilis* or *S. dolichostachya*, and according to Lahondère (2004) *S. nitens* and *S. veneta* are synonyms of *S. emerici*. *Salicornia borysthenica* is probably a synonym of *S. dolichostachya* (Kadereit *et al.* 2007). *Salicornia heterantha* differs from all known *Salicornia* species in having central flowers fused to the axis (Beer & Demina 2005). Therefore we compared *S. freitagii* with *S. emerici*, *S. fragilis*, *S. pojarkovae* and *S. dolichostachya* (Table 1). Since original descriptions do not comment on leaf apex shape for *S. emerici* and *S. dolichostachya* for this character we used the descriptions and drawings of Ball and Tutin (1959), Iberite (1996), Lahondère (2004) and specimens in the first author's collection. *Salicornia freitagii* can be distinguished from the morphologically similar species by its acuminate leaf apex and by its ecological preferences. An acuminate leaf apex can also be found in *S. bigelovii* which, according to molecular evidence, is not closely related to *S. freitagii* (Kadereit *et al.* 2007).

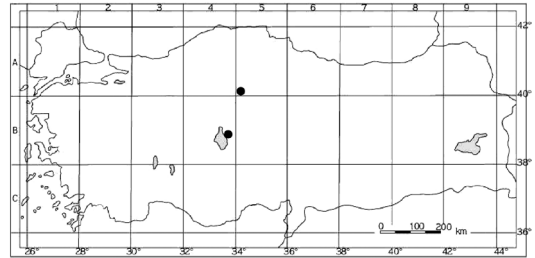


Fig. 5. Distribution map of *Salicornia freitagii*.

Salicornia heterantha differs from all known *Salicornia* species in having central flowers fused to the axis (Beer & Demina 2005). Therefore we compared *S. freitagii* with *S. emerici*, *S. fragilis*, *S. pojarkovae* and *S. dolichostachya* (Table 1). Since original descriptions do not comment on leaf apex shape for *S. emerici* and *S. dolichostachya* for this character we used the descriptions and drawings of Ball and Tutin (1959), Iberite (1996), Lahondère (2004) and specimens in the first author's collection. *Salicornia freitagii* can be distinguished from the morphologically similar species by its acuminate leaf apex and by its ecological preferences. An acuminate leaf apex can also be found in *S. bigelovii* which, according to molecular evidence, is not closely related to *S. freitagii* (Kadereit *et al.* 2007).

ADDITIONAL SPECIMENS EXAMINED. — *Salicornia freitagii* (paratypes). **Turkey.** A5, Corum, Sungurlu, Bahsili village, 675 m, A.E. Yaprak 2001-30 (ANK); B4, Ankara, Sereflikochisar, 900 m, A.E. Yaprak 2006-73 (ANK). — *Salicornia dolichostachya*. **Turkey.** B1: Izmir, Cigli, Camalti Tuzlasi, *s.l.*, 2.XI.2000 A.E. Yaprak 2000-12 (ANK); 18.X.2004 A.E. Yaprak 2004-85 (ANK); C1: Aydin, Soke, Dogan Bey Lagoon, *s.l.*, 17.X.2004 A.E. Yaprak 2004-82 (ANK). — *Salicornia emerici*. **Turkey.** A1: Edirne, Enez, Tuzgol, *s.l.*, 4.IX.2002 A.E. Yaprak 2002-28 (ANK); 20.X.2004 A.E. Yaprak 2004-417 (ANK); Canakkale, Gelibolu, Kavak village, *s.l.*, 4.IX.2002 A.E. Yaprak 2002-42 (ANK); B1: Balikesir, Ayvalik, Ayvalik Tuzlasi *s.l.*, 19.X.2004 A.E. Yaprak

Table 1. Morphological and ecological differences between *Salicornia freitagii* and other members of sect. *Dolichostachyae*.

	Leaf apex	Terminal spike length (cm)	Altitude	Habitat
<i>S. freitagii</i>	acuminate	1.5–3	675–900 m	inland saline
<i>S. emerici</i>	obtuse-subacute	3.5–5	sea level	coastal saline
<i>S. dolichostachya</i>	subobtuse	5–12	sea level	coastal saline
<i>S. pojarkovae</i>	subacute	5–7	sea level	coastal saline
<i>S. fragilis</i>	subobtuse	3–8	sea level	coastal saline

2004-379 (ANK); Izmir: Aliaga, *s.l.*, 19.X.2004 A.E. *Yaprak 2004-367* (ANK); Cigli, Camalti Tuzlasi, *s.l.*, 18.X.2004 A.E. *Yaprak 2004-86* (ANK); C2: Mugla, Koycegiz, Dalyan to Iztuzu, *s.l.*, 15.X.2004 A.E. *Yaprak 2004-70* (ANK); C1: Aydin, Soke, Dogan Bey Lagoon, *s.l.*, 17.X.2004 A.E. *Yaprak 2004-81* (ANK); C5: Adana, Karatas, Akyatan Lagoon, *s.l.* 19.IX.2006 A.E. *Yaprak 2006-64* (ANK).

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