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***Salicornia persica* AKHANI (Chenopodiaceae), a remarkable new species from Central Iran**

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A b s t r a c t : *Salicornia persica* AKHANI sp. nov. (Chenopodiaceae) is described and illustrated from the central inland salt marshes of Iran in Esfahan, Fars, and Yazd provinces. The species is characterized by having ascending habit, verticillate inflorescence branches, and reversed pentagonal central flowers that are truncated at the apex and reach to the upper segments. The species is tetraploid ($2n=36$), produces high biomass and plays a major role in the halophytic vegetation of central and south-central Iran. Its distribution, geographical and economical significance, and status of threat are discussed.

Key words : *Salicornia*, Iran, halophytes, Irano-Turanian region, Chenopodiaceae

Introduction

Salicornia is one of the taxonomically difficult genera of Chenopodiaceae. Although there are several contributions on the European and Mediterranean species (BALL 1964; BALL & TUTIN 1959; PIIRAINEN 1991; RIVAS-MARTÍNEZ & HERRERA 1996; BALL & AKEROYD 1993), there is no modern and critical revision of the Asian species. Three species, *S. perennans* WILLD., *S. acetaria* PALL., and *S. prostrata* PALL., were described from the northern Caspian lowlands (PALLAS 1803, WILLDENOW 1797) and these names were also used for the Asian populations by some authors (BALL 1967). However, most of the standard floras treat these as synonyms of *S. europaea* L. or *S. herbacea* L. (ILJIN 1936; GRUBOV 2000). FREITAG et al. (2001) used the name of *S. perennans* for the populations in the northern Caspian lowlands though they did not see the type specimen (FREITAG in litt.). My search for the type specimen in Willdenow's herbarium (Berlin) was not successful. HEDGE (1997) and BOLOUS (1996) tentatively used the name of *S. europaea* L. in their accounts of Flora Iranica and Flora of the Arabian Peninsula, respectively.

Large populations of *Salicornia* occupy many parts of the inland and littoral salt marshes in central, eastern, and southeastern deserts of Iran. I have been studying such populations since 1987, and those of the northwestern, north-central, and northeastern parts of Iran are somewhat homogenous morphologically, but the central and south-central populations are quite diverse and represents several species that are morphologically, cytologically, and ecologically well distinguishable. The present paper describes one of the most characteristic species in the area.

***Salicornia persica* AKHANI sp. nov.**

TYPE: Central Iran. Esfahan: Varzaneh, Zayandeh Rud river bed, 32°25'32"N, 52°39'5"E, 1493 m, 16 September 2001, H. Akhani & M. Ghobadnejhad 15670 (holotype, IRAN; isotype, Hb. Akhani). (Fig. 2, A-G).

Herba annua, plerumque ascendens, usque ad (60–)100 cm alta, ramis superioribus verticillatis; spica terminalis cum 19–35(–40) articulis; flores fertiles tres gerentibus 4–10 mm longa; flos centralis angulatis 2–2.8 × 1.3–1.8 mm, apice truncatis; flores laterales triangulares, basi 1.2–1.6 mm lati; antherae 0.4–0.6 mm longae; stigmata 0.2–0.3 mm longa; semina elliptica, pilosa, florum centralium 1.7–1.8 × 0.8–1 mm, florum lateralium 1.3–1.6 × 0.8–0.9 mm.

Annual plant, glabrous, dark green in flower, becoming purplish in fruit, up to 60(–100) cm tall, up to 80 cm in canopy diam., with a rootstock up to 2 cm in diam. Stems ascending in open habitats, erect in dense ones; lower and older branches with tubercles of salt-accumulated crystals; lower median internodes of main stem 2–3 cm long. Upper inflorescence branches usually verticillate, with 4–6(–8) spikes or lateral branches in each node; terminal spikes 4–10 cm long, 3–3.5 mm in diam., with 19–35(–40) fertile segments, at base with a sterile segment (0.5–)1.5–2.5 cm long; lower fertile segments 3–5.5 mm long, 3–4 mm in diam., with a scarious edge, 0.3–0.5 mm broad. Central flower in each segment reaches to upper segment, reversed pentagonal to sub-rhombic in outline, elongate, truncate, 2–2.8 × 1.3–1.8 mm; lateral flowers triangular in outline, 1.2–1.6 mm wide at base. Anthers 0.4–0.6 mm long. Stigma 0.2–0.3 mm long. Seeds elliptic, those of the central flowers larger, 1.7–1.8 × 0.8–1 mm, those of the lateral flowers 1.3–1.6 × 0.8–0.9 mm, surface ± smooth, sparsely with retrorse hooked hairs of 0.1–0.15 mm long.

Additional examined material: Iran. Esfahan: 37 km SE Varzaneh, near Siahkuh, northern coasts of Batlaq-e Gavkhooni (Gavkhooni wetland), high saline soils on the wetland delta, 32°17'45"N, 52°53'22"E, 1493 m, 17 September 2001, H. Akhani & M. Ghobadnejhad, 15677 (IRAN, Hb. Akhani). Fars: N Tashk lake, high salty soils near Gomban, 29°48'N, 53°28'E, 1590 m, 20 September 2001, H. Akhani & M. Ghobadnejhad 15719 (IRAN, Hb. Akhani); same area, 28 November 2001, Akhani 15907 (Hb. Akhani). Yazd: Kavire Marvast, near Rahmatabad, 1600 m, 25 November 1987, Assadi & Akhani 61771 (TARI).

Salicornia persica is one of the most common species of *Salicornia* in the central Iranian provinces Esfahan, Fars, and Yazd (Fig. 1, 2, A-D). Because of its habit, earlier investigations on this species (AKHANI & GHORBANLI 1993) suggested that the plant belongs to *S. ramosissima* J. WOODS. However, the latter is a diploid of western European coasts (BALL 1964; DALBY 1962; BALL & AKEROYD 1993; DAVY et al. 2001) with a completely different morphology. The new species has ascending habit and large, reflexed pentagonal central flowers that reach the upper segments of the spike (except the lowermost flowers). Without critical cytological, morphological, and molecular studies of all Eurasian and Mediterranean *Salicornia*, it is not possible to determine with certainty the affinities of *S. persica*.

Pollen morphology and chromosome numbers: Pollen morphology of *Salicornia persica* was studied recently and compared with that of nine other Chenopodiaceae species of the genera *Bienertia*, *Borszczowia*, *Halopeplis* and *Suaeda* (AKHANI et al. 2003). Pollen grains of *S. persica* are spherical, pantoporate, 21.6±0.9 µm in diam., with 66±11 pores and a pore diam. of 3.87±0.3 µm, and exine thickness 1.57±0.1 µm. Karyologically, *S. persica* is a tetraploid with 2n=36.

Photosynthetic pathway: Analyses of $\delta^{13}\text{C}$ of three above cited specimens showed that *S. persica* is a C_3 species with $\delta^{13}\text{C}$ values of -26.38‰ (15677), -27.46‰ (15711) and -26.36‰ (15907). For details on the method and comparison with other genera and species of *Chenopodiaceae* see AKHANI et al. (1997).

Plant geography, threats, and economic importance: The discovery of an isolated *Salicornia* in the central and south-central Iranian saline flats is of great phytogeographical interest. The area belongs to the Irano-Turanian floristic region. The isolated halophyte *Hypericopsis persica* BOISS. (Frankeniaceae), which belongs to a monotypic genus, is known from the same area (CHRTEK 1972). *Salicornia persica* is frequent along several salt marshes, river salt margins, and salty river estuaries in the Provinces Esfahan, Fars and Yazd (Fig. 2, A, C, D). However, populations in these areas are threatened because many important wetlands (e.g., Gavkhooni salt swamp) and rivers (e.g., Zayandeh Rud) are drying out. My field observations around Tashk lake show that the species is grazed by goats (Fig. 2D). The palatability of the species and its production of high biomass under favorable conditions suggest that it is a good candidate for consideration as a halophytic forage crop.

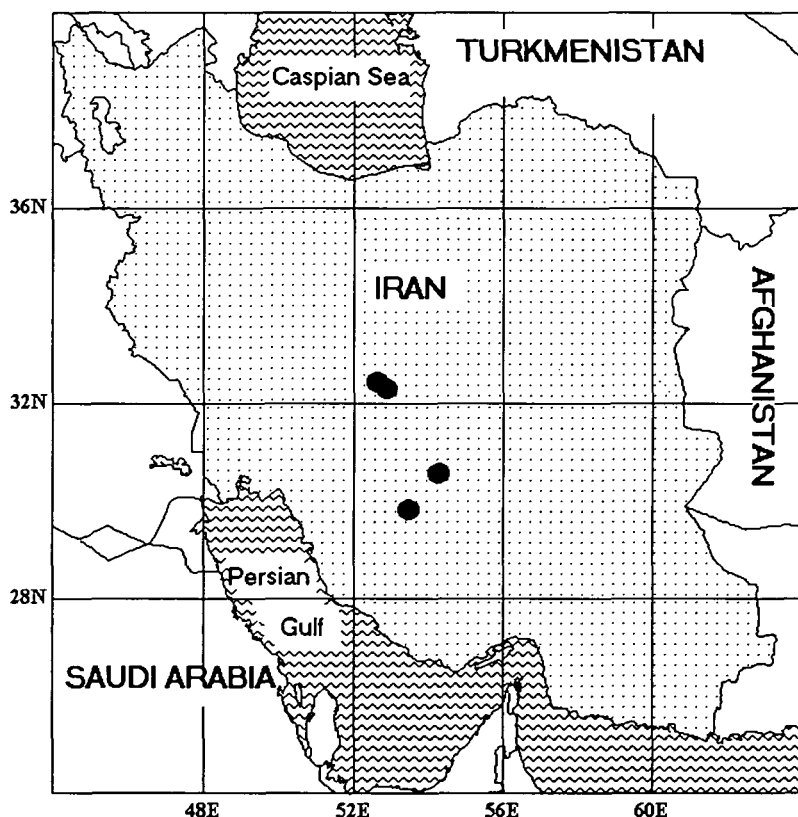


Fig. 1: Distribution map of *Salicornia persica* in Iran.

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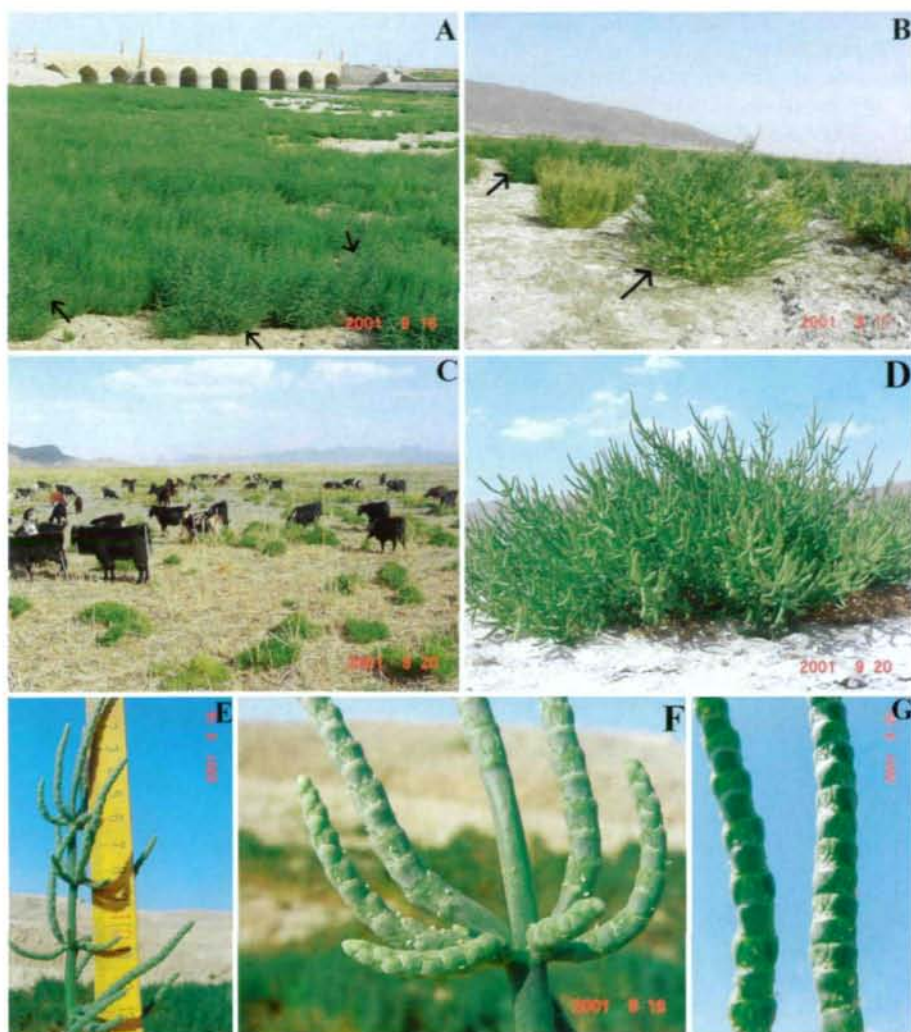


Fig. 2: **A** – Dense communities of *Salicornia persica* with other species in type locality, along Zayeandeh Rud river bed, in Varzaneh. **B** – Communities in Gavkhooni salty swamp, *S. persica* is indicated by arrow; nearby another species is distinguishable. **C** – Over grazing of *S. persica* by goats, around Tashk lake. **D** – Habit of species around Tashk lake. **E** – Upper inflorescence branches. **F** – Terminal inflorescence branches, showing verticillate branching and **G** – reversed pentagonal central florlets which are truncate at apex.

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