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HELMUT FREITAG[1]

Typification of *Salicornia perennans* Willd. *(Chenopodiaceae/Amaranthaceae)* and the significance of names by Pallas

Abstract

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Salicornia perennans is here typified for the first time, with a Pallas 1771 illustration selected as lectotype. A supporting epitype, recently collected close to the locus classicus, is designated and deposited in B, an isoepitype at LE. The identity of *S. perennans* is critically discussed and information about its variability in differing environments given.

Additional key words: Caspian lowlands, lectotype, epitype, *Salicornia acetaria, Salicornia europaea, Saliconia herbacea, Salicornia prostrata*

Introduction

When working on the molecular phylogeny of *Salicornia* L. (Kadereit & al. 2007), I named numerous specimens from interior Eurasia as *S. perennans* Willd. Based on a paper by Tzvelev (1993) that name was resuscitated in Czerepanov's "Vascular plants of Russia and adjacent states" (1995). The name was applied to plants that previously were named either as *S. prostrata* Pall., as in Czerepanov's earlier catalogues (1973, 1981), in the Med-Checklist (Greuter & Burdet 1984), in Flora Europaea (Ball & Akeroyd 1993), or, more commonly, they were included in an ambiguous *S. europaea* L. or its synonym *S. herbacea* L. as in Iljin's account of *Chenopodiaceae* in Flora SSSR (Iljin 1936). From the locations given by Pallas (1803) for *S. prostrata* and by Willdenow (1797) who refers to Pallas but used different epithets, Tzvelev (1993) assumed that both species were based on the same material. However, he did not give convincing evidence. The name has not been previously typified.

Clarification on the use of the name and its type became more urgent as a result of our molecular study. There, we detected four weakly differentiated diploid groups containing *Salicornia perennans, S. patula* Duval-Jouve and a few samples that could only be determined provisionally. They were collected in an area stretching from the Pannonian region in southeastern Central Europe and the shores of the Mediterranean to eastern Asia. Two other diploid groups, which included specimens identified as *S. europaea, S. ramosissima* J. Woods and *S. pusilla* J. Woods, proved to be separate from them. The area of the latter groups is more or less confined to the Atlantic coasts of Europe.

For a summary of the taxonomic problems in the extremely difficult Eurasian taxa of *Salicornia* see Kadereit & al. (2007: 1143–1145) and the conflicting treatments by Aellen (1960–61), Ball & Akeroyd (1993) and Dahmen & Wissskirchen (1998). The most recent survey of the relevant species was published by Piirainen (2009) in the

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Euro+Med Plant base project. Currently, a detailed taxonomic study is underway by Kadereit & Poorten (pers. comm.). Lectotypification of *S. europaea* L., the first and core species of the group, was carried out by Jafri & Rateeb (1978) and further elaborated by Piirainen (1991).

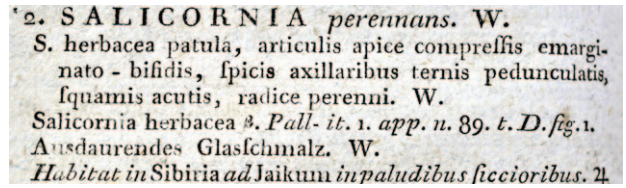
In order to elucidate the relationships among the different names given to what is now generally recognised as *Salicornia perennans,* all the relevant publications were consulted and original material searched for in B, BM, LE and LIV. In conjunction with other research projects (Freitag & al. 2001; Freitag & Lomonosova 2006), the type locality near the village Kalmykovo in the Ural river valley in W Kazakhstan was visited in order to collect specimens and carry out field studies on variation.

Names and original material

Naming the *Salicornia* populations under review started with Pallas's travel account (Pallas 1771). In the associated appendix under no. 89 he gave a detailed description (27 lines) of the new variety *Salicornia herbacea* var. *ß* from "paludibus siccioribus ad Jaikum" [drier marshes at river Ural] accompanied by an image showing the habit of the plant and details of the inflorescence (Pallas 1771: 479–480, t. A fig. 1a–d). The most striking features compared to the common variety were given as "Radix huius perennat, lignescit et aliquot trunculis, ceu capitibus supra terram expanditur. Caules ex ea annui pluirimi, prostrati, … structura simillima plantae annuae, sed longe tenuiores, et ramosiores (fig. 1.). Diuisura tamen eadem spicarumque disposition simillima plantae annuae, sed longe tenuiores sunt atque tenuiores, …" [(main) root perennial, woody and somewhat truncate, extending above the soil surface. Annual stems arising from the root numerous, prostrate, … in structure similar to annual plants but longer, thinner and more richly branched (fig. 1). Nevertheless, the branching system is alike and the arrangement of spikes is very similar, but they are longer and in particular they are thinner …]. The habit drawing (Pallas 1771: t. A fig. 1a, see Fig. 1) is rather schematic, but definitely shows an annual plant with terminal inflorescences and a pair of basal cotyledons. This clearly conflicts with the statement about a perennial habit. No original material of Pallas's plant has been traced.

The location was given as "in paludibus siccioribus ad Jaicum". In his diary Pallas (1771: 376) refers to the new variety only once, under 15.8.1769: "1.5 Werst" [1.59 km] north from "krepost [fortified place] Kalmykova"), near a backwater of the Ural river. There he also mentioned the most striking feature of the variety as "Ja, auch die gemeine, sonst gerade aufschiessende *Salicornia herbacea* hatte hier eine ganz besondre Bildung gewonnen und lag mit vielen Zweigen auf dem Boden ausgebreitet" [Indeed, the common *S. herbacea* that usually grows erect did show here a particular shape with numerous branches spreading out on the ground] (Pallas 1771: 378).

In the fourth edition of Species Plantarum, Willdenow (1797: 24) validly published Pallas's variety as *Salicornia perennans,* with the following protologue:


2. SALICORNIA *perennans.* W.
S. herbacea patula, articulis apice compreſſis emarginato-bifidis, ſpicis axillaribus ternis pedunculatis, ſquamis acutis, radice perenni. W.
Salicornia herbacea ß. *Pall. it.* 1. *app. n.* 89. *t. D. fig.* 1.
Ausdaurendes Glasſchmalz. W.
Habitat in Sibiria *ad* Jaikum *in paludibus ſiccioribus.* 4

Willdenow's description is much shorter, and only the (wrong) statement about the perennial (main) root concurs with that of Pallas. This suggests that he saw some material by his own, which seems likely as they were in contact with each other.

However, Willdenow's herbarium (B-W) does not contain any specimen labelled as *Salicornia perennans*. Instead, we found a small fascicle with three specimens, which are listed as Cat. no. 52 by Hiepko (1972) under the name *S. prostrata* and are accessible online (Röpert 2000+: ID nos. 312260–3):

Specimen 1 shows two plants with prostrate habit that look very much like Pallas's *Salicornia prostrata.*

Specimen 2 has three plants, with the upper one almost identical with those of specimen 1, and the two lower showing erect growth. Inside the folder, both specimens have a common label that reads "circa salinas kempendei lacum" with the addition "(Pallas)" in Schlechtendal's hand. The first sheet also carries a separate two-line note down right but bleached out except, in the first line, for "W. ...quoque Pallas", and, in the second, for "W." followed by three bleached-out words and "Pall." The material was certainly collected by Gmelin who mentioned in his Flora Sibirica (Gmelin 1768: 8) a locality "in Kaptendei ripa" [Kempendyai, a salt-mining village in E Siberia] where he collected *Salicornia herbacea*. Most likely it came into Willdenow's herbarium when Pallas in 1810 moved to Berlin from Crimea. This also might explain why the specimens are inserted under Pallas's and not Willdenow's name. As neither Pallas (1771, 1803) nor Willdenow (1797) refer to these plants and they most likely reached the Berlin herbarium only after the publication of *S. perennans,* they cannot be considered as original material.

Specimen 3 contains one Kalidium plant with some annual shoots arising from a thick perennial caudex.

As a result, we conclude that Willdenow's description was based on Pallas's illustration, though it is incorrectly cited as "t. D" instead of "t. A". This is more likely because at least the phrase about the whorls of three pedunculate axillary spikes, which conflicts with Pallas's description, seems to derive from the illustration because it is not observable in living plants or herbarium specimens.

Finally, Pallas in his Illustrationes Plantarum (Pallas 1803: 8), obviously unaware of Willdenow's description, also raised his variety to species rank, under the name *Salicornia prostrata.* He gave an elaborate and much improved new description. In particular, he corrected the

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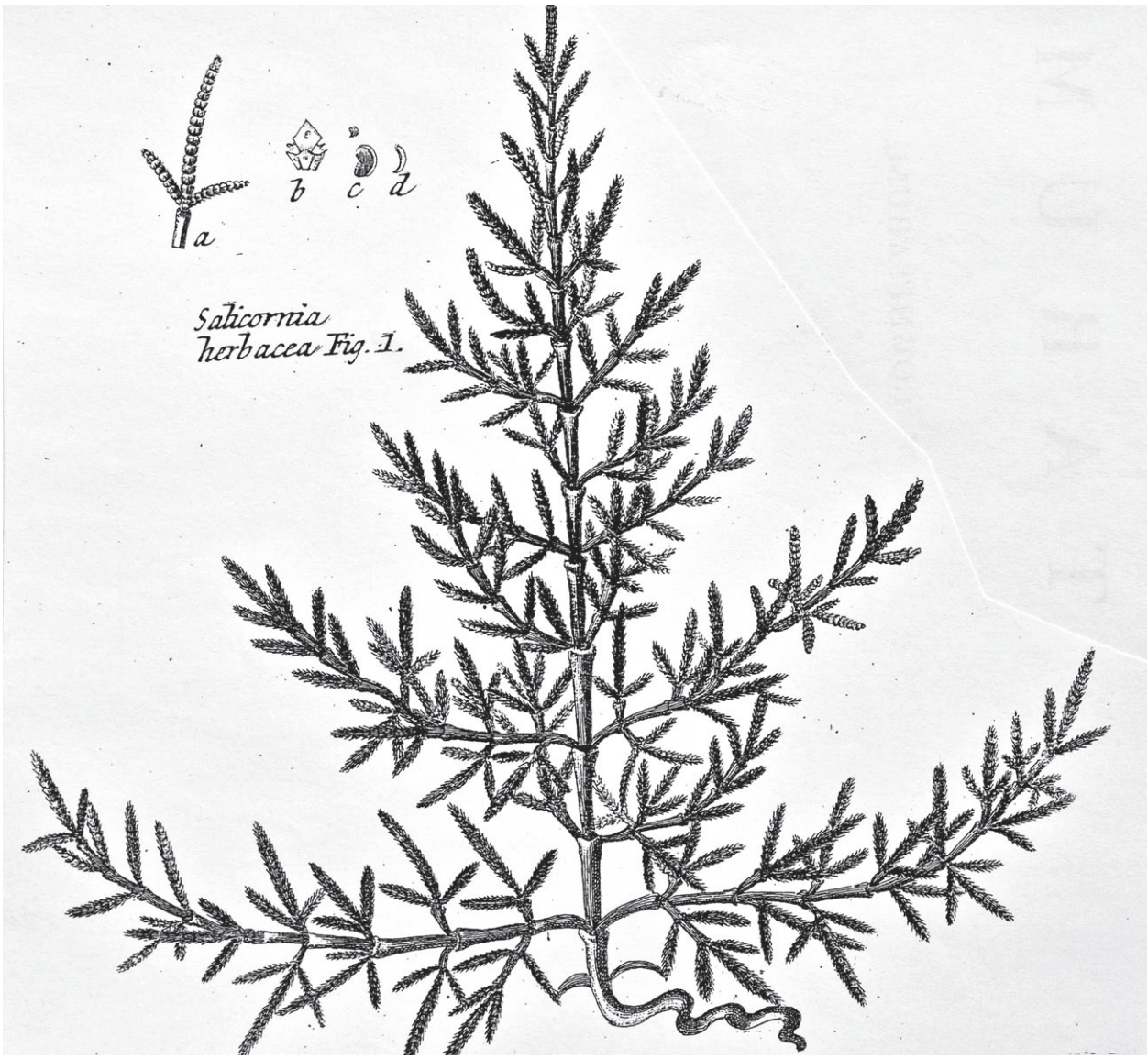


Fig. 1. Illustration Pallas (1771: t. A, fig. 1), the lectotype of *Salicornia herbacea* L. var. *β* Pall. and *S. perennans* Willd.

earlier statement concerning the habit of the plant from perennial to annual. Furthermore, he added a much better image in t. III (see Fig. 2) and reported a second locality of the species from SW Crimea at Inkerman (near Sevastopol) from where he cited it as growing in mixed stands with *S. acetaria* Pallas. He also added two more characters in favour of the species, viz. later flowering time and persistence of spikes.

Typification

Following the criteria of the Vienna Code Art. 11.3 (McNeill & al. 2007), there is no doubt that *Salicornia perennans* Willd. has priority because it is the earliest legitimate name of the taxon at species rank. Consequently, *S. prostrata* Pall. must be considered as illegitimate (as already stated by Piirainen 2009) because it was nomenclaturally superfluous when published (Art. 52.1). This is unfortunate in face of the brief and mostly misleading description given by Willdenow and an epithet that seemingly places the species in the perennial sister-genus *Sarcocornia* instead of the strictly annual genus *Salicornia*. However, because Willdenow referred in the protologue to Pallas and his illustration, the name has to be accepted. In the absence of original plant material, the Pallas illustration is here selected as lectotype,

To complement the lectotype and especially the handicaps and erroneously arranged lateral spikelets of Pallas's first image, a supporting epitype is designated here. It was collected near the type locality Kalmykovo and shows the important diagnostic features emphasised by Pallas.

Remarks on the identity of *Salicornia perennans*

Almost all authors, among them Pallas (1771), Iljin (1936), Skripnik (1986), Lomonosova (1992), Czerepanov

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Fig. 2. Illustration of *Salicornia prostrata* Pall. (Pallas 1803: t. 3).

(1995), Tzvelev (1996) and Sukhorukov (2006) agree that the diploid populations in SE Russia and W Kazakhstan, which generally can be separated from the tetraploids by the smaller anthers (0.25–4 mm), shorter spikes (up to 3–4 cm) and thinner central cylinders (König 1960), belong to one species. It is named *Salicornia herbacea, S. europaea, S. prostrata* or *S. perennans,* with the first and the third name being synonyms. Only Pallas (1803) recognised three species, raising his *S. herbacea* var. *ß* to species rank as *S. prostrata,* re-naming the erect growing plants as *S. acetaria* and describing the new species *S. pygmaea*. However, the last species was later recombined as *Halopeplis pygmaea* (Pall.) Bunge ex Ung.-Sternb. As far as is known to us, *Salicornia* was never critically studied in the area under review. Therefore, our observations about the variability of *Salicornia* gained during an expedition also aimed at studying the annual salt-marsh communities of the Caspian lowlands in 1996 (Freitag & al. 2001: 70–71), merit some discussion.

There we met with an enormous diversity of morphological forms that corresponds to an array of different plant communities where *Salicornia* occurs. In the end, we became convinced, that (almost) all the populations belong to the same species principally because they agree in branching structure, inflorescence and in floral characters. In studying habitats that differ in salinity, moisture regime and land use, recurrently all possible forms occur. According to ecological gradients, they were often found in belts or mosaics. Regarding the characters of *S. perennans* as highlighted by Pallas (1771, 1803) for his taxon called at first var. *ß* and later *S. prostrata,* it should be emphasised that from our observations they are just endpoints of phenotypic variation caused by environmental vectors:

(1) Particularly delicate branches and spikes are closely correlated with and most likely caused by low salinity, as in some other halophytes such as *Suaeda*. On the other hand, very high degrees of succulence, usually associated with stunted growth, are intimately related to excessive salinity. Besides, at the flowering stage the spikes are always much thinner than in fruiting stage. That might partly account for the different appearance of the plants drawn in Pallas's illustrations (Fig. 1–2).

(2) The prostrate habit usually is induced by trampling of grazing animals or by other disturbance vectors. In any case, it only occurs in loose stands while in the

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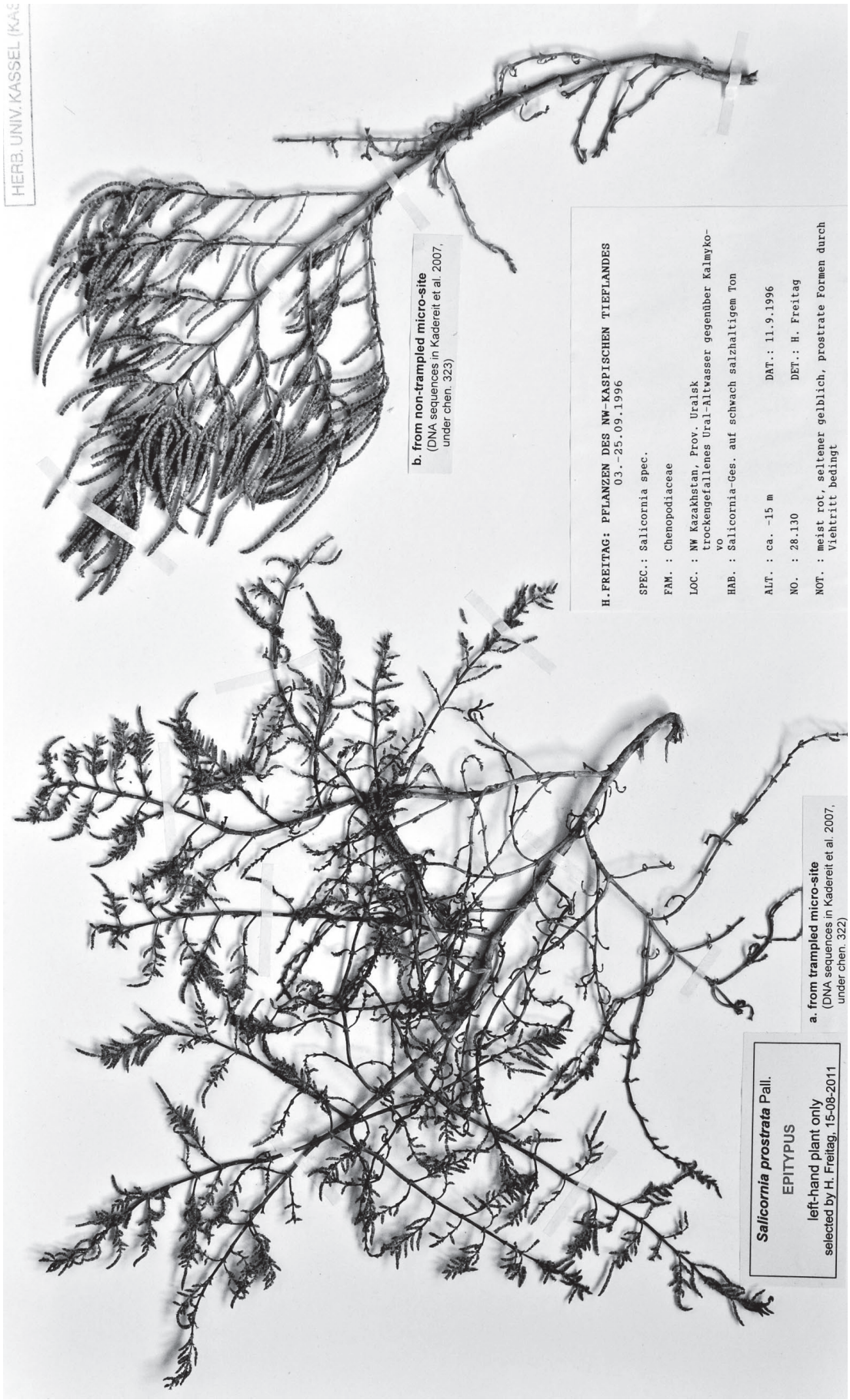


Fig. 3. Epitype of *Salicornia perenans* Willd. at B, left-hand plant only.

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more common dense stands competition between the individual plants strongly favours their upright growth.

(3) Besides, higher temperature near the soil surface and higher radiation intensity seem to favour a bushy and a prostrate habit. That becomes effective especially in plants that germinate later after long-lasting flooding of the sites. Otherwise, shortage of light enhances elongation and an upright growth of stem and main branches.

(4) Unusually late flowering and the subsequent persistence (of immature spikes) is associated with a late retreat of water from the respective habitats that results in delayed germination and later phenophases.

Particular ecological conditions favouring prostrate growth were present in the location where the epitype material was collected. The plants grew on the dried bottom of a shallow arm of the Ural river opposite Kalmykovo. Together with scattered individuals of *Suaeda salsa* (L.) Pall. and *S. acuminata* (C. A. Mey.) Moq. the species covered the deepest zone (50 m wide) on dry clayey soil with a cracked surface. Low salinity of the habitat could be deduced from the hydrology, with annual flooding from the river, and the adjoining vegetation belts *(Messerschmidia sibirica* (L.) L., on higher terrain *Alhagi* and *Glycyrrhiza)* composed of moderately salt-tolerant glycophytes. Besides, the area was heavily grazed. Plants that by chance escaped from trampling were found growing as bushes and erect with significantly longer spikes (see Fig. 3). Both types were included in the sampling used by Kadereit & al. (2007). They have shown identical ETS sequences (Kadereit & al. 2007: fig. 4b samples 322, 323), thus supporting their interpretation as phenotypic varieties. Certainly the same ecological conditions apply for Pallas's historical site. He collected 2 km further north but also from a frequently flooded location, and grazing pressure was probably even higher due to a shorter distance from the village.

Further evidence that the prostrate habit in *Salicornia perennans* is induced by external factors and that the species normally grows upright comes from my observations and collections in 2003 along the southwestern coast of the Crimea close to the second locality cited by Pallas. There, in the drift-line of the brackish Saks'ke lake, under temporary mechanical stress, the prostrate form of *S. perennans* was found, together with prostrate forms of *Suaeda acuminata, S. salsa* and *Sedobassia sedoides* (Pall.) Freitag & Kadereit, while in a distance of a few metres behind the shore line the same species exhibited their normal upright growth. Interestingly, under peculiar conditions along the European coasts very similar delicate and prostrate forms also occur and were sometimes even identified as *S. prostrata* (see König 1960, Aellen 1960–61) though they have to be grouped with *S. europaea*.

The name *Salicornia acetaria* given by Pallas (1803) to the erect plants is illegitimate because it is merely a superfluous name for what before was placed by him under *S. herbacea* as becomes evident from the synonyms cited. However, Pallas (1803: t. II fig. 1) figures a plant from near the river Kuma at the southwestern edge of the Caspian Lowland that clearly belongs to a tetraploid species, as is evident from its exceedingly long spikes. One specimen with four typical plants of erect growth but somewhat differing phenological stages belonging to original Pallas material is preserved in B-W under Cat. no. 53 (Röpert 2000+: ID 312263 under the name *S. stricta*) and bears the note (down right) "Pallas W." The name *S. stricta* was never validly published by Willdenow (see also Steudel 1821) but inside the folder is a glued label with "*Salicornia stricta* caule simplici spicis elongatis oppositis pedunculatis. *Salic. acetaria* P. Pall. illustr. T[ab.] 1, Fig. 2 & T 2, Fig. 1. Habitat in Sarepta, Irkutsk" followed up by the symbol for annuals. The header of the protologue "Monandria Monogynia" suggests that the draft was designed for a new edition of Species Plantarum but Willdenow died in 1812.

The more critical question as to whether on morphological characters *Salicornia perennans* differs sufficiently from *S. europaea* to keep it specifically separate still remains to be solved. As there exists at least a weak genomic separation, though with several intermediate populations (Kadereit & al. 2007: fig. 4), for at least the time being the proposal of Piirainen (2009) of a species aggregate *S. europaea* and a (micro)species *S. perennans* appears to be a practical solution.

Nomenclatural conclusions

Salicornia perennans Willd., Sp. Pl. 1: 24. 1797 ≡ *Salicornia herbacea* var. *ß* Pall., Reise Russ. Reich. 1: 479, t. A fig. 1. 1771 ≡ *Salicornia prostrata* Pall., Ill. Pl.: 8, t. III. 1803, nom. illeg. ≡ *Salicornia herbacea* var. *prostrata* Moq., Chenop. Monogr. Enum.: 131. 1840. – Lectotype (designated here): [icon] Pallas, Reise Russ. Reich. 1: t. A fig. 1. 1771. – Epitype (designated here): "NW Kazakhstan, Prov. Uralsk, trockengefallenes Ural-Altwasser gegenüber Kalmykovo" [dried out back-water opposite Kalmykovo (village)], 11.9.1996, *H. Freitag 28.130* (B, left-hand plant only, see Fig. 4; isoepitype: LE)

= *Salicornia acetaria* Pall., Ill. Pl.: 7, t. I fig, 1–2, t. II. 1803, nom. illeg. ≡ *Salicornia herbacea* var. *acetaria* (Pall.) Moq., Chenop. Monogr. Enum.: 114. 1840.

= *Salicornia prostrata* subsp. *simonkaiana* Soó in Acta Bot. Acad. Sci. Hung. 18: 173. 1973.

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