

First Data on *Spartina x townsendii* in the Lagoon of Venice (Italy)

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Abstract

In 2002 we found *S. x townsendii*, an non native hybrid, at several sites in the Venice lagoon salt marshes. This is the first record for Italy and, most likely, for the whole Mediterranean. The plants, usually living in circular clumps, were observed both in natural than man made salt marsh, at a wide range of elevation above sea level. Concern is expressed about the possible effects of the spreading of the hybrid in the whole lagoon.

Introduction

The smooth cord-grass *Spartina alterniflora* Loisel was introduced from the east coast of North America to Southampton Water, U.K., prior to 1870 and was first found on mudflats near Hythe (Doody 1984). Its subsequent crossing with the native small cord-grass *S. maritima* (Curtis) Fernald resulted in the appearance of a sterile hybrid *S. x townsendii* H. and J. Groves and, later on, of a fertile amphidiploid, the common cord-grass *S. anglica* C.E. Hubbard (Baumel et al. 2002). The two hybrids were extensively planted throughout Britain to stabilise soft sediments as well as in Europe, China, eastern USA, New Zealand and Australia (Adam 1990). Both forms of *Spartina* had also spread naturally, showing a considerable expansion over a relatively short period; frequently, clumps of *Spartina* arise by vegetative growth and these gradually

coalesce to form monospecific swards (Cornette et al. 2001; Doody 1984). These are often found in sheltered, estuarine conditions where mud flats are present.

Very often in the literature the two forms are not separated, referring to "Spartina", which usually refers only to *S. anglica*. Considerable concern has been expressed over the rapid colonisation of these Spartina in intertidal habitats, where they can cover huge areas of mud with thick populations, often outcoming native species such as *Spartina maritima* or even *Zostera marina* L. (Doody 1984; Davidson et al. 1991).

Due to the lack of distinction between the two forms, it is not easy to evaluate correctly the area where the *S. x townsendii* hybrid occurs; nevertheless, in Europe it is almost certainly limited to the coasts of the North Sea (UK, France, Germany, Denmark; Doody, pers. comm.). As far as we know, it has never been reported for the coasts of the Mediterranean; along the Atlantic coasts of Spain, some introduced species of Spartina occur, but *S. x townsendii* has never been recorded (Castillo com pers; Curtò com. pers.)

In June 2002, during field mapping of the salt marsh vegetation, *S. x townsendii* was collected and identified by one of us (L.Ghirelli); the correct identification was subsequently confirmed by experts from the Milan Natural History Museum. The first finding has been published (Ghirelli in press) and some specimens are conserved in the archives of the Herbarium Patavinum (PAD).

In this note we present the first data on distribution, surface elevation levels and biomass of *S. x townsendii* in the lagoon of Venice (Italy), collected during the summer 2002-spring 2003 period. Due to very short period considered, these data have to be considered as preliminary, and more detailed investigations are currently on going.

Study area

Venice Lagoon is a large (surface area is about 550 km²) shallow coastal lagoon located on the northeastern coast of the Adriatic Sea (about 45° 14' N, 12° 17' E). There are two barrier islands which separate the lagoon from the sea and water is exchanged through three large inlets. Most of the lagoon area is occupied by an open waterbody (about 370 km²) which is partially vegetated by macroalgae (*Ulva* sp., *Chaetomorpha* sp.) and seagrasses (*Zostera marina*, *Zostera noltii* Hornem. and *Cymodocea nodosa* Ucria). The mean depth of the lagoon is 1.1 m and the tidal range during spring tides is about one meter, 0.6 m being the mean tidal range; mean monthly water temperature ranges from 4 °C in winter to 28 °C at summer peak, while salinity ranges between 16 and 38 ‰ (Rismondo et al. 1997). There are extensive (about 4,000 ha) intertidal salt marshes, especially in the southwestern and northern portions of the lagoon. More than 60 dredge islands, with size and elevation often comparable to natural saltmarshes, have also been built in the last ten years. The salt marsh vegetation is mostly composed of *Spartina maritima*, *Sarcocornia fruticosa* (L.) Scott, *Limonium serotinum* (Rchb.) Pigh., *Salicornia* sp., *Puccinellia palustris* (Seenus) Grossh and *Halimione portulacoides* (L.) Aellen in order of decreasing abundance; *Ruppia spiralis* L. occurs in salt marsh creeks and ponds.

Methods

The coordinates of all the sites with *S. x townsendii* were measured with a Garmin 48 GPS, with an accuracy of about ± 10 m, and reported on detailed maps. At several sites the elevation (above the Genua 1942 Italian Ordinance Datum) at which the clumps occurred was taken with a Novatel DGPS, with ± 0.02 m of accuracy. In spring 2003, we started biomass sampling. Above ground biomass was collected inside 30 x 30 cm frames, with five replicates; the height of 10-15 culms was also measured. The below ground biomass was collected at the same sites using a cylindrical corer, to a depth of 30 cm. Biomass samples were rinsed with fresh water and dried at 80°C for 48 hours. Additional information, such as clump area, other specie occurring in the close proximity and sediment characteristics were opportunistically taken.

Results

Despite our intensive frequentation of the Venice lagoon saltmarsh for monitoring and mapping projects over the last decade (Scarton et al. 2000 and 2002, Day et al. 1999), *S. x townsendii* was observed only in 2002, which makes us to believe that its arrival and spreading must have been very recent. Its particular appearance, with brilliant green leaves at a almost right angle from the stem, the dense clumps and the remarkable height of the stems, can not be overlooked in the field where the difference with the native *S. maritima* become very clear (Fig. 1 and Fig.2).



Fig.1: *S. x townsendii*, October 2002, note the pen for comparison.



Fig. 2: Circular clump of *S.x townsendii* in the foreground; *S.maritima* on the right (September 2002).

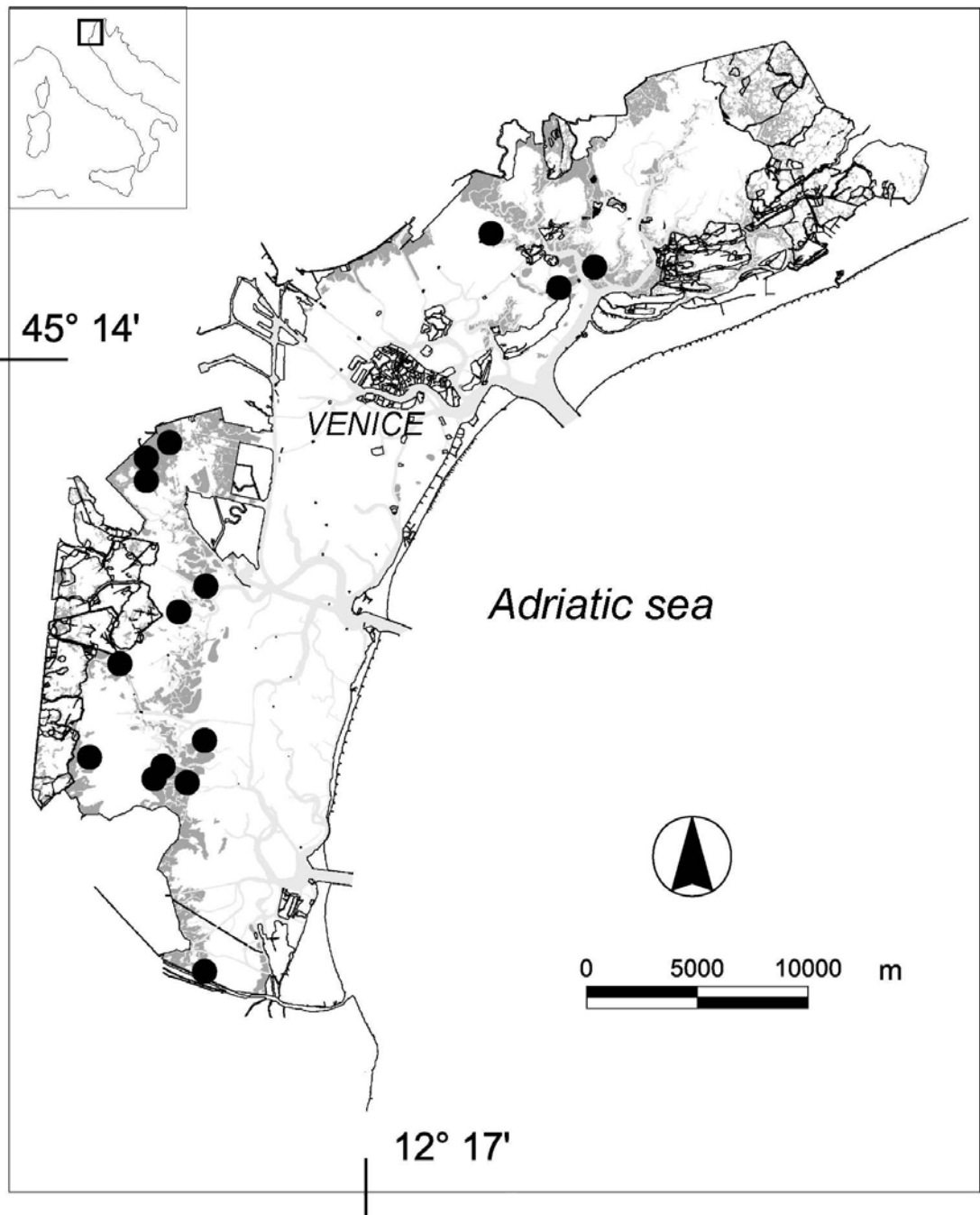


Fig. 3: Map of the Venice lagoon with sites (black dots) of *S. x townsendii*

Up to June 2003, 15 sites with *S. x townsendii* have been mapped (Fig.3); they are spread all over the lagoon, with about 35 km between the two furthest sites. In most cases, at each site *S. x townsendii* occurred in small clumps of circular shapes, most likely originated by cloning of a single stem. In spring 2003, the diameter of these clumps ranged between 0.8 and 2 m. Several clumps were usually located at close distance. Less frequently we found small, very dense meadows, covering an area of 50-60 m² each; in a couple of sites, the plants were aligned along the edge of the saltmarsh islets, forming a narrow band. Overall, the total surface covered by *S. x townsendii* in the Venice lagoon salt marshes may be estimated to at least 700 m².

Both natural and man made salt marshes were colonized; in these latter, the *S. x townsendii* always occupied bare substrates, both sandy than silty, at very low elevation, where no other terrestrial plants were found nearby.

At natural salt marshes, it occupied both patches devoid of vegetation (at the edge of tidal pond, for instance) and areas already vegetated by *Salicornia* sp., *S.maritima* or *Puccinellia palustris*, depending on the sites. Elevation data obtained with the DGPS gave results ranging from 0.05 m to 0.22 m above sea level. Considering the mean tidal range observed in the lagoon of Venice, this implies a frequency of submersion of 20%-40% of the time (Albani et al. 1984). In the salt marshes, the native species live mostly at elevation between 0.15 and 0.35 m, with only *S. maritima* and *Salicornia* sp. observed at lower elevation (Fig.4: MAV-CVN, 2001).

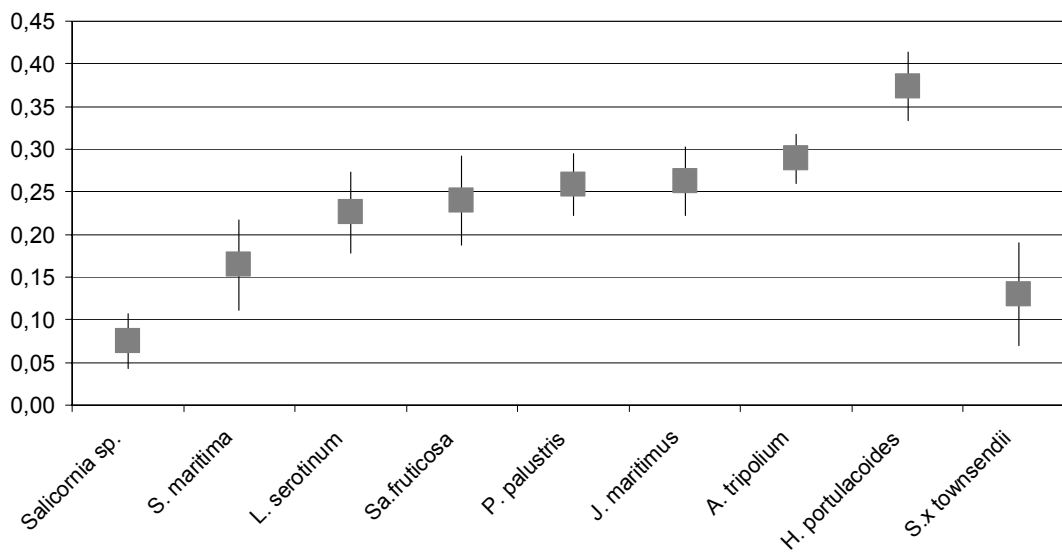


Fig. 4: Zonation (m above sea level; mean \pm 1 s.d.) of the most common native salt marsh species and of *S.townsendii*, measured at Venice lagoon salt marshes.

Above-ground biomass data collected at the beginning of May 2003 gave a mean of 0.47 kg d.w./m², with stems being about 20 cm high; at a different site, in June 2003 the stems were shorter, only 10 cm, with a biomass of 0.30 kg/m². Below-ground biomass was 2.8 kg/m² in the first case and 1.8 kg/m² in the second; roots and rhizomes formed a thick mat. In the previous year we did not collect biomass, but the height of several plants could reach in October about one meter (Fig. 1), so we believe the maximum biomass could reach values much higher than those observed in spring. It is also possible, as observed in *S. anglica*, that high variability could exist between plants growing at different zones (with maximum above ground biomass that can exceed 1.8 kg/m²; Doody 1984). From these first data, it seems that the growth of *S. x townsendii* takes place mostly in June-September, with the subsequent loss of leaves and stems.

Conclusion

We can only speculate about the reasons of the occurrence of this new form in the Lagoon of Venice. Due to its sterility, it is beyond dispute that it must have been planted at some sites, maybe for testing its effectiveness in stabilising sediments; nevertheless, we were not able to find any data confirming our hypothesis. In any case, it is striking to observe that after probably a few years since its introduction, *S. x townsendii* is nowadays (year 2003) spread all over the lagoon, even if generally restricted to very small areas. From our preliminary data, it seems that the hybrid can grow at an elevation range wider than that of all the other native species, being also able to colonize extension of tidal flats completely devoid of vegetation. Concern must be expressed about the possible effects of the occurrence of *S. x townsendii* on the Venice salt marsh ecosystem, considering that here habitat or species of European concern (sensu Habitat Directive 43/92) are still common at the present time.

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