

Ecological notes in Mediterranean halophytes. Towards an integrative approach

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Summary. In this work we try to propose an integrative manner in which halophytes could be ecologically approached. Taking into considerations many factors related to environmental conditions, as well as corresponding adaptations in halophytes, we can obtain a good picture of interrelationships established within a typical ecosystem.

Key words: adaptations, halophytes, integrative manner, Mediterranean salt marshes zonation.

1. Introduction

In the Mediterranean, the halophytic communities represent two categories: those that belong to the maritime salt marshes and those that belong to the salt deserts (Chapman 1974). The maritime marshes of the Mediterranean usually lie behind coastal dunes but are subjected to salt-water inundation (Rikli 1943).

2. Dissecting the multitude of halophytes adaptations in a salt marsh

Glancing at the general landscape of a salt marsh in Alicante (SE Spain) (Fig. 1), it can easily be noticed the distribution of halophytes, according to their adaptations following the soil salinity gradient. Thus, the vegetation is distributed in concentric zones (belts). One of the external belt is less halophytic (including *Phragmites australis*), bordering one side the salt marsh; the internal belts are more halophytic. This particular arrangement is strictly controlled by salinity levels in the ecosystem, which impose different constraints to various groups of plants. The highest salinity was recorded in the center of salt marsh; here, the soil

surface is often dried, and salt is deposited in a superficial layer (Fig. 1), due to an intense evapotranspiration, especially in the drought season.

Near to this central zone, only few, well adapted plants can survive in such harsh conditions. Actually, this area of salt marsh is dominated by perennial succulent euhalophytes (*Sarcocornia fruticosa* and *Arthrocnemum macrostachyum*). Their succulence is attributed to the well developed water storage tissues (Fig. 2).

Right in the central part of this salt marsh, only individual plants belonging to these taxa may be found (Fig. 3). Biochemically, *Sarcocornia* and *Arthrocnemum* seem to behave as glycine betaine accumulators, rather than proline accumulators, comparatively with other halophytes (Vicente et al., unpublished data). Actually, the entire evolution of adaptive mechanisms in halophytes from *Amaranthaceae* (here including and referring especially on *Chenopodiaceae*) are strictly related to saline environments (Grigore & Toma 2010a; Grigore 2011).

Another belt of vegetation, located in the opposite side of salt marsh – in the upper and drier but less salinized part of it – comprises species such as: *Suaeda splendens*, *S. vera*, *Salsola oppositifolia*, *Mesembryanthemum nodiflorum*, *Frankenia* and *Limonium* species. These taxa are



Figure 1. A salt marsh in Alicante (July of 2010)



Figure 3. Individual plants of *Sarcocornia fruticosa*



Figure 2. Water storage tissue in an articulated segment of *Sarcocornia fruticosa* (x200)

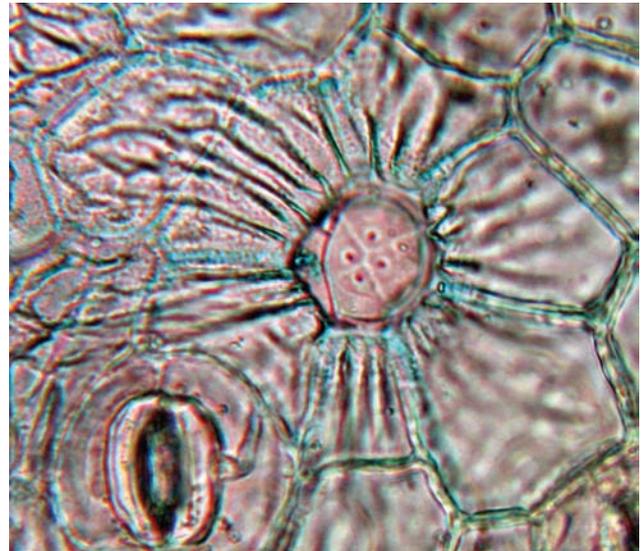


Figure 4. Salt gland in the lamina of *Limonium girardianum*, surface view (x400)

also halophytes, but less restricted to high salinity levels. *Frankenia* and *Limonium* (Fig. 4) have salt glands (Grigore & Toma 2010b) - specialized devices involved in removal of salts from plant organs.

On the slope connecting the upper part with the lower part of salt marsh other halophytes, such as *Tamarix canariensis* and *Centaureum spicatum* may be noticed. The first

mentioned species has a very interesting ecology, being salt tolerant (also possesses salt glands), phreatophyte, resistant to flooding and fires. All these features are very important and involved in some potential and even unpredictable ecological disturbances (Grigore & Toma 2010b). In the lower part of this slope, in wet and shaded small areas vegetates *Inula crithmoides*, a succulent euhalophytes.

3. Perspectives

Further ecological observations in the field, combined with interdisciplinary results obtained in the lab will contribute to better understanding of all interrelations established within a saline ecosystem.

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