Impact of Salinity on Reproductive Development in Cakile maritima: A Focus on Male Gametophyte Biology

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Projected changes in temperature and precipitation due to climate change entail significant challenges for food production. Such as conditions result in a rise of soil salinization, particularly in dry and semi-dry regions where irrigation is common. This threatens productive farmland by reducing soil fertility and crop yields, as most crops are glycophytes—species susceptible to salinity[1]. In contrast, halophytes are a small group of plants capable of completing their life cycle in naturally saline environments. Some halophytes present suitable nutritional features and have been proposed as alternative food sources in saline areas. In particular, *Cakile maritima* is an edible facultative halophyte proposed for human consumption and animal fodder. Whereas *Cakile maritima* response to salinity has been widely studied during its vegetative development, the information regarding to the impact of salt during its reproductive development remains scarce. In this work, we aim to study how increasing concentrations of salt in watering solutions affects its overall reproductive features, with a focus on its gametophyte histology.

Soil Salinity and Agriculture

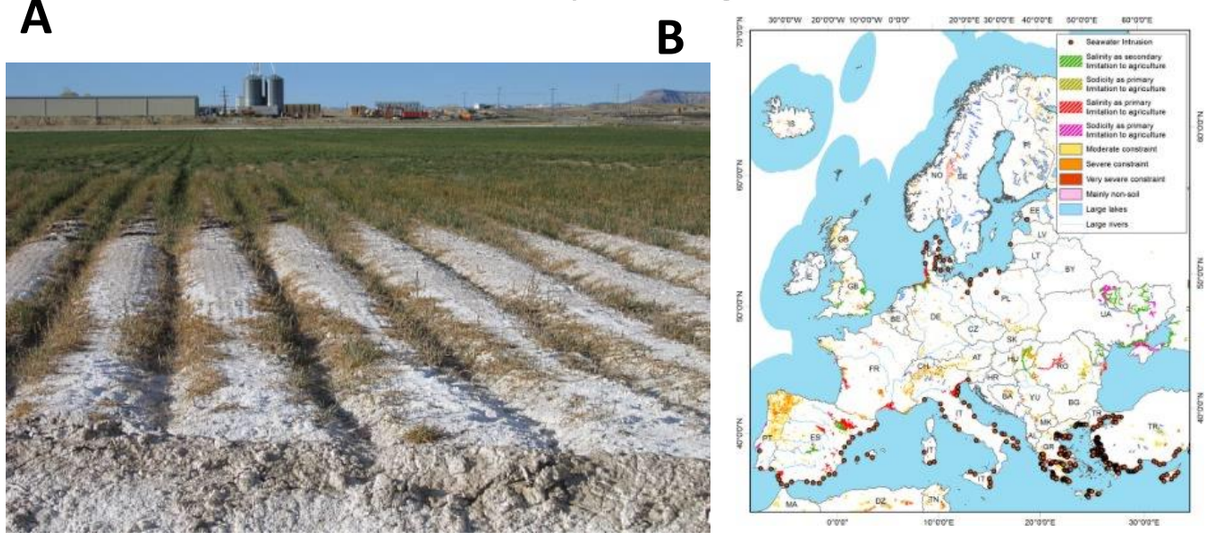

Figure 1. A. Agricultural soil affected by salinization[2]. **B.** Regions in Europe impacted by salinization from various causes[3].

Salinity and Vegetative Development

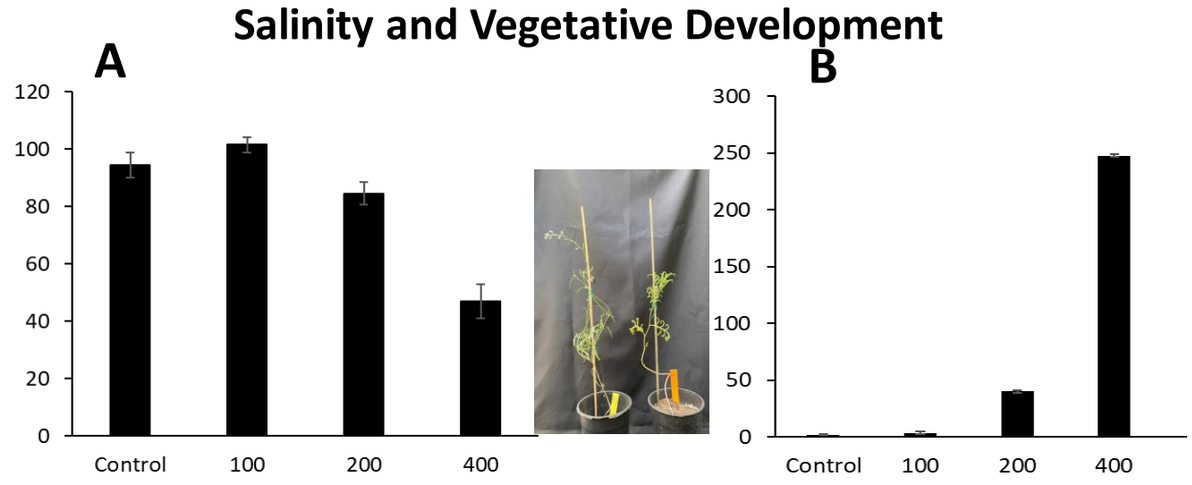

Figure 4. A. Plant height (mm) and **B.** proline accumulation in *Cakile maritima* under control and salt stress (100, 200, 400 mM NaCl). Most changes occur at 400 mM, with reduced height and increased proline levels.

Features of *Cakile maritima*

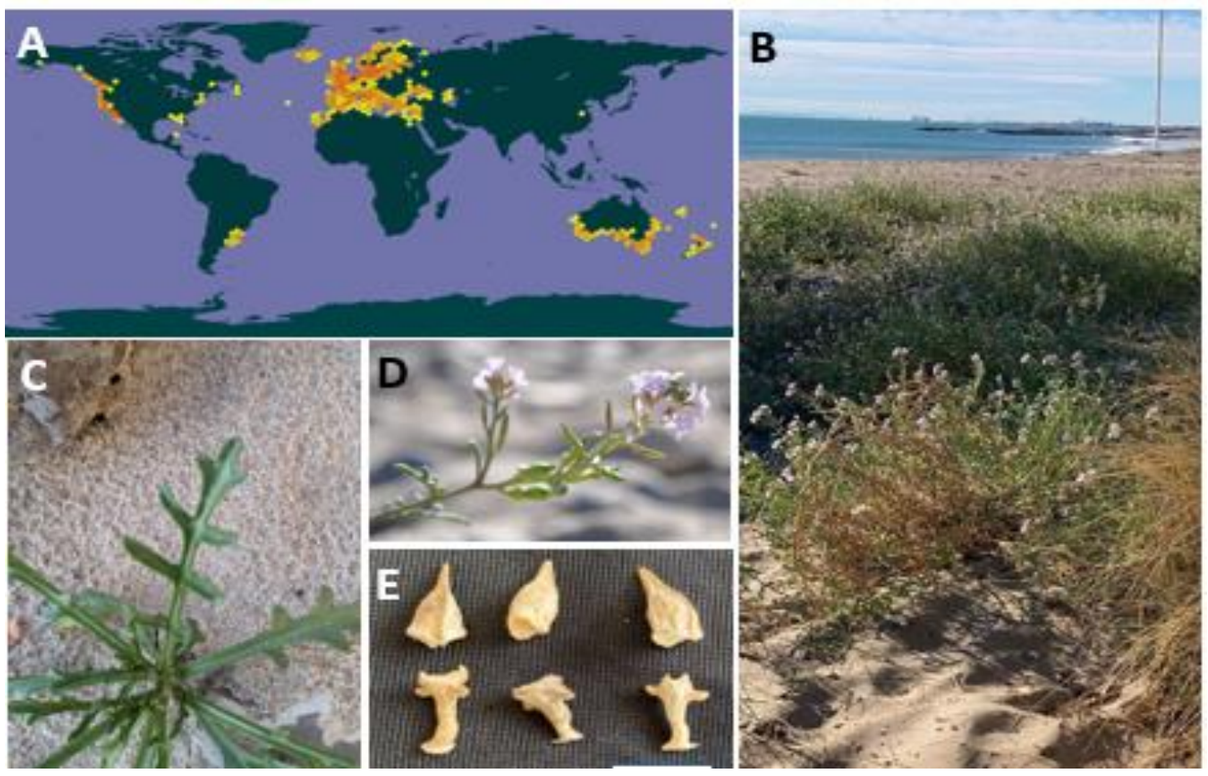

Figure 2. A. Natural distribution of *Cakile maritima*[4]. **B.** Specimens of *Cakile maritima* naturally growing on Xilxes beach, Castellón. **C-E**. Details of leaves **(C)**, flowers **(D)**, and fruits **(E)** of *Cakile maritima*.

Cakile maritima: Phylogenetic tree

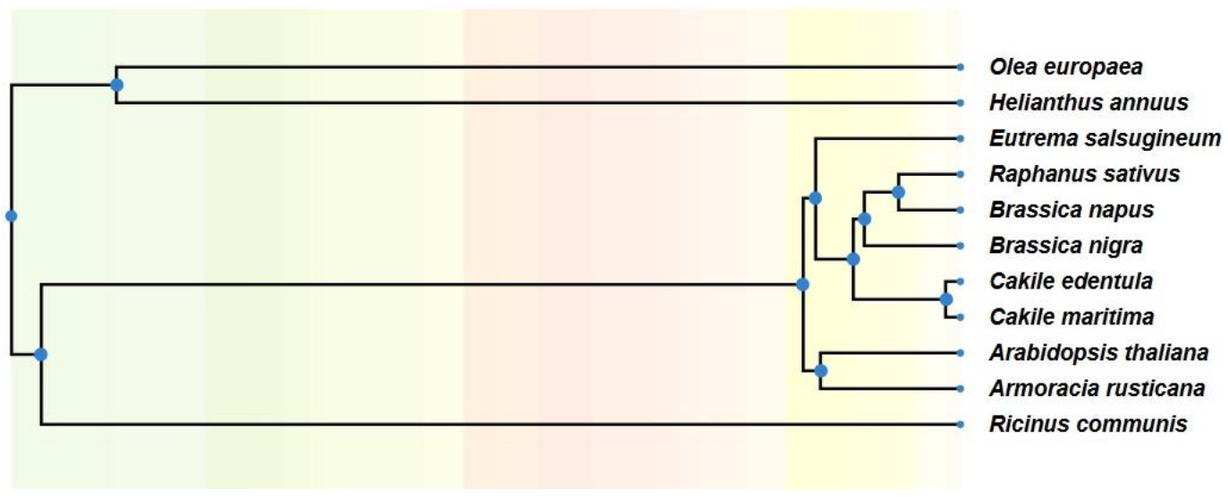

Figure 3. Phylogenetic tree showing the relationship between *Cakile maritima* and other plant species, including *Brassica napus*, *Arabidopsis thaliana*, *Cakile edéntula*, *Eutrema salsugineum*, *Raphanus sativus*, *Helianthus annuus*, *Olea europaea*, *Ricinus communis*, *Brassica nigra*, and *Armoracia rusticana*.

Salinity and Reproductive Development

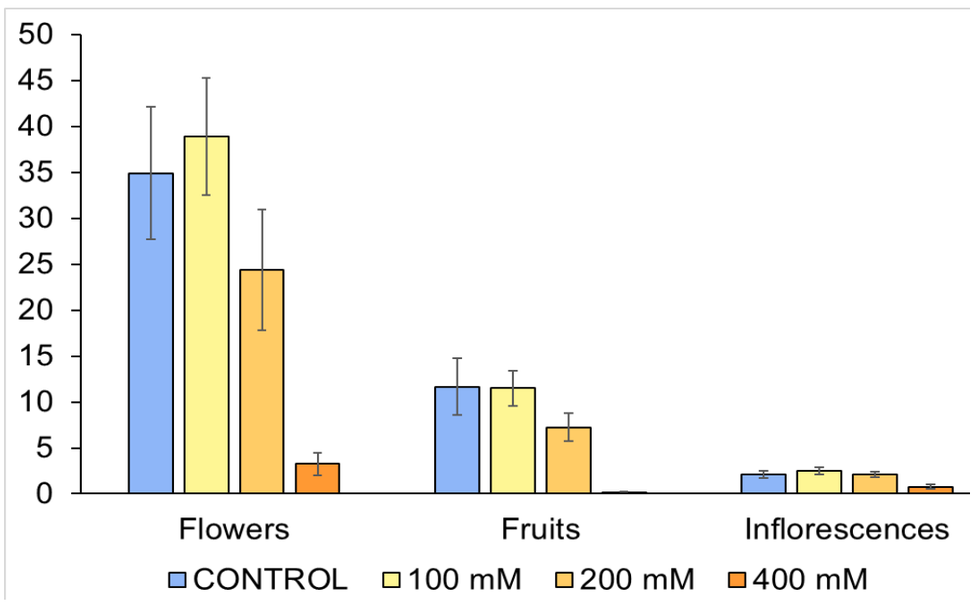

Figure 6. Reproductive traits of *C. maritima* under control and salt stress conditions, showing the number of flowers, fruits, and inflorescences in plants treated with 0, 100, 200, and 400 mM NaCl.

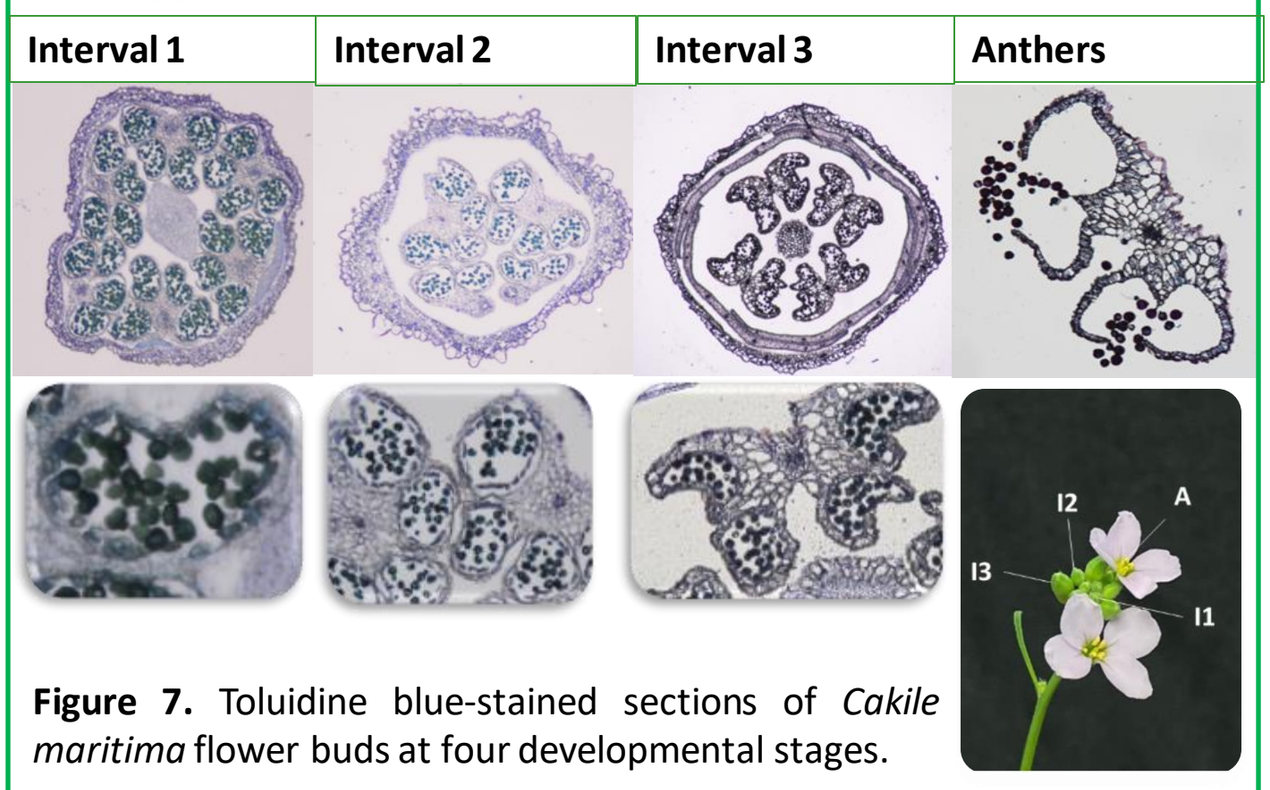

Figure 7. Toluidine blue-stained sections of *Cakile maritima* flower buds at four developmental stages.

[1] Arbelet-Bonnin, […], Bouteau, F. (2019). Cakile maritima, a promising model for halophyte studies and a putative cash crop for saline agriculture.
[2] Haghverdi, A. […], L. Wu (2018). Accounting for Salinity Leaching in the Application of Recycled Water for Landscape Irrigation.
[3] Daliakopoulos IN, […], Ritsema CJ (2016). Science of the total environment, 573, 727-739.
[4] Santos J, […], Flowers TJ (2016). Plant and Cell Physiology, 57(1), e10-e10.