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TITLE: Reproductive Physiology of Halophytes: Current Standing

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ABSTRACT:

Background: Halophytes possess efficient salt-tolerance mechanisms and can complete their life cycles in naturally saline soils with NaCl contents exceeding 200 mM. While a significant progress have been made in recent decades elucidating underlying salt-tolerance mechanisms, these studies have been mostly confined to the vegetative growth stage. At the same time, the capacity to generate high-quality seeds and to survive early developmental stages under saline conditions, are both critically important for plants. Halophytes perform well in both regards, whereas non-halophytes cannot normally complete their life cycles under saline conditions. Scope: Research into the effects of salinity on plant reproductive biology has gained momentum in recent years. However, it remains unclear whether the reproductive biology of halophytes differs from that of non-halophytes, and whether their reproductive processes benefit, like their vegetative growth, from the presence of salt in the rhizosphere. Here, we summarize current knowledge of the mechanisms underlying the superior reproductive biology of halophytes, focusing on critical aspects including control of flowering time, changes in plant hormonal status and their impact on anther and pollen development and viability, plant carbohydrate status and seed formation, mechanisms behind the early germination of halophyte seeds, and the role of seed polymorphism. Conclusion: Salt has beneficial effects on halophyte reproductive growth that include late flowering, increased flower numbers and pollen vitality, and high seed yield. This improved performance is due to optimal nutrition during vegetative growth, alterations in plant hormonal status, and regulation of flowering genes. In addition, the seeds of halophytes harvested under saline conditions show higher salt tolerance than those obtained under non-saline condition, largely due to increased osmolyte accumulation, more optimal hormonal composition (e.g., high gibberellic acid and low abcisic acid content) and, in some species, seed dimorphism. In the near future, identifying key genes involved in halophyte reproductive physiology and using them to transform crops could be a promising approach to developing saline agriculture.

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