

Preface

The world's food production will need to increase dramatically to match the predicted population growth. Achieving this goal will be very challenging because of the decreased availability of arable land, resulting from urbanization and land degradation caused by salinity (Panta *et al.*, 2014). The economic impact of soil salinity on agricultural crop production exceeds US\$27 billion p.a. (Qadir *et al.*, 2014) and is expected to rise, given present trends in climate change. Currently, soil salinity is claiming about 3 ha of arable land from conventional crop farming every minute (Shabala *et al.*, 2014), forcing agricultural production into marginal areas and making the use of traditional staple crops more and more challenging and less efficient. The physiological and genetic complexity of the salt tolerance trait means that real progress in crop breeding for higher salinity stress tolerance may be achieved only by a painfully slow pyramiding of essential physiological traits (Shabala, 2013; Flowers and Colmer, 2015). Given the time constraints, a safer solution to meet the 2050 challenge may be to find alternative crop and forage species for farming in salt-affected conditions and to restore salt-affected areas (Rozema and Schat, 2013; Panta *et al.*, 2014). In this context, halophytes 'tick all the boxes' and promise to become important components of 21st-century farming systems.

The term 'halophyte' entered plant biology literature at the beginning of the 18th century, and these plants have been fascinating generations of scientists ever since. Halophytes thrive in conditions that kill 99% of conventional crops and, over the course of evolution, have developed highly efficient mechanisms to cope with the salt load. What are these mechanisms? Are they unique to the halophytes, or are they simply underutilized by conventional crops? Can we make the latter more efficient? Some answers to these questions are given in this volume. The range of topics covered includes the patterns of ion accumulation in halophytes; specific anatomical traits such as leaf or stem succulence or secretory glands/salt bladders, conferring their superior salinity tolerance; and mechanisms of reactive oxygen species (ROS) detoxification. Several chapters also investigate specific features of interaction between halophytes and soil microorganisms.

While the number of halophytic species is relatively low (< 1%), they are present in about half of the higher plant families (Flowers and Colmer, 2008; Flowers *et al.*, 2010). Some orders contain many species of halophytes, but many orders only have a few (Flowers *et al.*, 2010; Shabala and Mackay, 2011). A similarly uneven distribution is also characteristic of the presence of specific physiological traits between orders (e.g. salt secretion through the glands; Dassanayake and Larkin, 2017). Why? How does the habitat affect mechanisms employed by halophytes to deal with the salt load? Several chapters in this volume address this question, dealing with various aspects of halophyte ecophysiology.

In addition to their potential use as a 'deciphering tool' to understand mechanisms of salinity stress tolerance to boost current breeding programmes for this trait, halophytes are already being used directly for human food, for forage and animal feeds, as oilseed and energy crops, and for desalination and phytoremediation purposes. Other chapters provide a comprehensive update on these topics.

The rapid progress in molecular biology and the recent genome sequencing of several halophyte species (Oh *et al.*, 2012; Wu *et al.*, 2012; Yang *et al.*, 2013; Zou *et al.*, 2017) will undoubtedly provide an additional boost to halophyte research. However, plant organisms are not merely a number of genes put together. Further progress in the field may only be achieved when various omics tools are intrinsically interspersed with the understanding of plant function and put into an environmental context. We hope this volume will contribute to this purpose. Happy reading!

Mirza Hasanuzzaman, Sergey Shabala and Masayuki Fujita

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