Arabidopsis Thaliana

Cultivation, Life Cycle and Functional Genomics

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PLANT SCIENCE RESEARCH AND PRACTICES

ARABIDOPSIS THALIANA

CULTIVATION, LIFE CYCLE AND FUNCTIONAL GENOMICS

ADRIANO SOFO
EDITOR

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PREFACE

Adriano Sofo, PhD
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Plants are sessile organisms and their only alternative to a rapidly changing environment is a fast adaptation to the abiotic and biotic stresses. Among the several known species of flowering plants, *Arabidopsis thaliana* is the only plant that has been most thoroughly studied. This angiosperm with dicotyledonous seeds belonging to the family Brassicaceae was known to the botanists for at least four centuries and has been used since then for experimental studies for about half a century, until it was Fried rich Laibach who had outlined the advantages of using it in genetic experiments and had also suggested that it could be used as a plant model system in 1943. Its unique features favor genetic experiments, which include its small size, a rapid generation time, the ability to grow well under controlled conditions and high fecundity if up to 10,000 seeds per plant. Like the peas that Mendel studied, it reproduces mainly by self-fertilization. Arabidopsis is considered a model plant for many studies as its genomic sequence was completely identified and its mechanisms in genomic, transcriptomic and proteomic regulation are often similar to other plant species.

The aim of this book is to give an up-to-date overview on the recent breakthroughs in the area of responses and adaptations of Arabidopsis, particularly those regarding its cultivation, life cycle and functional genomics.

I tried to focus my attention on the most exciting and innovative research on this species, involving authors with strong research experience. On this basis, I hope that the present volume will be an ideal source of scientific information to the advanced students, junior researchers, faculty and scientists involved in ecology, agriculture, environmental microbiology, genetics, molecular biology, biochemistry, biotechnology and other areas involving Arabidopsis studies and plant sciences in general.

The book is divided into seven chapters. The first one is focused on the biochemical antioxidant responses of Arabidopsis. In this chapter, the authors aim to summarize the essential information on the cellular redox active processes and their regulation.

This overview can help to advance our understanding of systemic acquired antioxidant and redox defense systems in plants, and to identify novel targets to develop stress-tolerant plant varieties. The second and third chapters of the book regard genetics in Arabidopsis, whose nuclear and chloroplast genomes provide new foundations for a more comprehensive comparison of conserved processes in all eukaryotes, allowing the identification of a wide range of the functions of specific plant genes and helping to establish methods to identify genes for crop improvement. These approaches, together with various bioinformatics tools, set a stage for elucidating gene functions of this genome and allow to track their origin as well as evolutionary pathways. In their interesting review, Wiktorek-Smagur et al. (Chapter 4) described the ability of Arabidopsis to produce transgenic plants with no need to use *in vitro* cultures (*in planta* transformation methodology), a transformation method routinely employed using the relatively low-tech approach of floral dipping to create stable gene knockout plant lines for most genes.

The role of microRNAs (miRNAs) in abiotic stress responses of Arabidopsis is reviewed in Chapter 5. In fact, recent studies have unraveled the role of various miRNAs, small, single stranded, non-coding, regulatory RNA molecules that control the gene expression through the sequence specific binding and eventual cleavage and degradation of target mRNAs. Finally, the last two chapters focus on two specific and stimulating phytopathological and toxicological aspects of Arabidopsis: the phenological phases of this species during the infection by some phytopathogenic fungi (*Fusarium* spp.) (Chapter 6), and the toxicity of graphene on specific (T87) Arabidopsis cell suspensions.

I am thankful to all of the authors for their interests, significant contributions, cooperation and patience that made the present volume possible. I was glad to work with all of them on this exciting project!

Special thanks are due to Prof. Antonio Scopa and Prof. Cristos Xiloyannis. Without their unending support, motivation and encouragement during all my years of my academic career the present task would have never been accomplished.

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