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Ulrich Lüttge • Erwin Beck • Dorothea Bartels
Editors

Plant Desiccation Tolerance

 Springer

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Foreword

‘Dark brown shrivelled dead-looking leaves’ ‘so dry they can be crushed to a powder between one’s fingers’ ‘the plant cost its own weight in gold’ ‘surprisingly, the rehydrating leaves became green again’ ‘the leaves expanded to ten times their area when they were dry’ – these phrases display the astonishment evoked by the novel vision of a desiccation tolerant ‘resurrection plant’ passing from a moribund dry state to a healthy active life as it re-hydrates! Such amazement has now been matched by rapidly advancing scientific understanding.

Researchers from countries widely spread from Hungary to New Zealand set out current knowledge on desiccation tolerant plants. It is appropriate that this book includes contributions of many eminent plant scientists from Germany – for German botanists played a substantial role in the initial reports of angiosperm species with desiccation tolerant foliage and in the subsequent research into the mechanisms involved in the survival and recovery of air-dry leaves. The first reports, by the taxonomist Kurt Dinter, of four desiccation-tolerant angiosperm species consisted of mere asides in his descriptions of species in the flora of southwest Africa. Fuller comments on one of these species, *Chamaegigas intrepidus*, were published by H. Heil in 1924. Four decades later P. Hoffman, G.H. Vieweg and H. Ziegler demonstrated renewed photosynthesis in re-hydrated shoots of the African ‘resurrection bush’ *Myrothamnus flabellifolia*, one of the species Dinter recognised to be desiccation-tolerant.

Focused exploration for desiccation-tolerant plants has extended our knowledge of the floristic spread and the geographic range greatly. Even a cursory perusal of the chapter topics shows that the phenomenon is found in the full range of phyla of chlorophyll-containing species from prokaryotes and cryptogams to angiosperms. Relatively few species in any one phylum have received intensive study. Among the angiosperms, Dinter’s species *Craterostigma plantagineum*, *Chamaegigas intrepidus*, *Myrothamnus flabellifolia* and *Xerophyta viscosa* have all received considerable but by no means exhaustive scientific attention, as has also *Sporobolus stapfianus* that was recognised as a desiccation-tolerant grass in 1970.

The present tome also displays how the scope of desiccation-tolerant plant studies has expanded to embrace ecological, evolutionary, physiological, biochemical and molecular biological areas. In the last two instances, the increasing knowledge of desiccation tolerance is being driven by the explosive growth in the technology and understanding in these fields. The first investigations of gene expression of drying and rehydrating resurrection plants were conducted in the Max Planck Institute at Köln by Professor Dorothea Bartels and her colleagues. I am indebted to Professor Bartels for guiding my first steps in this important aspect of desiccation tolerance. The rapid growth of this field has given us insights into the complex changes in mRNA complements and the proteome that support the survival of drying leaves and the revival of rehydrating plants, not only in the foliage but also in the pollen and seed of most spermatophytes. The investigations of a widening number of researchers active in this area have elucidated much about the compounds and processes implementing desiccation tolerance. Much remains to be discovered on the mechanisms of regulating the implementation of desiccation tolerance. The visual drama of desolate air-dry plants re-imbibing water, re-expanding and reviving is matched by the intellectual fascination of the enabling molecular machinery. I hold the hope that a full comprehension of the regulatory processes will lead to genetic transformation of crop and pasture species to enable them to express throughout the full vegetative plant the desiccation tolerance of their seed and pollen – and so bring a full knowledge of the phenomenon of desiccation tolerance to its fullest practical yield.

Melbourne, Australia
January 2011

Donald F. Gaff

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