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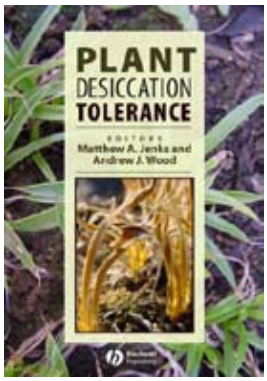
PALAIOS 2008
Book Review
DOI: 10.2110/palo.2008.BR38




**Plant Desiccation Tolerance,** Jenks, M.A., and Wood, A.J., editors, 2007, Wiley-Blackwell Publishers, 311 p., USD 199.99, ISBN 0813812631

Many plants are desiccation tolerant in the seed or spore stage, a physiological adaptation that allows dissemination of seeds or spores and delayed germination with no negative consequences (Chapter 9 by Walters and Koster). A handful of plants are also so-called resurrection plants, that is, able to withstand desiccation of the vegetative structures as well as the seeds. This book covers, in 10 review papers, both modes of desiccation tolerance.

Biologically, desiccation tolerance has a specific meaning: "the ability of an organism to dry to equilibrium with dry air (50% RH [relative humidity] and 20°C, corresponding to a water potential of –94 MPa) and to resume normal metabolic function on rehydration" (p. 6). This dry subject is quite fascinating, as this book amply illustrates.

Definition of the process of vegetative desiccation is difficult because the responses and mechanisms are complex. For example, the rate of drying is important; if dried too quickly, many desiccation-tolerant plants will not survive. Slow rates of drying seem to prime some resurrection plants for survival in the desiccated state. This is related to the cascade of chemical and biophysical responses that these plants undergo during drying. Major metabolic challenges, discussed in several of the chapters, include stresses induced by production and accumulation of free radicals (reactive oxygen species), protein denaturation, and loss of structural integrity of macromolecules. Strategies for addressing these challenges vary, but seem to involve sugars, particularly sucrose, which forms a biological glass in many instances (Chapter 3 by Farrant; Chapter 7 by Leprince and Buitink), prolific production of antioxidants (several authors), and abundance of specialized proteins (late embryogenesis abundant proteins, or LEAs; Chapter 3 by Farrant).

Much of the book covers biochemical and genetic mechanisms, rather than morphological responses, which limits the usefulness of the book to paleobiologists except to provide background on this adaptation. There are tidbits, however, that are of more direct potential benefit. For example, the gymnosperms conspicuously lack any taxa that have been identified as desiccation tolerant except in their seeds, whereas vegetative desiccation tolerance is found in all other groups, most commonly the bryophytes.

Evolutionary paleobiologists might also be interested in hypotheses of the evolution of the two mechanisms of vegetative desiccation tolerance, constitutive and inducible. Constitutive desiccation tolerance is the strategy of effecting all repair upon rehydration; this occurs in plants that can survive very rapid dehydration. Inducible desiccation tolerance refers to the strategy of biophysical and biochemical preparation for desiccation. Such plants cannot tolerate rapid dehydration, as indicated above, although drying curves (different for different species) indicate rapid water loss at critical times that apparently occur when the stomata open as part of the preparation process (Chapter 3 by Farrant). Some plants, mostly monocots, completely dismantle their photosynthetic apparatus during desiccation, and the ability to do this (poikilochlorophylly; Chapter 2 by Oliver) might have some interesting evolutionary implications. Reestablishment of photosynthesis has been demonstrated in one species (*Xerophyta humilis*) to be accomplished by RNA coding for the resynthesis of chlorophyll during drying, and translation immediately after rehydration, before reactivation of the nuclear genome (Chapter 2 by Farrant). Intraspecies variation occurs latitudinally, possibly related to the length of the growing season (Chapter 9 by Walters and Koster).

Morphological responses that might be of interest to paleobiologists are folding of the cell walls (Chapter 2 by Farrant; Chapter 5 by Bartels et al.; Chapter 9 by Walters and Koster) and desiccation pruning, which occurs when rehydration of a woody stem cannot overcome cavitation in the xylem beyond a certain branch height. The process of rehydration involves root pressure and capillarity (including facilitation by a lipid lining on the xylem walls). To date, this has only been observed in *Myrothamnus flabellifolius*, the only woody resurrection plant identified so far, but it is possible that it has been present in other taxa. Whether the morphological responses are of evolutionary significance is open to question. Farrant opines that the way

in which the morphological response plays out may "reflect[s] modification of the metabolic characteristics already present in each species" (p. 64).

In addition to the chapters mentioned above, there are interesting reviews of lichens (Chapter 4 by Beckett and Minibayeva), desiccation tolerance in seeds and pollen (Chapter 6 by Berjak et al.), the structure of DNA in seed desiccation tolerance (Chapter 8 by Boubriak et al.), and application of desiccation-tolerance research to crop improvement (Chapter 10 by Iyer et al.). This latter chapter focuses on a single gene that might be inserted in crop plants to enhance drought tolerance, but important for evolutionary paleobiologists is the fact that desiccation tolerance seems to involve a large array of genes and gene complexes (Chapter 5 by Bartels et al.).

This book is aimed primarily at specialists and agronomists. Nonspecialists seeking information may not, for example, appreciate the nuances among the various, seemingly identical treatments of the stress created by free radicals. In addition, many terms are not defined; this reviewer found herself wishing the chapter by Walters and Koster had been placed at the beginning, as they took more care to define terms than did other authors.

The book is nicely produced, with a minimum (though not absence) of typographical errors. The major annoyance was the aggregation of color figures in the center of the book, although all are reproduced in black and white in their corresponding chapters.

In summary, although paleobiologists may find interesting and useful information in this book, it is the sort of book one might go to the library for, rather than keep in one's own library.

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