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New Antioxidant Genes from an Anhydrobiotic Insect: Unique Structural Features in Functional Motifs of Thioredoxins

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Abstract

© 2016, Springer Science+Business Media New York.Polipedilum vanderplanki is the most complex known organism able to survive body desiccation via entering a state of suspended metabolism called anhydrobiosis. This unique ability is based on the specific molecular machinery involving a synthesis of non-reducing sugar trehalose and a variety of protective proteins. Genes encoding these protective proteins are extensively duplicated in the P. vanderplanki genome and become hugely upregulated in response to desiccation. Some of these highly expressed genes encode substitutions of amino acids crucial for the function of corresponding proteins. An intriguing group of protective proteins in P. vanderplanki are thioredoxins (TRX). These antioxidant proteins are important for P. vanderplanki anhydrobiosis since desiccation is tightly related to the elevated production of free radicals and oxidative damage. The TRX set is unprecedentedly expanded in the P. vanderplanki genome up to 25 TRX genes. Genomes of congeneric midge Polipedilum nubifer, Apis mellifera, Drosophila melanogaster, and Anopheles gambiae encode only 3–7 TRX genes. Moreover, all three P. vanderplanki thioredoxin genes most expressed at 24 h of P. vanderplanki larva desiccation encode for proteins missing the typical CxxC motif.

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Keywords

Amino acid substitution, Anhydrobiosis, CxxC motif, P. vanderplanki, Thioredoxins