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Initial characterization of newly identified mitochondrial and chloroplast small HSPs from sugarcane shows that these chaperones have different oligomerization states and substrate specificities

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ABSTRACT

Chaperones belonging to the small heat shock protein (sHSP) family are ubiquitous and exhibit elevated expression under stresses conditions to protect proteins against aggregation, thereby contributing to the stress tolerance of the organism. Tropical plants are constantly exposed to high temperatures, and the mechanisms by which these plants tolerate heat stress are of foremost importance to basic science as well as applied agrobiotechnology. Therefore, this study aims to characterize sHSPs from different organelles from sugarcane, an important crop that is associated with sugar and bioenergy production. An expression sequence tag database of sugarcane was searched, and sHsp genes of mitochondrial and chloroplast organelles were selected and cloned. The proteins were expressed in *Escherichia coli* and isolated and purified by two chromatographic steps with high purity as single species. Circular dichroism and fluorescence spectroscopy showed that both proteins were purified in their folded states with a predominant β -sheet secondary structure. Determination of the molecular weight, diffusion coefficient and Stokes radius parameters showed that both chaperones form large spherical-like oligomers in solution. The two sHSPs had different oligomeric states and substrate specificities. The mitochondrial sHSP was a 20-mer with ability to protect model substrates that differ from that of the 16-meric sHSP from chloroplasts. These results indicate that both sHSPs are key agents to protect against stress confirming the importance of the great diversity of sHSP chaperones in plants for homeostasis maintenance. Moreover, to our knowledge, this is the first report about small HSPs from sugarcane organelles.

Highlights

- First report on the cloning and purification of mitochondrial and chloroplast sHSPs from sugarcane
- The mitochondrial sHSP is a 20-mer, while the sHSP from chloroplasts is a 16-mer

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