SYMBIOTIC *Trebouxia* sp. TR9, *Asterochloris erici* AND FREE-LIVING *Chlorella vulgaris* GREEN MICROALGAE RESPOND DIFFERENTIALLY TO OSMOTIC AND SALINE STRESSES

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Tolerance to drought and salinity has been extensively studied in plants, as well as the adaptations of these organisms to hydric and salt stress. However, information concerning the responses to these types of stresses in free-living microalgae is scarce, or even unavailable in the case of lichen symbiont microalgae. In this study, molecular mechanisms of resistance to saline and osmotic stresses were analysed in the phycobiont *Trebouxia* sp. TR9 and compared to those of the symbiotic *Asterochloris erici* and the free-living microalga *Chlorella vulgaris*. Salt and osmotic stresses severely affected growth and functionality *in C. vulgaris;* however, *Trebouxia* sp. TR9 showed extraordinary ranges of tolerance, followed by *A. erici*. Ultrastructural modifications due to saline and osmotic stresses included chloroplast retraction, vesicle formation and starch accumulation, which were barely noticeable in *Trebouxia* sp. TR9 compared to the other two species. Abcisic acid, the hormone used by plant cells to cope with salt stress or water deficit appeared to play a role in the response of *Chlorella vulgaris*, but not in the case of the two phycobionts. Furthermore, the transcriptomic analysis carried out comparing the response of the three species to these stress conditions revealed groups of genes with a differential behavior. The function of these group of genes could be the key to understanding the observed differences of tolerance intervals between both phycobionts and the free-living *Chlorella*, as well as the extraordinary tolerance of *Trebouxia* sp. TR9. These results suggest that symbiont microalgae may have developed alternative adaptation mechanisms to those of vascular plants and free-living green microalgae to cope with extremely saline environments and other habitats with high osmotic stress. Funding: PROMETEO/2017/039 (GVA).