Identification of NTMC2T5, a new lipid transfer protein family at ER-chloroplast contact sites involved in stress response

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Plants are sessile organisms and they have perfected a complex molecular signalling network to detect and respond to different environmental stresses. In plants, fatty acid synthesis takes place at chloroplasts, and they are assembled into glycerolipids and sphingolipids at the ER. Then, the newly synthetized lipids in the ER are delivered to chloroplast via a non-vesicular pathway, likely through lipid transport proteins. These LTP would be localized in ER-chloroplast membrane contact sites (MCS), which are microdomains where membranes of these two different organelles are closely apposed but not fussing. SMP domain proteins are evolutionarily conserved LTP in eukaryotes that localize at MCS. We have studied the occurrence of SMP proteins in A. thaliana and S. lycopersicum. By using transient expression in N. benthamiana leaves and confocal microscopy, we have identified the NTMC2T5 family with two homologs in A. thaliana and only one in S. lycopersicum that are anchored to the chloroplast outer membrane and are interacting with the ER (at ER-chloroplast MCS. Our preliminary data have demonstrated that NTMC2T5 proteins are anchored to the chloroplast, and they bind in trans the ER. Additionally, it is predicted that these proteins contain a SMP domain which is a lipid-transfer domain, indicating that these proteins could be responsible for some of the lipid transferring events at ER-chloroplast MCS that are still unknown. We show the results of the lipidomic analysis we have performed in order to understand the role of these proteins. And our phenotypic analyses have shown that these proteins are involved in salt tolerance. Additionally, we have observed that clustering of chloroplasts occurred when we overexpressed these proteins. And Arabidopsis double knock-out mutant for these proteins showed less chloroplasts attached to the nucleus in epidermal cells, suggesting that these proteins could be involved in these chloroplast signalling events after stress.