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Autophagy: An Important Biological Process that Protects Plants from Stressful Environments

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Editorial

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AUTOPHAGY

Plants are sessile organisms that cannot escape stressful environments, such as drought, high temperature and shortage of essential minerals in the soil. Hence, plants have evolved practiced processes that protect themselves against these harmful conditions. One of these important processes is autophagy, a mechanism that destroys specific compounds that participate in efficient growth and requires extensive energy input and on the other hand stimulates biological processes that protect the plants from the stress. Autophagy can operate either as selective process, turning over specific components that are not needed in large amounts when plants respond to minor stresses, such as minor shortages of rain and/or non-significant shortage of important minerals in the soil, or a bulk process, turning over major components that may be harmful under the stress conditions and stimulate the production of important stress-protecting components. One of the major mechanisms protecting plants from stressful environments is autophagy, a biological that is responsible for the turnover of un-needed components in response to stress. Autophagy can be either a bulk process, turning over bulk amounts of various components in response to major stresses, or a selective process turning over specific components in response to specific and/or relatively minor environmental cues. One of the major protein components that are essential for the operation of the autophagy is an ubiquitin-like protein, termed Atg8. This protein is involved in the autophagy process, being particularly required for the formation of autophagosomes. Plants possess nine Atg8 protein isoforms, indicating the importance of this protein in the operation of autophagy in order to protect plants from various stresses [1,2].

Aiming to elucidate plant biological processes that are associated with selective autophagy in plants, we performed a yeast two-hybrid analysis, using the Arabidopsis autophagy-associated protein Atg8f as bait. This analysis identified a number of Atg8f binding proteins, all of which contain one or more Autophagy-Interacting Motifs (AIMs), thus indicating that the functions of these proteins and their steady state levels are associated with selective autophagy. One of these Atg8-binding proteins, termed "Autophagy interacting Protein 1" (ATI1) was further subjected to more detailed studies. When grown under regular, non-stress growth conditions, ATI1 was partially associated with the endoplasmic reticulum (ER) membrane. Furthermore, upon exposure of the plants to carbon or nitrogen starvation, ATI1 was assembled into two different types of novel bodies that were associated with either the endoplasmic reticulum (ER) or with the plastids.

When the plants were exposed to carbon starvation or to nitrogen starvation, ATI1 was incorporated into novel bodies that were either moved along the ER network, or were localized inside the plastids. These novel bodies were then transported into the central vacuole in which their contents have apparently being turnover inside the plastids. Interestingly, seedlings of the plants over-expressing ATI1 germinated faster and showed enhanced tolerance to carbon or nitrogen starvation, while plants with suppressed expression of ATI1 showed reduced tolerance to carbon or nitrogen starvation, indicating the biological processes using ATI1 confer faster growth and enhanced stress tolerance of the germinated seedlings [2-4].

The above results open new avenues to enhance plant germination and stress tolerance by using genetic and/or genetic engineering approaches that could enhance the production and intracellular trafficking of ATI1.

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REFERENCES

1. Honig A, et al. A new type of compartment, defined by plant-specific Atg8-interacting proteins, is induced upon exposure of Arabidopsis plants to carbon starvation. Plant Cell. 2012;24:288-303.
2. Honig A, et al. Selective autophagy in the aid of plant germination and response to nutrient starvation. Autophagy. 2012;1;8:838-839.
3. Michaeli S, et al. Arabidopsis ATG8-INTERACTING PROTEIN1 is involved in autophagy-dependent vesicular trafficking of plastid proteins to the vacuole. Plant Cell. 2014;26:4084-4101.
4. Michaeli S, et al. Autophagy in plants – What's new on the menu? Trends in Plant Science Trends in Plant Science. 2015;15:1360-1385.