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# Ultrastructural aspects of a NaCl-adapted potato cell line

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Salinity is one of the major factors limiting plant development and crop productivity. Damage to plants exposed to salinity has been ascribed to ion toxicity, water deficit, nutrient imbalance and oxidative stress. The physiological and biochemical aspects of salt tolerance in plants have attracted considerable interest, but few studies have been carried out to study the ultrastructural changes in plant cells adapted to salinity. These changes may be helpful in elucidating the mechanisms of salt tolerance at cellular level. In plants exposed to salinity, alterations of cell walls and structure of cellular membranes, the swelling of thylakoids and a decrease in the amount of grana stacking in chloroplasts, and the vacuolation of cells have been observed [1, 2].

In this study, a potato (*Solanum tuberosum* L.) calli line grown on medium with 150 mM NaCl [3] was used to detect potential ultrastructural alterations to better understand the response of potato callus tissue to high salinity. Since cell membranes are one of the primary target of salt stress, we also determined the lipid peroxidation in NaCl-tolerant calli by estimating the malondialdehyde (MDA) content.

Our results showed that lipid peroxidation was higher in 150 mM NaCl-tolerant line (61% over the control line); despite this difference, no ultrastructural changes were observed in membranes structure (Fig. 1).

Fig. 1. Ultrastructural aspect of callus tissue grown in the presence of 150 mM NaCl. Portion of cell showing the lower level of organisation of the plastids which displayed larger starch grains than control callus tissue (compare with Fig. 3) (Bar = 1 µm).

However, some alterations were detected in plastids from salt-adapted cell line. Round-shaped plastids were more common in salt-exposed cells and appeared less differentiated than those in the control cells, displaying a reduced membranous system and a lower number of grana (Figs. 1, 2A and 3). In addition to that, these plastids showed a less compact stroma displaying a higher number of large starch grains when compared to control material (Figs. 1 and 3). As illustrated in Fig. 2B, the stroma region of the organelle was partially occupied by starch grains, resembling the morphology of amylochloroplasts. An additional aspect observed in plastids from salt-adapted cells was the absence of vesicles that appeared regularly in the plastids of the control callus tissue (Fig. 3).

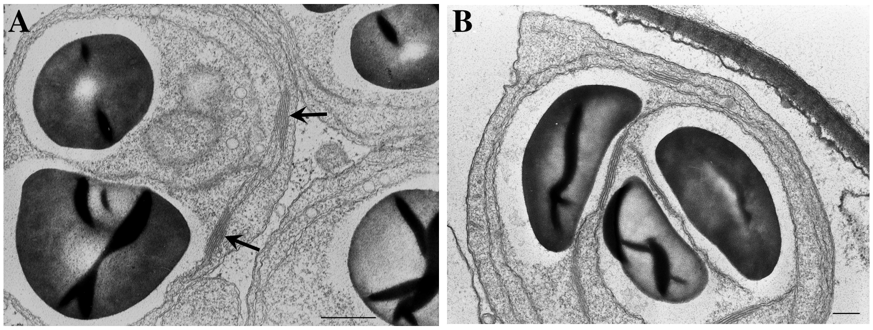


Fig. 2. Ultrastructural aspect of plastids from 150 mM NaCl-tolerant potato calli. A – Note lamellar system with a few grana (arrows) (Bar = 0.5 μm). B –Portion of a plastid containing huge starch grains (Bar = 0.5 μm).

The accumulation of starch under salt stress has been reported in other studies [4] and it is tempting to speculate that starch synthesis from sucrose play a role in moderating the osmotic condition. In order to confirm if starch accumulation in the plastids is a response of callus tissue to salinity, a morphometric analysis of the fractional volume of the starch in relation to the plastid is in progress.

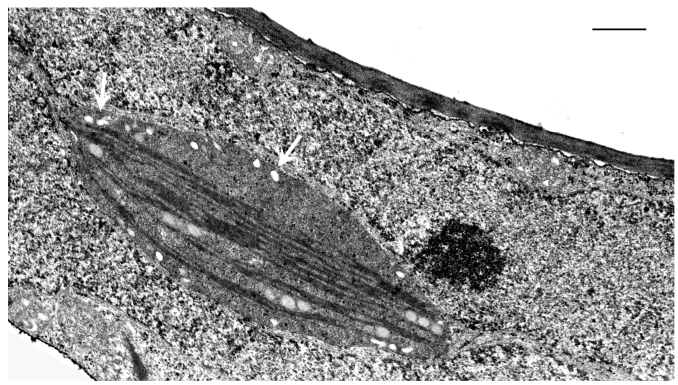

Fig. 3. Control callus tissue. Portion of cell showing a plastid which displayed a developed lamellar system. The presence of vesicles (arrows) at the periphery of the plastid is a common feature in this tissue. Note the absence of starch grains that are observed in NaCl-adapted cells (Bar = 0.5 μm).

In conclusion, the present study shows that the structural integrity of the NaCl-tolerant cells was not affected compared to control material, what is consistent with the macroscopic aspect of callus tissue grown under saline condition. However, the accumulation of starch in salt-tolerant cells may be related with the osmotic adjustment process and, consequently, contribute to the adaptation of cells to salinity.

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