ALTERATION OF KREBS CYCLE IN TRANSGENIC TOMATO PLANTS SHOWS A CRUCIAL ROLE OF ORGANIC ACIDS IN CROP DEVELOPMENT AND FRUIT QUALITY.

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ABSTRACT

Tomato (*S. lycopersicum*) is one of the most consumed vegetable in the world, moreover a model plant for the study of fleshy fruit. Organic acids (O.A.) play a crucial role in the plant primary metabolism (1, 2) and are one of the most important fruit quality traits (3). Transgenic tomato plants expressing a bacterial maleate isomerase (MI), which converts maleate to fumarate, were generated in order to improve our knowledge about the role of O.A. in the crop and fruit metabolism. Growth and reproduction were affected by the unbalance of O.A. The plants show a dwarf phenotype and a flowering delay. Furthermore, a lower level in chlorophyll content and a decrease in stomata indicated alterations of photosynthesis. Postharvest was also impaired. Transgenic fruits showed increased water loss and deterioration, pointing an implication of the O.A. in the cell wall metabolism. These changes have been confirmed by the expression analysis of the cell wall genes related.

RESULTS

Dwarf phenotype and flowering delay

Figure 1

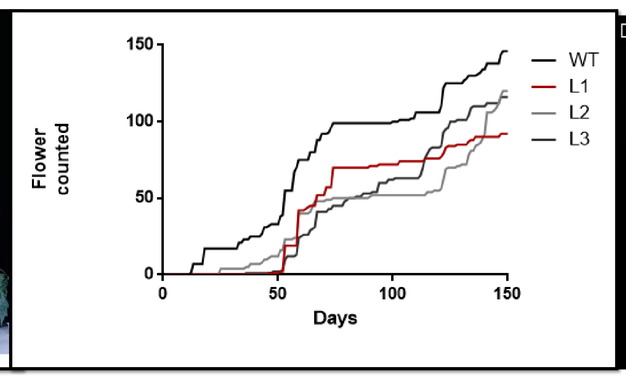

Figure 2

The transgenic plants showed a dwarf phenotype and a delay in the development (Figure 1). Furthermore, the transgenic lines had a delay in flowering (Figure 2).

Postharvest phenotype

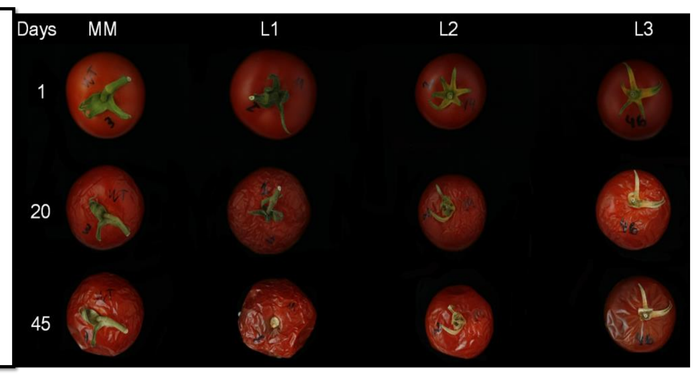

Figure 3

The postharvest senescence of the fruit was also affected, the transgenic lines showed worse postharvest than the MM fruits.

Ripening fruit metabolome

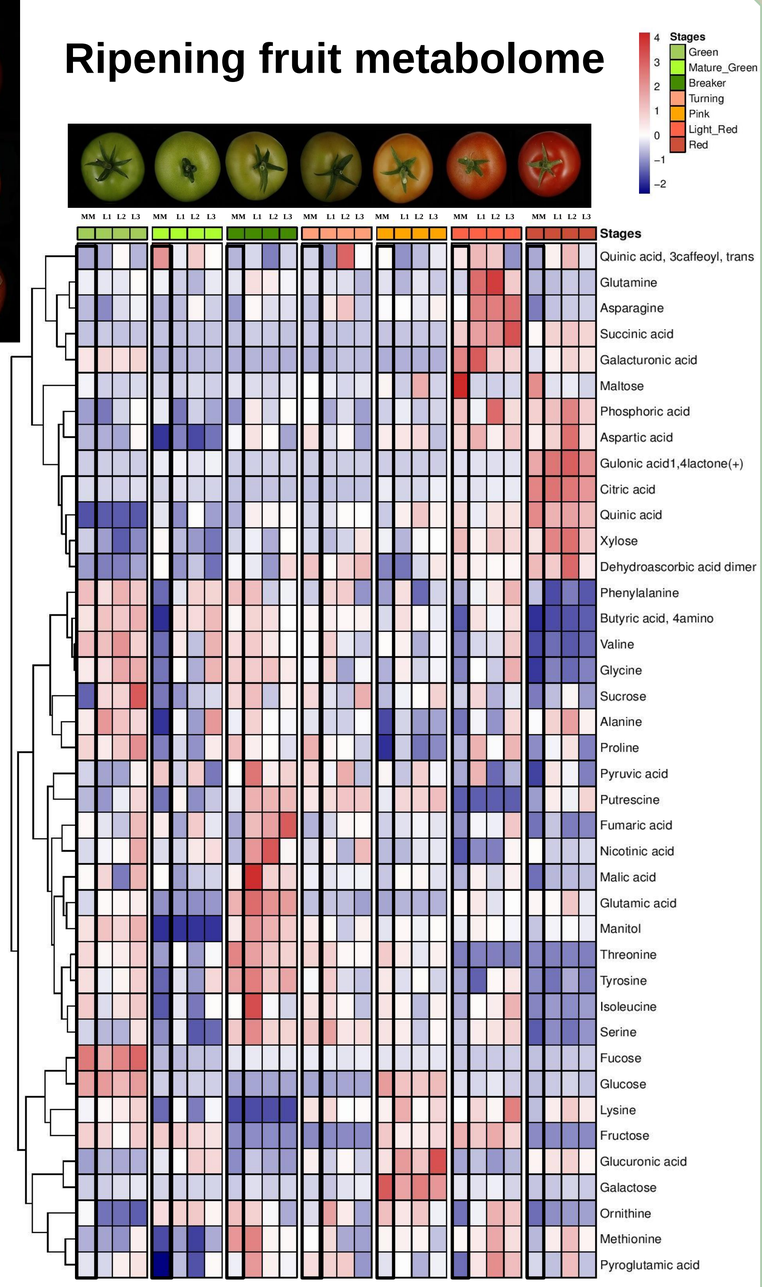

Figure 7

During fruit ripening a lot of metabolites change their relative amounts. In the transgenic lines the ripening was metabolically different regarding some sugars and organic acids. The changes are more accused in the late stages of ripening.

Stomatas number

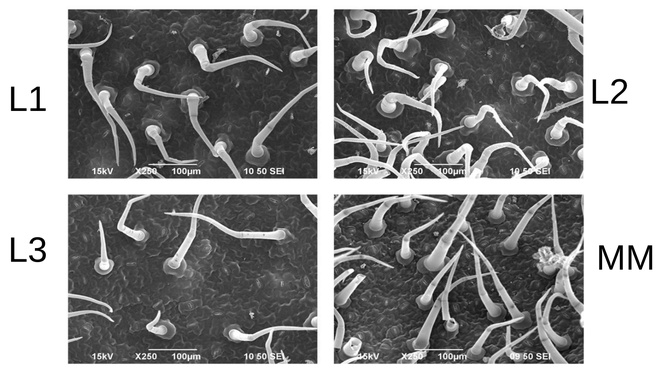

Figure 4

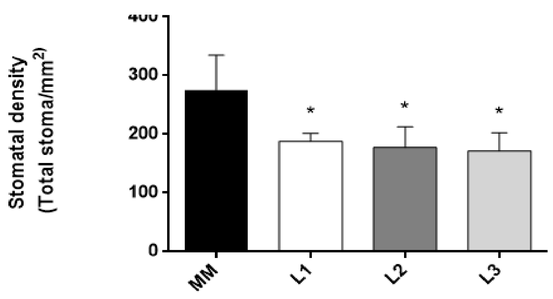

Figure 5

Under a scaninng electron microscopy the surface of the transgenic plant's leaves had a lower number of stomatas than the moneymaker plants.

Expression changes in cell wall genes in transgenic fruits.

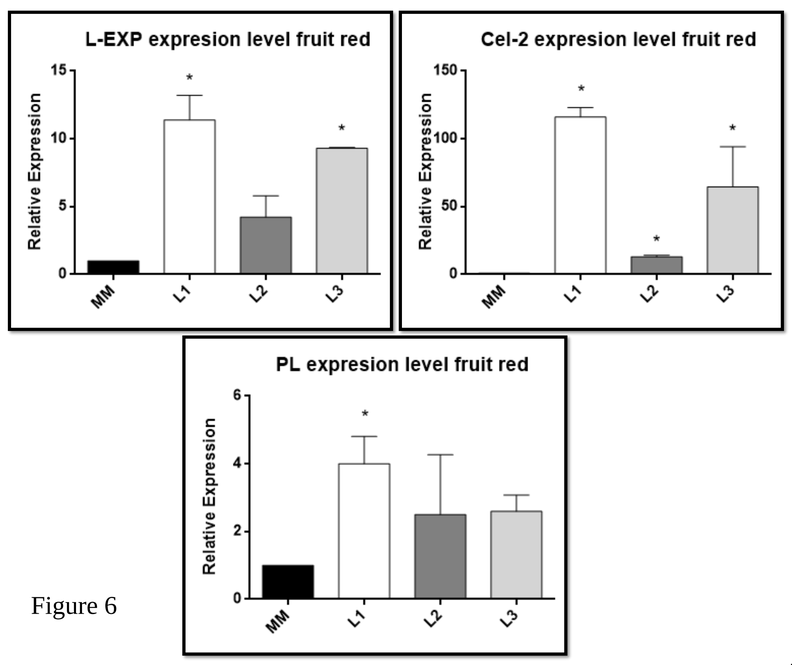

Figure 6

At red stage the fruits showed changes in cell wall genes expression, overexpressing L-*expansin (L-EXP)*, *celulase-2 (Cel-2)* and *pectate liase (PL)*.

CONCLUSIONS

- **Transgenic plants** showed an altered vegetative/productive development (Figures 1 and 2). It pointed out the important role of OA in **development** and an **affection of stomata number** (Figures 4 and 5).
- As affect the postharvest life of tomato fruits and the quality fruit traits (Figure 3). Indeed, the regulation of the postharvest life is affected by the **overexpression of cell-wall genes** (Figure 6).
- Sugars like Sucrose, Maltose, Xylose and OA like Succinic acid have a **different behaviour in ripening** of transgenic fruits and these influence the quality fruit (Figure 7).

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