Improvement of Nutritional Value of Tomatoes under Salt Stress Conditions

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Abstract: The aim of the work was to evaluate the change in antioxidant content with maturation stage in tomato berries under elevated salinity conditions. The examined antioxidants were lipoic acid, vitamin C and vitamin E. It was found that in the majority of berries examined the content of dihydrolipoic acid, reduced ascorbate and α-tocopherol increased with maturation. Furthermore, the interplay between them was shown. These results are of great importance also from nutritional and health point of view.

Keywords: salt stress; tomato; antioxidant; lipoic acid; vitamin C; vitamin E

INTRODUCTION

Nowadays nutritional value of food products is of great importance for modern consumer society. Nutritional value of food can be affected by various substances, some of them are antioxidants.

The antioxidants play a fundamental role in the protection of plant cells from oxidative damage and are also of primary importance for animal cells. In fact, antioxidants like vitamin C, vitamin E and ß-carotene with their antagonist functions against free radicals are very useful in protection against various diseases (De Pascale *et al.* 2001). From the nutritional and health points of view, tomato is characterised by high content in carotenoids (lycopene) and vitamin C. Recent studies on tomato (Mittova *et al.* 2000) showed the involvement of antioxidative enzymes in the tolerance mechanism to salt stress induced by NaCl but took into account their presence in shoots and roots. The data on mechanisms of the antioxidant response in tomato berries under salinity conditions are scarce and incomplete. Therefore this study focused on deeper comprehension of antioxidant response of tomato berries to salt stress and interplay between them.

MATERIAL AND METHODS

Tomato plants (*Lycopersicon esculentum* Mill.) of the cv. Jama and cv. Gimar were grown in a greenhouse on standard rockwool slabs using closed loop aggregate culture. The elevated salinity level corresponded to electric conductivity of 8 mS/cm. The berries at two ripening stages (red-breaking and red-ripe) were analysed on the content of qualitative characteristics and antioxidants. Qualitative parameters were determined as follows: titratable acidity by titration with 0.1N NaOH, total soluble solids using refractometer, reducing sugars content with colorimetric assay using the test of dinitrosalicylic acid. Lipoic acid and dihydrolipoic acid were extracted according to Vianey-Liaud *et al.* (1994) modified by Sgherri *et al.* (2002). Reduced ascorbate was determined according to Kampfenkel *et al.* (1995) and tocopherol according to Quartacci *et al.* (2001).

RESULTS AND DISCUSSION

In this study the antioxidant response of tomato berries, cvs Jama and Gimar, under salt stress

conditions represented by electric conductivity of 8 mS/cm, particularly the change in antioxidants level with maturation stage was evaluated. The content of dihydrolipoic acid, lipoic acid, reduced ascorbate and α-tocopherol was determined.

As for the content of dihydrolipoic acid, it increased with maturation under salinity condition by 226% in the berries of cv. Jama and by 101% in the berries of cv. Gimar. Since dihydrolipoic acid is able to regenerate other antioxidants (e.g. vitamin C), its increase in the berries is of great importance. On the other hand, the content of lipoic acid decreased in both cultivars, especially in cv. Jama by almost 50%. The content of the reduced ascorbate under higher salinity did not change significantly with maturation in the berries of cv. Jama but in cv. Gimar it increased by 27%. This antioxidant is the major antioxidant and in addition, it is able to recycle α-tocopherol. Therefore the maintenance of its high level is important. The α-tocopherol is considered to be the most active form of vitamin E. Its level in the berries of cv. Jama under salinity conditions decreased by 7% with maturation but in cv. Gimar it increased by 13%.

Taking into consideration the change in content of examined antioxidants and their interplay, the berries of cv. Gimar seem to have more potential antioxidant mechanisms than those of cv. Jama. This point is significant also for humans who need to intake these antioxidants in food.

The qualitative characteristics were determined only in cv. Jama. The fruit dry matter did not change significantly and titratable acidity slightly decreased. On the other hand, the content of reducing sugars increased by 54% and the ratio reducing sugars/titratable acidity increased by 56%. The increase in this ratio demonstrates improvement in quality since it is an indicator mediating the best taste of the fruit (Santamaria & Valenzano 2001).

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