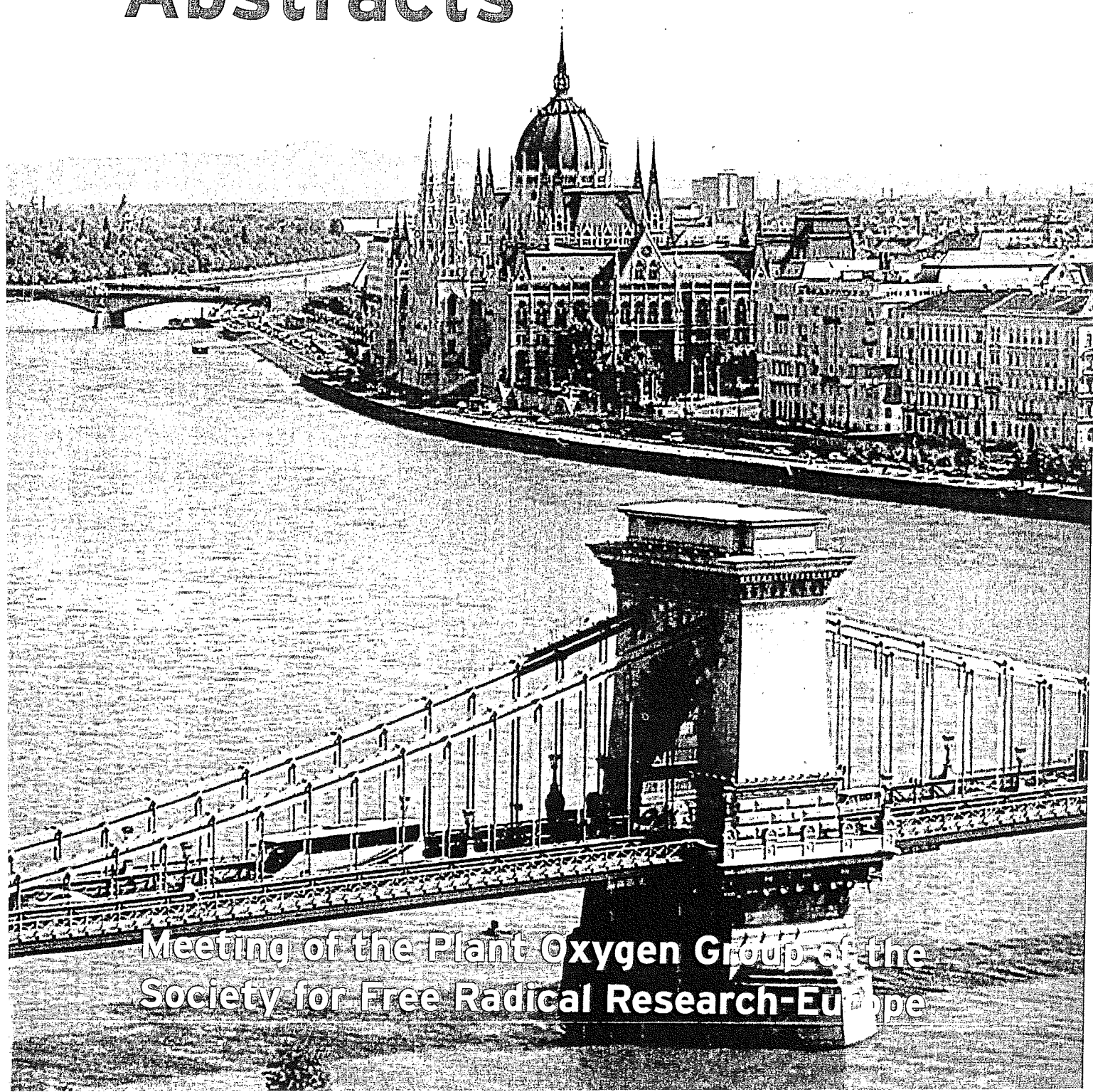


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Abstracts



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Society for Free Radical Research-Europe**

The role of polyamines and their metabolism in the regulation of H_2O_2 level in salicylic acid treated tomato plants

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Introduction

Polyamines (PAs) are small, organic polycations found in all eukaryotic cells. Putrescine (Put), spermidine (Spd) and spermine (Spm) are the major free PAs in plants and they are involved in various processes such as cell proliferation, growth, morphogenesis, differentiation and programmed cell death (Kumar et al., 1997). Polyamine oxidation is the main catabolic process of polyamines. The main catabolic enzymes are the diamine oxidase(s) (DAO, EC 1.4.3.6) and polyamine oxidases (PAO, EC 1.5.3.3). They can regulate the endogenous content of polyamines and they generate H_2O_2 , which can act as a signaling molecule. H_2O_2 produced by polyamine catabolism participates in important metabolic pathways involved in stress responses (Papadakis and Roubelakis-Angelakis, 2005).

Our previous studies proved that long-term pre-treatment with salicylic acid (SA) at low concentrations (10^{-7} and 10^{-4} M SA) can induce the synthesis of polyamines in tomato plants (Szepesi et al., 2009). In this experiments we investigated how SA can influence the polyamine contents and activities of enzymes in polyamine catabolism in the period of pre-treatment and how H_2O_2 produced by PA catabolism can interfere with the SA effect.

Materials and Methods

Solanum lycopersicum cv. Rio Fuego plants were grown in hydroponic culture in a controlled environment under $300 \mu\text{mol m}^{-2} \text{s}^{-1}$ light intensity with 12/12-h light/dark period, a day/night temperatures of 24/22°C and relative humidity of 55-60 %. Plants were treated for 3 weeks with 10^{-7} M and 10^{-4} M SA added to the nutrient solution. Samples were prepared from the second, fully expanded leaves and roots in 3 replicates. Experiments were repeated 3-5 times. Data of time-course analysis presented are means $\pm$ SE for 3 replicates.

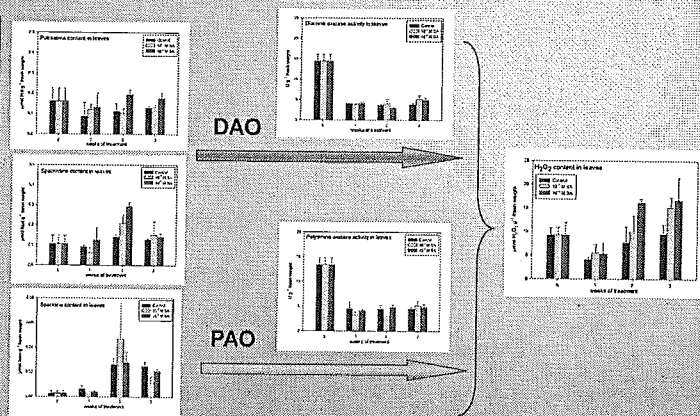
Free polyamines were determined as described by Flores and Galston (1982).

Hydrogen peroxide levels were measured according to Velikova et al. (2000).

Enzyme activities of diamine oxidase (DAO, EC 1.4.3.6) and polyamine oxidase (PAO, EC 1.5.3.3) were estimated by method of Federico et al. (1985) with some modifications (Moschou et al., 2008).

Results I.

In shoots, Put content increased in the case of 10^{-4} M SA while Spd and Spm contents did not change after 3 weeks compared to the control. This can be seen from the decrease of (Spd+Spm)/Put ratio. 10^{-7} M SA-treated plants showed elevated Spd and Spm contents while PAO activity decreased in the 2nd week. DAO and PAO activities did not change significantly compared to the control activities in leaves.



Conclusions

Free polyamines functioned as a substrate for the DAO and PAO may act directly or indirectly as free-radical scavengers. Accumulation of polyamines can stimulate DAO and PAO activities as a mechanism to maintain the balance of polyamine metabolism in plants. DAO and PAO catalyse the oxidative deamination of amino groups of Spd and Spm, producing the corresponding aldehyde, H_2O_2 and 1,3-diaminopropane. These enzymes also have been proposed to be involved in lignification and cell wall stiffening in plants. By investigating the enzyme activities and PA contents we can conclude:

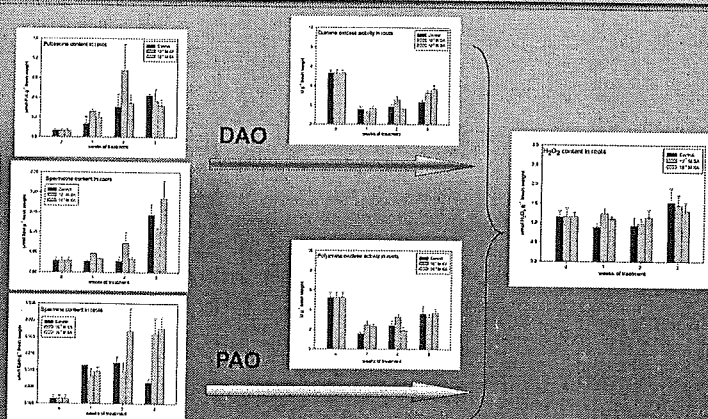
- In leaves, H_2O_2 content increased at both SA concentrations compared to the control but this change did not correlated with activities of enzyme in PA catabolism. In the case of 10^{-4} M SA, Put content increased which can be seen from the decreased (Spd+Spm)/Put ratio.

- In roots, 10^{-4} M SA Put contents decreased compared to the control, while Spd and Spm contents increased because of elevated DAO and unchanged PAO activities. Root H_2O_2 contents decreased in the case of both SA concentrations which may be a consequence of free-radical scavenging properties of free polyamines.

- It can be concluded that SA-induced polyamine synthesis and changes in PA-catabolism can contribute to the stress acclimation processes in tomato plants.

Results II.

In the roots, 10^{-7} M SA increased the content of Put and Spd but decreased Spm in the first 2 weeks. In the 3rd week spermine content showed a significant increase. At the end of the SA treatment 10^{-4} M SA increased the Spd and Spm levels, respectively. Put level decreased compared to the control because of increasing DAO enzyme activity. H_2O_2 content in roots declined compared to the control at the end of SA treatment but it was not significant because of high standard errors.



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