Unravelling the cold-induced regulation of ethylene and α-farnesene and its involvement with the development of scald-like disorders in different pear cultivars

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Abstract

To better understand the cold-induced regulation of scald-like disorders in pears and the specific roles played by ethylene and α-farnesene, three pear cultivars with different patterns of ethylene production and chilling requirement were used in this study. Fruit were treated with 1-MCP (ethylene inhibitor) and Lovastatin (α-farnesene inhibitor) and stored at -0.5 °C and 90 % RH during 6 months. Changes in targeted metabolites, enzymes and genes were monitored periodically up to 120 d of storage and superficial scald incidence was assessed after this time and after 180 d of cold storage. 1-MCP treatment induced in the three cultivars a down-regulation of *PcACS1*, *PcACO1*, *PcERF1* and *PcAFS1* gene expression, but also a significant up-regulation of *PcETR*1 and *PcEIN2* that led in all cases to the inhibition of the disorder incidence. In contrast, Lovastatin treatment caused diverse molecular or biochemical responses depending on the cultivar. In 'Blanquilla' pears, this treatment completely inhibited superficial scald reinforcing the idea that ethylene-α-farnesene interaction plays a decisive role in this specific cultivar. In contrast to 1-MCP, Lovastatin treatment did not control the disorder incidence in 'Flor d'Hivern' pears. Inversely, 1-MCP inhibited the development of the disorder, showing then that the inhibition of ethylene biosynthetic and signalling pathway may control superficial scald even in cultivars producing very low or undetectable ethylene levels. Finally, the inefficacy of both treatments to prevent the disorder development in 'Conference' pears, suggests the existence of a disorder different from that observed for the other cultivars whose biochemical basis remain unknown. Collectively our results show that the regulatory processes triggered by cold stress in pears are complex and cultivar dependent.