Abstract

Grape berries *(Vitis vinifera* cv. Jingxiu) were pretreated for 10 h in air either at 38 °C (heat pretreatment) or at 25 °C (control) and then transferred to −2 °C for 0, 3, 6,12, 24, 48 and 72 h, respectively. Compared with the control without heat pretreatment, membrane permeability and malondialdehyde (MDA) contents were reduced and the activities of peroxidase, superoxide dismutase (SOD) and catalase increased in the heat-pretreated berries under chilling stress. Heat pretreatment could protect the ultrastructure of the pericarp cells against subsequent chilling injury. In the control berries, the ultrastructure of pericarp cells was significantly damaged under chilling stress, with disordered stroma lamellae in the chloroplast or plastid, an indistinct nuclear membrane, looser cell walls, disorganized or absent middle lamella and a less identifiable nuclear membrane. After 72 h of chilling stress, the cellular organelles could no longer be identified. These results offered cytological evidence that berries subjected to a mild heat stress could acquire tolerance to subsequent lethal low temperatures. The heat pretreatment also induced expression of Hsp70 transcripts. The results suggest that cross-adaptation could be induced in grape berries and the fruit could adapt, at least partly, to low temperature through heat pretreatment-induced tolerance.