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The molecular response to low-temperature stress in peach cultivars with different cold tolerance

Tsyupka V.[1, 2]*, Smykov A.[1, 2], Grebennikova O.[1, 2], Chelebieva E.[1], Ibadullaeva E.[1], Bulavin I.[1, 2], Vodiasova E.[1]

[1] *Kurchatov Genomic Centre of the Nikita Botanical Garden – National Scientific Center of RAS, Yalta, Russia*

[2] *Nikita Botanical Garden – National Scientific Center of RAS, Yalta, Russia*

** valentina.brailko@yandex.ru*

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Motivation and Aim: The *Prunus persica* (L.) Batsch (peach) is a vital fruit crop that tends to be injured during early spring frost. Such stress could depress growth, development and distribution. The peach varieties have been developed using breeding methods, which is better adapt to the low temperature. At the same time, there are very few studies on the molecular mechanisms that make varieties tolerant to low temperatures. Most of these studies focus on one or two varieties of peach only, which is insufficient to understand the general patterns. Cold stress has a negative effect on many cellular processes, the most common one is the cell membrane damage and cell destruction due to reactive oxygen species (ROS) generation. It can be assumed that varieties with cold tolerance should have effective antioxidant protection. Thus, the aim of this work was to study cellular damage to lower temperatures by microscopy and to analyze the activity and expression of antioxidants in cold-resistant and cold-sensitive varieties.

Methods and Algorithms: Six cultivars were used for this experiment: three cold-tolerant (Krymskiy feyerverk, Podarok Like, Temisovskiy) and three cold-sensitive (Loadell, Springtime, Springold). The 9 healthy annual branches of each cultivar were collected from tree on 2nd of the March. Then they were divided into three group: control and two experimental groups. The experimental groups were placed in the growth chamber with temperature –6 ^{0}C for 24 h (first step) and then the temperature was raised to the control for 24 h (second step). Three stigmas were sampled from each branch and fixed in RNALater for genetic analyses and frozen at –80 ^{0}C for biochemistry. Catalase and peroxidase were selected as the key antioxidant enzymes.

Results: The cell damages were detected during cold stress by microscopy. Also, as the activity changes of antioxidant enzymes as gene expression changes of their encoding genes were observed.

Conclusion: It is assumed that varieties that are not frost-resistant will not have activated antioxidant defense mechanisms, which in turn can lead to an increase in ROS and cell damage. This, in turn, leads to the death of flower buds and inhibited growth and development.

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