Impacts of Cold Stress on Stringy Stonecrop and Linear Stonecrop in Northern China

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Introduction Grasses in Orpine family have the characters of high stress tolerance and shallow root in morphology. Due to its high economic and ecological values, these grasses have been embodied in city greening and roof greening in recent years. So far, they have become the most important plants used in roof greening in China. However, the growth and distribution of these plants are limited by low winter temperature in Northern China (Zhao D.G., 2005, Wang Y.F., 2006). In this study, the physiological and biochemical features of linear stonecrop and stringy stonecrop growing in controlled environment with different coldness gradient, so as to clarify the impact of cold stress on these two plants. This study aims to provide basic information about extending the linear stonecrop and stringy stonecrop on roof greening in Northern China.

Materials and methods From September of 2006 to January of 2007, stringy stonecrop and linear stonecrop were individually planted in 50 pots with 3-5 individual plants each pot in Shenyang Agricultural University Teaching Base The soil in pot was intimately mixed soil composed of field soil, sand, soddy soil with ratio of 1:1:1. Five treatments of temperature including 0℃, -4℃, -10℃, -17℃, -26℃ were applied. When the air temperature reached at one temperature gradient, the pots with the living plants were put into the icebox. After 24 hours treatment cold stress at corresponding temperature, Physiological and biochemical indicators such as soluble sugar, proline, chlorophyll, malonaldehyde and conductivity were measured.

Results With the decline of the temperature, the soluble sugar content of the two plants raised at first, then declined thereafter, and raised again at last. When the temperature declined below -4℃, the descending amplitude of soluble sugar content in stringy stonecrop was lower than linear stonecrop. From 0℃ to -18℃, there was significant difference ($P < 0.05$) of soluble sugar content between the stringy stonecrop and linear stonecrop. Protoplasm membrane relatively increased and plasma lemma peroxide enhanced with decreased environmental temperature, indicating that living cell membrane was hurt by hypothermia. Under severe freezing tress, the conductivities of stringy stonecrop and linear stonecrop were only 37.98% and 23.49% respectively, indicating that the leave cell membranes of these two plants could keep relative stable under the stress of hypothermia. Proline contents of these two plants rose with the decreased environmental temperature. Under the temperature of -10℃, stringy stonecrop had its highest proline content maximum. The accumulation rate of proline content in stringy stonecrop was faster than linear stonecrop. MDA content in both plants rose too. At the beginning of the freezing stress, stringy stonecrop was hurt more severely than linear stonecrop. Chlorophyll content in both plants declined with decreased environmental temperatur, stringy stonecrop was higher than linear stonecrop in chlorophyll content.

Conclusions The stringy stonecrop was more adaptable to cold stress than the linear stonecrop. In general, the content of proline, soluble sugar and chlorophyll in the stringy stonecrop are higher than the linear stonecrop in low temperature environment, while they had very similar mechanism to cope with cold stress.

References

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