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WINTER HARDINESS THE INTRODUCED SNOWBERRYS (*SYMPHORICARPOS* DUHAMEL) IN CONDITIONS OF KIEV

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There are given the results of studing of the winter hardiness of the alien spicies of Symphoricarpos Duhamel. in the botanical gardens of Kiev. The damage of tissues of 1-year propagules after artificial freezing were estimated. It was determined the potential abilities of the alien species of Symphoricarpos Duhamel. for low temperatures adaptation.

Symphoricarpos Duhamel, Snowberry, Winter-hardiness, frost-resistance, freezing, plants dormancy

For the successful introduction of economically valuable woody plants especially important is their adaptation to the impact of annual low temperatures and other adverse factors in winter, spring and autumn periods. During the evolutionary development of perennial plants produced a certain morphological rhythm, which is formed in specific climates depending on the area of cultivation, and consists of alternating periods of calm repetition (ie all of them - termoperiodychni plants). The depth and duration of rest may be different. It is believed that the deeper mind and its longer term, the longer frosty period with lower temperatures can sustain plants [9, 12].

In the process of joining the rest, providing wintering plants, the most important is their ability to hardening, ie the transfer of resistance to low temperatures (aklimatsiya). The most important changes produced by Acclamation plants appear to accumulate krioprotektornyh substances to prevent ice formation directly in cell development and water-holding capacity, providing resistance to dehydration cells. During deep calm (December, the first half of January) after a period of freezing temperatures -5 ... -15 C plants develop the most frost. During this period, the researcher can determine the biological stability limit - a potential frost aerial parts of plants [9, 12].

To analyze hardiness are two mechanisms for plant resistance to low temperatures, this prevent the formation of intracellular ice in which irreversible cell damage and the development of resistance to dehydration of protoplasm associated with the formation of ice crystals intercellular space [9, 8 16]. It is believed that plants more southern origin develop resistance to low temperatures for the first type - they accumulate cryoprotectants, which reduces the temperature of ice formation in the cell. These plants include, for example, grapes and some stone fruit species [7]. However, this mechanism has a threshold temperature below which is freezing the cells and their death. Although some species - such as plum Ussuriysk and develop resistance to minus 40 ° C, most have low frost within -20 ... - 28 ° C.

Plants north origin, such as birch, while tempering intense lose water (dehydration occurs cells) significantly reduces the risk of ice in them. Under these conditions, plants can develop resistance to -35 ... -45 ° C. As a result of hardening of black currants in the laboratory of frost reached the temperature of liquid nitrogen -196 ° C. However, in terms of tempering dehydration important is the development of high water-holding capacity cytoplasm to save enough for their restoration of functional activity of water. Yet for some crops, such as raspberries, the risk of cell death due to dehydration. This type of damage is called "dry winter." Still, most of the plants are implementing both mechanisms of resistance [12].

The processes occurring in the cells during freezing and ice formation is closely related to the physiological state of cells and especially of the permeability of the membrane structures for ions and water. Because of this property of cells depends on the speed of passing it through water, it proceeds to the intercellular space and, finally, the rate of freezing [5, 8, 13].

Plays an important role and structure of cell walls, which causes the resistance of tissue migration front of ice formation, the penetration of ice crystals in cellular space [15]. Dehydration is accompanied by loss of cell membranes regulatory capacity, as a result there are irreversible changes in the metabolic processes that the following is the direct cause of cell death. The extent of damage from low temperatures mainly determined by the stability of cell membranes and membrane proteins primarily to znevodnyuyuchoyi ice action [7, 13, 2].

To prevent freezing of water in plant cells and tissues functioning system of cryoprotectants, which consists of low molecular weight proteins, carbohydrates and glycoproteins. Cryoprotectants synthesized in plant cells at low temperatures, can prevent or greatly slow down the growth of ice crystals. Hydrophilic proteins, mono- and oligosaccharides, which have krioprotektornyy effect capable of binding a large amount of water. Bound so water will not freeze and not transported. Cryoprotectants begin synthesized primarily in the epidermis and cells surrounding the intercellular cavity, where the most intensive formation of ice crystals during the freezing of tissues [12, 16, 14].

After a period of deep calm plant goes to a state of forced rest, which is due to unfavorable climatic conditions of normal development. This period may be temporary thaw, under the influence of some species may wake up, they activate metabolic processes that further decrease in temperature leads to damage. From a technological point of view, for most regions of Ukraine, forced to rest - the most critical period of the lowest resistance of crop plants to low temperatures.

From the above it is clear that throughout the winter plants are influenced by factors extreme sensitivity of plants which characterizes their hardiness. That is why during the initial introduction is necessary to determine the adaptability of plants to unfavorable conditions and overwintering as one of the most important, the question arises determine levels of hardiness. The most common method is the field, but it takes a long time because of the frequency of winters critical temperatures quite low. It is believed that these winters occur every 10-12 years [1]. Therefore, to accelerate the evaluation of plants to low temperatures is also used and tested them in the laboratory.

Recently more and more widely used method of differential thermal analysis of the processes of ice formation in plant tissues [8, 4, 11, 17, 18]. However, the most common method is freezing laboratory test samples of tissue damage subsequent analysis of anatomical and mikroskopnym method [7, 1, 10].

The purpose of research - to establish actual (field) hardiness introduced plants of Symphoricarpos Duhamel tested in conditions unprotected soil and release them for the most stable species studied traits; explore potential frost selected (nayzymostiykishyh) species of the genus Symphoricarpos.

Materials and methods research. The objects of study were pre-tested plant species of the family Symphoricarpos: Symphoricarpos evening (Symphoricarpos hesperius GNJones), p. Western (S. occidentalis Hook.), p. White (S. albus (L.) S.F.Blake), p. riverine (S. rivularis Suksd.), p. Chenault (S. × chenaultii Rehder), p. rounded (S. orbiculatus Moench), p. soft (S. mollis Nutt.), p. Dorenboza (S. × doorenbosii Krűssm.), P. Mountain (S. oreophilus A.Gray), which reached reproductive age.

Field research was conducted during winter hardiness 2011-2013. At collection sites unprotected soil National Botanic Garden of them. MM Grishko National Academy of Sciences of Ukraine, the Botanical Garden of them. Acad. OV Fomin Kyiv National University. Taras Shevchenko National University Botanical Garden of Life and Environmental Sciences of Ukraine.

The actual hardiness establish a five-point scale icing OA Kalinichenko [3]. The potential frost studied by the method of Horticulture Institute [16], which is based on conducting research anatomomikroskopnyh after direct freezing shoots in a heat chamber. Freezing was performed in the laboratory of Plant Physiology and Microbiology Institute of Horticulture NAAS in the refrigerator for research CRO / 400/40, which is equipped with control temperature field.

For experiments selected shoots (annual branch) of equal strength development and branching order in the middle of the crown of the southern, southeastern and southwestern sides. One repetition selected shoots with 2-3 bushes that each sample was 5-10 shoots; 3-4-fold repetition for each temperature. Each sample was associated with a label in bunches, where recorded: variety, version, date, etc. All samples previously put in plastic bags and placed into the refrigerator.

Freezing all prototypes performed simultaneously, since temperature at which the samples were in the unprotected soil.

Lowering the temperature in the refrigerator was carried out at 5 ° C / h. Control the temperature field in the chamber was carried out using a special system of sensors and digital registrar. As temperature sensors used copper resistance thermometers with a linear dependence of resistance on temperature.

Freezing temperature was -15, -20, -25 and -30 ° C, the duration of exposure - 6 hours. An increase in temperature after freezing was performed at a speed of 2-4 ° C / h. For control samples were used as non promorozhuvalysya.

After freezing the samples were stored in bags on snow. Anatomical analysis was performed on cross sections made with a razor or microtome and mounted on a slide with a pre-image strip glycerol. From each of the shoot done in 3 sections, which are analyzed under a microscope at low magnification (microscope MBS-9). The degree of damage was assessed by a six-point scale. Analyzed separately bark, cambium, wood, core each shoot, and when cut through kidney damage indicator additionally determined the latter. Then summarized overall score damage.

Conclusions

1. Methods of laboratory freezing at -15, -20, -25 and -30 ° C set potential adaptive capacity of most studied of the genus Symphoricarpos (Symphoricarpos Duhamel) to low temperatures. In temperatures -30 ° C vast majority of species of a composite score of tissue damage at least 30 points out of maximum possible 65.

2. most sensitive to low temperatures were fabric tops shoots and interstitials. Among tissue damage had the highest score bark. In control samples bark top of the shoot was damaged from 1.2 to 2.0 points in the middle of - 0.5-1.7 points in the analysis of interstitial tissue damage and kidney - 1,4-2,3 points.

3. Temperature dependence of damage indicates the predominant mechanism for protection against low temperatures through the synthesis and accumulation of cryoprotective substances in the tissue cells, which is typical for the species of southern origin. However, the vast majority of the tested plant species of the genus Symphoricarpos not reached the 50% critical level of tissue damage even at a temperature of -30 ° C. Joined level of damage at different temperatures freezing points to a high enough level aklimatsiyi most studied species Symphoricarpos and a high level of potential frost primarily species S. hesperius, S. × doorenbosi and S. oreophilus.

4. The most actual resistance (winter hardiness) in terms of species observed Kyiv - Symphoricarpos hesperius, S. albus, S. oreophilus, and in some years - S. occidentalis, S. × chenaultii, S. orbiculatus. The main reason is somewhat lowered

actual resistance of one of the most cold-resistant species S. × doorenbosi, and the species S. × chenaulti and S. orbiculatus, apparently is their reliance on the presence of snow cover, which in vivo protects plants from the effects of negative factors.

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