Evtushenko Y. Diagnosis of heat- and drought resistance of Red Horse Chestnut (Aesculus carnea Hayne) in the city of Kiev

In recent years, interest in adaptation and enhancement of plant resistance to unfavorable stress factors in conditions of cities and settlements is increasing steadily. There is a problem not just of their adaptation to the conditions of anthropogenic pollution, but also to adverse climatic factors such as drought and abnormally high temperature. Lack of moisture causes the substantial violations of physiological and biochemical processes in the plant.

The lack of moisture causes substantial disruption to the majority of physiological and biochemical processes in plant organism. The adverse action consists primarily in changing the processes of respiration and photosynthesis. When there is a dehydration stomata are closed and, consequently, the supply of CO_2 to the leaf, the intensity of photosynthesis decreases, cell division slows down and the process of plant growth stops. The water deficit also affects the enzymatic activity, root pressure, seed germination etc.

Water deficit increases the adverse effect of high temperatures. Heat resistance is defined as the ability to carry: 1.) temporary or long-term dehydration; 2.) overheating. At a temperature of 35-40 ℃ in the majority of plants physiological functions are inhibited, the accumulation of soluble nitrogenous compounds and other toxic intermediate metabolic products occurs, which leads to cell death.

Red Horse Chestnut is a little common type in the conditions of Kyiv. It grows mainly in tapeworm and group plantings. In terms of age gradation trees by aged 10 to 20 years are dominated. The studied species is characterized by high estimation of decorativeness. Red Horse Chestnut (Aesculus carnea Hayne) is a mesophyte. Mesophytes, which are inherent by high plasticity and adaptability to environmental conditions, are characterized by a balanced water regime and they kept overheating and water deficits.

The evaluation of heat resistance was performed by the method of F.F. Matskova. The method is based on the substitution reaction of hydrogen ions from

the membrane of chloroplast to magnesium ions in a molecule of chlorophyll, which turns into a brown pheophytin at high temperatures.

Five leaves were immersed in a water bath with a temperature 40 °C. First sample was removed after 30 minutes and was transferred to a crystallizer with water at room temperature. Later the process was repeated, each time increasing the temperature of the water bath at 10 °C. Then the leaves were removed from the water and poured 0.2 n HCl. After 20 minutes the degree of damage was evaluated in percentage (%).

The estimation of potential drought resistance was conducted after the method of I.P. Grigoryuk by determination of daily water deficit and coefficients, which characterize water status of plants in the conditions of low moisture.

In the middle of the second decade of each month medium leaves from the middle tier of the different ecological zones were taken: zone № 1 (control) - M.M. Gryshko National Botanical Garden, zone № 2 - Mariinsky park, Taras Shevchenko park, zone № 3 - street plantings near highways with heavy traffic.

Comparing the results, note that the lowest coefficients of drought resistance are typical for species that grow near the roadway, the highest - on-site collection of M.M. Gryshko National Botanical Garden.

It is worth noting the high degree of leaves damage of horse chestnut chestnut by horse-chestnut leaf miner (Cameraria orhidella Deschka & Dimić). For reasons of pest mass reproduction the urban planting of Aesculus hippocastanum L. lose up to 70-80% of assimilation surface until mid-July. As a result, decorative properties and ability to perform phytosanitary and aesthetic functions significantly reduces.

The results of comprehensive evaluation of indicators that characterize the stability of Aesculus carnea Hayne to the action of drought and high temperatures during the vegetative period are presented. It was found that the lethal temperature for the leaves of Red Horse Chestnut is 65-70 ℃. The dynamics of water parameters according to which Aesculus carnea Hayne is characterized as highly drought-resistant species with high adaptive potential was discovered.