STUDYING THE HEAT RESISTANCE OF GOLDEN PINE VARIETIES

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Abstract: The article presents the results of a scientific study conducted in 2022-2024 to assess the tolerance of golden currant (Ribes aureum) varieties (Siyuma, Elixir, Yadgor, Rukhshona, Lyovushka, Podarok Ariadne and Valentin) to high temperature factors in the sharply continental and dry-hot climate of Uzbekistan. During the study, the degree of tissue damage to leaves under the influence of various critical temperatures (+40°C to +60°C) using a water bath in laboratory conditions and the difference in leaf temperature from the ambient temperature due to the transpiration process in natural field conditions (thermoregulation properties) were comparatively studied. The analyzes showed that at temperatures of +40...+45°C, leaf damage was minimal (4.5-18.5%), while damage increased sharply when the temperature reached +55...+60°C. Among the varieties studied, the variety "Elixir" was the most resistant to high temperatures, and the level of damage was significantly lower. It was also found that in field conditions, the leaf temperature of the variety "Elixir" was up to 7.9°C cooler than the outside air temperature, demonstrating strong thermoregulation capabilities. This variety "Elixir" is recommended as a valuable primary source for the establishment of plantations with consistently high yields in arid and hot regions and for breeding. The analyzes showed that at temperatures of +40...+45°C, leaf damage was minimal (4.5-18.5%), while when the temperature reached +55...+60°C, damage increased sharply. Among the varieties studied, the varieties "Elixir" and "Podarok Ariadne" were the most resistant to high temperatures, and the level of damage was significantly lower. Also, in field conditions, the leaf temperature of the "Elixir" variety was cooler than the outdoor air temperature by 7.9°C, and it showed a strong ability of thermoregulation. These cultivars are recommended as valuable primary sources for establishment and breeding of regular high yielding plantations in arid and hot regions.

Keywords: golden currant, heat tolerance, high temperature, leaf damage, Elixir, Podarok Ariadne, transpiration, thermoregulation, selection

The soil and climatic conditions of the Republic of Uzbekistan allow for high yields of fruits, vegetables, grains, legumes, oilseeds, and other crops that ripen at different times and whose product quality meets world standards, fully supplying the population and the processing industry with them.

Production requires accelerated varieties that are fast-growing, have high product quality and yield, are resistant to diseases and pests and adverse external conditions, and have other important biological and economic characteristics. That is why varieties are of great importance in production, and the demand for them is increasing year by year.

In our republic, atmospheric and soil droughts and sharp fluctuations in winter air temperatures are common, causing great damage to agriculture. Studying the problems of heat tolerance of fruit and berry crops in these drought conditions is an urgent issue.

During the study of this problem, the possibilities of distinguishing varieties resistant to high temperatures and determining the level of heat tolerance are evaluated.

The introduction of drought, heat, and cold-tolerant varieties into production will increase crop yield and yield quality. Heat reduces the amount of organic matter accumulated in plants, slows down leaf growth, and reduces the surface area for primary photosynthesis [9,1].

Water deficit in the leaves of fruit crops is most pronounced during the hottest part of the day, at noon. At this time, the difference between the amount of water entering the plant and the amount of water consumed by the leaves and other organs is large, and water deficit decreases towards evening, and at night, towards dawn, the water supply of leaf cells is restored, and water deficit decreases to a minimum, and in some cases even disappears [3].

When the leaves do not receive enough water, water stress occurs. The degree of water saturation of leaf cells is an indicator of water stress in the leaves. If this process continues for a long time, it leads to a decrease in growth rate, a decrease in photosynthesis, and, as a result, a decrease in plant productivity [5].

Plants are more severely damaged at high temperatures than at low temperatures. The harmful effects of high temperatures on plants vary. First, as a result of metabolic disorders in plants, toxic substances accumulate, and high temperatures cause the coagulation of protoplasmic proteins, which leads to cell death. The climate of Uzbekistan is sharply continental, with a continuous extremely hot summer. As a result of a sharp increase in air temperature and a decrease in air humidity, the sensitivity of many agricultural crops to high temperatures increases and the endurance of generative and vegetative organs decreases [7,10].

An important feature in the comprehensive assessment of drought resistance of berry fruit varieties is the ability of plants to withstand overheating [6,4].

Golden black currant has a high resistance to cold, drought, heat, and a wide range of resistance to high air temperature (leaves can withstand temperatures up to +39-+42°C without burning), so it is of special interest in drought and forest-steppe regions [2].

Golden currant is distinguished by a high degree of cold resistance, it can withstand short-term temperature drops (up to -35°C). On average, sometimes the tops of the branches freeze, but this does not significantly affect its condition and productivity. The plant is heat and salt tolerant, and is tolerant to smoke, gas, and dust. They prefer light, fertile, and well-drained soils with a pH of 5.5-6. They also grow in eroded areas, on steep cliffs, and in ravines. Their fertility allows them to be grown in areas where black and red currants do not grow [8].

Research object. Siyuma, Elixir, Yadgor, Rukhshona, Lyovushka, Podarok Ariadne and Valentin varieties of golden black currant are the object of research.

Research purpose . It is aimed at studying and determining the laws of physiological and biochemical mechanisms of increasing the resistance of golden currant varieties to abiotic factors of the external environment, i.e. heat and drought, as well as separating primary materials for selection.

Research method. The conducted scientific experimental work was carried out on the basis of the "Method and program for studying varieties of fruit, berry and nut plants" of the I.V.Michurin State Agricultural University of Agriculture and Forestry (Michurin, 1973) and the "Methodology of calculations and phenological observations in experiments with fruit and berry plants" by Buriev Kh.Ch., Enileev N.Sh., Faiziev Zh.N., and others. The statistical analysis of the experiments was carried out based on the method and recommendations of B.A. Dospekhov (1985). The research process also used economic, comparative analysis, mathematical processing, and field experiment methods.

Research results. The highest level of tolerance of golden currant leaves to high temperatures was 40°C in June, with very low damage observed in all studied varieties, including 7.1% in the

control variety Siyuma, 4.5% in the variety Podarok Ariadne, 6.3% in the variety Rukhshona, and 5.5% in the variety Elixir.

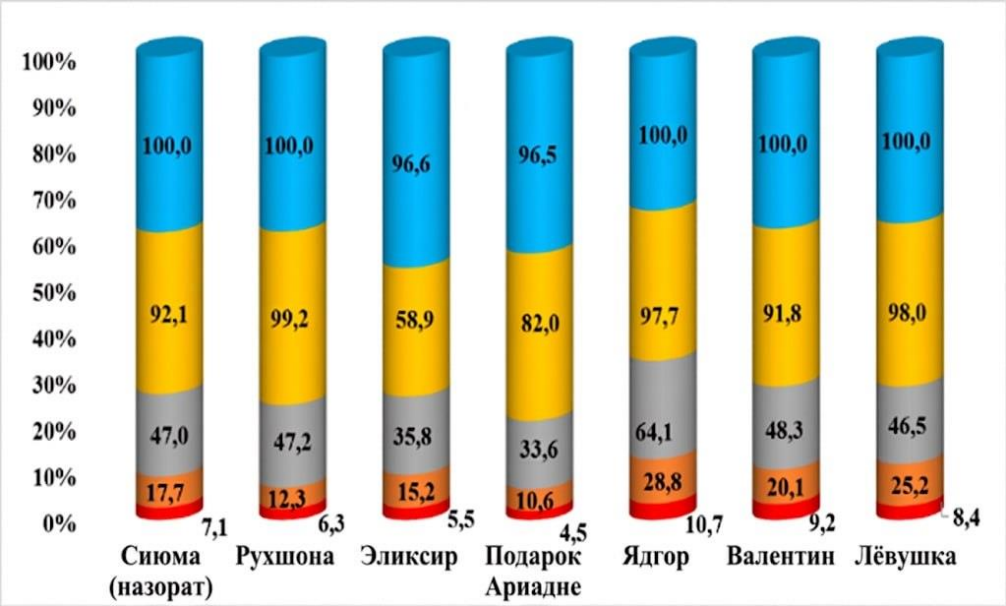


Figure 1 . Heat resistance of golden currant varieties in June (2022-2024), %

In the experiment, as the water bath temperature was increased to 45°C and 50°C, the degree of damage on the leaves increased. Especially when the temperature was increased to 55°C, the damage on the leaves increased sharply. The highest damage was observed in the Rukhshona variety (99.2%), the Lyovushka variety (98%), the Yadgor variety (97.7%), and the lowest damage was observed in the Elixir variety (58.9%) (Figure 1).

When the temperature increased to 60°C, the Elixir variety suffered 96.6%, Podarok Ariadne 96.5%, and all other varieties suffered 100%.

In July, at 40°C, leaf damage slightly increased compared to June. Among the cultivars, Podarok Ariadne (5.2%), Elixir (5.9%) and Rukhshona (6.2%) were less affected by heat, while Valentina (11.9%) and Yadgor (10.4%) were more affected. As the temperature increased to 45°C and 50°C, the degree of damage also increased. Especially in the heat of 55°S-60°S, damage increased dramatically (Fig. 2).

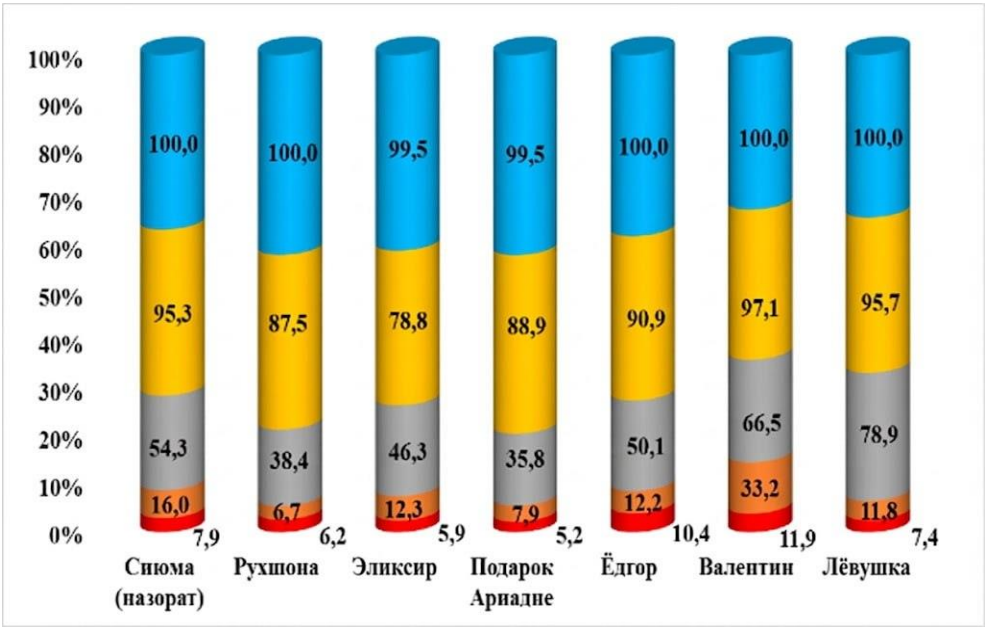


Figure 2. Heat resistance of golden currant varieties in July (2022-2024), %

In August, the heat tolerance of golden currant leaves also increased as the temperature increased, as did the above months (Figure 3).

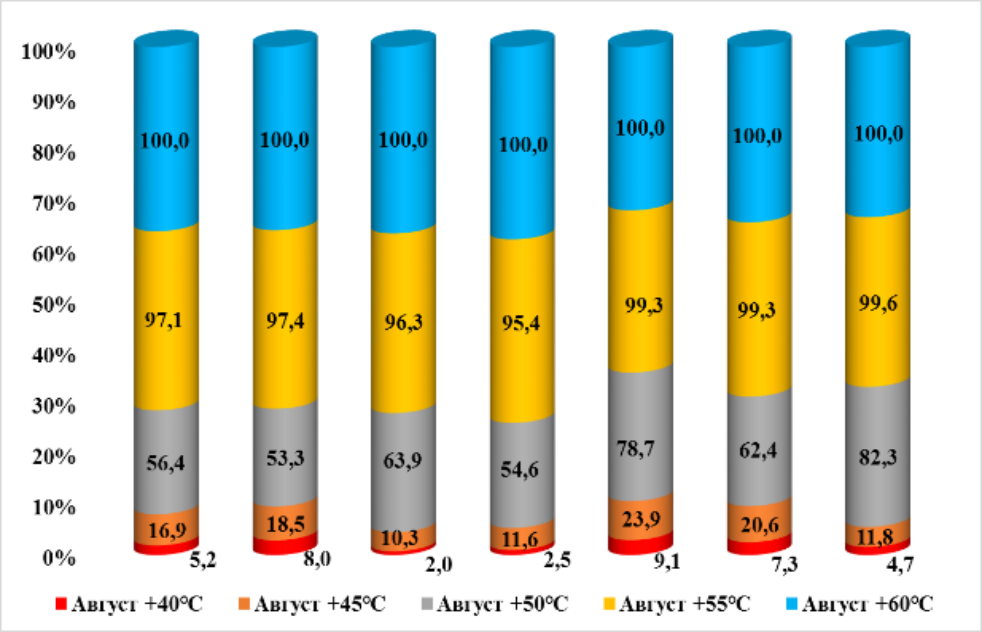


Figure 3. Heat resistance of golden currant varieties in August (2022-2024), %

Among the varieties are Elixir and Podarok Ariadne at a temperature of 60°C The damage rate for the varieties was 99.5%, while for the other varieties it was 100%. Among the varieties, the Lyovushka variety stood out for being more resistant than the other varieties (Figure 4).

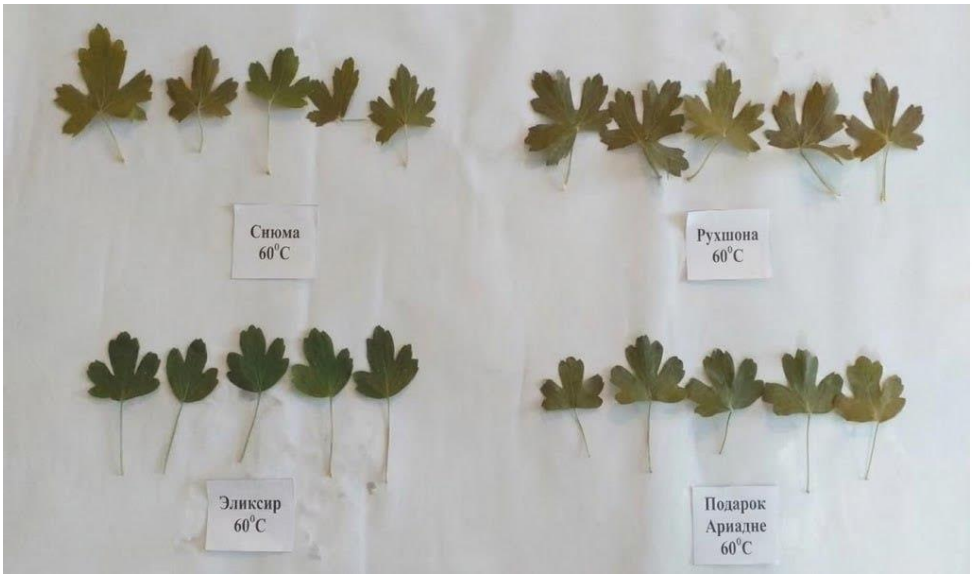
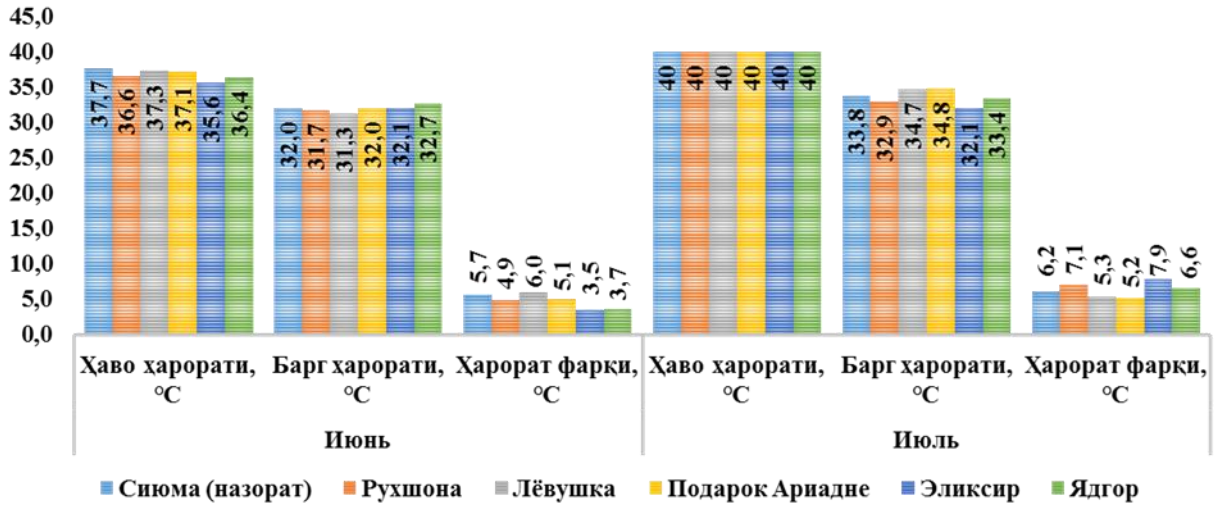


Figure 4. Damage of leaves of golden currant varieties at 60°C temperature

Also, the temperature of the leaves of golden currant varieties was determined under natural field conditions. As a result of constant evaporation (transpiration) of water from above-ground parts of the plant, the temperature in the leaves differs from the temperature of the outside environment. According to the experiments, it was found that the leaf temperature of all varieties is lower than the outside temperature.

In June, among the varieties, the temperature of the leaves of the Elixir variety was 32.1°C, and the temperature difference was 3.5°C compared to the external temperature of 35.6°C, while the leaf temperature of the Lyovushka variety was 31.3°C, the external temperature was 37.3°C, and the difference was 6°C (Fig. 5).



5 - picture. Golden currant cultivars under field conditions temperature in the leaves

In July, the temperature in the leaves of the Podarok Ariadne variety was 34.8°C, the difference was 5.2°C compared to the external temperature of 40°C, while the leaf temperature of the Elixir variety was 32.1°C, the difference was 7.9°C compared to the external temperature of 40°C.

CONCLUSION

The leaves of the Altynsimon currant varieties were tested for their heat tolerance at 40, 45, 50, 55, and 60ºC , the damage to the leaves of the varieties at 40-45ºC was from 7.1% to 17% in the Siyuma (control) variety, from 6.2% to 18.5% in the Rukhshana variety, from 5.5% to 15.2% in the Elixir variety, and from 4.5% to 11.6% in the Podarok Ariadne variety. At 60ºC, the leaves of all varieties were 100% damaged. Among the varieties, the Elixir and Podarok Ariadne varieties stood out for their high heat tolerance.

It was found that in natural field conditions, plants maintain leaf temperature below the outside air temperature due to active transpiration. In particular, in July, when the outside air temperature was +40°C, the leaf temperature of the “Elixir” variety was +32.1°C, the difference reached 7.9°C (the best indicator). This indicator was 5.2°C for “Podarok Ariadne” and 6.0°C for “Lyovushka”.

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