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Heat Resistance of Conifers in Absheron Conditions and Their Physiological Sustainable Aspects

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Abstract

This article describes the possible mechanisms of resistance of conifers to high ambient temperature of overheating. It is shown that the variation of total nitrogen and the amount of carbohydrates in needles, the plants under the influence of heat stress can be used for diagnostic purposes in the introduction and planting in Absheron Peninsula.

The impacts of high temperature have shown on the heat resistance of conifers. It is found that the high temperature (35-40C) has a negative effect on nitrogen metabolism, in particular on the content of total nitrogen. The increase in the number of total nitrogen is due to protein breakdown and accumulation of ammonia nitrogen, which has detrimental effect on the plants, accelerated respiration rate. Accumulation of ammonia nitrogen has degraded the cell walls of conifer needles and occurs to their droughts, followed to falling up needles early.

***Keywords**: Conifer species, high temperature, resistance, diagnostics*

Introduction

Given the importance of the use of certain trees and shrubs, particularly conifers in landscaping of parks and alleys in Absheron conditions required information about their ability to withstand to hot climates, those are resistant actions of negative factors, particularly high temperatures on metabolism. In connection with the above, there was a task to change the criterion of physiological and rapid assessment of species such as heat resistance of Eldar pine tree(Pinus eldarica Medw.), An Italian pine tree (Pinus pinea L.) and Aleppo pine tree (Pinus halepensis Mill.).

The studies were conducted at the Institute of Dendrology of ANAS, in the open ground in different parts of the Khazar region, in particular places where pine trees are accumulated in settlements Buzovna, Bina, Gala, Turkan and Shuvalan in 2015 pilot experience in greenhouse conditions with 2 and 5 year seedlings with full livelihood ensuring, standards watering was 100 ml, 80 ml, 70 ml, 60 ml and 40 ml per 1 kg of soil, respectively with and drought resistance when overheated. Experimental conditions are similar to the conditions of Absheron, where conifers are introduced.

The amount of total nitrogen in the needles of various kinds are carried out by the conventional method Keldal [1], the amount of carbohydrates on a method of Vorobyov [2], the characterization of biochemical analyzes by the method of Pleshkov [3].

Objects and Methods of Researches

For experimental studies in field condition are used a five-year seedlings perennials of Eldar pine tree (Pinus eldarica Medw.), Italian pine tree (Pinuspinea L.) and Aleppo pine tree (Pinus halepensis Mill.).

To determine the total amount of nitrogen in a sample of air-dried material (1 g) was placed in a Keldal flask of 100ml and poured 5 ml of concentrated H2SO4 is overnighted. Combustion was carried out on the weak gas burner by adding 1 ml of 30% hydrogen peroxide (H2O2) until complete decolorization of the liquid in the flask. After cooling, to the solution was added the distilled water. After titration 0,1H and 0,05H H2SO4, the amount of total nitrogen after the addition of reagent Nesler traced to the FEC-M. Estimates of the number of total nitrogen are judged by a calibration curve prepared in advance on the basis of indicators [1 and 3].

An important components of metabolism organic acids and carbohydrates are involved in photosynthetic and oxidative processes, cause the ratio of cations and anions at admission nutrient compounds to the root system and promote an adaptive mechanism in plants for forming protective properties to the adverse environmental conditions of temperature. Due to the reaction of organic acids are supported by the internal environment of the plants. [2]

The objects of study are an Eldar pine tree (Pinus eldarica Medw.), An Italian pine tree (Pinus pinea L.) and an Aleppo pine tree (Pinus halepensis Mill.).

Results

To obtain objective information sampling are carried out in the morning up to 1000 samples and during the hot midday hours at a temperature of 35-45^{0}C, in the middle of June and July months. For the Absheron Peninsula is characterized hot summer days. It should also be noted in group plantings temperature is a few degrees lower than in single crops.

The total nitrogen content, carbohydrates and organic acids was determined before and after heating. Repeated threefold analytical determinations, the results are averaged and partly exposed to mathematical treatment. The experimental results presented in the graph (1, 2) and in Figure1.

It is known that the negative impact of high temperatures caused by the collapse of the protein-lipid complex of the cytoplasm membrane. Modification and accumulation of total nitrogen in conifers of pine species caused by overheating promotes accumulation of ammoniac nitrogen and may be indicative of heat resistance of these species. However when overheated amounts of total nitrogen in the needles are increased, leading to early drying of needles and early abscission of 3 year needles.

Discussion of Results

However, in stress conditions of total nitrogen content in the needles varies something and in comparison with controls is reduced to 17, 20 and 24%, respectively by types. Commonly known as deciduous plants and conifers have air temperature rises above 35^0C and lowering the soil water content to 40% of water capacity in it, intensity respiration increases, and the decay monosaccharide are accelerating. The natures of the metabolism of organic compounds are expressed in Figure 2.

There are noticeable reduced the content of carbohydrates under the influences of high temperatures. It is especially marked on the Italian pine tree needles (about 22%). The trend of reduced amount of carbohydrates is relatively low observed on Eldarica pine tree (Pinus eldarica Medw.), and Aleppo pine tree (Pinus halepensis Mill.).

Reducing the amount of glucose in pine needles apparently due to the acceleration of respiration, which directly proportional to the increase in the temperature of the environment, accompanied by the accumulation of organic acids, particularly amino acids such as arginine, asparagine, and glutamic acids. At the initial stage of decay carbohydrates (anaerobic cycle) the formation of different organic acids, including amino acids, according to our hypothesis is associated with the accumulation of pyruvic acid, its oxidation in the cycle and dicarbonates and tricarbonates acids in the second cycle (aerobic cycle), there are formed a number of intermediate products, which provide the synthesis of other important compounds for plants. It is shown that oxaloacetic and α-ketoglutaric acids could restore ammonias, i.e. synthesis of aspartic and glutamic acids. Asparagine acid can be synthesized by addition of ammonia to fumaric acid by high air temperature. In such cases, there are clearly signed drying tips of needles, and sometimes their earlier fallen.

Some of the above mentioned amino acids are the keto acids, direct acceptors of ammonia formed by the collapse of the protein molecules, contributed to the oppression of metabolism. Raising the temperature above 35-40^0C occurs to deactivation of ammonia in needles under such stress factors as a marked slowdown in closing the stomata and photosynthesis. Significantly there is slowed down the synthesis of proteins and carbohydrates, there are reduced adaptive mechanisms of resistance to arid environmental factors in Absheron.

Among the investigated conifers species there are recognized Pinus eldarica Medw.,Pinus pinea L. and Pinus halepensis Mill. They are included into the group of moderate resistance species. In this regard it should be noted that Pinus eldarica Medw. is an endemic species included to the origins of our country, it has used well for widespread in gardening of Absheron. There are expressed a stable state in young plants during adaptation process in seedling of Pinus eldarica Medw. They are marked by a high level of accumulation of proteins and carbohydrates, which testifies in their high stability. Marked reductions in the proteins are observed in the Pinus pinea L., in which the reduction of carbohydrates, compared with other types consisted for almost 20%. (Table 1)

The most intensive accumulation of carbohydrates under heat shock is observed in the heat-resistant conifer species Pinus eldarica Medw. Products of oxidative conversions of carbohydrate (in an aerobic cycle) embody the role of acceptors, binding of excessive ammonias in the intermediate products of metabolism. The accumulated ammonia in the decay of the proteins has a toxic effect on the plant. Some of the patterns observed in the study may be recommended for assessing the sustainability of conifer species to high air temperatures.

Conclusions

1. Heat shock has definite impacts on conifers.
2. Overheating needles of conifer species in open areas exposed to more severe stress instead of group plantings.
3. High temperatures have a negative impact on the amount of nitrogen-containing substances.
4. Overheating contributes to the breakdown of proteins, in results of accumulating ammonias. The accumulated ammonias have a toxic effect on the plant.
5. Pinus eldarica Medw. has the most heat-resistance among the studied conifer species. Pinus pinea L.and Pinus halepensis Mill. have moderate resistance, they are recommended for group planting in the landscaping.
6. Plants respond to the impacts of environmental stresses by increasing of oxidation reactions

References

1. Rubina B.A. «Great practicum on plants physiology». Academy 1978., p 89-95
2. Pleshkov B.P. «Practicum on plants biochemistry». Moscow. Agro Industry Publishing. 1985. p 255
3. Vorobyov N.V. «Determination of sucrose structure, fructose and glucoses in plant tissues by using of Antrakov reagents». National Technological Initiative. Biology. All-Russian Rice Research Institute. State Scientific Institution of Krasnodar. Issue 33. p 11-13
4. The Short Guide by Plant Physiology. Edition. «Science and Thought». Kiyev.1973 p.286-294
5. Nikolayevskiy V.S. «Biological basis of plants gas resistance». Edition. «Science». Novosibirsk. 1979. p. 240-254

Annexures

Figures:

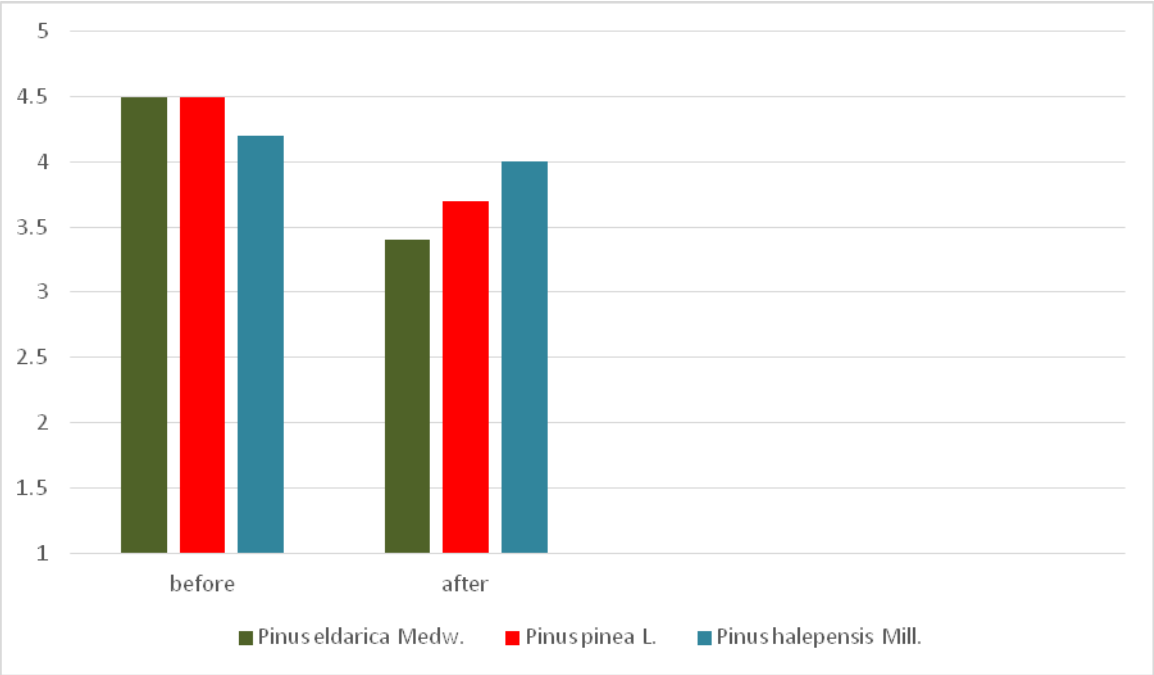

Figure 1: Total nitrogen quantity content in various species of conifer needles in % per 1 g of dry substance. (Summer 2015)

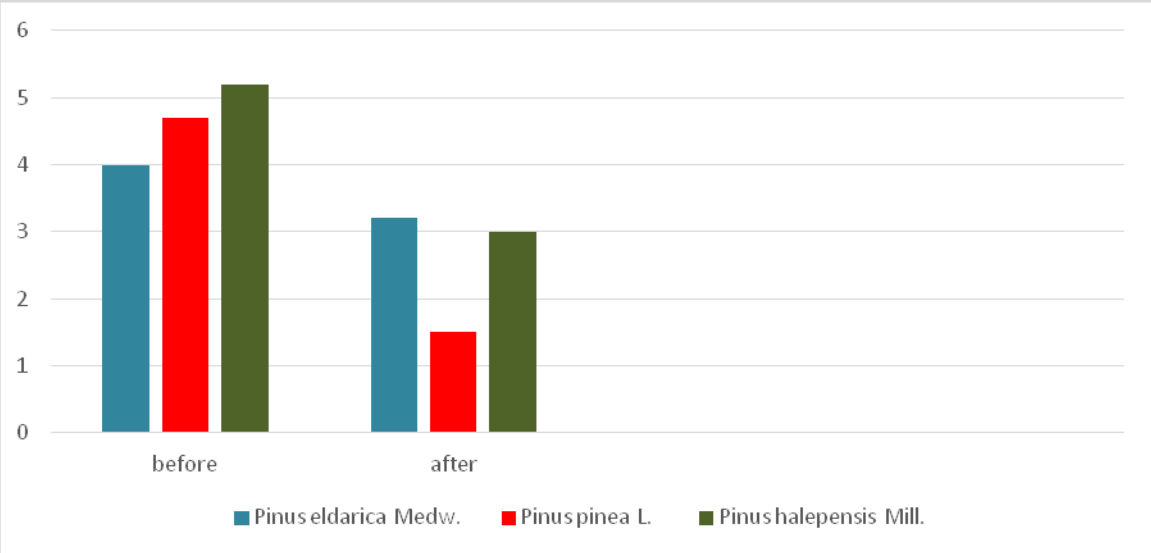

Figure 2: Characteristic changes in the content of the total number of carbohydrates at high temperatures in % to 1 g of dry substance (summer 2015)

Tables:

Table 1

Total content of carbohydrates in the species of conifers needles in mg / g of dry substance

Species of Conifers	Quantity of carbohydrates in mg/g	
	Before overheating	After overheating
Pinus eldarica Medw.	3,6±0,3	2,2± 0,4
Pinus pinea L.	3,4 ± 0,2	2,0 ±0,2
Pinus halepensis Mill.	3,2 ± 0,3	1,8 ± 0,2