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# THE REACTION INTRODUCED SPECIES OF PLANTS OF THE GENUS *BERBERIS* L. TO THE ACTION OF HIGH TEMPERATURES

Investigated heat resistance 18 introduced species of plants of the genus *Berberis* L. at the introduction in botanic gardens in Kyiv. Based on the received data allocated the groups of introduced species with a high, medium and a low heat resistance.

*Key words: barberry, heat resistance, high temperatures, introduction*

Genus Berberis L. – the most common in family *Berberidaceae* Juss., fossil more remnants than 60 million years, as evidenced Palaeocene deposits of in northeastern China and a younger- the northern hemisphere Age the family *Berberidaceae* is about 90-104 million years [5, 9]. Numerous fossil remains of ancestors of modern of plants *Berberis* L. found in the sediments of Cretaceous the period of Mesozoic [8]. The limits of modern habitat species plants of genus *Berberis* L. extending from 40° N to 30° S latitude and 160° east longitude 120° west longitude. For floristic regionalization Earth species of the genus *Berberis* circulated in 4 of floristic kingdoms, 18 regions, 69 provinces [7]. Ecological and phytocoenotic their optimum is in South East Asia and China, many of which grows in the mountainous regions of China with a mild, subtropical climates, as well as in the mountainous regions with a sharp continental climate.

Comparative assessment of regional of climatic conditions and of natural distribution of Kyiv certifies that most of the species plants the genus *Berberis* asian origin can be successfully introduced (table 1, 2).

Species that have a wide habitat or the growing in different climatic areas are quite prospective introduced species [4].

*Table 1*

Core perfomances climate East – Asian floristic region

| Region | Average monthly temperature the air, t°C | | The average annual total precipitation, mm | The average annual annual relative air humidity, % |
|---|---|---|---|---|
| | July | January | | |
| Northeastern, North and Northwest China | 21 – 23 | –18 –20 | 500 – 700 | 60 |
| North Korea | 22,6 | –21,1 | 700 – 900 | 70 |
| South Korea | 25,5 | –4,6 | 1400 | 80 |
| Japan, isl. Hokkaido | 21,1 | –6,2 | 1000 – 1200 | 80 |
| Japan,Isl. Honshu | 23,6 | –2,8 | 1000 – 1700 | 75 |
| Central, South and Southwest China | 22 – 24 | –15 –18 | 1000 – 1500 | 70 |

For endemic, narrow habitat of property is due biological property of species necessary the establishment of special, specific and loved ones to the natural habitats.

*Table 2*

Average climatic indicators in Kyiv (2000-2008 years)

| Months | Temperature, °C | Quantity precipitation, mm | Air humidity, % | Direct and scattered (total) solar radiation kDzh/sm2 |
|---|---|---|---|---|
| January | –5,8 | 43,8 | 86 | 10,5 |
| February | –4,9 | 41,9 | 84 | 17,6 |
| March | –0,2 | 43,5 | 80 | 30,1 |
| April | 7,7 | 49,7 | 68 | 39,8 |
| May | 14,8 | 56,1 | 63 | 59,9 |
| June | 17,9 | 75,5 | 64 | 66,1 |
| July | 19,6 | 80,2 | 66 | 63,6 |
| August | 18,6 | 68,2 | 69 | 54,4 |
| September | 13,9 | 49,8 | 73 | 37,7 |
| October | 7,6 | 45,4 | 80 | 22,6 |
| November | 1,4 | 52,7 | 86 | 9,2 |
| December | –3,2 | 48,5 | 88 | 6,7 |
| Averages indicators for year | +7,3 | 655,3 | 76 | 41,3 |

Appearance, size and longevity of plants is largely dependent on the influence factors of the environment. By actions action of prolonged exposure in plants the genus *Berberis* were formed a certain biological features and appearance, which allows them to survive in extreme conditions of growth.

For forecasting success of the introduction species plants the genus *Berberis* in the Kyiv necessary focus attention on studying their ability to withstand exposure to high temperatures of air and soil. It is shown that hardiest to high temperatures are plants that are protected thick the cuticle, a waxy coating and hairs, which reduces the degree of heating surface and drying out plants.

In this context, the aim of our work was detection the most heat resistant species plants the genus *Berberis* the botanical gardens in the city of Kyiv.

**Materials and methods**

Climatic conditions during the research (2010-2012 years) were not typical for the terms of Kyiv (tabl. 2). The average temperature in most droughty period of vegetation (July-August) was 21,7 – 2 4,6 °C, of precipitation dropped out 26 – 115 mm.

Heat resistant of plants was studied in laboratory conditions by the method of F. F. Matskova [6] in our modification, which is to determine the degree of damage to leaves caused by high temperature at intervals of every 2 °C. In experiments used a interval of temperatures between 40 °C to 60 °C.

In the thermostat TW 2.03 of coeval leaf submerged to preheated to 40 ° C water for 30 min. then brought out one leaf and to place it in a glass desiccator with cold water, replace the water after 0,2 N solution of HCl – 20 minutes. Was calculated the degree of leaf damage by the number of brown spots. Noted damage leaves from emergence separate small blemishes to the total browning the entire leaf surface. Further raised the temperature to 2 °C, kept 10 min interval, brought out next leaf and again placed him in a glass desiccator with cold water. The water temperature is gradually prove to 60 °C.

Heat resistant determined by the limits of water temperature with the following parameters: the threshold of damage – damage is 1 – 15% of the leaf the plate, the critical temperature – damage to more than 50% of leaf tissue plates lethal temperature – 100% of the leaf the plate. The results were recorded in the table (tabl. 3) in which marked the absence of browning sign "-" weak russeting of (1 – 15% of the leaf the plate) – "+" russeting of more than 50% of the surface of the sheet – "+ +" fully russeting – "+ + +".

Statistical processing of results was performed by conventional methods using applied programs on the PC. Received the data that expressed as a percentage, is the criterion of the degree of plant resistance to high temperature [1, 2, 3, 6].

**Results and discussion**

According to our results the study (tabl. 3), the plants are separated into three groups by the degree of stability to high temperatures (tabl. 4).

*Table 3*

The degree of damage to leaves of species plants the genus Berberis L. high temperatures

| Object | The degree of leaf damage to in t, °C | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 54 | 56 | 58 | 60 |
| *B. amurensis* | - | - | - | - | - | - | + | + | ++ | ++ | +++ |
| *B. boschanii* | - | - | - | - | - | - | + | + | ++ | +++ | +++ |
| *B. brachypoda* | - | - | - | - | - | - | - | + | ++ | +++ | +++ |
| *B. dasystachya* | - | - | - | - | - | - | - | + | ++ | +++ | +++ |
| *B. dielsiana* | - | - | - | - | - | - | | + | ++ | +++ | +++ |
| *B. dumicola* | - | - | - | - | - | - | + | ++ | +++ | +++ | +++ |
| *B. francisci-ferdinandii* | - | - | - | - | - | - | + | + | ++ | +++ | +++ |
| *B. heteropoda* | - | - | - | - | + | + | ++ | ++ | +++ | +++ | +++ |
| *B. japonica* | - | - | - | - | - | - | ++ | ++ | +++ | +++ | +++ |
| *B. lycium* | - | - | - | - | - | - | - | - | + | +++ | +++ |
| *B. lycoides* | - | - | - | - | - | - | + | ++ | +++ | +++ | +++ |
| *B. parviflora* | - | - | - | - | - | - | ++ | ++ | +++ | +++ | +++ |
| *B. poirettii* | - | - | - | - | - | - | - | + | ++ | ++ | +++ |
| *B. regeliana* | - | - | - | - | - | - | - | + | ++ | +++ | +++ |
| *B. silva-taroucana* | - | - | - | - | - | - | + | ++ | ++ | +++ | +++ |
| *B. thunbergii* | - | - | - | - | - | - | + | + | ++ | +++ | +++ |
| *B. vernae* | - | - | - | - | - | + | + | + | ++ | +++ | +++ |
| *B. virescens* | - | - | - | - | - | - | - | + | ++ | +++ | +++ |

Having made analysis of the distribution of species plants the genus *Berberis* by degrees of heat resistance can say that the leaves of plant *B. heteropoda* and *B. vernae* damaged by temperatures 48 °C, whereas in *B. lycium* – 56 °C.

*Table 4*

Groups of eastasian of plants species of the genus Berberis L. for heat resistance

| Parameter | Groups for heat resistance | | |
|---|---|---|---|
| | 1 – with high indices heat resistance | 2 – with the average indexes heat resistance | 3 – with low parameters ofheat resistance |
| Threshold damage, ° C | 54-56 | 48-50 | 40-42 |
| Critical temperature, ° C | 56-58 | 50-52 | 42-44 |
| Lethal temperature, ° C | 58-60 | 52-54 | 44-46 |

The critical for 12 species proved to temperature 56 – 58 ° C. In plants with a to threshold indices heat damage was 54 – 56 °C, the critical temperature of 56 – 58 ° C, lethal – 58 – 60 °C. Their include to the first group to the first group, that included 14 species of plants, including *B. amurensis*, *B. boschanii*, *B. brachypoda*, *B. dasystachya*, *B. dielsiana*, *B. francisci-ferdinandii*, *B. lycium*, *B. lycioides*, *B. poirettii*, *B. regeliana*, *B. silva-taroucana*, *B. thunbergii*, *B. vernae*, *B. virescens*. The third group did not entered no type of plant the genus.

**Conclusions**

Thus, our study allowed us to allocate most persistent to high temperatures species plants the genus *Berberis*, in particular *B. brachypoda*, *B. dasystachya*, *B. dielsiana*, *B. lycium*, *B. poirettii*, *B. regeliana*, *B. virescens*, which can be used to create the garden and park objects.


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Досліджено жаростійкість 18 інтродукованих видів рослин роду Berberis L. при інтродукції в ботанічні сади м. Києва. На підставі отриманих даних виділено групи інтродуцентів з високою, середньою та низькою жаростійкістю.

*Ключові слова: барбарис, жаростійкість, високі температури, інтродукція*

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РЕАКЦИЯ ИНТРОДУЦИРОВАННЫХ ВИДОВ РАСТЕНИЙ РОДА *BERBERIS* L НА ВОЗДЕЙСТВИЕ ВЫСОКИХ ТЕМПЕРАТУР

Исследовано жаростойкость 18 интродуцированных видов растений рода Berberis L. при интродукции в ботанические сады Киева. На основании полученных данных выделены группы интродуцентов с высокой, средней и низкой жаростойкостью.

*Ключевые слова: барбарис, жаростойкость, высокие температуры, интродукция*

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