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RESISTANCE TO THE ENVIRONMENTAL FACTORS OF *BERBERIS* L. SPECIES

T.S. Mammadov, E.Kh. Salakhova*

ANAS Institute of Dendrology, Baku, Azerbaijan

Abstract. Recently environmental pollution and climate change have become one of the global problems that concern the whole world. The creation of forest ecosystems and landscaping is the most environmentally friendly way to solve this problem. Nowadays along with ornamental plants industrial plants are widely used in modern landscaping in Azerbaijan. The paper analyzes the resistance to the environmental factors of *Berberis* L. genus species cultivated in Absheron Peninsula widely used in ornamental gardening and health care.

Keywords: *climate change, pollution, radiation, lethal temperature, alkaline soils.*

***Corresponding Author:** Elnara, Salakhova, ANAS Institute of Dendrology, Baku, Azerbaijan, Phone:+994552596702, e-mail: salahova.elnara@bk.ru*

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1. Introduction

In recent years environmental pollution and the effects of climate change have become a global problem which concern whole world. Greenery play an important role in the restoration of polluted ecosystems. Plants are biofilters for the environment. Plants purify the atmosphere, cool the air, reduce the level of sound waves, reduce winds and as a result have a calming effect on people's stress. For this purpose the selection and the use of resistant of indigenous species is a very important issue (Crawford, 2008; Prokhorov, 2015; Ying & Chen, 2001).

The aim of the research is to study the resistance of *Berberis* L. species to environmental factors in Absheron.

2. The object of the research

Nine species are used as the research object which included to the genus of *Berberis* L. of *Berberidaceae* Juss. family: *Berberis vulgaris L., Berberis iberica Stev. & Fisch. ex DC., Berberis densifolia* Rusby., *Berberis amurensis Rupr., Berberis levis Franch., Berberis thunbergii DC., Berberis julianae C.K.Schneid., Berberis koreana Palib., Berberis heteropoda Schrenk.*

The studied species of *Berberis* L. are widespread in the northern hemisphere. Thus, you can be found representatives of this genus in North America, North Africa and Eurasia. Also these species of the genus *Berberis* L. are common in the southern and eastern regions of Russia, in the Caucasus and Crimea, in the Far East. The variety of spreading areas, their development in different soil and climatic conditions testifies the ability of these species adapting to many variable environmental factors (Thordal-Christensen, 2001).

3. Materials and methods

The methods proposed by K.A. Akhmatov (1972, 1976) and V.P. Tarabrin (1969) were used to study the drought and heat resistance species of *Berberis* L. Frost resistance was estimated according to the S.V. Klimov's theory. The SOEKS Ecotester was used to determine the radiation background around species of *Berberis* L.

4. Results and discussion

It was determined the resistance of *Berberis* species to various environmental factors.

Light factor. Light is one of the important factors in the growth of plants (Karpisonova, 2005). Our observations show that *berberis* shrub are light-requiring. In other words species of the genus *Berberis* L. require light even in places exposed to direct sunlight, they grow normally, the umbrella is wider and more scattered, the branches grow in all directions, the leaves are dark green, fruits are well reddened. Bright or decorative leaf-shaped copies of species *berberis* should be planted in sunny areas to preserve their decorative appearance, otherwise the leaves in these forms lose their color due to lack of light, and the shrub is not fully formed. Based on this, we can say that species of *berberis* are less resistant to shade and it is not recommended planting them in such areas. Based on our observations, it turned out that studied species of *berberis* are heliophytes.

Heat and drought tolerance. The drought and heat resistance of *berberis* species introduced in the conditions of Absheron was studied by the method of K.A. Akhmatova. The research was carried out using thermos containers. Rising temperatures cause protein breakdown and the accumulation of ammonia in plants. As a result of high temperatures, the cell structure of *Berberis* species is destroyed (Akhmatov, 1972, 1976).

Heat and drought resistance of *Berberis* species was determined in July using thermoses. The results of the study are presented in Table 1. Studied *Berberis* L. species for heat resistance are divided into 3 groups:

1. Resistant species (49.0 ± 2.0 - 50.0 ± 2.0) - no burns were found on the leaves of *Berberis vulgaris* and *B. iberica*;
2. Moderately resistant species (47.0 ± 3.0–48.0 ± 2.0)- only minor burns were observed at the edges of the leaves: *Berberis densifolia, B. julianae, B. thunbergii, B. levis, B. heteropoda* and *B. koreana*;
3. Less resistant species (46.0 ± 3.0) - burns were observed up to half on the leaves: *B. amurensis.*

The heat resistance of the species studied is closely related to their biological properties and the area of natural distribution. The degree of resistance to heat and drought varies depending on the species of *berberis.*

As a result, we can say that the studied *Berberis* species are resistant to local conditions, since temperatures are not observed above 46°C in Absheron. The indicated lethal temperature is not observed on Absheron and under irrigation conditions it is possible to ensure the normal growth and development of these plants. In hot and dry July-August due to increase in air temperature leaf burning was observed only in 1-3-year-old plants. In such conditions plants need regular watering and shading.

Table 1. Heat resistance of leaves of *Berberis* L. species

№	Species	Lethal temperature, ^{0}C
1	*Berberis vulgaris*	50,0±2,0
2	*B. iberica*	49,0±2,0
3	*B.densifolia*	48,0±2,0
4	*B.amurensis*	46,0±3,0
5	*B. levis*	47,0±2,0
6	*B.thunbergii*	47,0±2,0
7	*B.julianae*	47,0±3,0
8	*B. koreana*	47,0±3,0
9	*B.heteropoda*	47,0±2,0

Dry soils are typical for the Absheron Peninsula in summer. During the study period (2015-2018) the average precipitation is 300 mm and the evaporation is approximately 700 mm. Therefore it is important that the species of *Berberis* L. brought to the Absheron peninsula adapted to climatic factors. In the dry, hot summer months plant's growth decreases or stops due to increase in temperature. After mid-August the temperature lowers, the humidity partially rises and as a result the plants continue to grow.

Cold hardiness of *Berberis* species

In the course of our research we studied cold resistance in 1-3-year-old plants and at the same time old specimens grown in the collection area of Absheron during 2015-2018 years. It should be noted that the cold resistance of the researched species was studied in the absence of severe frosts in the conditions of Absheron.

Frost resistance (cold resistance) of *Berberis* species under the conditions of Absheron was studied according to the theory of S.V. Klimov (2001).

When studying the cold resistance of *berberis* species, it was found that *Berberis* species which spread from the northern hemisphere to various tropical regions have a very high degree of winter adaptation in Absheron.

Analysis of meteorological data shows that the lowest temperatures were recorded in February. In general over the past decades and research years (2015-2018) were observed no severe frosts in the conditions of Absheron. In rare cases temperatures drop to -3^{0}C (according to the Bureau of Hydrometeorological Forecasts of the National Directorate of Hydrometeorology of the Ministry of Ecology and Natural Resources).

Visual observations showed that a short-term drop in temperature to -8^{0}C rarely causes freezing of 1-2 cm of the upper part of 1-3-year-old seedlings grown in the open field.

The results of our research during 2015-2018 showed that *Berberis* species studied by us in the conditions of Absheron are cold resistant and only 1-3-year-old seedlings overwinter with very little damage.

Our observations show that a mild and non-frost winter leads to early onset of phonological development in *Berberis* species. The vegetation of *Berberis julianae, B. koreana, B. heteropoda* and other species was observed 20-30 days earlier (Fig. 1).

Since *Berberis* species are cold resistant, decorate various compositions from early spring to winter.

Figure 1. Onset of earlyvegetation in species of *Berberis amurensis and B.julianae*

Soil as the ecological factor

Berberis species grow well on neutral or slightly alkaline soils of medium density (pH 7-8). These species dislike of sour and dense soil. They do not grow in standing water soil, species grown in such rot their roots after some time. When studying the root system of *Berberis* species, it was found that the main part of the root spreads mainly in the upper soil layer.

The entering of water into plants also depends on the physical properties of the soil in which the plant is grown. It is known that temperature and annual precipitation are factors that change soil quality. Therefore, it was studied the influence of soil composition on the growth and development of *Berberis* species in the dry subtropical climate. The chemical composition of the soil was studied in the laboratory of "Plant Ecology" of the Institute of Dendrology. The research results are shown in diagram 1.

It is known that the territory of the Institute of Dendrology is located close to the sea and depending on this, the composition of the soil does not remain stable and it often changes. Thus, gray soils are widespread along the shores of the Caspian Sea in the Absheron Peninsula, and the amount of humus in these soils is up to 2%.

Humidity and irrigation demand

Berberis species tolerate water shortages and even short-term droughts in the growing area. It does not require excessive humidity, but on dry summer days it is recommended to water early in the morning. When watering, water should not get on the flowers. On the basis of our observations, it has been established that the introduced *berberis* species are drought-resistant. However, due to prolonged lack of water, the leaves wrinkle and wither. This indication has been observed in the species *Berberis vulgaris, B.iberica, B.densifolia* and *B.thunbergii*.

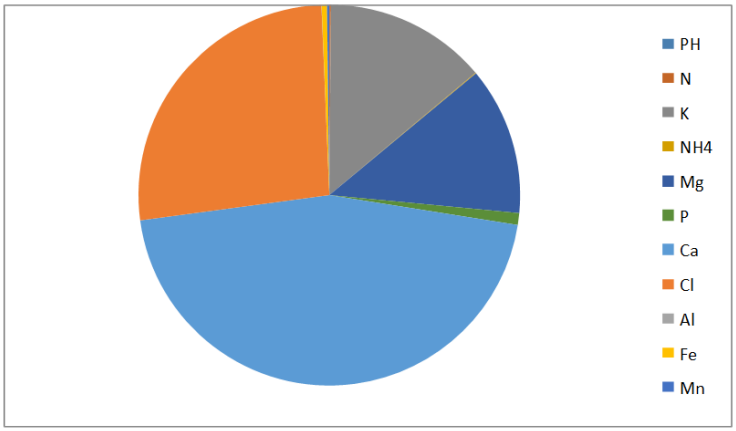

Diagram 1. Chemical composition of the soil on the territory of the Institute of Dendrology

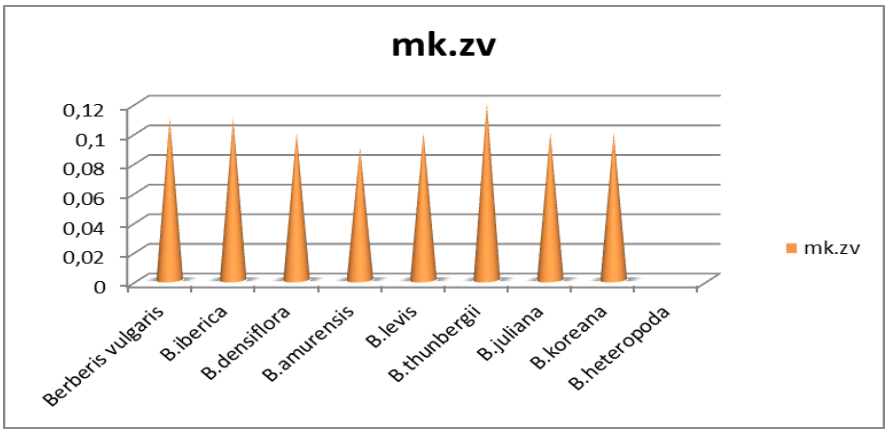

Diagram 2. The radiation background around the different *Berberis* species using the SOEKS ecotester, mc.sv/ h.

Berberis fences reduce noise levels by an average of 15 decibels on major city highways. Having dense umbrellas on older plants help to clean up the environment by protecting lawns and sidewalks from the dust. For this, the SOEKS ecotester measured the radiation fund around a living fence built from *berberis* species in the Institute of Dendrology, and it is shown in diagram 2.

Studies have shown that *Berberis* L. species continue to develop against a background of different radiation. The species *Berberis thunbergii* is 0.11 mc.sv, and the species *Berberis amurensis* continues their vital activity against the background of radiation of 0.08 mc.sv.

In general, *Berberis* species is very resistant to planting in gas and dusty areas - around roads, in the center of large cities, on highways. Thus, these plants have the property of an ecological barrier, accumulating harmful substances on the surface of the leaves.

5. Conclusion

Thus, when studying the influence of environmental factors on *Berberis* species under the conditions of Absheron, it was found that the studied species are resistant to heat, drought, cold and environmental conditions in which they are grown. The resistance of *Berberis* species to environmental factors and radiation absorption indicates the prospects of its use in landscaping of the Absheron Peninsula.

As a result of the research, it was established that the studied *Berberis* species are resistant to arid subtropical climatic factors of Absheron. These species also have the ability to continues their vital activity against the different background of radiation.

References

Akhmatov, K.A. (1972). Field method for determining heat resistance of plants. *Bulletin of the Main Botanical Garden,* 86, 24-26 (in Russian).

Akhmatov, K.A. (1976). *Adaptation of Woody Plants to Drought*. Frunze, Ilym, 197s (in Russian).

Crawford, R.M.M. (2008). Plants at the Margin: Ecological Limits and Climate Change. Cambridge University Press, Mar. 20, 478 pages.

Karpisonova, R.A. (2005). Flower Garden in the Shade. Moscow, 164 p (in Russian).

Klimov, S.V. (2001). Ways of plant adaptation to low temperatures, *Successes of Modern Biology*, *121*(1), 3-22 (in Russian).

Prokhorov, A.A. (2015). The dew point is an unexplored factor in ecology, physiology and plant introduction. *Hortus Botanicus*, 10 (in Russian).

Tarabrin, V.P. (1969). Heat resistance of woody plants and methods of its determination in the field. *Bulletin of the Main Botanical Garden,* 74, 35-37.

Thordal-Christensen, H. (2003). Fresh insights into processes of nonhost resistance. *Current Opinion in Plant Biology*, 6, 351–357.

Ying, J.S., Chen, D.Z. (2001). Lardizabalaceae and Berberidaceae in flora of China. *Beijing: Chinese Academy of Sciences*, 50-214.