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BIOECOLOGICAL CHARACTERISTICS AND ECOLOGICAL ADAPTATIONS OF CERTAIN SUPREME WATER PLANTS GROWING IN ARTIFICIAL WATER BASINS (ON THE EXAMPLE OF NUKUS CITY)

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Abstract

In the territory of Karakalpakstan, aquatic plants are considered a vital biological component of aquatic ecosystems, playing a crucial role in stabilizing the hydrological regime, regulating the physicochemical indicators of water, and maintaining biodiversity. Specifically, in the Amu Darya delta and adjacent lake systems, aquatic plants function as natural biofilters of the aquatic environment and participate in the circulation of organic and mineral substances.[2,3,4,]

The sharp change in the water regime in the Aral Sea basin, especially since the second half of the 20th century as a result of the decrease in the flow of the Amu Darya, has had a serious impact on the structural and functional state of aquatic ecosystems in the region. As a result, previously stable lakes and reservoirs have shrunk, and their hydrochemical regime has changed. These changes led to a disruption in the balance of the main environmental factors affecting aquatic plants: water level, temperature, salinity, and nutrients. In particular, as a result of increasing salinity and decreasing water volume, sensitive aquatic species are

shrinking, and their place is being taken by species with high ecological plasticity. This significantly reduced the species composition and structural diversity of plant communities [2,3,4,5]

The city of Nukus and its surrounding areas consist mainly of plains, and the land surface differs from each other in soil composition and climatic conditions.

The study was conducted at the Karakalpak Research Institute of Natural Sciences to study the ecological adaptation and bioecological characteristics of certain genera and species of aquatic plants from the families Nymphaeaceae and Nelumbonaceae. During the experiment, Nymphaea marliacea Lat.-Marl., Nymphaea alba L., Nuphar lutea (L.) The development of species such as Sm. and Nelumbo nucifera Gaertn. was systematically carried out in 6 specialized artificial reservoirs, each with a depth of 1 meter and dimensions of 6x5 meters (total area 30 m2) [2,3,4,]

In artificial reservoirs located on the territory of the Karakalpak Research Institute of Natural Sciences under the Karakalpak branch of the Academy of Sciences of the Republic of Uzbekistan, Nymphaea marliacea Lat.-Marl., Nymphaea alba L., Nuphar lutea (L.) Research was conducted on the species Sm. and Nelumbo nucifera Gaertn. This territory made it possible to study the bioecological characteristics of aquatic plants in the unique natural and climatic conditions of the Aral Sea region $42^{0}\,27^{1}\,21,\,84^{11}$ C $59^{0}\,36^{1}\,22.30^{11}$ B.

Figure 1. Location of artificial reservoirs on the territory of the Research Institute of Natural Sciences of the Republic of Karakalpakstan (Google Maps, 2024)

It is located in water bodies within the territory of the Research Institute of Natural Sciences; its exact geographical coordinates and general location are shown in Figure 1. The area marked with a blue line represents the general boundary of the institute's territory, and the red rectangle represents the immediate zone of the artificial reservoirs where the research was conducted. The area is located close to the city center, surrounded by construction sites and road infrastructure. This geographical location is also significant from the perspective of studying the interaction between the research area and urban ecosystems.

When assessing the phenological stages of development of aquatic plants belonging to the families Nymphaeaceae and Nelumbonaceae, the phenological

methodology of Rabotnov-Beideman and the international phenological scale BBCH were used. These methods made it possible to comprehensively assess the seasonal development processes of plants and their adaptive characteristics to environmental factors. The developmental stages of the research objects during the growing season were regularly evaluated.

During the study, *Nymphaea marliacea* Lat.-Marl., *Nymphaea alba* L., and *Nuphar lutea* (L.) Sm. species were grown in artificial reservoirs in the city of Nukus, and their phenological, morphological, and bioecological characteristics were systematically studied.

Nymphaeaceae - large, perennial, ornamental plants growing in water bodies, commonly known as water lilies. Members of this family are widespread in freshwater bodies, slow-flowing rivers, and lakes. Water lilies differ morphologically by their floating and underwater leaves. The leaf blade and petioles have air cavities that facilitate gas exchange and the floating of leaves on the water's surface. Usually, there is one large flower on a long stem. Their flowers are very beautiful, so they are cultivated as ornamental plants. Currently, in some regions of Uzbekistan, it is grown as an ornamental aquatic plant in ponds and parks [2,3,4,].

Systematic phenological observations were conducted annually on the plant samples selected for the experiment. During the observations, indicators such as vegetative growth dynamics, leaf formation rate, generative development stages, and flowering time and duration were analyzed.

Analysis of the research showed that the highest growth rate in the species Nymphaea marliacea Lat.-Marl. was recorded in the temperature range of 36-38°C. This result confirms that this species is well-adapted to high-temperature conditions, possessing thermophilic properties. However, the decrease in growth rates at temperatures above 40°C indicates the influence of thermal stress. In the

species Nymphaea alba L., maximum growth was observed at 34-36°C. Although this species is capable of growing in a wide temperature range, it was noted that the growth rate decreases relatively quickly under the influence of high temperatures. This indicates its adaptation to moderate temperature conditions. For the species Nuphar lutea (L) Sm., the highest growth rate was observed in the range of 30-34°C. At temperatures above 35°C, a sharp decrease in growth intensity was observed in this species, indicating that it is adapted to relatively low temperatures and possesses mesophilic properties (Fig. 2).

Figure-2 family Nymphaeaceae.

During 2023-2025, Nymphaea marliacea Lat.-Marl., Nymphaea alba L., and Nuphar lutea (L.) The influence of temperature on the growth activity of Sm. species was studied. According to the analysis results, it was established that the growth intensity depends to varying degrees on the temperature factor (Fig. 3).

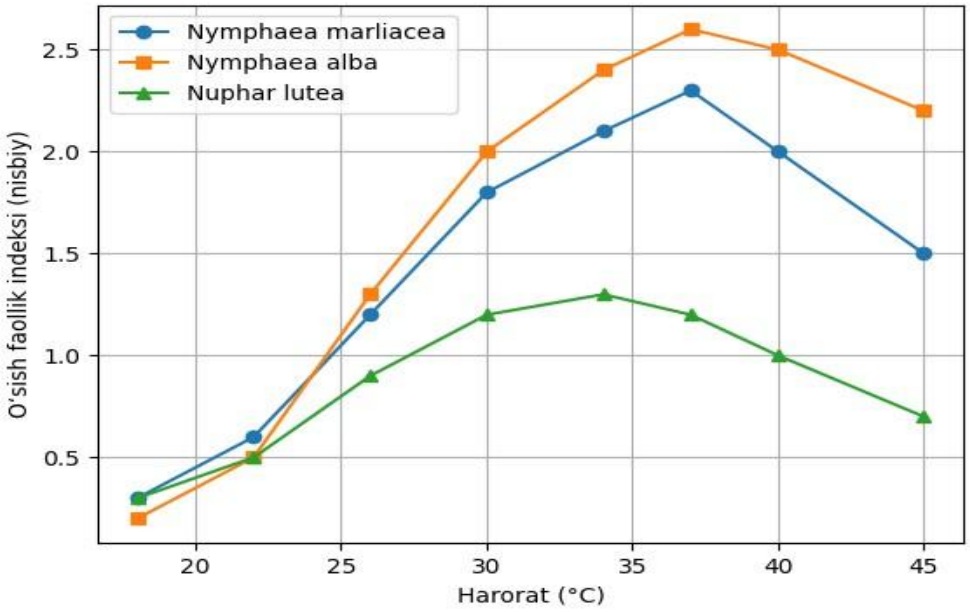

Figure-3. *Nymphaea marliacea* lat.-marl., N*ymphaea alba* l. and *Nuphar lutea* (l.) temperature-dependent growth indicators in sm. species.

The obtained data show that the growth activity of all species increased with an increase in temperature from 18°C to 30-36°C. This was explained by the fact that temperature has a positive effect on physiological processes, including photosynthesis, respiration, and metabolic rate. However, after reaching a certain temperature threshold, a decrease in growth intensity was observed, indicating the occurrence of stress states under high-temperature conditions.

In the species *Nymphaea alba* L., the highest growth rate was recorded in the temperature range of 36-38°C. This result confirms that this species is well-adapted to high-temperature conditions, possessing thermophilic properties.

However, the decrease in growth rates at temperatures above 40°C indicates the influence of thermal stress.

In the species *Nymphaea marliacea* Lat.-Marl., maximum growth was observed at 34-36°C. Although this species is capable of growing in a wide temperature range, it was noted that the growth rate decreases relatively quickly under the influence of high temperatures. This indicates its adaptation to moderate temperature conditions.

For the species *Nuphar lutea* (L) Sm., the highest growth rate was observed in the range of 30-34°C. At temperatures above 35°C, a sharp decrease in growth intensity was observed in this species, indicating that it is adapted to relatively low temperatures, i.e., possesses mesophilic properties.

According to the research results, an individual thermal optimum exists for each species, and a decrease in growth processes is observed in all species at temperatures near 40°C. This condition is associated with the negative impact of high temperatures on physiological processes, which is explained by a decrease in enzyme activity and disruption of cellular metabolism. The temperature factor determined individual optimum temperatures for the studied species: *Nymphaea marliacea* Lat.-Marl - 34 - 36°C, *Nymphaea alba* L. - 30 - 34°C, *Nuphar lutea* (L) Sm. In all species, growth activity increased with an increase in temperature from 18–20°C to 30–36°C; however, in conditions close to and above 44°C, growth rates decreased, and signs of physiological stress were observed. This condition was explained by a decrease in enzyme activity and metabolic disorders at high temperatures.

USEP LITERATURE

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