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Review Article

Some aquatic plants and their characteristics that can be used for biological ponds to be created in cold climate regions

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Abstract: Water has been the most necessary and valuable resource since mankind began to cultivate the earth. Water has a special place in all cultures and belief systems with its purifying, renewing and life-enhancing properties. In this study, some aquatic plants that can withstand cold climatic factors (-5°C to -15°C) and are utilized in biological ponds were investigated. This is a compilation study prepared with the aim of evaluating these plants in landscape areas and biological ponds by taking into account the climatic conditions, positively affecting the psychology of the people living in the place where they are used with their pleasant appearance and flowers, and enriching these areas visually.

Keywords: Aquatic plants, Biological Ponds, Climate

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1. INTRODUCTION

Water has been the most necessary and precious resource since mankind first began to cultivate the land. Water has a special place in all cultures and belief systems with its ability to purify, refresh and empower life.

Water, which was first used for functional purposes such as drinking, cooling off, washing away dirt or fishing to meet the need for food, later began to be transported to land (Simonds, 1983; Düzenli et al., 2019). In the historical process, its use as an indispensable element of the landscape has increased due to its visual and aesthetic effects, psychological, recreational and ecological contributions, and its usage patterns have also diversified.

One of the current uses of water is biological ponds. Although there have been similar forms of water use since ancient times, the concept of a "biological pond" emerged in Australia in the early 1980s with Werner Gamerith. The pond he built in his own garden was the first example of this. Since the 1990s, this form of use has become widespread. It has emerged by imitating nature in a sense with the intellectual basis of protecting the water provided from underground sources by natural methods by cleaning it with natural methods (Anonymous, 2024a).

2. MATERIAL AND METHOD

In this study, it was aimed to create examples of plant materials that can be used in biological ponds that can be created by combining some aquatic plants and their properties that can withstand cold climate conditions.

Biological ponds are ecological formations where the water is cleaned by bacteria in the environment without the need for chlorine or any other chemicals, and the algae concentration is reduced by micro-organisms in special filters, thus obtaining clean and harmless, high quality, hygienic fresh water (Anonymous, 2015; Erduran Nemutlu, 2021). The basic philosophy of biological ponds is based on the protection and enrichment of the ecosystem and water reserve, as well as the creation of recreational areas by creating aesthetic designs. These areas provide important services such as feeding the water cycle, cleaning the water supply, improving climate, reducing noise and pollution, and supporting wildlife (Erduran Nemutlu, 2021).

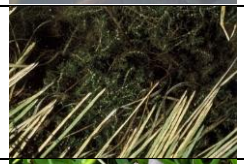
The advantages of biological ponds can be summarized as follows (Anonymous, 2024a);

- Providing the necessary hygiene without the need for mechanical drainage and without water loss, creating a clean and hygienic fresh water environment
- Providing a water ecosystem in harmony with nature without the use of chemicals
- Unlike traditional pools, unlike traditional pools, they are sustainable systems that have a four-season visual effect since they are not drained in winter due to freezing.
- Lower operating costs due to the fact that the treatment process is carried out by means of organic materials
- Forming in desired size and form according to the land form and project design
- Providing habitat for freshwater fauna in addition to its plant material

Figure 1. Biological pond (Anonymous, 2024b)

Plant materials, which are an important part of these systems, also form the basis of the ecosystem component. It is of great importance to consider climatic conditions and natural vegetation in the selection of plants to be used in biological pond design, and to determine the ecological requirements of the plants to be used such as temperature, shade, semi-shade, sun, humidity. The water depths at which plants can survive and the adoption of a design approach that will reveal harmonious compositions with each other are also extremely important. This will make it possible to select and grow suitable plants (Figure 1).

Table 1. Some aquatic plants that can be used for biological ponds and their characteristics

Familya	Latin Name	Türkçe name	Features	Propagation	Withstand Temperature (°C)	Photos of plant materials.	Referanses
Salviniaceae	*Azolla filiculoides*	Kızıl eğrelti	*Likes sunny or slightly shaded areas *It has a perennial, herbaceous structure. * Care should be taken because of its invasive character. * It is not suitable for arid conditions.	c	-5		Anonymous, 2024c Anonymous, 2024d Anonymous, 2024e Gevrek, 2001 Gevrek, 2004
Plantaginaceae	*Callitriche hermaphroditica*	Suyıldızotları	*Likes sunny or slightly shaded areas *It has a perennial, herbaceous structure.*It blooms in summer.*It has a positive effect on increasing the amount of Oxygen in water.	b	-10		Anonymous, 2024f Anonymous, 2024g Anonymous, 2024h Anonymous, 2024ı Kösesakal, 2013
Primulaceae	*Anagallis tenella*	Farekulakları	*It has a perennial, herbaceous structure. * It also covers the surfaces well in areas with moist and permeable soil structure. *It blooms in summer. *Likes sunny places.	b	-10 to -15		Anonymous, 2024j Anonymous, 2024k Anonymous, 2024l
Asteraceae	*Cotula coronopifolia*	Altındüğmeler	*Perennial, herbaceous and creeping. *Likes sunny, wet and humid places. *It can bloom from early summer to early fall.	a,b	-10		Anonymous, 2024m Anonymous, 2024n Anonymous, 2024o Anonymous, 2024p
Campanulaceae	*Lobelia cardinalis*	Sulobelyaları	*Perennial, herbaceous, rhizomatous structure. *Depending on the amount of light they receive, their colors can vary from green to purple. *It is among the plants that are also evaluated in the aquarium.	a, b	-10		Anonymous, 2024q Anonymous, 2024r
Gunneraceae	*Gunnera manicata*	Gunnera	*Perennial, rhizomatous, evergreen, herbaceous. *Likes full sun and semi-shady areas. *Negatively affected by wind.	b	-12		Anonymous, 2024s Anonymous, 2024t Anonymous, 2024u Anonymous, 2024v

Cyperaceae	*Scirpus*	Sazotu (Hasırsazı)	*Herbaceous, perennial plants. *Likes full sun and semi-shady areas.	b	-15 to -20		Anonymous, 2024w Anonymous, 2024x
Amaryllidaceae	*Leucojum aestivum*	Kartaneleri	*It has a bulbous, perennial, herbaceous structure. *It can be grown in swampy, very moist soils. *It is among the plants at risk of depletion. *It blooms for 1 month in April.	b	-15		Anonymous, 2024y Anonymous, 2024z Çelikel and Demir, 2020 Çiçek et al.., 2013
Araceae	*Zantedeschia aethiopica*	Gelinçiçeği	*Rhizomatous, herbaceous, perennial structure. *Likes moist, wet, semi-shady areas. *It should be grown with caution as it has an invasive and poisonous nature.	b	-8 to -10		Anonymous, 2024a1 Anonymous, 2024b1 Yıldırım and Erdem, 2019
Polygonaceae	*Rheum ribes L.*	Ravent, Işkın	*Perennial, woody structure. *They like mountainous, rocky areas as well as wetlands, moist lakes and ponds. * In the spring period, agricultural control may be necessary due to slugs.	b	-15		Anonymous, 2024c1 Yenikalaycı, 2023 Mercimek Takcı, Uçan Türkmen, Güneş ve Bakırhan, (2021).

Propagation: a: by seed, b: by cuttings, c: by spores

3. RESULTS

In particular, plant materials that can withstand and survive cold climatic conditions are very important. Because, in general, cold climatic conditions can cause irreversible damage to plant materials. It is extremely important to create and protect a sustainable environment by contributing to the living conditions of living things in the ecological environment by growing plants with appropriate resistance considering the climatic conditions. A literature review was made for the plants that were thought to be usable, and as a result of this scanning, a table was created and the ecological requirements of the plants were stated. The aquatic plants whose characteristics are listed in Table 1 can be used for biological ponds.

4. DISCUSSION AND CONCLUSION

In conclusion, in this study, some aquatic plants that can withstand cold climatic conditions and can be used in biological ponds in a sustainable ecological environment and their characteristics were included. These plant materials are expected to contribute to a sustainable ecological life.

Authors' Contributions

ZD: Manuscript design, Writing, Draft checking, Reading, Editing.
AA: Manuscript design, Writing, Draft checking, Reading, Editing.

Conflict of Interest

The authors declare that there is no conflict of interest.

Statement on the Welfare of Animals

Ethical approval: For this type of study, formal consent is not required.

Data Availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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