

## ORNAMENTAL SPECIES USED IN WATER GARDENS FROM SOUTH KOREA

PARK SANG KUN<sup>1</sup>, CHO HAE RYONG<sup>1</sup>, BUTA ERZSEBET<sup>2</sup>, CANTOR MARIA<sup>2</sup>,  
ZAHARIA ADRIAN<sup>2</sup>

**Abstract:** Aquatic plants (hydrophytic plants or hydrophytes) are plants that have adapted to live in or on aquatic environments. Because they are living under the water require numerous special adaptations, aquatic plants can only grow in water or permanently saturated soil. Aquatic vascular plants can be ferns or angiosperms (from a variety of families, including monocots and dicots). As opposed to plants types such as mesophytes and xerophytes, hydrophytes do not have a problem in retaining water due to the abundance of water in its environment. This means the plant has less need to regulate transpiration (indeed, the regulation of transpiration would require more energy than the possible benefits incurred).  
The Korean vascular flora contains 217 families, 1.045 genera, 3.034 species, and 406 infraspecific taxa [CHONG-WOOK PARK, 2007].  
In Mokp'o region (South Korea), in 1995, was identified hydrophytes species composed by 11 orders, 22 families, 23 genera, 38 species, 9 varieties, total 48 taxa. These were composed by 22 taxa emerged plants, 15 taxa floating-leaves plants, 8 taxa submerged plants and 3 taxa free-floating plants [JEONG WOO-GYU & al., 1995].  
The same research collective, in 1996, in Paksil, Yundang (South Korea) swamp region was identified hydrophytes species composed by 11 orders, 22 families, 31 genera, 41 species, 10 varieties; it represents 12.1% of total plants. These is composed of 25 taxa emerged plants, 15 taxa floating-leaves plants, 9 taxa submerged plants and 3 taxa free-floating plants [JEONG WOO-GYU & al., 1996].  
This paper contains the classification of water plants and a brief description of some aquatic species used in Korean ancient and modern gardens in order to introduce in our country.

**Key words:** hydrophytes, hygrophytes, flowering species, wetland, characteristics

### Introduction

Water gardens were favorites of the Moors, for whom water was a symbol of life and purity. Early Asians, too, valued water gardens as an aid to meditation and delight in breeding rare fish. In ancient times, Chinese nobility would spend their afternoons lolling in small boats on water gardens while servants floated tea filled cups to them on lily pads. The Renaissance Italians, water was a toy. They loved ornate fountains and whimsical sprays and installed them throughout their estates [VERONICA L. FOWLER & H. BEYER, 1999].

Today, hydrophytes garden have more popularity, even in our yards. Modern homeowners find the water features and beautiful and peaceful addition to the landscape (Fig. 1).

Many species of aquatic plant are invasive species in different parts of the world.

Typical water garden plants are classified after habit and biological characteristics, in 5 main categories: floating, submerged, marginal, waterlilies and oxygenators. After the

<sup>1</sup> National Horticultural Research Institute, RDA, 540-41 Tap-Dong, Kwaeonseon-Gu, Suwon, Korea

<sup>2</sup> University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, 3-5 Manastur Street, Romania, 0264-562774 int.287, ebuta2008@yahoo.com

origin and placement area, they can be: wetland and swamp species [DUMITRAȘ & al., 2008].

**Floating species** float in the water, are not anchored to the soil, their leaves and blossoms are on the surface, their roots dangling loose beneath. In a pond community, they receive more sunlight than submerged plants. In water gardening, these are often used as a provider of shade to reduce algae growth in a pond. These are often extremely fast growing/multiplying. The floater group, which includes *Azolla caroliniana*, *Trapa natans*, *Marsilea quadrifolia*, *Euryale ferox*, *Salvinia natans*, provides shade and often food for fish or wildlife. Some species are natural water filters (*Eichhornia crassipes*, *Lemna minor*, *Pistia stratiotes*).

*Lemna minor* is simple free-floating thalli on the water surface. The plant is small, not exceeding 5 mm in length, with a single root hanging in the water. *Lemna minor* has an invasive character, in this case it can be removed mechanically, by the addition of herbivorous fish or treated with a herbicide. It propagates mainly by division, and flowers are rarely produced; when produced, they are about 1 mm diameter, with a cup-shaped membranous scale containing a single ovule and two stamens. The seed is 1 mm long, ribbed with 8-15 ribs (Fig. 2).

**Submerged plants** are those that live almost completely under the water surface, sometimes with leaves or flowers that grow to the surface such as with the water lily. These plants are placed in a pond or container usually 30-60 cm below the water surface. Some of these plants are called oxygenators because they create oxygen for fishes that live in a pond. Examples of submerged plants are: *Elodea canadensis*, *Hippuris vulgaris*, *Aponogeton distachyos*, *Orontium aquaticum*.

*Nelumbo nucifera* is an aquatic perennial plant. In different conditions its seeds may remain viable for many years, with the oldest recorded lotus germination being from that of seeds 1300 years old recovered from a dry lakebed in northeastern China [[http://en.wikipedia.org/wiki/Nelumbo\\_nucifera](http://en.wikipedia.org/wiki/Nelumbo_nucifera)]. Common misconception is referring to the lotus as a water-lily (*Nymphaea*), an entirely different plant as can be seen from the centre of the flower, which clearly lacks the structure that goes on to form the distinctive circular seed pod in the *Nelumbo nucifera*. It should also be noted that water-lilies come in various colors, whereas the lotus has flowers only in hues of pink, or white [[www.wikipedia.org](http://www.wikipedia.org)].

The roots of lotus flower are planted in the soil of the pond or river bottom, while the leaves float on top of the water surface. The flowers are usually found on thick stems rising several centimeters above the water. The plant normally grows up to a height of about 150 cm and a horizontal spread of up to 3 meters, but some unverified reports place the height as high as over 5 meters. The leaves may be as large as 60 cm in diameter, while the showy flowers can be up to 20 cm in diameter (Fig. 3).

**Marginal plants** are shallow-water plants grown in pots or shelves and they live with their roots in the water and the rest of the plant above the surface. These are usually placed so that the top of the pot is at or barely below the water level. The function of marginal plants is almost always purely ornamental. They add color and form and help the water garden blend visually into the rest of the landscape. Examples of these are: *Iris sibirica*, *Iris pseudacorus*, *Iris levigata*, *Caltha palustris* var. *palustris*, *Acorus calamus*, *Butomus umbellatus*, *Lobelia chinensis*, *Mentha aquatica*, *Sagittaria trifolia*, *Pontederia cordata*, *Persicaria amphibia*.

*Caltha palustris* var. *palustris* grows in wet, boggy places, such as marshes, fens, ditches and wet woods. It becomes most luxuriant in partial shade, but is rare on peat.

The plant is an herbaceous perennial growing to 80 cm tall. The leaves are rounded to kidney-shaped, 3-20 cm across, with a bluntly serrated margin and a thick, waxy texture. Stems are hollow. The flowers are yellow, 2-5 cm diameter, with 4-9 (mostly 5) petaloid sepals and many yellow stamens; they are borne in early spring to late summer and is very valuable to insects at this time as they provide nectar and pollen to them (Fig. 4).

It is sometimes considered a weed in clayey garden soils, where every piece of its root will survive and spread. In warm free-draining soils, it simply dies away.

A **wetland** is an area of land whose soil is saturated with moisture either permanently or seasonally. Such areas may also be covered partially or completely by shallow pools of water. Wetlands include swamps, marshes, and bogs, among others. The water found in wetlands can be saltwater, freshwater, or brackish.

Wetlands are considered the most biologically diverse of all ecosystems. Plant life found in wetlands includes semiaquatic plants as: *Astilbe rubra*, *Colocasia esculenta*, *Typha latifolia*, *Alisma plantago-aquatica* var. *orientalis*, *Sium suave*, *Lysichiton americanus*, *Lysimachia thyrsoflora*, *Saururus chinensis* and grasses: *Scirpus fluviatilis*, *Triadenum japonicum*, *Juncus effesus* var. *decipiens*, *Juncus gracillimus*, *Eleocharis acicularis* var. *longiseta*, *Eleocharis mamillata* var. *cyclocarpa*, *Carex biwensis*.

*Alisma plantago-aquatica* var. *orientalis* grows in shallow water, and consists of a fibrous root, several basal leaves 15-30 cm long, and a triangular stem up to 1 m tall, with a branched inflorescence bearing numerous small flowers with three round or slightly jagged, white or pale purple, petals (Fig. 5).

The word *alisma* is said to be a word of Celtic origin meaning "water", a reference to the habitat in which it grows. Early botanists named it after the *Plantago* because of the similarity of their leaves [FRANCIS, 2006].

**Water lilies** or *Nymphaea* is a genera with 50 species which has a cosmopolitan distribution. They are considered by many to be the jewels of the pond. Rooted in pots at the bottom of the pond, water lilies and their look-alike cousins, lotuses, send up leaves to float on the surface. They shade the water and keep it cool. There are two kinds of water lilies: tropical and hardy. Tropical water lilies grow from tubers and are profuse bloomers with yellow, white, pink, red, blue and purple blooms that stand on stems above the water surface. The flowers are very fragrant (*N. gigantea*, *N. capensis*).

There are two kinds of tropical water lilies: night bloomers and day bloomers [<http://www.victoria-adventure.org/waterlilies/intro.htm>].

Hardy water lilies grow from rhizomes and are somewhat less showy. Their blossoms are smaller and most float on the water surface. They live for years even in the coldest climates; can survive through freezing winters in the pond and filling your pond with gorgeous blossoms lying just at the water's surface from April until October (*N. pygmaea*, *N. alba*, *N. sphaerocarpa*, *N. tuberosa*, *N. odorata*, *N. flava*).

Most water lilies open for three days in succession, closing at night. Night blooming tropical open those three days but from evening to mid-morning. In warmth and health, they can produce clusters of flowers from a single plant [<http://www.victoria-adventure.org/waterlilies/intro.html>].

*Nymphaea alba* grows in water from 30-150 cm deep and likes large ponds and lakes. The leaves can be up to thirty centimeters in diameter and they take up a spread of 150 cm per plant. The flowers are white and they have many small stamens inside (Fig. 6).

The red variety which is in cultivation came from lake *Fagertärn* (Fair tarn) in the forest of Tiveden (Sweden) where they were discovered in the early 19th century. The discovery led to a large scale exploitation which nearly made it extinct in the wild before it was protected [www.wikipedia.org].

Some water plants are called “**oxygenators**” because they add oxygen to the water garden during the day and absorb carbon dioxide during the night. Nutrient-rich water in full sun is the perfect situation for algae growth.

As a purifier, the submerged plants compete with algae by removing unwanted and excess nutrients from the water, which helps prevent algae, build up [www.garden-pond-filters.com/garden-plant-oxygenatorplants.htm].

Oxygenating plants have very weak stems that can't support themselves; therefore, spend their lives completely under the water's surface. Instead of getting their nutrients through their roots in the soil, they get them directly through their leaves. Although most of these plants grow completely under water, some have flower stalks that rise above the water surface.

Usually, this plants are sold in bunches; a good way to decide how many bunches to buy is to get about one bunch for every surface of water. All of these plants are easily propagated by taking 20-30 cm cuttings from the new growth during the summer [www.watgardens.suite101.com].

The oxygenator group includes: *Hydrilla verticillata*, *Cabomba caroliniana*, *Ceratophyllum demersum*, *Eleocharis acicularis*, *Fontinalis antipyretica*, *Myriophyllum spicatum*, *Potamogeton octandrus*, *Potamogeton fryeri*, *Ranunculus aquatilis*, *Utricularia vulgaris* and *Vallisneria spiralis*.

*Hydrilla verticillata* is an aquatic oxygenator plant with yellowish rhizomes growing in sediments at the water bottom at up to 2 m depth. The stems grow up to 1–2 m long. The leaves are arranged in whorls of two to eight around the stem, each leaf 5–20 mm long and 0.7–2 mm broad, with serrations or small spines along the leaf margins; the leaf midrib is often reddish when fresh. It is monoecious (sometimes dioecious), with male and female flowers produced separately on a single plant; the flowers are small, with three sepals and three petals, the petals 3–5 mm long, transparent with red streaks. It reproduces primarily vegetatively by fragmentation and by rhizomes and turions (overwintering buds), and flowers are rarely seen (Fig. 7).

*Hydrilla* has a high resistance to salinity (>9-10 ppt) compared to many other freshwater associated aquatic plants.

In all water gardens the clarity of water and the health of plants depends on a balanced ecosystem. One of the most common signs of imbalance in a water garden is free-floating algae, which makes the water green and murky [FOWLER & BEYER, 1999].

Algae are found in all ponds. There are hundreds of species of algae that can grow in garden ponds but they are only usually noticed when they become abundant. Algae often grow in very high densities in ponds because of the high nutrient levels that are typical of garden ponds. Generally alga attaches itself to the sides of the pond and remains innocuous. Some species of algae, namely the dreaded 'blanket weed' can grow up to 30 cm a day under ideal conditions and can rapidly clog a garden pond. On the other hand, free floating algae are microscopic and are what cause pond water to appear green.

### References

1. CHONG-WOOK P. 2007. *The Genera of Vascular Plants of Korea*. Academy Publishing Co., ISBN 978-89-7616-380-6 94480, 1948 pp.
2. DUMITRAȘ ADELINA, SABO GEORGETA MINODORA, SINGUREANU V., CSOK ERZSEBET, MOLDOVAN G. 2008. Flower species used in aquatic landscape desingn. *Bulletin USAMV of Agricultural Sciences and Veterinary Medicine Cluj-Napoca*, **65**(1): 486, ISSN 1843-5254.
3. ROSE F. 2006. *The Wild Flower Key*. Frederick Warne & Co.: 483-484. ISBN 978-0723251750.
4. JEONG WOO-GYU, YEONG-SIK KONG & WOON-JIN YANG. 1995. The flora of vascular hydrophyte and hygrophyte in Mokp'o swamp and their protection. *Environmental Problems Researchs Institute, Kyungnam University*, **17**: 77-94.
5. JEONG WOO-GYU, YEONG-SIK KONG, CHEAL-SOO KIM & WOON-JIN YANG. 1996. The flora of vascular plants in Paksil and Yundang swamp and their protection. *Environmental Problems Researchs Institute, Kyungnam University*, **18**: 7-34.
6. BAKER K. H. & SAJID D. R. 2007. *Gardens of Korea: Harmony with Intellect and Nature*. Saffron Books. 160 pp. ISBN: 978 1 872843 85 8.
7. LORSON FOWLER V. & BEYER J. 1999. *Garden pools and fountains*. Iowa: Meredith Books, Des Moines. 95 pp. ISBN 0-89721-431-5.
8. [www.garden-pond-filters.com/garden-plant-oxygenatorplants.htm](http://www.garden-pond-filters.com/garden-plant-oxygenatorplants.htm)
9. [www.victoria-adventure.org/waterlilies/intro.html](http://www.victoria-adventure.org/waterlilies/intro.html)
10. [www.watergardens.suite101.com](http://www.watergardens.suite101.com)
11. [www.wikipedia.org](http://www.wikipedia.org)



Fig. 1. *Hydrophyte garden*



Fig. 2. *Lemna minor*



Fig. 3. *Nelumbo nucifera*



Fig. 4. *Caltha palustris* var. *palustris*



Fig. 5. *Alisma plantago-aquatica* var. *orientale*



**Fig. 6.** *Nymphaea alba*



**Fig. 7.** *Hydrilla verticillata*