Review article

Aquatic plants of the Far East of Russia: a review on their use in medicine, pharmacological activity

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Abstract: The review provides information on the medicine application of 30 aquatic plant taxa growing in the Russian Far East, and the prospects for their practical use. A list of aquatic plants on the pharmacotherapeutic action is done. The greatest number of species of aquatic plants has analgesic, antipyretic, anti-inflammatory, stomach and antidiarrheal, wound-healing properties. It is revealed that the most widely in traditional medicine in Asia and Europe are used Nelumbo nucifera, Trapa natans, representatives of the family Lemnaceae, Nymphaeaceae, genus Potamogeton.

Key words: aquatic plants; traditional medicine; wound healing; analgesic; Far East of Russia

Introduction: Aquatic plants are widely used in medicine of the peoples of Europe and Asia. Medicinal properties of plants are determined by the presence of chemical substances with physiological effects on humans and animals in their bodies.

Medicinal plants: from history

The most widely used in traditional medicine of Asia is Nelumbo nucifera Gaertn. (N. komarovii Grossh.), it is evidenced by the large number of publications. There is a detailed description of the lotus and its medicinal properties in ancient Chinese books and treatises. Chinese Pharmacopoeia indicates that Lotus is one of the major drugs in medicines. The rhizomes are used as sedative, nutritional agent, with nervous exhaustion, metabolic disorders, liver diseases, avitaminosis B. Rhizome decoction is used as an antipyretic in pneumonia and bronchial asthma. The seeds are used as an antiemetic. Leaves and nuts are prescribed for avitaminosis and as a diuretic, anti-inflammation agent; have styptic, anthelmintic and demulcent actions, in particular with hemmorhoids. It is recommended as an antiseptic for gonorrhea, liver, kidney, spleen diseases; as an antidote with bites of snakes and scorpions. Contained in embryos, shoots and young leaves alkaloid nufarin restores and stimulates respiration after its stopping. In Japan, in conjunction with other plants it is used for the treatment of cervical cancer. In India, Korea, Thailand, Egypt leaf extract is used in treating tumors of different etiology.

All species of family Nymphaeaceae have pronounced pharmacological properties. Essence of fresh rhizomes of Nipher pumila (Timm) DC. has a stimulating effect on the function of the sex men glands and women use in prolapse of the uterus. Furthermore, extracts of leaves and flowers are used for stomach cramps, enuresis, cough, back pain, kidney disease, nervous exhaustion, metabolic disorders. The plant is toxic and should be used with caution, fearing overdose. All parts of Nymphaea tetragona Georgi are used in folk medicine of Siberia and China. In diseases of the bladder and kidneys it is used infusions and decoctions of leaves and petioles; infusions of flowers have antipyretic effect, rhizomes help with bronchial asthma and lung disease.

Representatives of the family Lemnaceae are widely used in folk medicine in Russia, China and some European countries. Herb powders of Lemna minor L., L. trisulca L., Spirodela polyrhiza (L.) Schleid. have antipyretic, diuretic, analgesic, emollient, styptic, tonic, cooling, choleretic, antiscorbutic, anthelmintic, anti-inflammation, antimicrobial actions. Those are an important source of micronutrients, polysaccharides and essential proteinogenic amino acids. In Chinese and Russian folk medicine, tincture of Lemna minor is used in hives, vitiligo, asthma, influenza, and as a general tonic. In Eastern Siberia infusion of Lemna minor is recommend for diabetes. In some Western European countries it is used for asthma, polyps, rhinitis and other diseases of the nose and throat, inflammation.

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and swelling of the mucous membrane of the respiratory tract. Compress made of leaves *Spirodela polyrhiza* is used for erysipelas and leprosy; infusion of herbs is for edema and gout, as a diaphoretic in pediatric practice, together with *Lemna minor* it is used as a poultice for gout, rheumatism; for washing and rinsing it is used with scorbutic and syphilitic ulcers, eye diseases. Herb *Lemna trisulca* has choleric properties and phytoncific activity.

In the literature there are reports on the use in traditional medicine of the species of the genera *Utricularia* L. and *Myriophyllum* L. The herb *Utricularia macrorhiza* Le Conte is considered diuretic; it is applied to wounds and burns as wound healing. *Myriophyllum spicatum* L. is used as an external agent for cleaning wounds festering.

In Indian medicine, the herb *Ceratophyllum demersum* L. is used in jaundice, for scorpion bites, as an antipyretic and antimalarial; in China it is used with hemoptysis; aqueous extract of the plant has antidiarrhoeal and wound healing effect.

In Chinese medicine leaves and shoots of *Brasenia schreberi* J.F. Gmel. are used as a tonic, astringent and gastric mucous remedy for respiratory diseases (tuberculosis). Extracted from leaves quercetin-7-O-α-D-glucopyranoside has antiinflammation activity. *Ottelia alismoides* (L.) Pers. is used for hemoptysis, asthma, difficulty urinating, externally for skin diseases, burns. According to Chinese scientists the plant is a promising drug raw material, having anti-tuberculosis effect. *Salvinia natans* (L.) All. finds its application in general exhaustion, fever, eczema, skin diseases, herb extract exhibits antimicrobial and antioxidant activity.

In Europe the herb *Batrachium eradicatum* (Laest.) S.F. Gray., in Transbaikalia it is used to treat gout and diabetes, in Altai for hemorrhoids, in Tajikistan for bone fractures; in folk medicine in Austria it is used to treat nasal polyps and cancers, in Indian medicine – it founds the use in syphilis, opium poisoning (as an antidote), in Chinese for dysentery, skin diseases.

Species of the genus *Trapa* L. has long been used in folk medicine in Russia, India, China as an anti-inflammatory, astringent, chologogue, tonic, stomachic, diuretic, anti-toxic agents. It is revealed significant antioxidant properties compare to other natural and synthetic antioxidants. In its leaves pharmacologists found valuable medicinal substance – neorutin. Contained in the kernel of the seed *Trapa natans* L. s.l., indispensable fatty acids have anti-sclerotic action. The juice from the fruit of the ancient Greek physicians used in inflammation of the eyes and against abscesses in the mouth. Tea made of the shell *Trapa* in Cambodia is considered a tonic for fever, but in large doses causes impotence. The extract of the fruits has a high antibacterial activity against a number of pathogenic bacterial species.

Circassians used plants *Trapa* as a remedy for the treatment of obesity and the weak-
ness of the nerves. Modern research of Japanese scientists has identified properties of polyphenols from fruits *Trapa japonica* Fler. significantly to reduce the blood glucose level.

Recently it is discovered high antimicrobial activity of lipids of the genus *Potamogeton* L., which completely inhibited the growth of most test cultures of microorganisms, including pathogens of the most common and dangerous diseases. In folk medicine of China *P. natans* L. is used in the treatment of inflammation in the lining of the eye, as anthelmintic, used together with *P. perfoliatus* L. is a treatment in diseases of the skin. In Japanese medicine broth of *P. distinctus* A. Benn. is used with a treatment in diseases of the skin. In Arabic medicine *P. pusillus* L. is used for stomach cramps, diarrhea (similar to *P. crispus* L., *P. crassus* L.) and as antiscorbutic and wound healing. In Tibetan medicine *P. bertholdii* Fieb., *P. pusillus* used in the treatment of arthritis.

**Conclusion and recommendations:**

Thus, the analysis of literature data allowed us to establish a wide range of pharmacological action of aquatic plants. The species *Nelumbo nucifera*, *Trapa natans* of the genus *Potamogeton*, families Lemnaceae, Nymphaeaceae have the greatest effect of pharmacotherapeutic action. Many of them have retained their importance to the present.

For usability of using information there is a list below of aquatic plants on the pharmacotherapeutic action:

Antioxidant agents – *Salvinia natans*, *Trapa natans*, *Nelumbo nucifera*.

Antitoxic agents – *Ceratophyllum demersum*, *Nelumbo nucifera*, *Nymphoides peltata*, *Potamogeton distinctus*, *Persicaria amphibia*, *Trapa natans*.

Bactericidal and antiseptic agents – *Nelumbo nucifera*, *Sagittaria natans*, *Sagittaria trifolia*, *Trapa natans*.


Astringents – *Brasenia schreberi*, *Trapa natans*.

Hepatoprotective agent – *Ceratophyllum demersum*, *Nelumbo nucifera*.

Antiallergic agents – *Lemma minor*, *Nymphoides peltata*.

Gastric and antiarrheals – *Batrachium trichophyllum*, *Brasenia schreberi*, *Ceratophyllum demersum*, *Hippuris vulgaris*, *Monochoria korsakowii*, *Persicaria amphibia*, *Potamogeton natans*, *Potamogeton crispus*, *Potamogeton pusillus*, *Trapa natans*.

Cholagogue – *Lemma minor*, *Lemma trisulca*, *Spirodela polyrhiza*, *Trapa natans*.

Hemostatic agents – *Lemma minor*, *Lemma trisulca*, *Nelumbo nucifera*, *Spirodela polyrhiza*.

Exterior agents – *Brasenia schreberi*, *Ceratophyllum demersum*, *Myriophyllum spicatum*, *Nelumbo nucifera*, *Spirodela polyrhiza*.

Anthelmintic agents – *Lemma minor*, * Lemma trisulca*, *Nelumbo nucifera*, *Potamogeton natans*, *Spirodela polyrhiza*.

Antiemetics – *Nelumbo nucifera*.

Healing agents – *Callitriche palustris*, *Ceratophyllum demersum*, *Lemma minor*, *Persicaria amphibia*, *Potamogeton distinctus*, *Potamogeton natans*, *Potamogeton perfoliatus*, *Utricularia macrorhiza*, *Sagittaria natans*, *Sagittaria trifolia*, *Salvinia natans*.

Medications for the uterus – *Nelumbo nucifera*, *Nuphar pumila*, *Sagittaria natans*, *Sagittaria trifolia*.

Sedatives – *Nelumbo nucifera*.

Antispasmodic agents – *Nuphar pumila*.

Treatments for avitaminosis – *Nelumbo nucifera*, *Lemma minor*, *Lemma trisulca*, *Potamogeton natans*, *Spirodela polyrhiza*.

Use in diseases of the eye diseases – *Callitriche palustris*, *Lemma minor*, *Potamogeton natans*, *Spirodela polyrhiza*, *Trapa natans*.

Use in of the respiratory diseases – *Batrachium eradicatum*, *Brasenia schreberi*, *Ceratophyllum demersum*, *Hippuris vulgaris*, *Lemma minor*, *Ottelia alismoides*, *Nelumbo nucifera*, *Nymphaea tetragona*.

Use in diseases of the genitourinary system – *Batrachium eradicatum*, *Brasenia schreberi*, *Callitriche palustris*, * Lemma minor*, *Lemma trisulca*, *Nelumbo nucifera*, *Nuphar pumila*, *Nymphaea tetragona*, *Nymphoides peltata*, *Persicaria amphibia*, *Spirodela polyrhiza*.

Use for diseases of the central nervous system – *Trapa natans*. 


Use in the treatment of tumors – *Nelumbo nucifera*, *Persicaria amphioba*.

Use for metabolic disorders – *Lehma minor*, *Nelumbo nucifera*, *Nuphar pumila*, *Persicaria amphioba*, *Spirodela polyrhiza*, *Trapa natans*.

Use for the prevention and treatment of atherosclerosis – *Trapa natans*.

Stimulants – *Nelumbo nucifera*.


Diaphoretics – *Spirodela polyrhiza*.

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