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Research Article

A PRELIMINARY QUANTITATIVE PHYTOCHEMICAL SCREENING OF FIVE MACROPHYTES, N. PARAVUR, ERNAKULAM, KERALA, INDIA

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ABSTRACT
An understanding of the chemical constituents of plants is a prerequisite for their use in medicine and also for the synthesis of complex chemical substances. Aquatic plants have both economic and environmental uses depending on their natural characteristics. In the present study, a quantitative phytochemical investigation was carried out in five plant species namely *Hydrilla verticellata*, *Eichornia crassipes*, *Pistia stratiotes*, *Salvinia molesta* and *Lagenandra toxicaria* Dalz. The study revealed the presence of many medicinally active constituents like carbohydrates, total soluble proteins, tannin, total carotenoids, alkaloids, flavanoids, terpenoids, saponin and phenol. The occurrence of the above bio active constituents could be exploited for their potential applications for medicinal and other purposes.

Keywords: *Bioactive, Macrophytes, Metabolites, Phytochemical Screening, Quantitative*

INTRODUCTION
Plants are used as medicine since time immemorial. One of the areas of ethnobotany, ethnopharmacology is considered as the scientific evaluation of traditional medicinal plants (Cotton, 1996). Cox, (1994) has suggested that the ethnodirected sampling is most likely to succeed in identifying drugs used in the treatment of gastrointestinal, inflammatory and dermatological complaints. The plant kingdom is a virtual goldmine of potential drug targets and other active molecules awaiting to be discovered. It has been estimated that only 10-15% of the 7,50,000 exiting species of higher plants have been surveyed for biologically active compounds. Natural products produced by plants, fungi, bacteria, insect and animals have been isolated as biologically active pharmacophores. Approximately, one-third of top-selling drugs in the world are natural products or their derivatives often with ethnopharmacological background. Moreover, natural products are widely recognized in the pharmaceutical industry for their broad structural diversity as well as their wide range of pharmacological activities (Raman, 2006).
A characteristic of plant life is the production of a vast number of natural compounds, i.e., metabolites often called secondary metabolites. Phytochemicals are basically divided into two groups; primary and secondary metabolites based on the function in plant metabolism. Secondary, metabolites consist of alkaloids, saponins, steroids, flavanoids, tannins and so on (Kumar, 2009). They have crucial role in plant development as well as in the interaction of a plant with its biotic and abiotic environment. Phytochemical constituents are the basic source for the establishment of crude drugs (Savitharamma, 2011).
The phytochemical research based on ethno-pharmacological information is generally, considered an effective approach in the discovery of new anti-infective agents from higher plants. Aquatic plants have economic and environmental uses depending on their natural characteristics. Some are consumed in human diet, while other species have medicinal values and still other species are good resources of minerals and vitamins. Aquatic plants possess rich content of carbohydrates and proteins, hence, they are used as food and feed (Pepsi *et al.*, 2012).
The amount of phytochemical substances varies considerably from species to species and even from plant to plant, depending on the age and various ecological and climatic factors (Baguor, 1989). A large number of phytochemicals belonging to several chemical classes have been shown to have inhibitory

effects on all types of microorganisms in vitro. Plant products from barks, leaves, flowers, roots, fruits, seeds have been part of phytomedicines since time immemorial (Criagg and David, 2001). Knowledge of the chemical constituents of plants is desirable for synthesis of complete chemical substances (Mojab *et al.*, 2003; Parekh and Chanda, 2007, 2008). Today, there is growing interest in chemical composition of plant based medicines. Several bioactive constituents have been isolated and studied for pharmacological activity. In the present work, a quantitative phytochemical analysis were carried out on some aquatic macrophytes, of which majority are considered as weeds.

Hydrilla verticellata Royle belongs to the family Hydrocharitacea. It is an aquatic weed, submerged, rooted (usually) perennial with long sinewy branching stems that often reach the surface and form dense mats. The stems are covered in small, pointed, often serrate leaves arranged in 4-8 whorls. Leaf midribs are often reddish with one or more sharp spines. Small pale subterranean tubers occur attached to the roots. Small white flowers grow above the water line on stalks.

Salvinia molesta D. S Mitchel (Salviniaceae) is a potentially serious aquatic weed that is indigenous to South eastern Brazil, but has been widely distributed to many parts of the world (Mitchell and Tur, 1975; Mitchell *et al.*, 1980).

Under favorable conditions, this floating water fern can become a devastating aquatic nuisance disrupting native species as well as human activities by rapidly covering large areas (Forno and Harley, 1979). Dense mats of giant salvinia interfere with rice cultivation, dog fishing nets, and disrupt access to water for humans, livestock, and wildlife (Mitchell, 1979) and recreation, transportation, irrigation, hydroelectric generation and flood control are also hampered (Jolm *et al.*, 1977). Common name of *Salvinia molesta D. S Mitchel* include Giant salvinia, African payal, Kariba weed, butterfly weed, and aquarium water moss (Mitchell, 1972).

Pistia stratiotes Linn, also known as 'Jal kumbhi', water cabbage, water lettuce, Nile cabbage, or shellflower is a free floating aquatic plant of streams, lakes and ponds. Due to its stoloniferous nature it is always found anchored to the hydro soil when the water level recedes and in marshland conditions with alkaline/lime- rich water. *P stratiotes Linn* belongs to Arum/ Araceae family. As a floating weed it forms dense mats on surface of water bodies, disrupting aquatic flora and fauna underneath and thus, adversely affects the water ecosystem and hinders water flow, fishing, swimming, boating, water sports and navigation. It lowers available oxygen and pH of water and thus, damages paddy fields, competing with the crop under shallow water conditions. It replaces the native hydrophytes in ponds and other water reservoirs (Khan *et al.*, 2014).

Eichornia crassipes (C. Martius) Solms-Lamb commonly known as water hyacinth is an aquatic plant, native to the Amazon basin, belongs to the family pontederiaceae with broad, thick, glossy, ovate leaves, water hyacinth may rise above the surface of water as much as one meter in height. The leaves are 10-20 cm across and float above the water surface. They have long, spongy and bulbous stalks. The feathery, freely hanging roots are purple – black. An erect stalk supports, a single spike of 8-15 conspicuously attractive flowers.

Lagenandra toxicaria Dalzell belongs to the family araceae is endemic to South India. It is a semi aquatic herb, growing gregariously in semi evergreen forest, often abundant in marshes and streams usually submerged during monsoon rains. It has thick creeping rhizome, leaf blade simple, ovate to almost linear, fine venation transverse reticulate.

MATERIALS AND METHODS

Fresh plants of *Eichornia crassipes, Pistia stratiotes, Salvinia molesta, Hydrilla verticellata and Lagenandra toxicaria* were collected from different water bodies in and around N. Paravur, Ernakulam District of Kerala state.

The collected plants were identified and plant parts were washed thoroughly with normal tap water, followed by sterile distilled water. Preliminary quantitative phytochemical analysis for the presence of various compounds like total carbohydrates, total soluble protein, tannin, total carotenoids, alkaloids, flavanoids, terpenoids, saponin and phenol were performed by standard methods given by Hode and

Hofreite, (1962), Lowry *et al.,* (1951), Makkar *et al.,* (1993), Zakaria *et al.,* (1979), Zhisen *et al.,* (1999), Ferguson, (1956), Hiai *et al.,* (1976), Asis, (1989).

RESULTS AND DISCUSSION

The phytochemical screening and quantitative estimation of secondary metabolites of five selected aquatic macrophytes were summarized in the table 1. The results revealed that total carbohydrates, total soluble protein, tannin, total carotenoids, alkaloids, flavanoids, terpenoids, saponin and phenol were present in all the plants.

Total carbohydrates are found to be maximum in *Lagenandra toxicaria* i.e. 25.2 mg/g. Carbohydrates are one such group of carbon compounds which are essential to life. Almost all organisms use carbohydrates as building blocks of cell and as a matter of fact exploit their rich supply of potential energy to maintain life.

Total soluble proteins are also found to be higher in *Lagenandra toxicaria*, 2.86 mg/g where as it is lowest in *Salvinia molesta*. Proteins are essential in maintaining the structure and function of all life and vital growth and development.

The presence of higher protein level in *Lagenandra toxicaria* points towards their possible increase in food value or that a protein based bioactive compound could also be isolated in future (Thomson *et al.*, 1991).

Maximum levels of tannins were found to be higher in *Eichornia crassipes*, 44µg/g and lowest in *Salvinia molesta*, 22µg/g.

The growth of many fungi, yeasts, bacteria and viruses was inhibited by tannins. Apart from these tannins contribute the property of astringent activity i.e. faster healing of wounds and inflamed mucous membrane (Cheng *et al.,* 1998; Okwu and Josiah, 2006).

Total carotenoids are found to be highest in *Eichornia crassipes*, 140 µg/s and lowest in *Salvinia molesta* i.e. 90µg/g Carotenoids, also called tetraterpenoids, are organic pigments that are found in chloroplasts and chromoplasts of plants and some other phytosynthetic organisms.

Carotenoids absorb light energy for use in photosynthesis and they protect chlorphyll from photo damage. Carotenoids that contain unsubstituted beta –ionone rings have vitamin A activity and these and other carotenoids can also act as antioxidants.

The highest levels of alkaloids were found to be maximum in *Salvinia molesta* i.e. 35µg/g. The alkaloids are one of the most diverse group of secondary metabolites found in living organisms and have an array of structure types, biosynthetic pathways, and pharmacological activities. The presence of alkaloid contained in plants is used in medicine as aesthetic agents.

Flavanoids are reported to possess many useful properties, including anti – inflammatory, antimicrobial, enzyme inhibition, estrogenic, antiallergic and antitumor activity (Harbone and Williams, 2000; Havesteen, 1990). In the present study maximum levels of flavanoids are found to be higher in *Eichornia crassipes*.

Plant terpenoids are used extensively for their aromatic qualities and play a role in traditional herbal remedies. Terpenoids (or isoprenoids), a subclass of the prenyllipids represent the oldest group of small molecular products synthesized by plant. The highest level of terpenoid was found in *Eichornia crassipes* and least in *Salvinia molesta.*

Maximum levels of saponins are present in *Salvinia molestia* 38 µg/g. Traditionally saponins have been extensively used as detergents, as pesticides and molluscides, in addition to their industrial applications as forming and surface active agents and also have beneficial health effects (Shi *et al.,* 2004).

The phenolic compounds are one of the largest and most ubiquitous groups of plant metabolites. They possess biological properties such as antiapoptosis, anti aging, anticarcinogen, anti inflammation, anti atherosclerosis, cardiovascular protection, improvement of endothelial function, inhibition of angiogenesis and cell proliferation activities (Chandrakala *et al.,* 2015). In the present analysis maximum amount of phenol is found in *Salvinia molesta* and least in *Lagenandra toxicaria*. Exploitation of these pharmacological properties involves further investigation of active ingredients.

Table 1: Phytochemical Analysis of 5 Macrophytes of N. Paravur, Ernakulam, Kerala, India

	Sample	Parameters	Result	Test Method	Unit (as Fresh Weight)
1	1	Total carbohydrates	13.0	Hodge & Hofreite, 1962	mg/g
	2		25.2		
	3		19.5		
	4		12.5		
	5		13.2		
2	1	Total soluble protein	2.37	Lowry and Rosebrough, 1951	mg/g
	2		2.86		
	3		2.12		
	4		1.95		
	5		1.86		
3	1	Tannin	44	Makkar et al., 1993	µg/g
	2		37		
	3		39		
	4		28		
	5		22		
4	1	Total carotenoids	140	Zakaria et al., 1979	µg/g
	2		100		
	3		150		
	4		90		
	5		90		
5	1	Alkaloids	29	Ajanal et al., 2012	µg/g
	2		32		
	3		27		
	4		30		
	5		35		
6	1	Flavanoids	49	Zhisen et al., 1999	µg/g
	2		48		
	3		31		
	4		33		
	5		48		
7	1	Terpenoids	14	Ferguson, 1956	µg/g
	2		7		
	3		11		
	4		11		
	5		9		
8	1	Saponin	33	Hiai et al., 1976	µg/g
	2		33		
	3		31		
	4		34		
	5		38		
9	1	Phenol	5.2	Asis, 1989	mg/g expressed as pyrogallic acid
	2		4.5		
	3		5.5		
	4		5.7		
	5		6.2		

1. Eichornia Crassipes 2. Lagenandra Toxicaria 3. Hydrilla Verticellata 4. Pistia Stratiotes 5. Salvinia Molesta

Conclusion

The preliminary phytochemical screening results reveal the presence of several phytochemical compounds in the plants studied. Many evidences gathered in earlier studies confirmed the identified phytochemicals to be bioactive. Several studies confirmed that these secondary metabolites contribute to medicinal as well as physiological properties to the plants. Literature referred further revealed their use in the treatments of different ailments. Therefore, extracts from these plants could be seen as a good source for useful drugs.

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