African Journal of Microbiology Research Vol. 3(8) pp. 418-421 August, 2009
Available online http://www.academicjournals.org/ajmr
ISSN 1996-0808 ©2009 Academic Journals

Full Length Research Paper

Biomolecular and phytochemical analyses of three aquatic angiosperms

Kandukuri Vasu*, Jakku Vinayasagar Goud, Aruri Suryam and M. A. Singara Charya

Department of Microbiology, Kakatiya University, Warangal – 506 009, India.

Accepted 26 May, 2009

Aquatic plants produce a variety of compounds of known therapeutic properties and can be utilized as food and feed. These substances are used for developing new antimicrobial drugs. The present study deals with three aquatic plants dominant in Warangal district A. P. region *Eichhornia crassipes, Ipomoea aquatica* and *Nymphaea pubescens* were selected. These three aquatic angiosperms were analysed for their biomolecules and phytochemicals.

Key words: Aquatic angiosperms, *Eichhornia crassipes, Ipomoea aquatica, Nymphaea pubescens,* biomolecules, phytochemicals.

INTRODUCTION

The search for new molecules, nowadays has taken a slightly different route where the science of ethnobotany and ethno-pharmocognasy are being used as guide to lead the chemist towards different sources and classes of compounds. These compounds may derive by primary or rather secondary metabolism of living organisms. The secondary metabolites are chemically and taxonomically extremely diverse compounds with obscure function. An important part of the natural products from plants, biomolecules and secondary metabolites usually exhibits some kind of biological activities. They are widely used in the human therapy, veterinary, agriculture, scientific research and in countless other areas.

It is estimated that there are 2, 50,000 to 5, 00,000 species of plants on earth (Boris, 1996). A relatively small percentage (1-10%) of these is used as food by both humans and other animal species. It is possible that even more are used for medicinal purposes (Moermann, 1996). Most of the molecules are secondary metabolites, of which at least 12,000 have been isolated and the number estimated to be less than 10% of the total (Schultes, 1978). Useful antimicrobial phytochemicals can be divided into several categories of phenolic and polyphenols, quinones, flavones, flavonoids, flavonols, tannins, coumarins, terpenoids, essential oils, alkaloids, lectins and polypeptides (Scalbert, 1991; Kumar and Singh, 1992; Ahmed, 1993; Brantner and Grein, 1994; Ghoshal et al., 1996).

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.

Anjana Dewanji (1993) indicated that leaf protein extracted from unwanted aquatic plants could be used for food and feed purposes. A large number of phytochemicals belonging to several chemical classes have been shown to have inhibitory effects on all types of microorganisms *in vitro* (Cowan, 1999). Biologically active compounds present in the medicinal plants have always been of great interest to scientist working in this field. Bandarunayake (2002) studied on mangrove plants and bioactive compound and chemical constituents were identified which are having medicinal values. Rahman *et al*. (2007) revealed that because of rich content of carbohydrates and proteins in aquatic plants they can be utilized as food and feed. Example, *Alternathera philoxeroids, Eichhornia crassipes,* etc.

The present study was conducted to determine the biomolecules, secondary metabolites and phytochemicals of aquatic plant species.

*Corresponding author. E-mail: kandukurivasu@yahoo.com. Tel: +91 9849500462

Table 1. Quantitative screening of biomolecules in three aquatic plants.

Biomolecules	*E. crassipes*	*I. aquatica*	*N. pubescens*
Total chlorophyll(mg/g)	4.34	5.76	5.54
Carotenoids (mg/g)	1.88	2.57	3.11
Proteins (mg/g)	176	312	348
Carbohydrates (mg/g)	195	62.5	165
Lipids (mg/g)	103	76	100
Total phenols (mg/ml)	440	615	850

MATERIALS AND METHODS

Plant material

Three aquatic plants dominant in this sub-tropical region were collected in Warangal district, A. P. and the taxonomic identities of these plants were identified at the Department of Botany, Kakatiya University. Fresh plant material were washed under running tap water, and dried under shade and then powdered.

Preparation of plant extracts

Dry powdered plant material was used for extraction, 50 gms of each of the powdered plant material were extracted in a soxhlet extractor containing 200 ml of methanol. The resulting extracts were evoparated to make more concentration and it was stored at 4°C for further investigations.

Determination of biomolecules

Chlorophyll and carotenoids are estimated as suggested by Arnon (1949). The chlorophyll content can be taken as an index of photosynthetic productivity. Carbohydrates are estimated by Anthrone method (Jermyn, 1975). Proteins by Lowry method (Lowry et al., 1951). The total lipids as suggested by Folch et al. (1957). Ascorbic acid was estimated as method suggested by Tiyagi and Kumar (1994) and Phenols were estimated as method suggested by Plummer (1993).

Determination of phytochemicals

Chemical tests were carried out on the methanol extract to identify the constituents utilizing standard methods of analysis (Gibbs et al., 1974; Jayaraman, 1981)

RESULTS

Quantitative screening of biomolecules

In three aquatic plants the chlorophyll and carotenoids were estimated (Table 1). The Chlorophyll content *in E. crassipes* was 4.34 mg/g and in *Ipomoea aquatica* it was 5.76 mg/g while in *Nymphaea pubescens* it was 5.54 mg/g. Carotenoid quantities were less in *E. crassipes* (1.88 mg/g) and maximum with *N. pubescens* (3.11 mg/g)and in *I. aquatica* the quantity was moderate (2.57 mg/g).

The protein content minimum recorded in *E. crassipes* (176 mg/g) and maximum in *N. pubescens* (348 mg/g) while in *I. aquatica* it was 312 mg/g. The carbohydrate content in *E. crassipes* was 195 mg/g and in *I. aquatica* and *N. pubescens* it was 62.5 mg/g and 165 mg/g respectively.

The lipid quantities in *I. aquatica* was 76 mg/g and in *E. crassipes* it was 103 mg/g while in *N. pubescens* it was 100 mg/g. Total phenols were observed in three aquatic plants. The quantity was minimum in *E. crassipes* (440 µg/ml) and maximum in *N. pubescens* (850 µg/ml), while, in *I. aquatica* the quantity was moderate (615 µg/ml)

Qualitative screening of phytochemicals

Qualitative screening for the presence of phytochemicals like tannins, phenols, steroids, flavonoids and saponins were assayed using the methanolic extracts of the three plants Table 2.

The biochemical studies revealed that most of the biomolecules were present in the three aquatic plants. Alkaloids, ellagic acid, phenols, steroids, tannins, triterpenoids, saponins were present in *E. crassipes,* while, falvonoids were absent. The biomolecules, alkaloids, ellagic acid, phenols, tannins, saponins, falvonoids were present in *I. aquatica* and *N. pubescens.*

DISCUSSION

Similar to our studies Michael and Nicholas (1998) also observed the pigments chllorophyll, carotenoids in submerged angiosperms which varied in wide range due to ecological conditions such as light and temperature. Gulmira et al. (2006) revealed the differences in photosynthetic activity, chlorphyll and carotenoid levels and chlorophyll parameter in green sun and shade leaves of *Ginkyo biloba* and *Fagus sylvatica.* Nagendra Prasad et al. (2008) also analysed the protein contents in aquatic plant, *I. aquatica.* Imbs and Pham (1995) observed the lipid composition of ten edibile seeds species from North Vietnam. Nagendra Prasad (2008) analysed the spectral data and isolated antioxidant compound from aquatic plant, *I. aquatica.* Daniel (1989) determined the polyphenols in some Indian vegetables. Jain and Verma (1981) worked on medicinal plants in the folklore of North-

Table 2. Qualitative screening of phytochemicals in three aquatic plants.

Phytochemicals	*E. crassipes*	*I. aquatica*	*N. pubescens*
Alkaloids	+	+	+
Ellagic acid	+	+	+
Phenols	+	+	+
Steroids	+	-	-
Tannins	+	+	+
Triterpinoids	+	-	-
Saponins	+	+	+
Flavonoids	-	+	+

East Haryana. Chen and Chen (1992) determined the carotenoids and chlorophylls in water convolvulus by liquid chromatography. Chu et al. (2000) worked on flavornoid contents of several vegetables and their antioxidant activity. Ngamsaeng et al. (2004) revealed that *Lemna minor* and *Ipomoea aquatica* as protein supplements for ducks. Rehman (2002) reported a triterpenoid from an aquatic herb *Nymphoides cristatum*, which was used for treatment of fever and jaundice. Rahman (2000) reported the crude extract of *Trapa bispinosa* possesses the antimicrobial and cytotoxic acitivty and they reported few compounds from the extract of *T. bispinosa* and also discussed about the antibacterial spectra of the compounds. Attaway and Zaborsky (1993) reported that marine organisms produce a variety of secondary metabolites, some of which are antibacterial, anti-fungal, antiviral and anti HIV. Nagendra Prasad et al. (2008) studied the phytochemistry of *I. aquatica* and identified various biomolecules and medicinally important com-pounds in this plant. Plants are proving to be an increasingly valuable reservoir of compounds and extracts of substantial medicinal merit.

REFERENCES

Ahmed AA, Mahmoud AA, Williams HJ, Schott AI, Reibenspies JH, Mabry TJ (1993). New sesqui terpene α-methylene lactones from the egyptian plant *Jasonia candicans*. J. Nat. Prod. 56: 1276-1280.

Anjana Dewanji (1993). Amino acid composition of leaf proteins extracted from some aquatic weeds. J. Agric. Food. Chem. 41: 1232-1236.

Arnon DI (1949). Copper enzymes in isolated chloroplasts. Polyphenol oxidase in *Beta valgaris*. Plant Physiol. 24 : 1-15.

Attaway DH, Zaborsky OR (1993). Marine Biotechnology Volume I. Pharmaceutical and bioactive natural products, Plenum Press, New York.

Bandarunayake M (2002). Bioactivities, bioactive compounds and chemical constituents of mangrove plants. Wetland Ecol. Manage. 6: 421-452.

Borris RP (1996). Natural productions research: perspectives from a major pharmaceutical company, J. Ethnopharmacol. 51: 29-38.

Brantner A, Grein E (1994). Antibacterial activity of plant extracts used externally in traditional medicine. J. Ethnopharmacol. 44: 35-40.

Chen BH, Chen YY (1992). Determination of carotenoids and chlorophylls in water convolvulus (*Ipomoea aquatica*) by liquid chromatography. Food. Chem. 45: 129-134.

Chu YH, Chang CL, Hsu HF (2000). Flavonoid content of several vegetables and their antioxidant activity. J. Sci. food. Agric. 80 : 561-566.

Cowan MM (1999). Plant products as antimicrobial agents. Clin. Microbiol. Rev. 564-582.

Daniel M (1989). Polyphenols of some Indian vegetables. *Curr. Sci.* 58: 1332-1333.

Folch J, Lees M, Stanely GHS (1957). A simple method for the isolation and purification of total lipids from animal tissues. J. Biol. Chem. 226: 497-509.

Ghoshal S, Krishna Prasad BN, Lakshmi V(1996). Antiamoebic activity of *Piper longum* fruits against *Entamoeba histolytica in vitro* and *in vivo*. J. Ethnopharmacol. 50: 167-170.

Gibbs RD (1974). Chemotaxonomy of flowering plants. McGill – Queen's university press, Montreal and London I : 523 – 619.

Gulmira S, Knapp M, Lichtenthaler HK (2007). Differences in photosynthetic activity, chlorophyll and cartenoid levels, and in chlorophyll fluorescence parameters in green sun and shade leaves of *Ginkgo and Fagus*. J. Pl. Physiol. 7 : 945-955.

Imbs AB, Pham LQ (1995). Lipid composition of ten edible seed species from North Vietanam. J. Am. Oil. Chem. Soc. 72: 957-961.

Jain SP, Verma DM (1981). Medicinal plants in the folklore of North-East Haryana, Natl. Acad. Sci. Letters (India), 4 : 269-271.

Jayaraman J (1981). Laboratory manual in Biochemistry. Wiley Eastern Ltd.,

Jermyn MA (1975). Increasing the sensitivity of anthrone method for carbohydrate. Anal. Biochem. 68 : 332-335.

Kumar O, Singh B (1992). Effect of Ayurvedic liver stimulants on live weight gain of broilers in North-Eastern region. *Indian* J. Anim. Res. 26: 1-5.

Lowry OH, Rosebrough NJ, Farr AC, Randall RJ (1951). Protein measurement with folin-phenol reagent. J. Biol. Chem. 193: 265-275.

Michael PC, Nicholas AW (1998). Pigment composition of putatively achlorophyllous angiosperms. Plant systematics, Evolution 210 : 105-111

Moermann DE (1996). An analysis of the food plants and drug plants of native North America. J. Ethnopharmacol 52 : 1-22.

Nagendra Prasad K, Shivamurthy GR, Aradhya SM (2008). *Ipomoea aquatica*, an under utilized green leafy vegetables: A review Int. J. Bot. 1: 123-129.

Ngamsaeng A, Thy S, Preston TR (2004). Duckweed (*Lemna minor*) and Water spinach (*Ipomoea aquatica)* as protein supplements for ducks fed broken rice as basal diet. Live stock Res. Rural. Dev. 16: 18-24.

Plummer DT (1993). An Introduction to practical Biochemistry III published by Tata Mc.Graw Hill publishing Com. Ltd., New Delhi.

Rahman AHMM, Rafiul Islam AKM, Naderuzzaman AKM, Hossain MD, Rowshatul A (2007). Studies on the aquatic angiosperms of the Rajshahi University campus. Res. J. Agri. & Biol. Sci. 3: 474-480.

Rahman MM, Mosaddik A, Wahed MII, Haque ME (2000). Antimicrobial activity and cytotoxicity of *Trapa bispinosa. Fitoterapia,* 71: 704-706. Rehman A, Abu Sayeed AI, Chowdhary D, Sadik G, Astaq Moha Khan GRM (2002). Characterization and biological screening of a

triterpenoid from *Nymphoides cristatum.* J. Biol. Sci. 2 : 46-48.
Scalbert A (1991). The kingdom of plants. In W.A.R. Thomson (ed.,) Medicines from the earth. Mc Graw-Hill Book co., New York, N. Y. p. 208.
Schultes RE (1978). The kingdom of plants, In W.A.R. Thomson (ed.), Medicines from the earth. Mc Graw-Hill Book Co., New York, N.Y. p. 208.
Tiyagi A, Rishikumar S (1994). Changes in ascorbic acid content in tamato fruit. Indian Phytopath. 47: 179-180.