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Der Pharma Chemica, 2012, 4(4):1481-1484

(<http://derpharmachemica.com/archive.html>)



ISSN 0975-413X
CODEN (USA): PCHHAX

Variations in distribution of flavonoids in some seaweed of Visakhapatnam coast of India

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ABSTRACT

Fifteen seaweeds belonging to three classes of algae were analyzed for flavonoids. All the seaweeds studied were found as rich sources of flavonoids and it was varied from 6.03 to 33.39 mg/g. Differences among the flavonoids were apparent among the species. The Phaeophyceae members were observed with higher content of (with the range 20.72-32.89mg/g and mean of 26.80) flavonoids than the Chlorophyceae and Rhodophyceae. Among the fifteen species analyzed, *Enteromorpha compressa*(33.39mg/g) and *Padina tetrastromatica*(32.89mg/g) have higher content.

Key Words: Flavonoids, Seaweed, Visakhapatnam coast.

INTRODUCTION

Seaweeds are used for various purposes such as food, Pharmaceutical industry and in agriculture. Flavonoids are largest group of polyphenolic compounds and are known to contain a broad spectrum of chemicals and biological activities including antioxidant and free radical scavenging properties [3]. They are remarkable group of plant metabolites. Flavonoids possess 15 carbon atom, two benzene rings joined by a linear three carbon chain. They serve a variety of important functions in all plants. Gene sequence and protein location may be functions of flavonoids in plants.

Flavonoids are perhaps best known to enhance the effects of ascorbic acid. They are also known for their ability to protect the vascular system. Plants and flowers get their colours from flavonoids. The plants richest in flavonoids are those coloured dark green and rich in chlorophyll. They serve as signal for pollinators. They reduce the palatability of plants or cause the herbivores to deter the plants. Together with carotenes, flavonoids are also responsible for colours of fruits, vegetables and herbs. They serve anticarcinogenic and cardioprotective function in humans.

Literature on flavonoid content of seaweeds was scarce [5,7-9]. The objective of this study was to analyse the total flavonoids of seaweeds for their use in food, human health. To understand their role in plant physiology and also flavonoids are indispensable markers for chaemotaxonomic purpose.

MATERIALS AND METHODS

Fifteen seaweeds were collected from Visakhapatnam coast from February to June 2008 during the low tide period. The seaweeds were brought to the laboratory, washed thoroughly with fresh water and cleaned carefully to remove the extraneous matter. They were shade dried, powdered and used for analysis.

The total flavonoids were determined according to the method of [6]. These were extracted using one gram material of the sample with ten times the volume of 80% ethanol. Centrifuged and the supernatant was evaporated to dryness. The residue was dissolved in 5 ml of distilled water. 1 ml of the Plant extract was taken in to 10 ml of volumetric flask containing 4 ml of distilled water. To the above mixture 0.3 ml of 5% NaNO₂ was added. After 5 minutes 0.3ml of 10% of AlCl₃ was added. At the next minute 2 ml of 1M NaOH was added and the total volume was made up to 10 ml with distilled water. The solution was mixed well and the absorbance was measured at 415 nm by Spectrophotometer. The samples were extracted and analysed in triplicate. Quercetin was used as standard and the equivalents were determined from a standard concentration curve and expressed as mg/g dry weight of the Seaweed.

Statistical analysis

All analysis was run in triplicate and was expressed as Mean, \pm Standard deviation. Data were analysed using one way analysis of variance. ANOVA calculated showed a significant difference, which was significant at $P < 0.05$.

RESULTS AND DISCUSSION

The distribution of flavonoids in the fifteen species of seaweeds, collected from Visakhapatnam coast was analysed. Of these fifteen species, 6 belong to Chlorophyceae, 2 to Phaeophyceae and 7 to Rhodophyceae. Many of the species were analysed for the first time for flavonoids i.e., *Chaetomorpha antennina*, *Chaetomorpha torta*, *Spongomorpha indica*, *Bryocladia thwaitesii*, *Centroceras clavulatum*, *Hypnea valentiae*, and *Pterocladia heteroplotos*. Higher content of flavonoids were observed in all the species analysed and it was varied from 6.03 to 33.39 mg/g. The range and mean values of flavonoids for different classes of algae was presented in Table 1. The range and mean was high in Phaeophyceae than the Chlorophyceae and Rhodophyceae. Among the Chlorophyceae the range was varied from 8.43 to 33.39 mg/g with a mean value of 19.24 mg/g. In Phaeophyceae the range varied between 20.72 to 32.89 mg/g with a mean of 26.80 mg/g. And among the Rhodophyceae the range varied from 6.03 to 20.91 mg/g and the mean value was 12.12 mg/g. Higher content of flavonoids in seaweeds were also reported from other places [1,4&8]. The highest polyphenolic concentration in brown seaweeds was reported by [2]. These reports were also in agreement with the present findings.

Table 1. Range and mean values of flavonoids in some seaweeds mg/g dry weight

Class	Range	mean	SD
Chlorophyceae	8.43 – 33.39	19.24	± 1.71
Phaeophyceae	20.72 – 32.89	26.80	± 4.35
Rhodophyceae	6.03 – 20.91	12.12	± 1.05

The variation in distribution of total flavonoids in fifteen seaweeds was shown in Fig.1. Differences in flavonoid content were apparent among the species. The flavonoids content was highest in *Enteromorpha compressa* with 33.39 mg/g and *Padina tetrastromatica* with 32.89 mg/g. It was also high in *Chaetomorpha antennina* with 29.73 mg/g and *C. torta* with 24.49 mg/g. In *Gracilaria corticata* it was 20.91 mg/g and in *Sargassum vulgare* it was 20.72 mg/g. A medium level of flavonoid content was observed in the following three species. In *Bryocladia thwaitesii* it was 16.39 mg/g, in *Grateloupia lithophila* 15.85 mg/g and in *Spongomorpha indica* 11.01 mg/g. In the following four species (*Pterocladia heteroplotos*, *Hypnea valentiae*, *Ulva fasciata* and *Caulerpa sertularioides*) the content was observed from 9.85 to 8.43 mg/g. The lowest content was observed in *Centroceras clavulatum* with 7.11mg/g and *Gelidium pusillum* with 6.03 mg/g. The plants rich in flavonoids are those coloured dark green and rich in chlorophyll. The flavonoid content of *Ulva lactuca* and *Sargassum whitii* [5] and *Enteromorpha spirulina* [1] was found relatively lower than the present species. The reason may be due to variation in species, season or other geographical conditions.

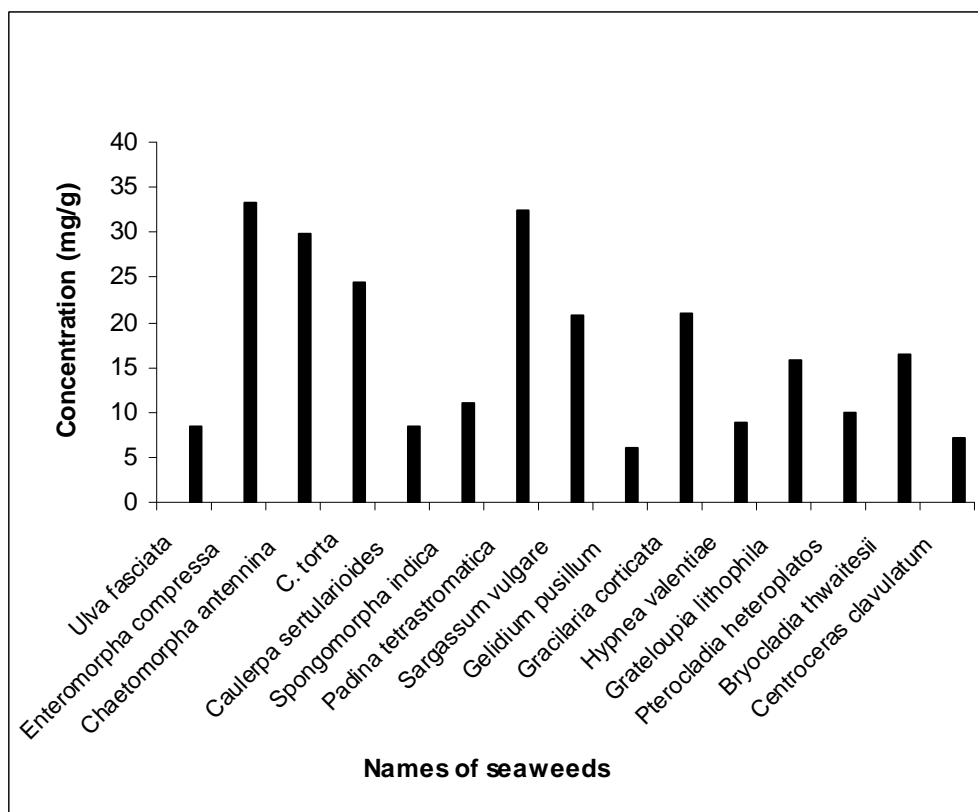


Fig.1. Variations in flavonoids content of some seaweeds

CONCLUSION

In conclusion, we noticed among the species analysed Phaeophyceae members were observed higher content of flavonoids and seven species were analysed for the first time for the flavonoids. These findings may lead to useful evaluation of flavonoids from marine plant resources which are used in treatment of multiple disease categories such as cardiovascular, ulcers, viruses, inflammation, osteoporosis, diarrhea and arthritis. Caulerpenyne from *Caulerpa racemosa* var. *cylindracea* shows its bioactivity against Cancer. More research on biological activity of flavonoids is desirable in future.

Acknowledgements

The authors gratefully acknowledge the Department of Science and Technology, New Delhi for the women scientist fellowship granted to the first author. They are thankful to Dr. A. Sujatha and S.A. Rao for their technical help in analysis.

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