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PHYCHOCHEMICAL COMPOSITION ON THREE SPECIES OF SARGASSUM FROM SOUTHEAST COAST OF TAMIL NADU, INDIA

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Abstract

Phycochemical studies on three species of *Sargassum* have been made to understand which is the most important and useful for mariculture. The species studied were *Sargassum ilicifolium, Sargassum liniarifolium* and *Sargassum polycystum*. Phycochemical studies such as the amount of protein, amino acids, carbohydrate and iodine have been made for comparison. Macro-elements such as Nitrogen, Phosphate and Potash and micro-elements like Calcium, magnesium and Iron have been made for interrelationship among the taxa. The amount of iodine (206.08 mg/100 g) in *Sargassum ilicifolium* was higher than the other two species. The amount of protein (44.4 mg/g f.w) in *Sargassum liniarifolium* was higher whereas the amount of amino acids (0.45 mg/g f.w) was high in *Sargassum ilicifolium*. But the total sugar (0.67 mg/g f.w) in *S. polycystum* showed maximum value. With reference to micro and macro-elements, *Sargassum ilicifolium* showed maximum values. The phycochemical studies of the three species showed better result in *Sargassum ilicifolium* and this may be a good species for Mariculture.

Key word: Phycochemical, Macro element, Microelement, Macro algae, Sargassum, Southeast Coast, Rameswaram.

Introduction

Seaweeds are one of the most important marine resources of the world and being used as human food, animal feed and raw material in seaweed based industries. Seaweed are rich in minerals, protein, carbohydrates, amino acid, lipid etc which enhance the yield and quality of crops, seed germination, resistance of frost, fungal and insect attract (Erulan *et al*., 2009) The use of natural seaweed products as substitutes to the conventional synthetic fertilizers has gained importance.

Application of seaweed extract as organic biostimulant is fast becoming accepted practice in horticulture due to its beneficial effects. It is now possible to regenerate all commercially important plants in large numbers by tissue culture techniques (Hameed *et al.*, 2006). Cytokinins and auxins are two major groups of phytohormones and regulate cytokinesis in plant cells. Auxins, gibberellic acid and cytokinins derivatives present in green algae and brown algae are usually used to enhance the plant growth at very low concentrations (Sridhar and Rengasamy, 2010).

Marine algae contain more than 60 trace elements in a concentration much higher than in terrestrial plants. They also contain protein, iodine, bromine, vitamins and substances of stimulatory and antibiotic nature. Seaweeds are the only source for the production of agar, alginate and carrageenan. These phycochemicals are extensively used in various industries such as food, confectionary, textile, pharmaceutical, dairy and paper industries mostly as gelling, stabilising and thickening agents. The brown seaweed *Sargassum* has been exploited for its alginate, since it is abun-dantly occurring along the sea coast of India. In the present study three species of *Sargassum* such as *S. ilicifolim, S. liniarifolium* and *S. polycystum* have been chosen for bio-chemical comparison from Rameswaram coast. From the specimens phyco chemical studies such as total sugars, reducing and non-reducing sugars, total protein, amino acids, iodine, NPK, Ca, Mg and Fe were estimated and compared.

Materials and Methods

About 2.5kg of each species of Sargassum was collected at Rameshwaram coast in Tamilnadu during 2017-2018 at depths ranging from 0.1 to 3 m at low spring tide. The material were then washed thoroughly in sea water to remove the sand particle and .^epiphytes. The

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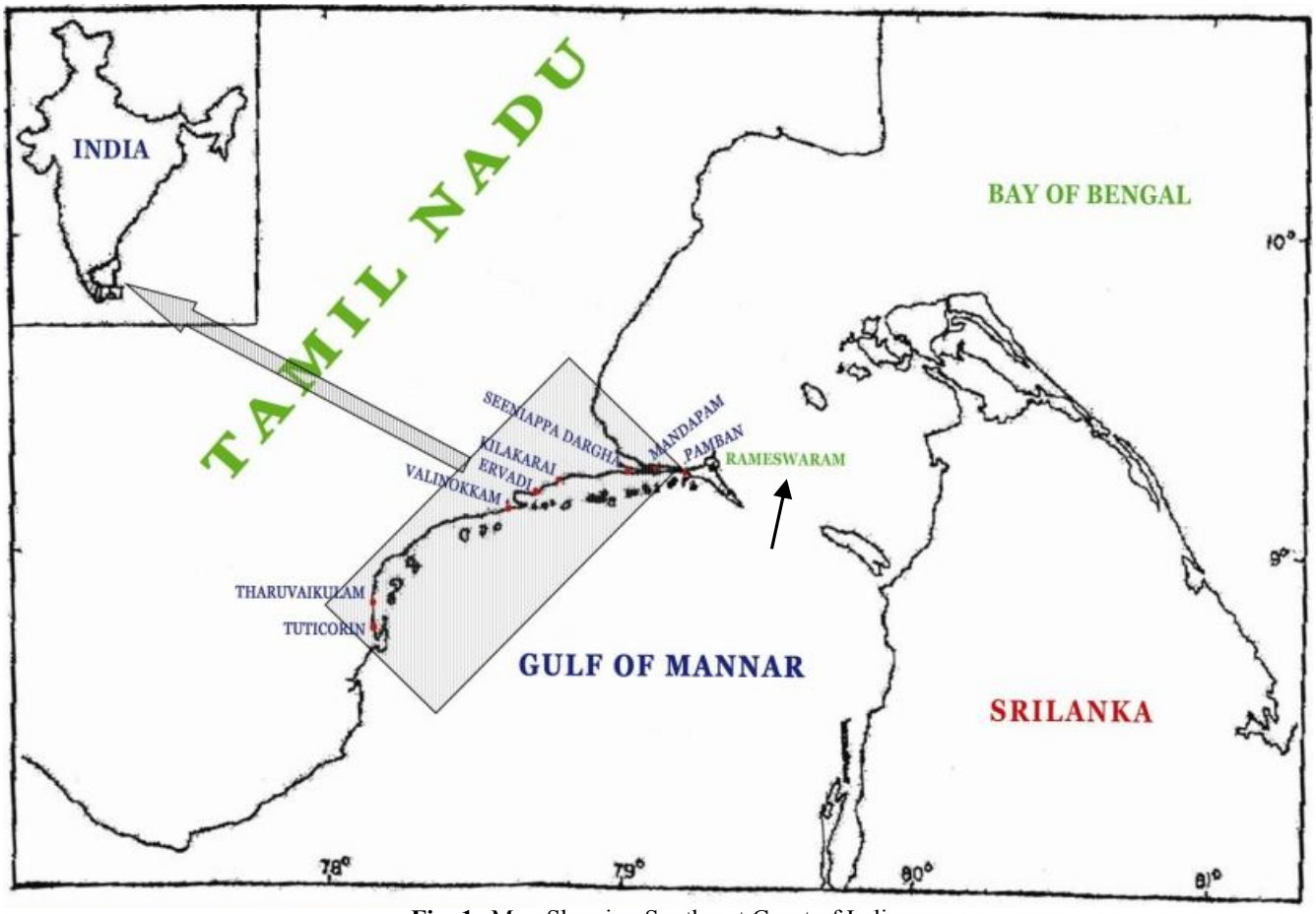

Fig. 1: Map Showing Southeast Coast of India.

specimens were kept in refrigerator for further studies. For the estimation of protein (Lowry *et al*., 1951), for the total sugar, reducing sugar and non-reducing sugar (Nelson, 1944), for amino acids (Moore *et al*., 1948), fresh specimens were used. The remaining samples were shade dried for five days in room temperature and they were used for the estimation of iodine (Kappanna and Sitakara Rao, 1962) and the macro and micro elements like NPK, Ca, Mg and Fe were analysed using Atomic Absorption Spectroscopy.

Results and Discussion

The quantitative estimation of protein in the three species of *Sargassum* showed wide range in mg/g fresh weight. In *Sargassum ilicifolium* (Fig. 2) it was 34.8 mg/g. In *S. liniarifolium* (Fig. 3), it was 44.4 mg/g and in *S.*

Fig. 2: *Sargassum ilicifolium* (Turner) C. Agardh.

Fig. 3: Sargassum liniarifolium J. Agardh.

Fig. 4: *Sargassum polycystum* C. Agardh.

polycystum (Fig. 4) it was 21.2mg/g. The maximum amount of protein was observed in *S. liniarifolium* (44.4) and the minimum was in *S. polycystum* (21.2). When compared the amount of amino acids in *Sargassum* species, it showed a close correlation among them *(S. ilicifolium* 0.45 mg/g, *S. liniarifolium* 0.39 mg/g and *S. polycystum* 0.37 mg/g).

Table 1: Protein, Amino acid and Iodine from three species of Sargassum during 2017-2018.

Name of the Species	Total sugar mg/g f.w.	Amino acid mg/g f.w	Iodine mg/100g dried material
Sargassum ilicifolium	34.8	0.45	206.80
Sargassum liniarifolium	44.4	0.39	116.24
Sargasssum polycystum	21.2	0.37	105.03

Table 2: Carbohydrates in three species of Sargassum during 2017-2018.

Name of the Species	Total sugar mg/g f.w.	Reducing sugar mg/g f.w	Non-reducing sugar dried material
Sargassum ilicifolium	0.60	0.36	0.24
Sargassum liniarifolium	0.65	0.63	0.02
Sargasssum polycystum	0.67	0.55	0.12

Table 3: Macro and Micro-elements in three species of Sargassum during 2017 to 2018.

Name of the Species	Macro-elements (mg/kg)			Micro-elements (mg/kg)		
	N	P	K	Ca	Mg	Fe
Sargassum ilicifolium	9383	533	8960	280	88	1176
Sargassum liniarifolium	1953	1507	9631	238	121	793
Sargasssum polycystum	1553	434	8765	205	90	751

The amount of iodine present in the *Sargassum* species was maximum in *S. ilicifolium*, (206.08mg/100g) and minimum in *S. polycystam* (105.03 mg/100g). Results are given in table 1.

The quantitative estimation of carbohydrates from the *Sargassum* using Nelson technique showed very close correlation among species. In *S. ilicifolium* it was 0.60 mg/g, *S. linarifolium* it was 0.65mg/g and *S. polycystum* it was 0.67. The results are given in table 2.

The amount of macro and micro-elements in *S. ilicifolium* was considered as an elite one. The amount of NPK in *S. ilicifolium* was 9383, 533, 8960 in mg/kg. Similar trend was observed in micro-elements in *S. ilicifolium.* They were Calcium 280mg/kg, Magnesium 88 mg/kg and Iron 1176 mg/kg. The minimum amount was observed in *S. polycystum.* The results are given in table 3.

The phycochemical studies with reference to protein, amino acid, iodine, total sugar, reducing sugar, non-reducing sugar, elements like NPK, Ca, Mg and Fe have been made to understand the interrelationship among these species. Of the three species of *Sargassum, S. ilicifolium* was considered as the elite one for mariculture.

Mohan Narasimha Rao and Prayagamurthy, (2012) Stated monthwise contents of proteins, carbohydrates, fat, crude oil, sodium, potassium, calcium and phosphorus from algae Lobophora variegata from Visakhapatnam coast. He also concluded low carbohydrates values were reported when thallus growth was high. Arumugam *et al*., point out protein content in green algae varied from 5.20 to 12.18% during the this study and highest amount of protein (12.18%) has recorded in *Cladophora glomerata* in February 2008. In red algae maximum protein yield gas shown by *Kappaphysic alvarezii* (14.7%), that protein percentage was higher in red algae than green algae. Gowdhami and Rayasulochana, 2013 reported carbohydrate content and maximum (39.3%) than protein and lipid. However, low carbohydrate values were reported in *Ulva raticulata*. The biochemical studies revealed that the order of concentration was carbohydrate protein lipid. This is conformity with the earlier reports (Kaliaperumal *et al*., 1994; Meenakshi *et al*., 2010). Since the algae were collected during winter season for this study, the carbohydrate content was high due to the peak period of growth in this season. Increased light penetration enhancing the carbohydrate content of seaweeds and more dissolved oxygen in water as reported by Sarojini

and Subharangaiah, (1999). Lipids provide much more energy in oxidation process than other biological oxidation (Meenakshi *et al*., 2010. Murugaiyan and Sivakumar, (2010), showed the distribution of minerals in certain brown and red seaweeds in the order of Ca>Mg>Na>K>Fe. This could be variation in salinity of seawater since the environment and physiologcal factors play important role in the accumulation of minerals in algae. Further the growth enhancing potential of seaweeds might be attributed to the presence of hormones, macro and micro elements as the Mg and Fe content of seaweeds influenced the synthesis of chlorophyll.

Murthy and Radia, (1978) studied the biochemical contents of *Ulva lactuca* from Port Okha in relation to ecological factors and presented the month-wise protein, fat, carbohydrate, crude fibre, sodium, potassium, calcium and phosphorus contents of these species. Seasonal variations in biochemical composition of some seaweeds from Goa coast was made by Sumitra Vijayaraghavan *et al.,* (1980). She found that the carbohydrate contents in all marine algae more or less closely correlated. Seaweeds like *Sargassum* and *Turbinaria* compost with fish offal and shark-oil sediments in the ratio of 15:3:4 by weight after a period of three months contained 2.4% Nitrogen, 3.5% Potash and 0.7% Phosphate (Chidambaram and Unny, 1947). The protein content in the marine algae were estimated by Chidambaram and Unny, (1953), Neela, (1956), Pillai, (1957) and Sitakara Rao and Tipnis, (1964). The iodine content of the Indian *Sargassum* was studied by Joseph *et al.,* (1948); Pillai, (1956) estimated in a more elaborate way the iodine contents of eleven species of algae growing around Mandapam. The quantity of iodine present in many green, brown and red algae of the Gujarat coast was determined by Pillai, (1956), Kappanna and Sitakara Rao, (1962), Sitakara Rao and Tipnis, (1967) and Dave *et al.,* (1969).

The results obtained from these studies predict that *Sargasum ilicifolium* is considered to be in first rank than the other two species. Iodine content of these species has been one of the criteria for species specific. The distribution of amino acid showed more or less close correlation. In protein distribution, *S. ilicifolium* has first rank. The amount of total sugar distribution was closely correlated. The amount of reducing sugar in *S. ilicifolium* was highest. The various accounts of the detailed study of the macro and micro-elements revealed a close correlation among species.

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