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THE ECONOMICALLY VALUABLE SEAWEEDS OF THIRUMULLAVARAM, SOUTHWEST COAST OF KERALA

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Abstract: Seaweeds constitute one of the commercially important marine renewable resources of the world. About 20,000 marine algal species are distributed throughout the world, out of which only 221 species are utilized commercially. These include 145 species for food and 110 species for phycocolloid production. The estimated standing stock of seaweeds in Kerala is 1000 tons (wet wt.) of which 150 tons are economically important seaweeds. The agarophytes formed 27 tons followed by alginophytes and agaroidophytes. Production potential of seaweeds in Kerala is one lakh tons. Commercially important seaweeds of Thirumullavaram coast and its potential uses are discussed in this paper. The coast of Thirumullavaram has vast resources of seaweeds, both in terms of species diversity as well as the luxuriance in growth.Out of the 37 species of economically important seaweeds recorded from this region 12 belong to Chlorophyta, 8 to Phaeophyta and 17 to Rhodophyta. Twenty seven species are edible, 23 species best suited for industrial purposes, 7 species can be used for medicinal purpose, and 17 species can be used as animal feed and 13 macro algal species can be used as manure.An updated checklist of economic seaweeds from Thirumullavaram coast is described.

Key words: Marine algae, macro algae, seaweeds, Thirumullavaram

INTRODUCTION

Seaweeds constitute one of the commercially important marine renewable resources (Mohan and Ravi, 2007). They are beneficial to man in one way or other. About 20,000 marine algae species are distributed throughout the world, out of which only 221 species are, utilized commercially (Sahoo *et al.,* 2002). These include 145 species for food and 110 species for phycocolloid production. The estimated standing stock of seaweeds in Kerala is 1000 tones (wet wt.) of which 150 tons are economically important seaweeds. The agarophytes formed 27 tones followed by alginophytes and agaroidophytes (Chennubhotla *et al*., 1988). Production potential of seaweeds in Kerala is 100000 tons. Seaweeds are rich in proteins, vitamins, aminoacids, growth hormones, minerals and other elements. These marine plants are also the industrial sources for various fine chemicals (phycochemicals) like agar, agarose, carrageenan, alginates, iodine, mannitol etc (Percival *et al.,* 1967). Partial substitution of costly protein sources in animal feeds with seaweed protein may improve feed quality while reducing the cost (Kumar and Kaladharan, 2007). As sea vegetables are able to accelerate the growth of oysters, tilapia, salmon, trout etc., all are of great commercial interest (Fleming *et al.,* 1996). Seaweed has many unique properties with innumerable applications in large number of industries. It is considered as the medicinal food of the 21st century. The bioactive compounds found in seaweeds await a major breakthrough for a variety of applications in medical field. Many types of seaweed are eaten in various parts of the world. Seaweed cultivation has started in South East Asia and other parts of the world, still India remains as a sleeping giant. Our state is endowed with a long coastline and

wide shelf area for mariculture, large-scale cultivation of seaweeds for commerce is yet to be taken place. Tropical countries like India which possess abundant marine resources from which the novel pharmaceuticals may be derived. There is no doubt that greater investment in the development of marine bio technology will produce novel compounds that may contribute significantly towards drug development over the next decade. Seaweed culture is a profitable livelihood option for fisherwomen, who can earn a substantial income for the household with little effort (Narayankumar and Krishnan, 2011).

MATERIAL AND METHODS

The study was carried out at Thirumullavaram, situated on the west coast ($8^0 42'$ NLatitude and $76^0 34'$ E Longitude) in Kollam district of Kerala state. The shore is partially formed of rocky substratum and sand and subjected to heavy wave action. Algal species in the intertidal zones were collected by hand picking. Complete plants with holdfast were detached carefully and preserved in 5% formalin and brought to the laboratory for identification.

Taxonomic determination was made by using morphological characters and authentic keys of NIO, Bold and Wynne (1978), Dawes (1981), Umamaheswara Rao (1987) and Dhargalkar and Kavlekar (2004). All the specimens were identified and compared with the earlier reports and keys provided (Anon, 1995 a; Gopinathan and Panigrahy, 1983; Sulekha and Panikkar, 2006; Chennubhotla *et al.,* 1987; Vijayaraghavan and Kaur, 1997c; Vijayaraghavan and Bela, 1997 and Subramanian, 2004).

RESULTS AND DISCUSSION

A total of 37 economic seaweeds were collected from Thirumullavaram coast. Twelve species of chlorophytes are known to be commercially important. These species are being used as human food throughout the world. Seventeen species of rhodophycean algae were commercially important and then followed by eight species of Phaeophyceae. Potential uses of commercially important seaweeds are recorded in Table 1. Of which 27 species are edible, 23 species were best suited for industrial purposes, 7 seaweed species can be used for medical purpose, and 17 species can be used as animal feed and 13 macro algal species from Thirumullavaram can be used as manure.

Commercially important seaweeds of Thirumullavaram coast includes 7 species of agarophytes, 4 species of agaroidophytes, 8 species alginophytes and 27 species of important edible seaweeds (Table 2). From the results it becomes clear that among 37 species of commercially important seaweeds at Thirumullavaram there were 18.92% agarophytes, 21.62% alginophytes, 10.81% agaroidophytes and 72.97% edible seaweeds (Table 3). Shere (1985) suggests that many species of agarophytes form an important component of the seaweed vegetations at various localities along the Indian shores.) At Thirumullavaram 7 species of agarophytes were present. Red Algae, which comprise the largest group of marine algae, include the major agarophytes and carrageenophytes. *Gracilaria* was recorded throughout the year.Reeta and Ramamoorthy (1997) states that *Gracilaria* has very high regenerative capacity so that they can be recorded throughout the year at the rocks and crevices of mid and low littoral zones.*Grateloupia* occurs in considerable quantities in Thirumullavaram. It can be used as an alternative and potential source of phycocollloids of commercial value (Rajasulochana, 2005). The abundance of Alginophytes in the shallow littoral zones and rocky pools were reported earlier by Bhanderi and Raval(1975).*Centroceras clavulatum* is one of the major inhabitants of Thirumullavaramcoast.The occurrence of *Centroceras clavulatum*in the sandy bottom of shallow tide pools of mid littoral zone has been reported by Mantri *et al.*(2003).

The east coast of India is fairly known for the distribution, taxonomy and ecology of marine algae. The south-west coast of India, especially Kerala, remains little explored. Thirumullavaram is blessed with rich algal growth which is so far un- touched by human interference, although there appears to be only a limited scope for the exploitation and utilization of the naturally

Table 1. Commercially important seaweeds from Thirumullavaram, Kerala cost.

Sl. No.	Species	Potential Use
1	*Ulva fasciata* (C)	hf, af, mp
2	*Ulva lactuca* (C)	hf, af, ma, mp
3	*Ulva rigida* (C)	hf, af, mp
4	*Ulva quilonensis* (C)	hf, af, mp
5	*Ulva intestenalis* (C)	hf, af, mp
6	*Ulva compressa* (C)	hf, af, mp
7	*Cladophora prolifera* (C)	hf, af, ma
8	*Cladophora fascicularis* (C)	hf, af
9	*Bryopsis plumosa* (C)	hf, af, ma
10	*Caulerpa peltata* (C)	hf, af, ma
11	*Caulerpa taxifolia* (C)	hf, af, ma
12	*Caulerpa sertularioides* (C)	hf, af, ma
13	*Dictyopteris bartayresiana* (P)	hf, af, ma, iu
14	*Padina gymnospora* (P)	hf,, af, ma, iu
15	*Padina tetrastromatica* (P)	hf, af, ma, iu
16	*Sargassum myriocystum* (P)	hf, ma, iu
17	*Sargassum wightii* (P)	hf, ma, iu
18	*Sargassum tennarimum* (P)	hf, ma, iu
19	*Turbinaria ornata* (P)	hf, iu
20	*Lobophora variegate* (P)	iu
21	*Gelidium micropterum* (R)	iu
22	*Gelidiopsis intricate* (R)	iu
23	*Gracilaria corticata* (R)	hf, af, iu
24	*Gracilaria edulis* (R)	hf, iu
25	*Gracilaria folifera* (R)	iu
26	*Gracilaria verrucosa* (R)	ma, iu
27	*Grateloupia filicina* (R)	hf, iu
28	*Corallina elongate* (R)	mp
29	*Jania adhaerens* (R)	iu
30	*Hypnea musciformis* (R)	hf, iu
31	*Hypnea valentiae* (R)	hf, iu
32	*Ceramium fimbriatum* (R)	iu
33	*Centroceras clavulatum* (R)	af,iu
34	*Acanthophora spicifera* (R)	hf, iu
35	*Porphyra kanyakumariensis* (R)	hf
36	*Laurencia papillosa* (R)	hf, iu
37	*Portieria hornemannii* (R)	iu

af - Animal food, hf- human food, iu - industrial use, ma – manure, mp - medical purpose,

available seaweed resources in this coast. However, attempts can be made for culture of alginophytes, agarophytes and agaroidophytes, since the seeding material of this group of algae is available in substantial amounts along this coast. Seaweed mariculture has now become a potential employment generating and income earning activity. Seaweed farming is an economically viable and financially feasible alternate livelihood option, providing adequate income to the fishers. However, seaweed farming needs adequate and assured institutional financial support.

The members of economically important seaweeds are fairly high in Thirumullavaram coast (Table 2). About 37 species of marine algae can be regarded as economically important. This is a clear indication that Thiurmullavaram is an ideal place for the culture and production of economically important seaweeds. This work brings out the immense potential which Thirumullavaram has with regard to seaweeds.

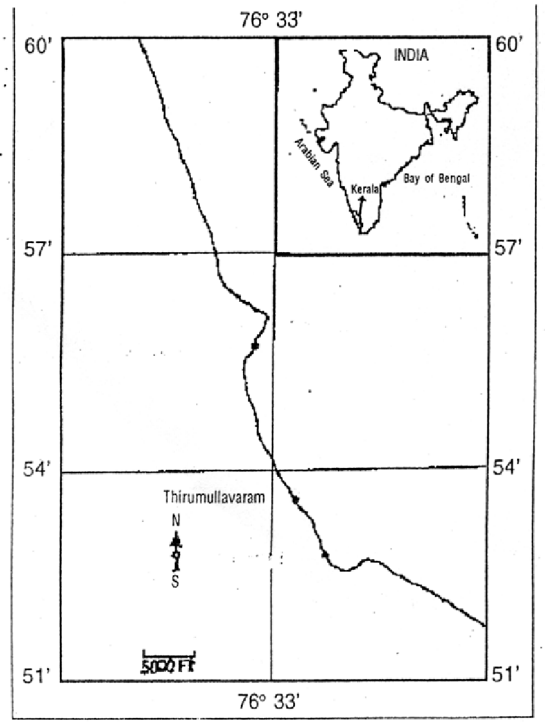

Fig. 1. Location of study site at Thirumullavaram, Kerala

Table 3. Percentage occurrence of commercially important seaweeds at Thirumullavaram, Kerala.

Seaweeds	No. of species	% of occurrence
Agarophytes	7	18.92
Agaroidophytes	4	10.81
Alginophytes	8	21.62
Edible Seaweeds	27	72.97

Table 2. Commercially important seaweeds from Thirumullavaram, Kerala.

Division	Algae Species
Agarophytes	*Gelidium micropterum*
	Gelidiopsis intricata
	Gracilaria corticata
	Gracilaria edulis
	Gracilaria folifera
	Gracilaria verucosa
	Hypnea musciformis
Agaroidophytes	*Hypnea musciformis*
	Hypnea valentiae
	Laurencia papilosa
	Acanthophora spicifera
Alginophytes	*Sargassum wightii*
	Sargassum myriocystum
	Sargassum tennarimum
	Dictyopteris bartayresiana
	Padina gymnospora
	Padina tetrastromatica
	Turbinaria ornata
	Lobophora variegate
Edible seaweeds	*Ulva fasciata*
	Ulva lactuca
	Ulva rigida
	Ulva quilonensis
	Ulva intestinalis
	Ulva compressa
	Cladophora prolifera
	Cladophora fascicularis
	Bryopsis plumosa
	Caulerpa peltata
	Caulerpa taxifolia
	Caulerpa sertularioides
	Dictyopteris bartayresiana
	Padina gymnospora
	Padina tetrastromatica
	Sargassum myriocystum
	Sargassum wightii
	Sargassum tennarimum
	Turbinaria ornata
	Gracilaria corticata
	Gracilaria edulis
	Grateloupia filicina
	Hypnea musciformis
	Hypnea valentiae
	Acanthophora spicifera
	Laurencia papilosa
	Porphyra kanyakumariensis

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