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Farming of *Hypnea valentiae* (Turner) Montagne at Minicoy Lagoon (Lakshadweep)

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ABSTRACT

The red alga *Hypea valentiae* (Turn.) Mont. is one of the carrageenan producing seaweeds. Experiment was carried out at Minicoy Lagoon of Lakshadweep during 1998 to find out the feasibility of farming of *H. valentiae*. Two sites were selected in the intertidal zone of Minicoy lagoon, namely South end and Fisheries Jetty and farming was carried out in three seasons (pre monsoon, monsoon and post monsoon). Single line bottom coir rope method was adopted for farming. The vegetative fragments of *H. valentiae* collected from wild were inserted between the twists of long coir ropes. Both ends of the ropes were tied to the coral stones and introduced in the intertidal waters of the lagoon. During the first harvest maximum yield of 6 fold increase was obtained in 37 days and in the second harvest during monsoon months 25 fold increase was recorded in 40 days. Large scale farming of *H. valentiae* without causing any damage to the lagoon ecosystem by adopting single bottom coir rope method may be taken up by the fishermen during the lean fishing season.

Introduction

Seaweeds are the only source for the production of phytochemicals namely agar-agar, algin and carrageenan which are extensively used in various industries such as food, confectionary, textiles, pharmaceuticals, dairy and paper industry mostly as gelling, stabilizing and thickening agents. Seaweeds are also used as human food, animal feed and manure in several countries. The total standing crop of seaweed resources in India is 2.45 lakhs tons (wet wt.) and out of this 20% is exploited i.e. 50,000 tons. The standing crop of seaweeds at Lakshadweep is 19,345 tons (wet wt.) and out of which 1701 tons i.e. 10% occur at Minicoy Island. For more than three decades *Eucheuma* has been the world's primary source of carrageenan.Carrageenan finds its use in bakery, confectionary and culinary purposes especially in the preparation of condiment products, syrups, whipped creams, ice deserts, cheese etc. Carrageenan is also used for clarification of beer, fruit juices and other beverages, besides its use to improve the quality of wheat flour in spaghetti. The food sector accounts for nearly 70% at world market for carrageenan (Kaladharan *et al.*, 1988). Carrageenan is a sulphated galactan polymer obtained from various red seaweeds belonging to families such as Gigartinaceae, Solieriaceae and Hypneaceae.

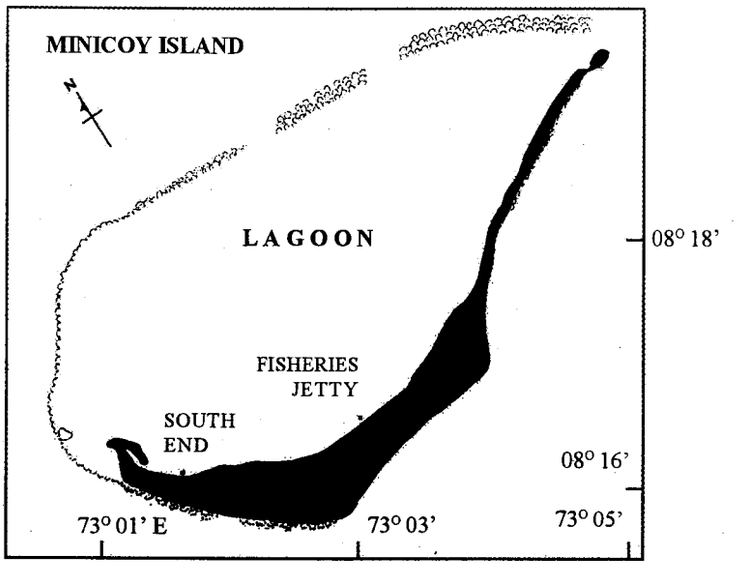

Fig. 1. *Map of Minicoy Island showing the seaweed culture sites*

Hypnea valentiae and *H. musciformis* are the resources of carrageenan. Rama Rao *et al.* (1983) cultured *Hypnea valentiae* at Krusadai Island, Mandapam. Rama Rao and Subbaramaiah (1986) developed a technique for field cultivation of carragenophyte *Hypnea musciformis*. Culture of *Gracilaria edulis* (Chennubhotla *et al.*, 1992 a, 1992 b; Kaliaperumal *et al.*, 1992 and Kaladharan *et al.*, 1996) has established the suitability of Minicoy Island for the culture of seaweeds. The present study was conducted to find out suitable period and site for *Hypnea valentiae* culture at Minicoy Island.

Materials and Methods

The Union Territory of Lakshadweep consists of 36 islands covering an area of 32 sq.km and out of which 10 islands are inhabited. This archipelago consists of 12 atolls, 3 reefs and 5 submerged banks and lagoon area consists of 420 sq.km. Minicoy Island (8° 17' N; 73° 04' E) is one of the inhabited islands of Lakshadweep and it is 11.57 km long with land area of 4.4 sq.km and lagoon area of 25 sq. km. (Fig. 1). The average depth of the lagoon is 4 m with tidal amplitude of 1.57m. The hydrography and meteorological characteristics of the area, mainly the monsoon currents, the equatorial current and the equatorial counter current, play an important role in the seaweed ecology of the island. In 1998, monsoon months (June to September) contributed 70% of rain. Monthly surface seawater temperature at Minicoy varied from 28.1° C (Sep.) to 32.3° C (Jan.) with annual range of 4.2° C. The annual variation of salinity was from 31.61 ppt (June) to 35.19 ppt (January). Maximum dissolved oxygen values were recorded in January (6.72 ml/l) and minimum in November (5.35 ml/l). The winds are south westerly during southwest monsoon and northeasterly during northeast monsoon. In general, the winds are stronger and steadier during the southwest monsoon with 45-55 knots speed. The southwest monsoon prevails during June - September and northeast monsoon during November – February.

The culture experiments were carried out at two culture sites in the lagoon of Minicoy Island located at the Fisheries Jetty and Southend (Fig. 1). The bottom is sandy with seaweed and seagrass vegetation. Method adopted for bottom culture was single coir rope method. *Hypnea valentiae* was collected from the natural beds of Minicoy lagoon. Vegetative fragments of *Hypnea* were inserted between the twists of seven metre long coir ropes. Seeded ropes with the fragments were tied to the small dead coral stones and placed in the intertidal area of the lagoon. Ropes were cleaned periodically. Fresh weight of harvested material over initial seed material gives the yield value. Water temperature was measured in the field using a calibrated thermometer. Salinity was determined by Mohr's titration method (Strickland and Parsons, 1968). Dissolved oxygen was analyzed by Winkler method (Anon., 1975). Phosphate was determined following the method given in the manual of FAO (Anon., 1975) while nitrate was analysed by modified method of Mullin and Riely (1955).

Results

Culture and harvest details of *Hypnea valentiae* during 1998 at two sites are given in Table -1. Increase in yield was maximum during monsoon months at two sites, both in first as well as second harvest. In the first harvest, a maximum of six fold increase in yield in 37 days during monsoon from Southend site and a minimum four fold increase in yield in premonsoon also at Southend site were obtained (Table 1). In the second harvest both the sites showed maximum increase in yield in monsoon months. A maximum of 25 fold

Table 1. *Harvest details of* Hypnea valentiae *during 1998 at two culture sites*

Culture site	Season	Culture period (in days)	Wt. of seed material introduced (in kg)	Wt. of crop harvested (in kg)	Increase in yield
FIRST HARVEST					
Fisheries Jetty	Pre monsoon	40	1.200	5.400	4.5
	Monsoon	40	1.200	6.000	5.0
	Post monsoon	40	1.200	5.400	4.5
Southend	Pre monsoon	39	1.500	6.000	4.0
	Monsoon	37	0.900	5.400	6.0
	Post monsoon	37	1.200	5.400	4.5
SECOND HARVEST					
Fisheries Jetty	Pre monsoon	38	0.600	6.000	10.0
	Monsoon	39	0.700	10.800	15.5
	Post monsoon	41	0.600	7.800	134
Southend	Pre monsoon	39	0.700	8.400	12.0
	Monsoon	40	0.500	12.500	25.0
	Post monsoon	42	0.600	8.100	13.5

Pre monsoon – Jan. to May; Monsoon – June to Sep; Post monsoon – Oct. to Dec.

increase was obtained at Southend site during monsoon in 40 days. The minimum increase in yield was recorded at Fisheries Jetty with only 10 fold in 38 days. Increase in yield difference between first and second harvest at Fisheries Jetty and Southend site is shown in Fig. 2.

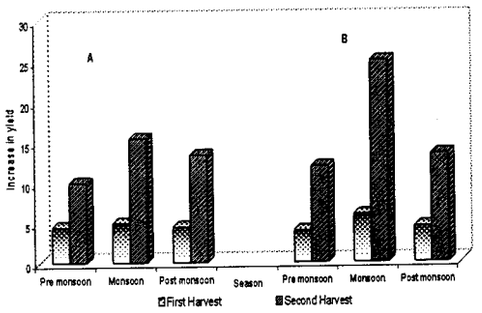

Fig. 2. *Increase in yield of* Hypnea valentiae *over seed material at Fisheries Jetty (A) and Southend (B)*

Mean seasonal averages of environmental parameters such as water temperature, salinity, dissolved oxygen, phosphate and nitrate are given in Table 2. There was not much variation between seasons at two sites in respect of water temperature, salinity and dissolved oxygen. Phosphate and nitrate was maximum during monsoon and minimum during premonsoon at both sites of culture. One – way ANOVA between first and second harvest of *Hypnea valentiae* culture showed high significance (1%) (Table 3). Linear regression of phosphate in seawater with *Hypnea valentiae* harvested at Fisheries Jetty : $r^2 = 0.95$, n = 12, and phosphate in seawater with *Hypnea valentiae* harvested at Southend: $r^2 = 0.62$, n = 12. Nitrate in seawater with *Hypnea valentiae* harvested at Fisheries Jetty : $r^2 = 0.59$, n = 12. Nitrate in seawater with *Hypnea valentiae* harvested at Southend : $r^2 = 0.75$, n = 12.

Table 2. *Environmental parameters during 1998 at two culture sites*

Parameters	Fisheries Jetty site			Southend site		
	Pre monsoon	Monsoon	Post monsoon	Pre monsoon	Monsoon	Post monsoon
Water Temp. (° C)	30.8	29.3	30.2	30.3	28.8	28.2
Salinity (ppt)	33.37	32.35	32.97	33.08	33.23	33.64
Dissolved Oxygen (ml/l)	6.16	5.94	5.60	5.58	5.74	5.34
Phospahte (µg.at/l)	0.83	1.19	0.92	0.80	1.17	1.12
Nitrate (µg.at/l)	1.01	2.19	1.78	1.40	2.45	2.16

Pre monsoon – Jan. to May; Monsoon – June to Sep; Post monsoon – Oct. to Dec.

Table 3. *One way Anova between first and second harvest of* Hypnea *culture*

Source	df	SS	MSS	F	P
Treatment	1	305.021	305.021	21.37	Highly Significant (1%)
Error	10	142.708	14.271		

Discussion

The present study on *Hypnea valentiae* culture was the first attempt at Lakshadweep. Rama Rao *et al.* (1983) cultured *Hypnea valentiae* at Krusadai Island, Mandapam, Tamilnadu from "Stellate bulbs". Rama Rao and Subbaramaiah (1986) obtained 4 fold increase in 25 days for *Hypnea musciformis* in first harvest using the long line rope method. Chennubhotla *et al.* (1992b) recorded 30.1 fold increase for *Gracilaria edulis* during monsoon. In the present investigation during the first harvest a 6 fold increase was obtained in 37 days from Southend site. In Fisheries Jetty site as well as Southend site maximum increase in yield was recorded during monsoon period in the first harvest. A maximum of 25 fold increase in yield was obtained from the Southend site during monsoon period in the second harvest, while at Fisheries Jetty site 15.5 fold increase in yield was recorded in the same season. When seaweeds are introduced into ropes for the first time, it takes time to establish on ropes. So during first harvest increase in yield was not much high. After the first harvest profuse branching occurs at the base of the first harvested seaweed. During the second harvest increase in yield were was higher than that of the first harvest.

During the monsoon period enrichment of nutrients is more than that of other seasons, such as premonsoon and post monsoon. During the monsoon season the high tides bring dead and decayed seaweeds and seagrasses from the beaches into the lagoon, which in turn enriches the lagoon waters with high nutrients in respect of phosphate and nitrate (Table 2). The second harvest during the monsoon period recording higher yield can result from the increase in nutrient content of the lagoon waters. Grazing constituted one of the major constraints for the culture of *Gracilaria edulis* at Minicoy Island (Chennubhotla *et al.*, 1994), but in the present *Hypnea valentiae* culture no grazing was observed. It shows that extensive culture is possible in Minicoy Island and other Islands of Lakshadweep. The method is simple, ecofriendly and cost effective. Culture of *Hypnea valentiae* can bring additional income to the fishing communities during the lean fishing monsoon season.

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