

Short Communication

Cultivation of marine red alga *Gracilaria edulis* (Gigartinales, Rhodophyta) from spores

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Gracilaria edulis, a major Indian agarophyte, has been successfully cultivated in an experimental scale from spores at sea off Narakkal, Kochi. Artificial objects like floating raft, nylon ropes and net pieces were provided in the open sea for collection of spores of *Gracilaria edulis*. They were allowed to grow to mature size of 30 cm. After 76 days of culture period, fully grown healthy plants of *Gracilaria edulis* were harvested from the nylon rope by hand pruning. Further growth was much faster. A total yield of 7.220 kg plants was obtained during 122 days of the culture period. The work has resulted in the successful cultivation of the species from the east coast to a coastal area of the west coast, Narakkal, and also in the identification of a fertile culture ground (open sea off Narakkal, Kochi) along the Kerala coast during favourable period of growth.

[**Key words** : Spores, propagation, *Gracilaria*, cultivation]

Demand for marine red alga *Gracilaria* has increased significantly over the last ten years for extraction of phycocolloids and this has led to overharvesting of the natural stock. The decline of the natural population of *Gracilaria edulis* in recent years has prompted the development of several restoration techniques and spore culture is one of the important techniques used for seaweed cultivation. Experimental research work has been carried out in the artificial propagation mainly by vegetative method in economically important red seaweeds like *Gelidiella acerosa*¹, *Gracilaria edulis*²⁻⁴ and *Hypnea musciformis*⁵. The vegetative method of seaweed culture, as the report suggests, is labour intensive, uneconomical and requires large quantity of seed material. On the other hand, equipments needed for spore cultivation is simple and can easily be utilized by fishermen cooperatives^{6,7}. Earlier works, which highlight the importance of culture of economically important seaweeds from spores^{8,9} have reported successful cultivation of the plants by this method.

A large-scale trial for cultivation of *Gracilaria edulis* from spores was done under the Bay of Bengal Programme during 1988-89, but it was reported¹⁰ to be unsuccessful, as the spores could not be grown to germling stage. Successful nursery rearing of *Gracilaria edulis* from the spores and their propagation was reported for the first time in India¹¹. The pre-

sent work is again an experimental one but aimed at a large-scale cultivation of agar yielding seaweed, *Gracilaria edulis* (Gmelin) Silva. (Gigartinales, Rhodophyta) from carpospores in an area where there is no natural vegetation of the particular seaweed.

Cystocarpic plants of *G. edulis* were collected from Mandapam, Tamil Nadu, south east coast of India (78° 08'E and 9° 17'N) during November 1999. Collection was made during lowtide in the morning. Healthy reproductive plants (app. weight 70 g) were selected, washed thoroughly in sterilized seawater and transported to Kochi in enriched seawater. The plants were kept under continuous aeration for 24 h in the marine hatchery complex in fresh enriched seawater to recover from transportation stress. Coastal area off Narakkal, Kochi, was selected as culture site. Floating raft of 5 × 5 m² size which was floated for mussel culture by fishermen with the aid of the Krishi Vigyan Kendra, Narakkal, was used for *G. edulis* culture too. The structure was anchored at a distance of about 125 m from the shore, where the depth is about 4 m.

Usually *Gracilaria* culture from spores requires a nursery unit for settling the spores till germling stage before they are transplanted to the natural environment. But in this experiment, the plants (approximately 70 g) were kept for spore output on the nylon twine for 48 h in the nursery and then transplanted to the natural environment in perforated plastic bags

(2 sq.ft), off Narakkal in the mussel culture raft. Culture materials such as nylon rope, fishing nets and netted bags were provided in the floating raft in open sea for natural collection and attachment of spores and growth. The plants in the packets were maintained at a depth not more than 30-50 cm from the surface water, so that sufficient light always reached the plants. The plants were always maintained at a constant depth regardless of the change in tide levels due to the floating raft. The culture period was from last week of November 1999 to mid-April, 2000.

Natural vegetation of *Gracilaria edulis* is usually found in a protected area near islands having sandy or rocky bottom. On the other hand, Arabian Sea is very rough with high tidal amplitude. The sea bottom in the nearshore area is muddy and polluted. This may be the reason for non-availability of natural vegetation of *Gracilaria edulis* in this place. But the present experiment was taken up to know the feasibility of *Gracilaria* culture in the area where there is no natural vegetation and also to find out the suitability of seaweed growth on artificial surface.

The reproductive plants were transplanted to the natural environment in perforated plastic packets. After 30 days of the transplantation of the reproductive plants, germlings appeared on the culture materials with average size of 2 cm. Fully grown plants of *Gracilaria edulis* (1.150 kg fresh weight) was harvested from the nylon bag after 76 days of transplantation during the mid week of February. The harvest was done by pruning leaving the holdfast attached to the substrata. The substrata were again tied in the sea for further growth. Second harvest was done after 99 days of transplantation with a yield of 1.22 kg constituting 520 g of cystocarpic and 750 g of vegetative plants. Final harvest was done during the mid week of April, which yielded 4.850 kg of *Gracilaria edulis* exactly after 46 days of the first harvest (Table 1). Harvest of the crop was not carried out at regular interval. Once the plant reached to harvestable size, they were pruned to avoid loss of crop by strong wave action. Final harvest was done in the second week of April before the sea became turbulent before the onset

Table.1 — Rate of harvest and yield of *Gracilaria edulis* cultured in open sea off Narakkal, Kochi

No. of harvest	Period of harvest (after transplantation)	Quantity harvested (in kg)
1 st harvest	76 days	1.150
2 nd harvest	99 days	1.220
Final harvest	122 days	4.850
Total harvest		7.220

of southwest monsoon. This work showed similarities with the earlier study¹¹ where the first harvest of the plant was carried out 78 days after transplantation of germling to the natural environment followed by a second harvest after 44 days of the first harvest. In the present study a total yield of 7.220 kg was obtained during the culture period of 122 days. The culture period in Gulf of Mannar was for 135 days due to the nursery rearing¹¹ of the spores for 17 days.

Culture of *G. edulis* in natural environment depends on the environmental parameters such as salinity and temperature. The role of nutrients may not play a vital role due to continuous exchange of seawater by wave action. In the Gulf of Mannar, the salinity and the temperature during the culture period depend on the rainfall. If monsoon fails, it may affect the growth of *G.edulis* adversely¹². On the otherhand, continuous influx of river water during low tide in Kerala coast maintains the salinity optimum. The temperature in this place remains low compared to other Indian coast. Thus Kerala coast may be more suitable for culturing seaweeds on floating rafts. The results suggest that, *G. edulis*, a species of the east coast of India could be economically grown in the west coast, Arabian Sea, during favourable months of the year, provided suitable culture materials and areas are selected. Further works in this line will prove the possibilities of seaweed cultivation in Kerala coast.

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