

Studies on the common Green Seaweeds of the Thirumullavaram Coast of Kollam District, Kerala, India

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Abstract

Seaweeds are seen natural condition only at the time of low-tide. During low tide the rocks are exposed and seaweeds are seen, firmly attached on the rocks. The upper region of the intertidal rocks is covered with green seaweeds. The grow period of a particular seaweed is hardly three months. Seaweeds are purely seasonal-green, seaweeds can be seen only during July – September. Only ten green algal species were collected and identified from Thirumullavaram coast. We could see these plants under natural condition of the first time and observed the morphological and anatomical characteristics for identification. In the present study, total number of ten green seaweeds was collected from the Thirumullavaram coast of Kollam were belong to 4 orders, 5 families, 7 genera from the Division Chlorophyta

Keywords: Seaweeds, Autotrophs, Algae.

Introduction

Green algae are photosynthetic eukaryotes bearing double membrane-bounded plastids containing chlorophyll a and b, accessory pigments found in embryophytes (beta carotene and xanthophylls), and a unique stellate structure linking nine pairs of microtubules in the flagellar base (Mattox and Stewart, 1984; Sluiman, 1985; Bermer et al., 1987; Kenrick and Crane, 1997). Marine algae are properly known as seaweeds. They are autotrophic small filamentous or large parenchymatous advanced forms and are available largely in shallow coastal waters. Seaweeds are mainly of three type depending on the pigments or coloration: green, brown, red. They are usually found attached on the rocky substratum. Men harvest them for centuries particularly in Japan and china where they from a part of staple diet. Uses of seaweeds as food, fodder and manure are well known in many countries. They contain protein, vitamins, trace metals and substances of stimulatory and antibiotic in nature. The green seaweeds are edible and protein rich, the brown seaweeds are main source of gelatinous alginic acid, red seaweeds are the main source of agar and carrageenan. Alginic acid agar and carrageenan are gelatinous polysaccharides. These phytochemicals are used in various industries such as food confectionary, textile, pharmaceutical diary and paper industry. They are also used as stabilizing and thickening agents of a variety of food items. Starch is stored inside the plastid and cell walls when present are usually composed of

cellulose (Graham and Wilcox, 2000a). The green algae are mainly localized in the intertidal regions of the sea. The Indian coastal regions are divided into two (i) west coast region (ii) south east coast region.

Materials and Methods

The green algal species were collected from Thirumullavaram coast during low tide. The species of *Ulva* and *Enteromorpha* were collected by hand picking. The species of *Caulerpa*, *Cladophora*, *Chaetomorpha* and *Bryopsis* were collected with the help of scalpel. The collected plants were washed several times in seawater and preserved in plastic bottles containing 10% seawater-formalin. The species were identified in the basis of morphological and anatomical characteristics. Standard references were used for the identification of the species.

Results

The green algal species were identified in the basis of morphological and anatomical characteristics representing seven genera: *Ulva*, *Enteromorpha*, *Chaetomorpha*, *Caulerpa*, *Cladophora*, *Bryopsis* and *Valoniopsis*. The plants were firmly attached on the surface of the rocks, and in the rocks of the tide pools. The species of *Caulerpa* were found in the upper and mid inter tidal regions. *Enteromorpha* species are found mainly on the supra littoral region, exposed for long time during low tide. The green seaweeds are mainly localized on the rocky coasts of the upper inter tidal region. The species of *Ulva*, *Enteromorpha* and *Caulerpa* represent the largest green seaweeds. Most of the members of Chlorophyceae and lithophytes and epiphytes.

The species of *Enteromorpha* occur in the upper most (upper inter tidal / supra littoral) during the rainy season. The species of *Ulva* are found below the level of *Enteromorpha* belt. Most of the species are localized on the upper inter tidal region. *Chaetomorpha* species are lithophytes occurring on both exposed rocks and on the crevices of laterite rocks. *Cladophora* species are lithophytic and attached on the rocks of upper inter tidal region. *Caulerpa* species are localized on the lower inter tidal region. Some species like *C. recemosa*, *C. peltata* are lithophytic attached on the rocks by means of the rhizoids arising from the rhizome. The details of collected and identified species are as follows;

Division: Chlorophyta

Class: Chlorophyceae

Order: 1 . Ulvales

Family. 1. Ulvaceae

Genus 1. *Ulva* L.

Plants yellowish to dark green, expanded, membranous, erect or prostrate. Thalli of various shapes and sizes, attached to rocks or other substratum. Thalli simple or lobed, ribbon like or small, rounded lobes forming rosettes, variously incised made up to layers of cells. In surface view cells quadrate to polygonal and quadrate to rectangular in section. Chloroplast single, plate like with one or more pyrenoids.

Species 1. *Ulva fasciata* Delile

Plants dark green up to 150cm high, ribbon shaped with pointed tip, deeply divided into several lobes, each lobe 1.5 – 2.5 cm wide, attached by a small circular disc, cells in surface view polygonal, chloroplast plate like, pyrenoids.

Species 2. *Ulva lactuca* L.

Thallus pale green, flattened, irregularly lobed, translucent attached by basal disc of 2 – 4mm diameter lamina 7 – 12cm long 6 - 15cm broad deeply lobed with ruffled margin, old lamina sometimes perforated, cells in surface view polygonal, closely packed, chloroplast cup shaped, pyrenoid 1 - 2.

Genus 2 *Enteromorpha* Link

Thallus tubular small or large size, monostromatic simple profusely branched, sometimes compressed, attached by means of rhizoidal outgrowths, sometimes forming a discoid base, cells arranged inside a mucilaginous sheath, quadrate or polygonal in surface view, quadrate to rectangular in cross-section, inner and outer membranes thickened, chloroplast single laminate or cup shaped completely or partially filled, with one or two pyrenoids.

Species 3. *Enteromorpha intestinalis* L.

Plantstubular, 15cm high 3mm or more wide, at first attached by basal rhizoidal portion, later free floating, green, mature filaments intestine like appearance irregularly constricted simple or branched, cells in surface view rounded or polygonal, arranged irregularly, diameter 10 – 20mm, in

section thallus 23 – 26mm thick, cells 16.65 – 20mm long, 13.2 - 15mm broad inner cuticle 6.6 mm thick, outer cuticle 1.6 – 3.3mm thick, chloroplast complete, cup shaped, pyrenoid 2 – 3.

Order 2. *Cladophorales*

Family 2: *Cladophoraceae*

Genus:3 *Chaetomorpha* Kuetzing

Plants green, filamentous, uniseriate, unbranched, cells cylindrical or barrel shaped with numerous peripherally placed nuclei chloroplast reticulate many pyrenoids, cell wall thick, lamellate attached by an elongate basal cell with holdfast.

Species: 4. *Bryopsis pennata* Lamouroux

Plants dark green, large tufts of 4-9cm height, fronds erect, feather like, 7mm wide consisting of cluster of simple or branched axis. Measures 300mm broad at the base, 450mm at the middle and 240mm towards the apex, rhizoids elongated, lower part of the axis naked, ramuli small, cylindrical 110 – 18mm broad, 1.5 – 2mm long dichotomously or rarely unilaterally disposed on the frond, leaf like lanceolate linear, ramuli at the base, chloroplast discoid to spindle shaped with one pyrenoid.

Order 3: *Caulerpales*

Family 3: *Caulerpaceae*

Genus 4: *Caulerpa* Lamouroux

Thallus unicellular, aseptate, coenocytic differentiated into a creeping branched cylindrical rhizome covered with many scales, hairs or naked rhizoids branched adhering to the substratum, assimilators erect with a central axis and ramuli of varying sizes and shapes, radically or bilaterally arranged. Cell wall firm produces internally rod like skeletal strands or trabeculae showing branching of various types branches often anastomosing or looping and traversing the central cavity of the thallus, cytoplasm lining the cell wall and surrounding the trabeculae here and there, forming extensive cytoplasmic masses and a central vacuole. Vegetative reproduction by the fragmentation of thallus, sexual reproduction by means of biflagellate anisogametes.

Family 4: *Valoniaceae*

Genus 5: *Valoniopsis* Boergesen

Thallus forming dense cushion attached to rocks and coral stones by irregularly branched lobed septate rhizoids, erect growing frond consist of cylindrical branches, branches arising as unilateral or irregularly clustered outgrowths, upper branches curve downwards and become rhizoid like, chloroplast discoid or polygonal with prolonged angles enclosing one or two large pyrenoids.

Species 5. *Valoniopsis pachnema* Boergesen

Thallus green, dense tufts of 4 – 7cm diameter, at lower intertidal or subtidal rock. Attached by rhizoid like branches with separate, rhizoids, branches cylindrical curved, irregularly clustered upper branches bend to form separate

rhizoid like structures, branches 600 – 900mm or up to 1mm thick chloroplast numerous, discoid or polygonal pyrenoid.

Order 4: Bryopsidales

Family 5: Bryopsidaceae

Genus 6: Bryopsis Lamouroux

Plant erect, tufted, coenocytic, composed of a prostrate rhizome like portion anchored by rhizoids, and an upright feathery portion, which consist of an axis with uni or bilaterally or arranged pinnae formed in acropetal succession. Plant diploid, coenocytic inner to cell wall the lining layer of cytoplasm contain minute nuclei and numerous discoid to spindle shaped chloroplast, each with pyrenoid, the older pinnules are separated from the main axis by a transverse wall. Vegetative reproduction takes place by detachment of the older pinnule below the cross wall at its base.

Species 6: Chaetomorpha antennina Kuetzing

Plants dark green up to 15cm tall, erect rigid filaments, growing gregariously, attached to rocks in upper intertidal region by means of rhizoidal basal cell, basal cell elevate, 220-260mm at the apical end, 5 -7mm long in thickness.

Genus 7: Cladophora Kuetzing

Thallus uniseriate, branched filament with long cylindrical cells, branching lateral from terminal end of a cell, appearing dichotomous, attached to substratum by means of rhizoidal branches arising from cells near the base of thallus, cells with thick stratified walls, chloroplast reticulate or discoid with several pyrenoids, cells multinucleate.

Species 7: Chladophora glomerata Kuetzing

Plants dark green, attached to substratum by septate long rhizoids with hapteroid base, filaments branched, branches in acute angles with the axis, verticillate in lower portions, solitary or crowded above, apical cell slightly attenuate, ending with pointed tip. Cells in main axis 40 – 70mm in diameter and 160 – 60mm in length.

Species 8: Caulerpa recemosa J. Agardh

Plants light green, erect axis, 4-6 cm high, rhizome naked, dichotomously branched creeping, 1.75 acute apex, cell wall 23.1 – 33mm thick; trabeculae arises from the cell wall at an interval of 10 – 20mm, diameter of ranges from 9.9 – 13.2mm at the point of origin, 2.6 – 6mm in other regions, branching dichotomous, lateral, loops frequent, irregular patches of cytoplasm observed. Rhizoids arising from the lower side of the rhizome, intervals ranging from 2 – 9mm alternate or opposite to assimilators rhizoids branched, short or long branches seen. Assimilators erect, simple or branched dichotomously arising at interval of 2-15mm from the rhizome, ramulipeltate, radially arranged on the central axis, oblique position directly arising from the horizontal axis also present. Trabeculae range from 10-1.6mm, branching dichotomous or lateral, irregular masses of cytoplasm with starch grains observed.

Species 9 Caulerpa peltata Lamouraux

Plants light green, erect axis, 4-6cm high, rhizome naked, dichotomously branched creeping, and acute apex. Trabeculae arise from the cell wall at an interval of 10 – 20mm, branching dichotomous, lateral loops frequent, irregular patches of cytoplasm observed. Rhizoids arising from the lower side of rhizome, alternate or opposite to assimilators, rhizoids branched, short or long branches seen. Assimilators erect, simple or branched dichotomously arising at an interval of 2 – 15mm from the rhizome, ramuli peltate, radially arranged on the central axis, oblique position, directly arising from the horizontal axis also present, diameter of disc 3 – 6mm gap between the ramuli 2 – 3mm, stalk of the ramuli up to 2mm long. Trabeculae arising from the cell wall, branching dichotomous or lateral, and irregular masses of cytoplasm with starch grains observed.

Species 10: Caulerpa sertulariodes Howeforma

Plants dark green, 6.5 -10cm height, rhizome creeping naked branched, forming a mat like structure, diameter 5 – 1.2mm rhizome not bearing assimilators up to 4 – 6cm from the tip, tip pointed. Trabeculae is having a diameter of 13.2 – 3.3mm at various places, loops present branching dichotomous or lateral. Rhizoids alternate or opposite to assimilators at intervals 1 – 15mm. Rhizoidal ends tubular or discoid. Cell wall having lamellation. Branching of trabeculae lateral or dichotomous. Assimilators feather like, erect, lanceolate arising from rhizome at intervals of 3 – 20mm, pinnate 6.5 – 10cm long 4 – 10 mm wide, pinnules distichous, opposite narrow incurved, pointed tip.

Discussion

A total number of ten green seaweeds were collected from the Thirumullavaram coast of Kollam, Kerala. They belong to 4 orders, 5 families, and 7 genera from the Division Chlorophyta. Details of the systematic position of the green algal species collected and identified from the Thirumullavaram coast of Kollam. Among these ten species of green seaweeds, the species of Ulva, Enteromorpha and Caulerpa are edible. The present study may help to increase in the interest of persons to develop a systematic method to conserve it.

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