Int J Pharma Res Health Sci. 2018; 6 (1): 2264-68
DOI:10.21276/ijprhs.2018.01.30
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CODEN (USA)-IJPRUR, e-ISSN: 2348-6465

PHS Scientific House
PHARMAHEALTHSCIENCES

International Journal of Pharma Research and Health Sciences

Available online at www.pharmahealthsciences.net

Original Article

Diversity and Distribution of Macro-Algae in the Gulf of Mannar

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ARTICLE INFO

Received: 08 Feb 2018
Accepted: 26 Feb 2018

ABSTRACT

This study examines the presence of seaweeds in the Gulf of Mannar comprising five coastal regions, and determines the distribution and diversity of macro algae found along the coastal area. From this field investigation, Chlorophyta, including four species and Phaeophyta, nine species and Rhodophyta are nine species are found in different localities of Gulf of Mannar. A total of 22 species of seaweeds were identified and characterized by standard methods.

Keywords: Gulf of Mannar, Coastal Region, Diversity, Distribution, Seaweeds, Thallus.

1. INTRODUCTION

India is one of the richest countries for biodiversity of seaweeds in the world. A myriad of economically and environmentally valuable species are present in the southern coastal region of Tamil Nadu because of different ecosystems. In comparison with the Gulf of Kutch in Gujarat, Lakhsadweep, Andaman and Nicobar Islands in India, Gulf of Mannar is the major coral reef region that stretches about 1076 km length which is in Ramanthapuram district (9.4071° N, 78.7023° E) 236.8kms.

Seaweeds are the important renewable living resources for human welfare and are highly diversified tropical species

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commonly found on rocks, pebbles, dead corals and shells with a maximum depth of 180 m at the bottom of the shallow coastal region. Chlorophyceae (green algae), Phaeophyceae (brown algae) and Rhodophyceae (red algae) are the predominant classes with 900, 1500, and 4000 species, respectively, in nature.

Seaweeds are highly potential of biomass and widely used in various forms and also as direct food [1, 2]. Products of macro-algae are defensive against various diseases and enhance health [3]. Seaweeds are also used in animal fodder used as fertilizer for agriculture and used as food, gels and/or act as emulsifiers in various sectors [4]. Macroalgae have interesting physiological properties when compared to higher plants.

This study examines species diversity of seaweeds to have a better understanding of the features of macro algae conditions in the Gulf of Mannar coastal region of five locations.

2. MATERIALS AND METHODS

The present diversity study was carried out in five localities along the coast of the Gulf of Mannar in southeast coast of India, such as Pudumadam (9.27702°N 78.993845°E), Kilakarai (9.2343° N, 78.7836° E), Ervadi (9.2192° N, 78.7108° E), Mandapam (9.2770° N, 79.1252° E) and Dhanushkodi (9.1794° N, 79.4183° E) (Figs 1–7). Macro alga were collected in the month of February 2017 from the intertidal zone during low tide. To remove extra debris from the collected seaweeds, they were thoroughly rinsed.

The samples were stored in polythene bags filled with fresh sea water for identification and for further uses. The collected macro algae samples were fixed using 4% formaldehyde for further studies. Collected seaweeds were examined under stereo and light microscope following standard manual [5,6,7,8,9,10,11].

3. RESULTS

A total of 17 genera and 22 species of seaweeds were recorded from the Gulf of Mannar at five region (Fig. 1). Rhodophyta division containing 9 species, Chlorophyta division containing 4 species and Phaephyta division had 9 species from five regions of our study area (Table 1). During the entire study period, the seaweeds were collected from sandy, pebbles and rocky environmental condition.

***Chaetomorpha antenina* (Bory) Kützing** [12]

Thalli about 3–15 cm in tall, firm and crisp in texture, unbranched filamentous, attached, long branches; strong surge, spongy mass, basal holdfasts short rhizoids; light green in colour (Fig. 2a).

***Cladophora fascicularis* (Mertens ex C.Agardh) Kützing** [13]

The main axis of thalli is stout, sparingly, densely fasciculated about 1–3.5 mm in tall, ultimate indefinite branched about 25–60 cm in tall; crowded at the end of tips, pectinate arrangements; fresh samples are greenish colour (Fig. 2b).

***Enteromorpha intestinalis* (Linnaeus) Nees** [14]

Light green membranous, gregarious or solitary, thallus about 25–70 cm tall; stalk elongated, tubular, attenuated, clevated and cylindrical; membrane thickness about 15–45 micron length; fresh samples are greenish in colour (Fig. 2c).

***Caulerpa peltata* Lamouroux** [15]

Thalli are small plats, size of thallus is generally 5–30 cm tall; stolons freely forked; peltate branchlets, slender pedicel; rhizoid-bearing branches, foliar and erect branches about 5–50 mm tall; fresh samples are greenish with light brown colour (Fig. 2d).

***Padina gymnospora* (Kützing) Sonder** [16]

Thallus are blades about 9 – 25 cm long and broad tall; hair lines, tufted, lower parts – stupose, dark lines of spongia, broad rounded or split into narrower portions; fresh samples light red with brownish colour (Fig. 3a).

***Padina tetrastromatica* Hauck** [17]

Thallus are blades about 9–25 cm long, broad and tall; flabelliform thallus, several small lobes, divided in to several times in lobes; fresh samples are dark brown with green in colour (Fig. 3b).

***Spatoglossum asperum* J.Agardh** [18]

Thalli foliar, variable in size from 10 to 80 cm; broad tall about 1–3 mm diameter; narrow segments, flat, sub-dichotomously, palmate, lobes with smaller and larger, elongated lobes; 300–600 micron thickness, apex acute or rounded, sinvate margin; fresh samples dark brown colour (Fig. 3c).

***Stoechospermum marginatum* (C.Agardh) Kützing** [19]

Thalli reach from 15 to 50 cm in tall, rigorously forking; dichotomously branches, 6 – 15 mm thickness; thalli flat, spathulate, erect, entire margin is flatly truncate or bifid apex; fresh samples are apex light yellow and dark brown in colour (Fig. 3d).

***Turbinaria conoides* (J.Agardh) Kützing** [19]

Thalli about 8–26 cm in tall; erect, subcylindrical, alternative, polystichously; thalli thickness about 10–15 mm long; tape stalk, triangular; vesiculate blade margin or evesiculate, 10–20 mm in long; sharp prominent teeth; fresh samples are dark brown in colour (Fig. 3e).

***Sargassum myriocystum* J.Agardh** [18]

Thalli about 10–80 cm in tall; discoid holfast, cylindrical with rough out growth, alternately arranged branches, vesicles, stalk about 1–18 mm in diameter; oblong tapered leaves, blades leaf-like; air bladders bulbous, obvious, emarginated or retuse; serrated margin, apices are round, acute outer margin; prominent midrib; cryptostomates blade, pedunculated vesicles; fresh samples are yellowish brown in colour (Fig. 3f).

***Sargassum plagiophyllum* C. Agardh** [20]

Thalli about 20–96 cm in tall, thallus with one or many axes, main axes terete or globose**,** discoid holfast, cylindrical with rough out growth, alternately arranged branches, vesicles,

stalk about 3–22 mm in diameter; oblong tapered leaves, blades leaf-like; air bladders bulbous, obvious, emarginated or retuse; serrated margin, apices are round, acute outer margin; prominent midrib; cryptostomates blade, pedunculated vesicles; fresh samples are yellowish brown in colour (Fig. 3g).

***Sargassum wightii* Greville ex J.Agardh** [21]

Thallus is about 15–40 cm in tall; holdfast, branched; axes are cylindrical, glabrous; leaves are about 4–9 cm long and 2–10 mm broad, tapering base, midrib; vesicles large, ellipsoidal or spherical, long tip, receptacles are clusters; fresh samples dark brown colour (Fig. 3h).

***Sargassum polycystum* C.Agardh** [22]

Thalli is about 10–60 cm in tall; discoid holfast, cylindrical with rough out growth, alternately arranged branches, vesicles, stalk about 1.5–15 mm in diameter; oblong tapered leaves, emarginated or retuse; serrated margin, apices are round, acute outer margin; prominent midrib; cryptostomates blade, pedunculated vesicles; fresh samples are yellowish brown in colour (Fig. 3i).

***Amphiroa fragilisima* (Linnaeus) Lamouroux** [23]

Thallus is multiaxial, articulate, height of 5–6 cm length; branches are calcified, cylindrical, thin, segmented, dichotomous; extremely fragile, multi-tiered genicula, dichotomies arising from genicula, basal genicula are prominent and brownish; fresh specimens have a light purple colour (Fig. 4a).

***Jania adherence* Lamouroux** [24]

Thallus are erect about 0.8–3.0 cm in height, highly branched and wide angled, fresh specimens are light brown with purple colour, branches are 100–250 µm in diameter, sometimes less in the uppermost branches. The segments are 2.5–7.8 µm in diameters long; articulation present at the base of branch, apices conical, acute (Fig. 4b).

***Cheilosporium spectabile* Harvey ex Grunow** [25]

Thalli about 1–3.5 cm in tall, clump-like growth, tufted, forming a compact tuft; alternate-dichotomously branched, irregular, conceptacles, frond cylindrical or sub-cylindrical; genicula present; segments, Intergenicula compressed apically, prominent midrib; 0.6 mm length. Fresh samples are pinkish red in colour (Fig. 4c).

***Hypnea valantiae* (Turner) Montagne** [26]

Thallus is about 90–350 mm in tall, definite upright branches bearing. Branches are erect, laxly, radial side, stichidia, filiform and lightly spine-like branches, distinct cylindrical main axis. Fresh samples are purple with light green in colour (Fig. 4d).

***Hypnea musciformis* (Wulfen) Lamouroux** [24]

Inflated and hooked main branches, branchlets are simple, slender with dense clothing, length of the thallus is about 10–20 cm. Fresh samples are pink with light greenish in colour (Fig. 4e).

***Gracilaria corticata* (J.Agardh) J.Agardh** [22]

Thallus 10–15 cm long containing bundles of flat and divided blades with 1–3 mm length; dichotomous branching at young blades; mature thallus possess numerous marginal projection lines the edges with 1–2½ cm long; fresh samples are dark purple to green colour (Fig. 4f).

***Chondrococcus hornemanni* (Lyngbye) F.Schmitz** [27]

Thallus about 3–8 cm in tall; usually caespitose, disc-shaped holdfast; four or more times pinnately branched in distichoalternate manner, subftabellately expanded, thickened but entire from the base upward; branches are prominently in-rolled; reddish colour (Fig. 4g).

***Champia parvula* (C.Agardh) Harvey** [25]

Thallus is densely tufted, crisply membranous in texture and 2–13 cm in length; alternate branching system with 0.3–2.5 mm. tapering, segmented, 0. 9–1.8 µm diameter long segments, the tips of the branches obtuse. Fresh samples are pinkish brown or greenish in colour (Fig. 4h).

***Acanthophora specifera* (M.Vahl) Børgesen** [28]

Thallus is bushy, filamentous and tall about 3–8 m, wing clumps; lower branches are creeping and entangled; attached to the substrate by rhizoids; branching is irregular with subdichotomous; fresh samples are purplish brown in colour (Fig. 4i).

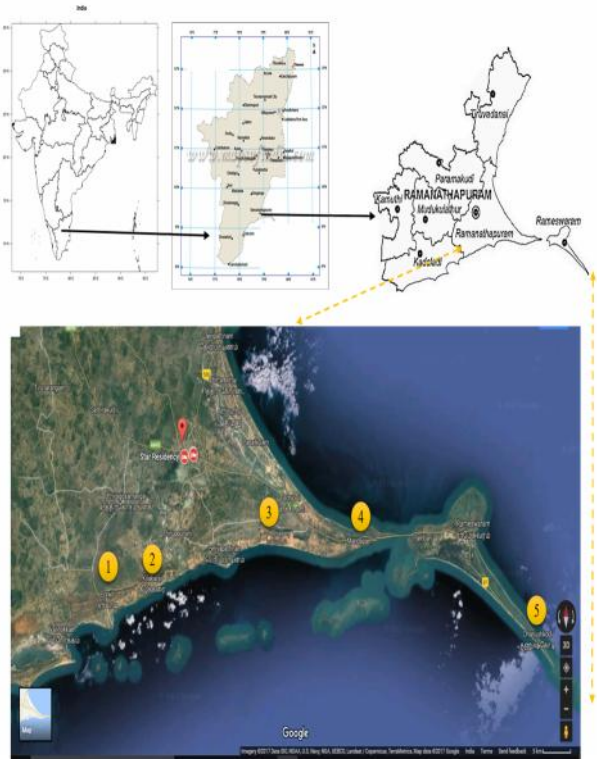

Fig 1: Map showing study area of Gulf of mannar.
1). Pudumadam (9.27702°N 78.993845°E); **2).** Kilakarai (9.2343° N, 78.7836° E); **3).** Ervadi (9.2192° N, 78.7108° E); **4).** Mandapam (9.2770° N, 79.1252° E); **5).** Dhanushkodi (9.1794° N, 79.4183° E).

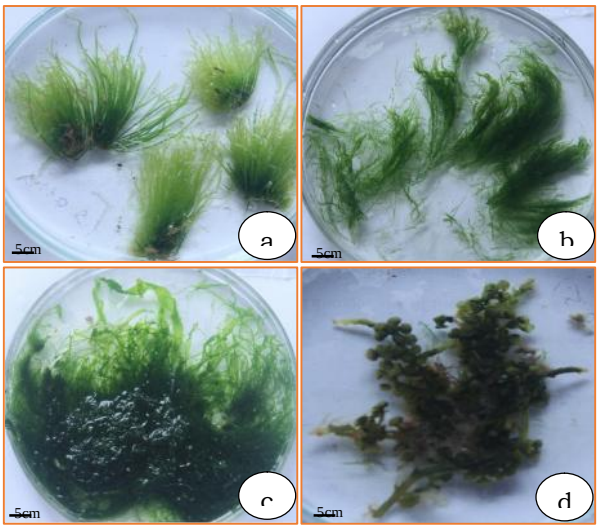

Fig 2: Morphological features of Chlorophyta
a). Chaetomorpha antenina; b). Cladophora fascicularis; c). Enteromorpha intestinalis; d). Caulerpa peltata

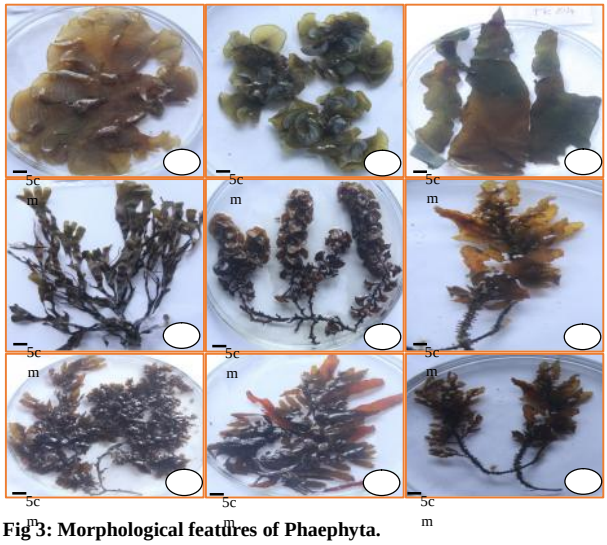

Fig 3: Morphological features of Phaephyta.
a). *Padina gymnospora*; **b**). *Padina tetrastromatica*; **c**). *Spathoglossum asperum*; **d**). *Stoechospermum marginatum*; **e**). *Turbinaria conoides*; **f**). *Sargassum myriocystum*; **g**). *Sargassum plagiophyllum*; **h**). *Sargassum wightii*; **i**). *Sargassum polycystum*

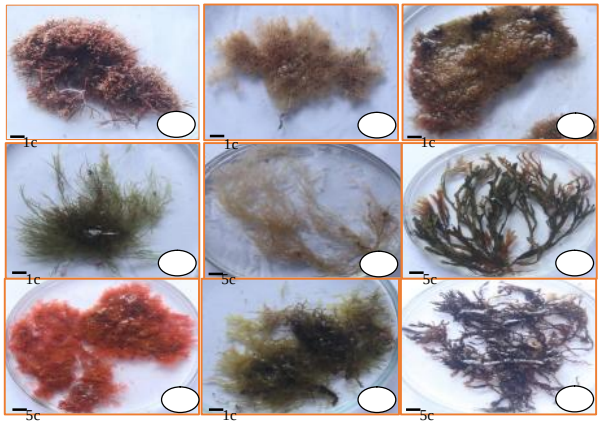

Fig 4: Morphological features of Rhodophyta and Chlorophyta
a). *Amphiroa fragilisima*; **b).** *Jania adhaerens*; **c).** *Cheilosporium spectabile*; **d).** *Hypnea valantiae*; **e).** *Hypnea musciformis*; **f).** *Gracilaria corticata*; **g).** *Chondrococcus hornemanni*; **h).** *Champia parvula*; **i).** *Acanthophora spicifera*

4. DISCUSSION

From the studied five localities of Gulf of Mannar are widely and densely distributed with seaweeds on sandy, corals, and rocky habitats. We have reported, *Amphiroa fragilisima, Jania adhaerens, Cheilosporium spectabile, Hypnea valantiae, Hypnea musciformis, Gracilaria corticata, Champia parvula, Acanthophora spicifera* from the Gulf of Mannar, which was early reported by Desikachary *et al.* (1990 & 1998) [5,6]. Similarly, *Padina tetrastromatica* were recorded in the Gulf of Mannar region (Sahayaraj *et al*., 2014) [29]. According to Baluswamy (2006) [30], 125 taxa red algae were reported previously, in contrast our present data only 9 taxa to the maximum were recorded followed by 9 green algae and only 4 brown algae. From previous literature, the alien taxa of *Hypnea* sp. are present in the Gulf of mannar (Sahayaraj *et al*., 2014) [29]. The natural resources are being depleted even under the sea. It is an alarming ecological imbalance being created due to various human factors that have to be identified.

Diversity of seaweeds are distributed all over the coastal region. But numerous seaweeds are still now unclear taxa. In near, we need more drug for various pharmagological aspects, the seaweeds could be a remedy for the upcoming problem.

5. ACKNOWLEDGEMENTS

Authors are thankful to Periyar University for permitting us to do the research as Faculty Improvement Programme.

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Conflict of Interest: None

Source of Funding: Nil