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RESEARCH ARTICLE

BIODIVERSITY OF SEAWEEDS OF PUDUCHERRY HAVING LARVICIDAL AND OVICIDAL ACTIVITIES AGAINST MEDICALLY IMPORTANT VECTOR MOSQUITOES

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ABSTRACT

Objective: To identify and preliminary screening on the biodiversity of marine seaweeds and sea fans extract against *Aedes aegypti, Anopheles stephensi* and *Culex quinquefasciatus* in Puducherry.

Methods: Monthly wild seaweeds were collected from coastal region of Puducherry. The identified seaweeds and sea fans were authenticated from the regional centre of CMFRI, Chennai. All the collected samples were washed thrice with tap water and twice with distilled water to remove the adhering salts and other associated animals.

Results: 44 species of seaweeds and three species of sea fans were identified, belonging to three families such as, Phaeophyta (16 species), Rhodophyta (14 species), Chlorophyta (14 species) and three sea fans were collected from the Puducherry coast.

Conclusion: From the results it can be concluded the coastal region of Puducherry highlights the ambient habitat for dominant occurrence of Phaeophyta, Rhodophyta and Chlorophyta species of sea fans having bioactive potentials against larvicidal, ovicidal activities for mosquitoe vectors.

INTRODUCTION

Mosquitoes constitute a major public health problem as vectors of serious human diseases like malaria, flariasis, Japanese encephalitis, dengue fever, chikungunya and yellow fever (Jang et al., 2002) cause substantial mortality and morbidity among people living in tropical and sub tropical zones. Seaweeds are the extra ordinary sustainable resources in the marine ecosystem which have been used as a source of food, feed and medicine. It was estimated that about 90% of the species of marine plant are algae and about 50% of the global photosynthesis is contributed from algae (Dhargalkar and Neelam, 2005). Approximately 841 species of marine algae found in both inter – tidal and deep water regions of the Indian coast (Oza and Zaidi, 2000).

Marine algae were also reported to have some antioxidant properties (Faten *et al*., 2009). Commercially available species of marine macro algae are commonly referred to as seaweeds. Seaweeds have some of valuables medicinal compounds such as antibiotics, laxatives, anticoagulants, antiulcer products and suspending agents in radiological preparation (Rajasulochana *et al*., 2009). Fresh and dry seaweeds are extensively consumed by people especially living in coastal areas. Seaweeds are classified as Rhodophyta (red algae) or Phaeophyta (brown algae) or Chlorophyta (green algae) depending on their nutrient and chemical composition (Cox *et al*., 2010).

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Mosquitoes coming under the order Diptera, are ravaging humans and other animals for generations. There are nearly 2,500 mosquito species in the world but a mere fraction of them transmit an array of pathogens including viruses (e.g., arboviruses), protozoans (e.g., malaria) and nematode worms (e.g., lymphatic filariasis) (Taubes, 1997), annually more than 700 million people suffer from mosquito – borne diseases. The immense usage of many synthetic aerial, terrestrial and aquatic insecticides offer logistic problems on the environment (Chowdhury *et al.,* 2008) and causes resurgence of different mosquito – borne diseases (Milam *et al*., 2000). Extensive use of chemical insecticides for control of vector borne diseases has created problems related to physiological resistance to vectors, adverse environmental effects, high operational cost and community acceptance, numerous plant products have been reported either as insecticides for killing larva or adult mosquitoes or as repellent for mosquito biting and are one the best alternatives for mosquito control (Rajkumar *et al*., 2009).

The production on inhibitor substance by seaweeds has larvicidal, ovicidal, repellant actions and some of their substances have potential use in mosquito control (Nagi *et al*., 2010). Use of synthetic insecticides to control vector mosquitoes has caused physiological resistance and adverse environmental effects in addition to high operational cost (Samidurai *et al*., 2009). The larvicidal potentials were identified by Thangam, 1991. The secondary metabolites synthesized by seaweeds demonstrate a broad spectrum of bioactivity varying from neurologically active in humans to

algicidal, nematicidal, insecticidal and ichthyotoxicity in lower form of animals (Smith, 2004). Hence, there is a urgent need to develop safer, more eco – friendly and efficient alternatives that have the potential to replace synthetic pesticides and are convenient to use. Seaweed pesticides can reduce the use of chemical insecticides by avoiding unnecessary synthetic chemical applications (Thangam and Kathiresan, 1991). In this background, the present study was initiated to explore the larvicidal potential of major seaweeds infested along coastal region of Puducherry, India as a potential resource of marine bio-prospecting.

MATERIALS AND METHODS

Seaweeds belonging to Chlorophyta, Phaeophyta and Rhodophyta were collected in different season (September to August 2013) during the lowest tide of *chart datum* from the seaweed infested locations along coastal region of Puducherry, India. The study area, coastal region comprising of numerous study beaches and irregularly distributed rocky substratum interspersed with sandy intertidal pools inhabited with a wide variety of marine algae (Map: 1).

Map 1: Study area - Puducherry

The algae, which infested exclusively on the intertidal rocky and other substratum, were selected for the collection in order to avoid other algal contamination. These algae were collected using a metal scraper. Immediately after collection, they were washed in fresh seawater to remove the epiphytes, sand and other extraneous matter. After draining off the water, the algae were wiped with a blotting sheet and air – dried under shade. After completing the shade drying process, they were cut into small pieces and shade dried again. Completely dried material was weighed and ground finely in a mechanical grinder.

RESULTS AND DISCUSSION

South east coast of India is a unique marine habitat infested with diverse seaweeds. Therefore, the present study was initiated to explore diversity of seaweeds and seafans, used against larvicidal, ovicidal activities of mosquito larvae of *Ae. aegypti*, *An. stephensi* and *Cx. quinquefasciatus*. Fourty four seaweeds and three sea fans were identified, belonging to three families such as Phaeophyta (16 species), Rhodophyta(14 species), Chlorophyta(14 species) and three sea fans were collected from the Puducherry coast. It is the first report on the diversity of seaweeds and sea fans used as mosquitocidal in this region.

Nature has good source of medicinal agents for thousands of years and an immersive number of modern drugs have been isolated from natural sources based on the traditional information (Nair *et al*., 2005). Historically, many plants have provided large contricutions to human health and well being (Astal *et al*., 2005). Traditionally, marine plants are used to cure many of the infectious and non infectious diseases (Bandaranayake, 1998), in that, seaweeds are scientifically proved to have many of the biological activities such as antibacterial, antifungal, antiviral, anti – inflammatory, cytotoxic, nematicidal, antifeedant, larvicidal and anticoagulant activities (Manilal *et al*., 2009, 2011). Interestingly, the authors have identified eight marine algae showing antiplasmodial activity against malaria (Ravikumar *et al*., 2011). Similarly, green and brown algae such as *Ulva fasciata*, *Acanthophora spicifera* were identified as larvicidal against *Culex quenquifasciatus* found in the Kovalam, Chennai (Poonguzhali *et al*., 2012). The red and brown algae such as *Acanthopora spicifera*, *Sargassum wightii* were identified as phytochemicals found along the Mandapam coast, Tamil Nadu (Janarthanan and Senthil Kumar, 2013). Among the marine macroalgae collected *Gracilaria verrucosa* and *Sargassum muticum* were identified as antibacterial activity and larvicidal activity against *Aedes aegypti* in the Rameshwaram, Tamil Nadu (Anandhan and Sona Kumari, 2011). Therefore, the initiated to explore bioactive potential of major seaweeds were identified as cytotoxicity, larvicidal, ichthyotoxic and nematicidal activities against seaweeds in the South west coast of India (Manilal *et al*., 2009). The present study reveals a dominant occurrence of Phaeophyta comprising of 16 species, Rhodophyta comprising of 14 species and Chlorophyta 14 species; and species of sea fans. Therefore, the present study describes on the diversity and occurrence of major seaweeds dominant during post and premonsoon seasons followed by summer and monsoon seasons. Therefore, the coastal region of Puducherry highlights the ambient habitat for these seaweeds having bioactive potentials against larvicidal, ovicidal activities for mosquitoe vectors (Kovendan *et al*., 2012).

Conclusion: The present study reveals a dominant occurrence of Phaeophyta comprising of 16 species, Rhodophyta comprising of 14 species and Chlorophyta comprising of 14 species; and 3 species of sea fans. The premonsoon seasons revealed an abundance of seaweeds followed by summer and monsoon. The identified seaweeds and sea fans are being used as effective compounds against vectoricidal of *Aedes aegypti*, *Anopheles stephensi* and *Culex quinquefasciatus.* Therefore, the coastal region of Puducherry

Table 1: Diversity of marine seaweeds of Puducherry

S. No.	Name of species Seaweeds	Family	Seasons			
			Monsoon	Post monsoon	Summer	Pre monsoon
		Phoeophyta				
1	*Sargassum wightii*	Sargassaceae	+	+++	++	+++
2	*Sargassum muticum*	Sargassaceae	+	+++	++	+++
3	*Cystoseira myrica*	Sargassaceae	+	+++	++	+++
4	*Turbinaria decurrens*	Sargassaceae	+	+++	++	+++
5	*Sargassum microystum*	Sargassaceae	+	+++	++	+++
6	*Turbinaria conoides*	Sargassaceae	-	+++	++	+++
7	*Dictyota dichotoma*	Dictyotaceae	+	+++	++	+++
8	*Padina tetrastromatica*	Dictyotaceae	+	+++	++	+++
9	*Stoechospermum marginatum*	Dictyotaceae	+	+++	++	+++
10	*Lobophora variegata*	Dictyotaceae	-	+++	++	+++
11	*Spatoglossum asperum*	Dictyotaceae	+	+++	++	+++
12	*Canistrocarpus cervicornis*	Dictyotaceae	+	+++	++	+++
13	*Padina boergesenii*	Dictyotaceae	+	+++	++	+++
14	*Padina pavonica*	Dictyotaceae	+	+++	++	+++
15	*Nitophyllum punctatum*	Delesseriaceae	+	+++	++	+++
16	*Chnoospora bicanaliculata*	Scytosiphoraceae	+	+++	++	+++
		Rhodophyta	+	+++	++	+++
17	*Centeroceras clavulatum*	Ceramiacea	+	+++	++	+++
18	*Jania rubens*	Corallinaceae	+	+++	++	+++
19	*Hypnea valentia*	Cystocloniaceae	+	+++	++	+++
20	*Hypnea pannosa*	Cystocloniaceae	+	+++	++	+++
21	*Ciona intestinalis*	Cionidae	+	+++	++	+++
22	*Gracilaria edulis*	Gracillariaceae	+	+++	++	+++
23	*Gracilaria corticata*	Gracillariaceae	-	+++	++	+++
24	*Gracilaria crassa*	Gracillariaceae	+	+++	++	+++
25	*Gracilaria foliifera*	Gracillariaceae	+	+++	++	+++
26	*Portieria hornemannii*	Rhizophyllidaceae	+	+++	++	+++
27	*Acanthophora spicifera*	Rhodomelaceae	+	+++	++	+++
28	*Grateloupia lithophila*	Halymeniaceae	+	+++	++	+++
29	*Ceratodictyen spongiosum*	Lomentariaceae	+	+++	++	+++
30	*Gracilaria verrucosa*	Gracillariaceae	+	+++	++	+++
		Chlorophyta				
31	*Ulva fasciata*	Chlorophyceae	+	+++	++	+++
32	*Enteromopha compressa*	Chlorophyceae	+	+++	++	+++
33	*Helimida gracilus*	Chlorophyceae	+	+++	++	+++
34	*Enteromorpha intestinalis*	Caulerpaceae	+	+++	++	+++
35	*Chaetomorpha antennina*	Caulerpaceae	+	+++	++	+++
36	Caulerpa recemosa	Caulerpaceae	+	+++	++	+++
37	Caulerpa prolifera	Caulerpaceae	+	+++	++	+++
38	Caulerpa serrulata	Caulerpaceae	+	+++	++	+++
39	Caulerpa toxifolia	Caulerpaceae	-	+++	++	+++
40	Caulerpa scalpelliformis	Caulerpaceae	+	+++	++	+++
41	Chaetomorpha indica	Cladophoraceae	+	+++	++	+++
42	Acrosiphonia orientalis	Acrosiphoniaceae	+	+++	++	+++
43	Valoniopsis pachynema	Valoniaceae	+	+++	++	+++
44	Bryopsis plumose	Bryopsidaceae	+	+++	++	+++
	Sea fans					
1	Heterogergia suberosa	Ellisellidae	+	+++	++	+++
2	Junceela juncea	Ellisellidae	+	+++	++	+++
3	Gorgonella umbraculum	Ellisellidae	+	+++	++	+++

+++ = Abundant: ++ = Less abundant: + = Rare: = Nil

highlights the ambient habitat for these seaweeds having bioactive potentials against larvicidal, ovicidal activities for mosquitoe vectors.

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