

PHYTOCHEMICAL EVALUATION AND BIOACTIVE POTENTIAL OF BROWN SEAWEEDS.

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Abstract

The brown seaweeds *Padina gymnospora* and *Turbinaria ornata* collected from Keelakarai coast, Ramnad, Tamil Nadu. Both the seaweeds were subjected in to phytochemical screening and antibacterial activity. The results of phytochemical screening of *Padina gymnospora* found tannins, terpenoids, cardioglycosides, saponins, phlobatannins and phenols. Saponins, steroids, cardioglycosides and phenols were detected in extracts of *Turbinaria ornata*. Both the extracts showed significant activity against four pathogenic bacteria due to contains active secondary metabolites. In future, further studies will be helpful to the discover new drugs from these marine natural resources.

Keywords Seaweed, *Padina gymnospora*, *Turbinaria ornata*, Phytochemical screening, Antibacterial activity.

INTRODUCTION

Seaweeds are the source of phytochemical namely agar-agar, carrageenan and algin which are extensively used in various industries such as food, confectionary, textiles, pharmaceuticals, dairy and paper industries mostly as gelling, stabilizing and thickening agents [1]. Seaweeds and their extracts have generated enormous amount of interest in the pharmaceutical industries as a fresh of bioactive compounds with immense medicinal potential seaweeds are rich in anti-oxidants such as carotenoids, pigments, polyphenols, enzyme and diverse functional polysaccharides [2].

More than 1140 secondary metabolites have been reported from phaeophyceae (brown seaweed). Seaweeds represent a potential source of antimicrobial substances due to their diversity of secondary metabolites with antiviral, antibacterial and antifungal activities [3-6].

Anticancer alkaloids obtained from brown seaweeds namely fucoidans are the polysaccharides which containing substantial percentage of L-fucose and sulphate ester group. Fucoidans is a bioactive compound which is isolated from different species of brown seaweeds. The bioactivity of fucoidans were extensively studied because of their bioactivity including anticoagulant, antithrombotic, antiviral, antitumour, immunomodulatory, anti-inflammatory, blood lipids reducing, antioxidant, gastric protective effects and therapeutic potential in surgery [6]. The above said facts are keeping in mind, the present investigation carry on the following objectives to evaluate the phytochemical screening of seaweeds *Padina gymnospora* (Kützinger) Sonder and *Turbinaria ornata* (Turner) J. Agardh to study the bioactive potential of brown seaweeds.

MATERIALS AND METHODS

Collection of seaweeds

Padina gymnospora (Kützinger) Sonder and *Turbinaria ornata* (Turner) J. Agardh (Fig1) were collected from the Keelakarai Coast, Ramnad, Tamil Nadu. The samples were picked and

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washed thoroughly with sea water to remove all the unwanted impurities, epiphytes and adhering sand particles. Seaweeds were washed thoroughly with tap water to remove extraneous materials and shade dried for 15 days at room temperature. The dried samples were chopped into fine fragment with the help of mixer. The powder samples were stored in refrigerator for further use.

Preparation of Seaweed extracts

The selected seaweeds *Padina gymnospora* (Kützinger) Sonder and *Turbinaria ornata* (Turner) J. Agardh powders (25 g) were extracted successfully with 250 ml Methanol and distilled water for 72 hours. The extracts were filtered through Whatman No. 1 filter paper and the extracts were used for phytochemical screening and antibacterial studies.

Phytochemicals screening

Chemical tests were performed for the aqueous extracts of seaweed using standard procedures identify the presence of various phytochemicals as described by (Sofowora, 1993 and Raman, 2006)[7,8].

Collection of Pathogens (Bacteria)

The bacterial mother culture *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli* and *Klebsiella pneumoniae* were collected from Department of Microbiology, Periyar University, Salem, Tamil Nadu.

Antibacterial Activity (Disc diffusion method)

Antibacterial Activity was demonstrated by modification of the method described by Barry and Thornsberry, (1985)[9].

RESULTS AND DISCUSSION

The results of preliminary phytochemical screening of methanol and water extracts of *Padina gymnospora* (Kützinger) Sonder and *Turbinaria ornata* (Turner) J. Agardh were presented in table 1. The methanol extract of *Padina gymnospora* (Kützinger) Sonder shows the presence of tannins, terpenoids, cardioglycosides and steroids. The water extracts of *Padina gymnospora* shows the

presence of saponins, phlobatannins and phenol. The result of phytochemical screening of methanol extract of *Turbinaria ornata* showed the presence of cardioglycosides, steroids and phenol. In water extract of *Turbinaria ornata* saponins and steroids were present only.

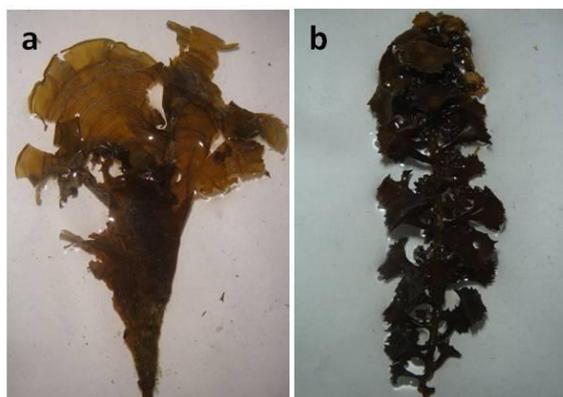


Figure.1: collected seaweeds from the Keelakarai Coast, Ramnad, Tamil Nadu a. *Padina gymnospora* b. *Turbinaria ornata*.

Different chemical compounds such as tannins, terpenoids, cardioglycosides, steroids, saponins, phlobatannins and phenol were detected in *Padina gymnospora* (Kützinger) Sonder and *Turbinaria ornata* (Turner) J. Agardh extracts which could make the seaweeds useful for treating different ailments as having a potential of providing useful drugs of human use.

Tannins, terpenoids, cardioglycosides, steroids were not present in water extract of *Padina gymnospora* (Kützinger) Sonder and saponins, phlobatannins and phenol not showed in methanol extract of *Padina gymnospora* (Kützinger) Sonder. Flavonoids are absent in both the extracts of *Padina gymnospora*. In *Turbinaria ornata*, Steroids are present and phlobatannins are altogether absent in both the extracts. Cardioglycosides, and phenols were not present in water extract of *Turbinaria ornata*. Methanol extract of *Turbinaria ornata* not exhibit saponins. Tannins, flavonoids, terpenoids and phlobatannins altogether absent in both the extract of *Turbinaria ornata*.

Steroids may provide as an intermediate for the biosynthesis of downstream secondary

Table 1: Phytochemical evaluation of *Padina gymnospora* and *Turbinaria ornata*

S.No	Phytochemicals test	<i>Padina gymnospora</i>		<i>Turbinaria ornata</i>	
		Methanol	Water	Methanol	Water
1.	Tannins	+	-	-	-
2.	Saponins	-	+	-	+
3.	Flavonoids	-	-	-	-
4.	Terpenoids	+	-	-	-
5.	Cardialglycosides	+	-	+	-
6.	Phlobatannins	-	+	-	-
7.	Steroids	+	-	+	+
8.	Phenol	-	+	+	-

(+) Present, (-) Absent

the biosynthesis of downstream secondary natural products and it is believed to be a biosynthetic precursor for carotenoids in plants [10]. Saponins are considered a key ingredient in traditional Chinese medicine and are responsible for most of the observed biological effects. Saponins are known to produce inhibitory effect on inflammation. Saponins possess numerous biological properties which include antimicrobial, anti-inflammatory, anti-feedent and haemolytic effects [11].

Seaweeds extracts are source of variety of phenolic compounds [12, 13]. The study revealed that phenol present in water extract of *Padina gymnospora* and methanol extract of *Turbinaria ornata*. Phenolic compounds are one of the most effective anti-oxidant agents in brown algae [14]. Wang *et al* [15] reported that some brown seaweed contain high amount of phenolic compounds. Tannins are naturally occurring plant polyphenolic compounds and are widespread among terrestrial and marine plants [16, 17]. Phlobatannins purified from several brown algae have been reported to possess strong antioxidant activity which may be associated with their unique molecular skeleton [18]. Marine algae are a rich source of structurally novel and biologically active metabolites. Secondary metabolites produced by these algae may be potential bioactive compounds of interest is the pharmaceutical industry. It has been reported that the presence

of phytoconstituents such as flavonoids, tannins and phenols help in preventing a number of diseases through free radical scavenging activity [19]. The methanol extract is the most prominent extract in extraction the major phytoconstituents of the species compared to other organic extracts. Preliminary phytochemical screening of various organic extracts revealed the presence of phytoconstituents including Alkaloids, Anthraquinones, Cardiac glycosides, flavonoids, reducing sugars, saponins and terpenoids [20].

The previous phytochemical studies revealed the presence of phenols, alkaloids, tannins, steroids, glycosides, saponins and flavonoids in the different seaweeds with variation degree. The ethanolic and methanolic extract of *Turbinaria* were observed predominant phytochemicals such as alkaloids, Phenolics, flavanoids and quinones. Similarly, The preliminary phytochemical screening of ethanolic (70%) extract of three marine algae *Chatomorpha antennina*, *Gracilaria corticata* and *Ulva fasciata* from Visakapatnam coast, Andhra Pradesh, India showed positive results for bioactive components like steroids, terpenoids, alkaloids, glycoside, amino acids, carbohydrate, saponins and oils [21]. A similar result was found in *Gelidium acerosa* which contained large amount of valuable phytochemicals like saponins, flavonoids, and alkaloids etc., which are known for its medicinal uses. The preparations of the seaweeds are also useful for the common

ailments, including dysentery; hypertension, urinary tract infection, and some other microbial infections among people [22].

Antibacterial activity

Antibacterial activity of methanol and water extracts of *Padina gymnospora* was represented in Fig. 2. Methanol extract of *Padina gymnospora* showed maximum inhibitory activity against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli* and *Klebsiella pneumoniae* (Fig.3).

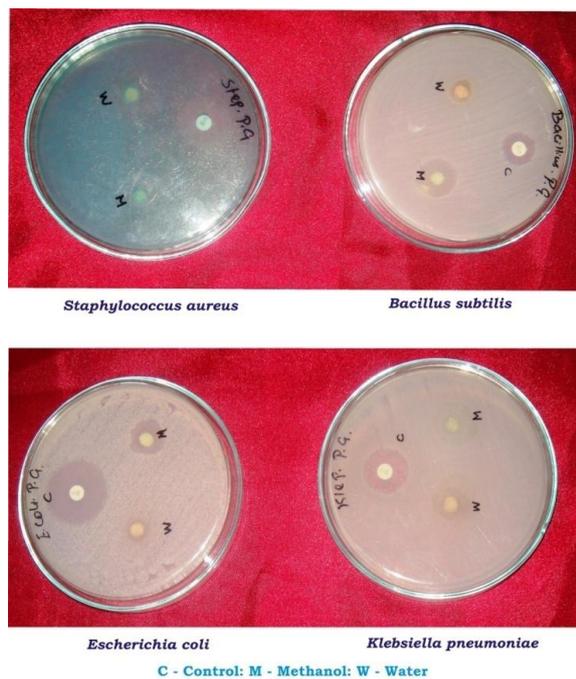


Figure 2: Antibacterial activity of Methanol and Water extracts of *Padina gymnospora*.

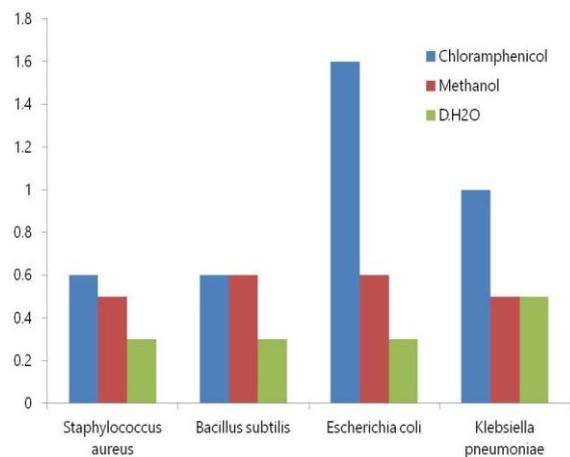


Figure 3: Antibacterial activity of Methanol and Water extracts of *Padina gymnospora*

Maximum antibacterial activity was observed against *Klebsiella pneumoniae* and moderate activity was observed against *Bacillus subtilis*, *Escherichia coli* and *Staphylococcus aureus* in water extract of *Padina gymnospora*.

The antibacterial activity of methanol and water extracts of *Turbinaria ornata* were represented in Figure 4 and Figure 5. Methanol extracts of *Turbinaria ornata* showed maximum inhibitory activity against *Escherichia coli* followed by *Bacillus subtilis*.

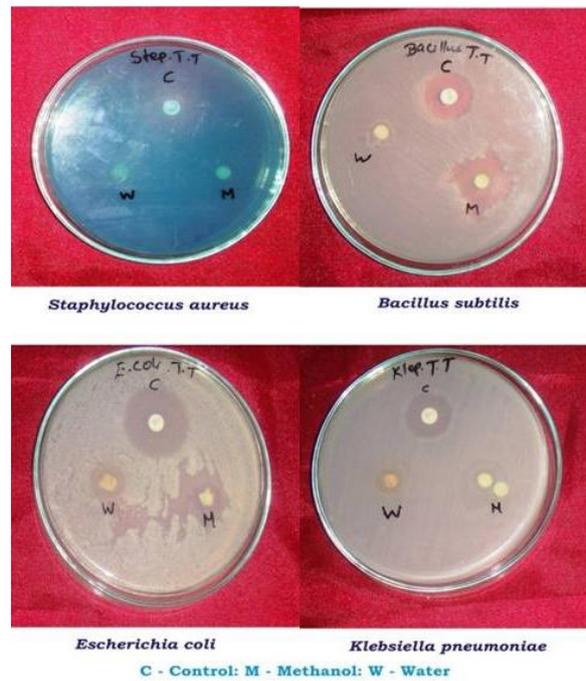


Figure 4: Antibacterial activity of Methanol and Water extracts of *Turbinaria ornata*

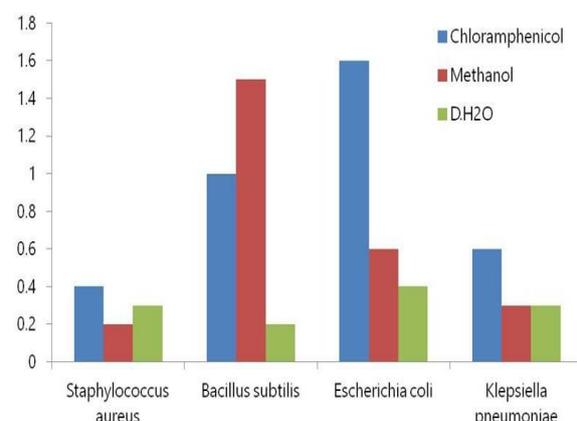


Figure 5: Antibacterial activity of Methanol and Water extracts of *Turbinaria ornata*

The antibacterial activities of the seaweeds may be attributed to the presence of bioactive principles such as tannins, flavonoid, terpenoid, cardioglycosides, phlobatannins, steroids, saponnin and phenol as suggested by several literatures. The maximum antibacterial activity was reported in the class Rhodophyceae (80%) followed by the chlorophyceae (62.5%) and the Phaeophyceae (61.9%) [23].

The antibacterial activities of four vital marine algae specifically *Ulva lactuca*, *Sargassum wightii*, *Padina gymnospora* and *Gracilaria edulis* were examined for the human bacterial pathogens *Vibrio cholera*, *Staphylococcus aureus*, *Salmonella paratyphi*, *Shigella dysenteriae*, *Seudomonas aeruginosa*, *shigella bodii* and *Klebsiella pneumoniae*. The greatest activity (8.8mm) was noted in *Gracilaria edulis* compared to *Staphylococcus aureus* and minimum by *Ulva lactuca* (1.2mm) compared to *Padina gymnospora* [24]. Methanol extracts of seaweeds exhibited broad spectrum of antibacterial activity [25]. The presence of different bioactive constituents in the methanolic extract of *Champia parvula* could contribute to different biological activities [26].

CONCLUSION

In the present study the collected seaweeds were examined for phytochemical screening and they are exhibits following chemical compounds such as tannins, terpenoid, cardioglycosides, phlobatannins, steroids, saponnin and phenol. Due to the presence of above said secondary metabolites and according to earlier reports the present investigation is evidences for the two brown seaweeds namely; *Padina gymnospora* and *Turbinaria ornata* have excellent antibacterial potential. The present study exhibit subsequent data on the bioactive potential of methanol and water extracts of *Padina gymnospora* and *Turbinaria ornata*. The study reveals seaweed has bioactive potential equal to terrestrial plants. And also it is another document for future drug discovers studies.

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