

Probing the Phytochemicals in the Brown Seaweed *Turbinaria ornata*

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ABSTRACT

The macro algae with potent phytochemicals were reported to have extensive biological activities with noteworthy uses in developing novel drug molecules, leads for pharmaceuticals and nutraceuticals in managing various human diseases. Numerous investigations reported that primary and secondary metabolites from algae exhibited remarkable pharmacological activities, thus the present investigation was carried out to explore the phytochemical constituents of the brown seaweed *Turbinaria ornata* collected from the Mandapam coastal area of Tamil Nadu, India. The preliminary phytochemical profiling was conducted to establish the presence of carbohydrates, alkaloids, saponins, phenolic compounds, flavonoids, tannins, coumarines, steroids and terpenoids in the extracts of *Turbinaria ornata*. Our study results elucidated that compared to other solvent extracts there is the presence of more phytochemicals in methanolic extract and the presence of phenolics was also clearly exhibited in the UV-VIS analysis of *Turbinaria ornata* methanolic extract which shows a promising evidence for the antioxidant activity of *Turbinaria ornata*. Similarly, the GC-MS spectrum elucidates the presence of different pattern of bioactive compounds which were reported to possess remarkable bioactivities. The present work supports and revealed the presence of bioactive compounds in *Turbinaria ornata* and may exhibit wide biological activities.

Key words: *Turbinaria ornata*, Bioactive compounds, FTIR, GC-MS

Seaweeds, the macroscopic marine algae are major resource of the ocean. Products of seaweeds like alginate and agar are useful in food items such as milk, ice cream and in processed foods for human consumption and in manufacturing toiletries of daily use. In countries like Japan, Indonesia and China seaweeds are having prominent role in their food habits as staple food [1]. According to their nutritive value and chemical constituents they are classified as red algae (Rhodophyta), brown algae (Phaeophyta) or green algae (Chlorophyta). Seaweeds are having traditional use in treating various disorders of thyroid glands due to the presence of notable minerals in them. The bioactive compounds in seaweeds made them to act as antibiotics, antioxidants, wound healers and anti-ulcer products [2]. The antioxidant compounds with good bioactive potentials like fucoxanthin, astaxanthin, carotenoid and polyphenols like phenolic acids, flavonoids, tannins are abundantly present in seaweeds which are effectively rendering the beneficial roles in managing various illness [3]. Seaweeds are loaded with dietary fibre, polyphenols, unsaturated fatty acids, and minerals which are beneficial to human health [4]. Presently, quite a lot of studies

have been done to investigate the therapeutic value of seaweeds as a source of active biochemical compounds [5]. The major compounds responsible for different bioactivities of seaweeds are mostly phenolic compounds and polysaccharides [6]. *Turbinaria ornata* is a brown alga in Indian and Pacific Oceans, they are edible and consumed by the people in Indonesia, Malaysia and other Asian countries. The present study investigates the preliminary phytochemical screening, spectrometric evaluations of phytochemicals of *Turbinaria ornata*.

MATERIALS AND METHODS

Chemicals

Potassium bromide was obtained from Himedia laboratory Ltd., Mumbai, India. All other chemicals were of reagent grade and organic solvents were of spectral grade.

Collection of samples

The marine brown alga *Turbinaria ornata* was collected from the Mandapam coast of Rameshwaram, Tamil Nadu. The algal material was identified and authenticated by Dr. B. Andrews, Project Scientist, National Biodiversity of India, Chennai, Tamil Nadu and a voucher specimen was maintained for future reference. The dried seaweed (50 g) was grounded in electrical mixer and extracted using 250 ml of various solvents such as Acetone, ethanol and methanol for 24 hours in Soxhlet apparatus. Each filtrate was concentrated to dryness and was lyophilized into fine powder.

Preliminary phytochemical Screening

As per the procedures previous well defined procedures

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preliminary phytochemical screenings of three different extracts were carried out [7].

FTIR analysis of methanolic extract of *Turbinaria ornata*

The FTIR analysis of methanolic extract of *Turbinaria ornata* was recorded in the region of 4000-400 cm^{-1} at a resolution of 4 cm^{-1} using an FTIR spectrometer (Bio-Rad, USA) coupled with a TGS (Tri-glycinesulphate) detector. In brief, 1 mg of the dried sample was mixed with 100 mg of potassium bromide (KBr) and was compressed to prepare salt-discs around 3 mm in diameter. These discs were analysed with a Fourier transform infrared spectrophotometer [8].

GCMS analysis of methanolic extract of *Turbinaria ornata*

GCMS analysis of methanolic extract of *Turbinaria ornata* was performed by injecting 1mL of sample on a 5MS column of a GC-MS instrument (PerkinElmer, USA) with helium as the mobile phase. The temperature was set at 80° C at the rate of 3° C/min. The ion temperature was 200°C, and the scan range was 20-500AMU (Atomic Mass Unit). The chemical constituents were identified after comparison with the data available in the library search results attached to the GC-MS instrument [9-10].

RESULTS AND DISCUSSION

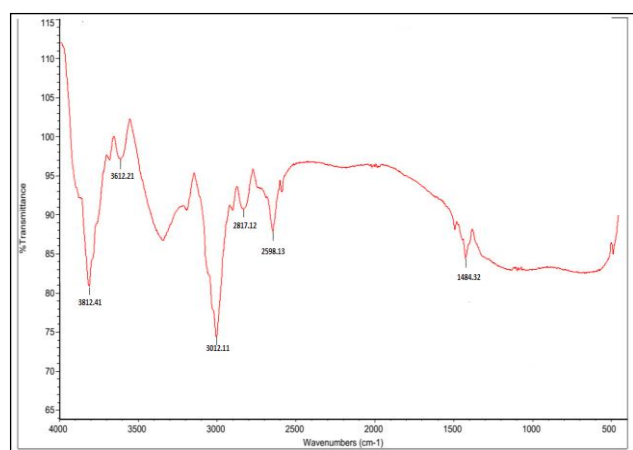


Fig 1 FTIR Spectrum of methanolic extract of *Turbinaria ornata*

FTIR analysis of methanolic extract of *Turbinaria ornata*

(Fig 1) depicts the FTIR analysis of TOME. The FTIR analysis of the samples was done and the associated functional groups were determined, the FTIR spectrum of the TOME sample showed the peaks at range of 3812.41, 3612.21, 3012.11, 2817.12, 2598.13 and 1484.32. The peak ranges are similar to the FTIR spectrum of standard gallic acid. The large absorption peaks at 3152.41 - 3612.21 cm^{-1} was the C-H stretching vibration of alkenes. The peak of asymmetrical O-H stretching absorption band at range of 3612.21 cm^{-1} was plotted. Absorption peak beyond 3612.21 cm^{-1} and between 3012.11 cm^{-1} was N-H stretching of hetero aromatic compounds. C-H stretching peak of alkanes (methyl group) was around 2817.12 cm^{-1} . Thus, the FTIR spectrum clearly elucidated the presence of promising bioactive compounds in *Turbinaria ornata*. Our results are very well supported by the findings of an earlier study [12-13].

GC- MS analysis

(Fig 2) elucidates the GC- MS analysis of crude methanolic extract of *Turbinaria ornata* showed the

Phytochemical analysis of methanolic extract of *Turbinaria ornata*

The (Table 1) elucidates the ethanolic, acetone and methanolic extracts of *Turbinaria ornata* were analysed for the presence of phytochemicals. Methanolic extract of *Turbinaria ornata* shows the presence of carbohydrates, alkaloids, saponins, phenolic compounds, flavonoids, tannins, coumarines, steroids and terpenoids. Our findings are much similar to the reports of earlier study [11].

Table 1 Phytochemical profiling of *Turbinaria ornata* extracts of different solvents

Phytochemicals	Ethanol	Acetone	Methanol
Carbohydrates	-	-	+
Alkaloids	-	-	+
Saponins	-	+	++
Phenolic compounds	+	++	+++
Flavonoids	+	-	+
Tannins	+	+	++
Coumarines	+	+	+
Proteins	-	-	-
Steroids	+	+	+
Anthroquinones	-	+	-
Terpenoids	+	-	+
Cardiac glycosides	-	+	++

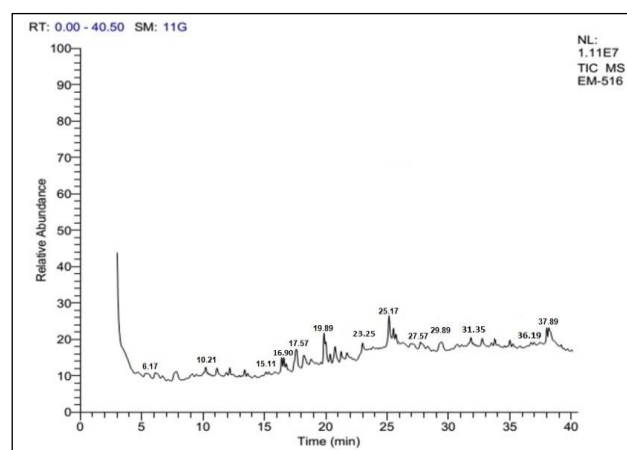


Fig 2 GCMS of methanolic extract of *Turbinaria ornata*

presence of mixture of bioactive compounds. A total of 11 peaks were observed with varied retention times and the noteworthy compounds like neophytadiene, 2-Hexadecen-1-ol, 3,7,11,15-tetramethyl-, [R-[R*,R*-(E)]] and 2,6,10,14,18,22 Tetracosahexaene, 2,6,10,15,19,23 hexamethyl- (CAS) were identified. The molecular formula and molecular weight for the compounds identified were fetched from the library search results of the GC-MS systems and are given in (Table 2).

Neophytadiene was reported to have antipyretic, analgesic, antiinflammatory, antimicrobial and antioxidant activity, likewise 2-Hexadecen-1-ol, 3,7,11,15-tetramethyl-, [R-[R*,R*-(E)]] was established for its exhibition for antimicrobial, anti-inflammatory activity [14]. 2,6,10,14,18,22-Tetracosahexaene, 2,6,10,15,19,23 hexamethyl- (CAS) was reported to have antibacterial, antioxidant, Pesticide, Antitumor, Cancer preventive, Immunostimulant, Chemo preventive and lipoxygenase-inhibitor activity [15]. The results are much corresponds to the previous reports [16].

Table 2 Bioactive compounds identified in GC-MS systems

Retention Time (min)	Compound	Formula	Mwt. (g/mol)
6.17	trans-3-Chloro-1-isopropyl-2-(4-methylphenyl) azetidine	C ₁₃ H ₁₈ ClN	223
10.21	3-Acetyl-2-methyl-3a,4,5,8,9,9a-thexahydro-cyclooctafuran	C ₁₄ H ₁₈ O ₂	218
15.11	1,2-Benzenedicarboxylic acid bis(2-methylpropyl) ester	C ₁₆ H ₂₂ O ₄	278.34
16.90	9-hexadecenoic acid	C ₁₆ H ₃₂ O ₂	254.41
17.57	1,1-Dimethyl-2-(1'-hydroxyethyl)-3,5bis(hydroxymethyl) cyclopentane	C ₁₁ H ₂₂ O ₃	202
19.89	Neophytadiene	C ₂₀ H ₃₈	278
23.25	Bufencarb-2	C ₁₃ H ₁₉ NO ₂	221.30
25.17	2-Hexadecen-1-ol, 3,7,11,15-tetramethyl-, [R-[R*,R*-(E)]]		
31.35	Di-(2-ethylhexyl) phthalate	C ₂₄ H ₃₈ O ₄	390
36.19	2,6,10,14,18,22-Tetracosahexaene,2,6,10,15,19,23 hexamethyl- (CAS)	C ₃₀ H ₅₀	410
37.89	Acetamiprid	C ₁₀ H ₁₁ ClN ₄	222.67

CONCLUSIONS

In the present investigation, preliminary phytochemical profiling of methanolic extract of *Turbinaria ornata* has been done. The phytochemical profiling of *Turbinaria ornata* with FTIR and GC-MS clarified the presence of remarkable

bioactive compounds in the methanolic extract, thus the brown seaweed *Turbinaria ornata* with potent bioactive compounds may significantly have significant protective role in different metabolic insults and disorders.

The authors have no conflict of interest.

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