



## Research Article

### Antibacterial Activity of Aqueous Extract of Sea Weed

#### *Ulva Fasciata* : An *In Vitro* Study

K. Mohana Priya\*, Shabana Kouser Ali

*Biosciences Lab, Medical Biotechnology Division, School of Bio Sciences and Technology,  
VIT University, Vellore, Tamil Nadu - 632 014, India*

---

#### **ABSTRACT**

*Ulva fasciata* is a common sea weed and known for various medicinal properties. The aim of the present study was to screen the antimicrobial activity of *Ulva fasciata* against clinical isolates of bacteria. The aqueous extract of the *U. fasciata* was studied for its antagonistic activity against *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Klebsiella pneumoniae*. In vitro antimicrobial activity was performed by Agar well diffusion method in Muller Hinton agar. The extract showed significant effect on the tested organisms. The extract showed maximum zone of inhibition against *E. coli* ( $15.6 \pm 1.3$ ) whereas, lowest against *K. pneumoniae* ( $11.2 \pm 1.02$ ). Minimum Inhibitory Concentration (MIC) of aqueous extract was measured by modified agar well diffusion method. The MIC value of crude extract was 16.2, 5.4, 7.1 and 15 mg/ml against *E. coli*, *K. pneumoniae*, *P. aeruginosa* and *S. aureus* respectively.

**Keywords:** Antibacterial; *Ulva fasciata*; Well diffusion method; MIC.

---

#### **INTRODUCTION**

Seaweed or Marine macroalgae are renewable resource in marine environment, nearly 6000sps of seaweeds have been identified and divided into different divisions<sup>1</sup>. Seaweeds are excellent source of bioactive compounds such as carotenoids, dietary fibres, protein, essential fatty acids, vitamins and minerals<sup>2</sup>. Seaweeds are used as a manure, cattle feed, food for human consumption and as a source of phycocolloids<sup>3</sup>. Seaweeds have been used as a

---

\*Author for Correspondence

Email: [mohanapriya.k@vit.ac.in](mailto:mohanapriya.k@vit.ac.in)

biofertilizers because of the presence of trace elements and metabolites<sup>4</sup>. Recently, marine algae have been utilized in Japan as a raw material for the various seafood products<sup>5</sup>. Seaweed contains high nutritional value, so it has been widely used for human consumption<sup>6</sup>. Seaweed can be a source of essential fatty acids. It has antiviral activity<sup>7</sup>.

*Ulva fasciata*, also known as Lime palahalaha and Sea lettuce is common green alga that is used for consumption in many parts of the world. *U. fasciata* belongs to the family Ulvaceae grows in coastal region of Asia-pacific region Chlorophyton seaweeds. They are widely distributed in both inter-tidal and deep water region of the seas. These seaweeds are immense pharmaceutical and agricultural value<sup>8</sup>. Many compounds are isolated from green algae are known to exhibit biological activities<sup>9</sup>. Sphingosine derivative of *U. fasciata* isolated from West coast of India shows antiviral activity<sup>10</sup>. *U. fasciata* is used in soups and salads, and has been reported to possess antioxidant and antibacterial activity. *Ulva* species are rich in essential nutrients and they exhibit anti-peroxidative and anti-hyperlipidaemic activities<sup>11</sup>.

## **MATERIALS AND METHODS**

### **Sample collection**

Sea weed, *Ulva fasciata* was collected from Ennore coast, Chennai, TN, India, during January 2011. The sample was brought to the Bioscience Laboratory, VIT University. Sea weed was identified by the experts of VIT University, Vellore, TN, India

### **Processing of the sea weed**

Sea weeds were collected and washed properly with distilled water. The weeds were shade dried at room temperature. Dried weeds were uniformly grinded using mortar and pestle. Ten grams of plant powder was soaked in 100 ml of distilled water in a conical flask and kept on an orbit shaker at a speed of 120 rpm for 24 hours. The mixture was filtered using Whatman filter paper no 1. The filtrate was concentrated using rotary evaporator and dried using lyophilizer. Dried extract was collected in an air tight container and stored at 4°C<sup>12</sup>.

### **Test Microorganism**

The following six clinical isolates of bacteria were used for the study: *S. aureus* ATCC 25923, *K. pneumonia* ATCC 13883, *P. aeruginosa* ATCC 27853 and *E. coli* ATCC 25922. All these cultures were maintained on nutrient agar plates at 37°C.

### **Positive and negative control**

Ampicillin disc was used as a positive control for all organisms. Sterilized distilled water was used as negative control.

### Antibacterial assay

Antimicrobial activity of the crude extracts was determined by the agar well diffusion method<sup>13</sup>. All test organisms were inoculated in Luria Bertani broth (pH 7.4.) for 24 hours. The cultures of the organisms were seeded on Mueller Hinton agar plates by using sterilized cotton swabs. Agar surface was bored by using sterilized gel borer to make wells (7 mm diameter). The 100 µl of the test extract and 100 µl of sterilized distilled water (negative control) were poured in to separate wells. The standard antibiotic disc was used as positive control. Plates were incubated at 37°C for 48 hours. Triplicates were maintained for each test.

### Determination of minimum inhibitory concentration (MIC)

MIC of the sea weed extract was performed by modified agar well diffusion method<sup>14</sup>. Two fold serial dilution of the stock solution was prepared in sterilized distilled water to make concentration range from 0.1-100 mg/ml. The bacterial suspensions were seeded on MHA plates using a sterilized cotton swab. In each of these plates four wells were cut out using a standard cork borer (7 mm). Using a micropipette, 100 µl of each dilution was added in to wells. All the plates were incubated at 37°C for 24 hours. Antibacterial activity of the leaf extract was evaluated by measuring the zone of inhibition.

### Statistical analysis

The values of antimicrobial activity of the aqueous sea weed extract of *U. fasciata* were expressed as Mean ± Standard deviation (n= 3) for each sample.

## RESULTS AND DISCUSSION

Sea weeds are being probed as an alternate source to get therapeutic compounds based on their medicinal properties. *U.fasciata* is easily available in south coast of India. The usage of this sea weeds for medicinal purpose was reported by several researchers. The aqueous extract of *U.fasciata* exhibited the antibacterial activity against four isolates of bacteria (Table. 1) and the results were expressed as Mean ±Standard deviation (n=3). Minimum inhibitory concentration values were showed in Table 2.

<i>E. coli</i>	<i>K. pneumoniae</i>	<i>P. aeruginosa</i>	<i>S. aureus</i>
16.2	5.4	2.8	15

Methanol extract of the sea weed *Ulva fasciata* were active against *P.aeruginosa*, *X. campestris* and *E. carotovora*. Methanol-insoluble extract inhibited the growth of T.mentagrophytes<sup>15</sup>. Compounds isolated from *Ulva fasciata* shows antibacterial activity

against marine aquacultural pathogens, namely *Vibrio parahaemolyticus* MTCC 451, *Vibrio alginolyticus* MTCC 4439, and *Vibrio vulnificus* MTCC 1145<sup>8</sup>.

**Table 1. Antimicrobial activity of *Ulva fasciata*:**

<i>Test organisms</i>	<i>Aqueous Extract</i>	<i>Positive control</i>	<i>Negative control</i>
<i>Escherichia coli</i>	15.6±1.3	17.2±1.8	0
<i>Klebsiella pneumoniae</i>	11.2±1.02	13.2±0.86	0
<i>Pseudomonas aeruginosa</i>	8.4±1.15	11.8±1.56	0
<i>Staphylococcus aureus</i>	14.8±0.96	16.5±1.37	0

Zone of inhibition measured in mm.

Values are expressed as mean ± standard deviation of the three replicates.

**Table 2. MIC values of aqueous extract of *Ulva fasciata* on test organisms.**

Minimum inhibitory concentration (mg/ml)
--

Previous studies shows *Ulva fasciata* contains certain phytochemicals such as alkaloid, flavanoid, phenolics, tannins, sterols, glycosides, terpenoids may acknowledge the medicinal properties of sea weed<sup>16</sup>.

We conclude that represents an *Ulva fasciata* rich source of valuable medicinal compounds and extract of *Ulva fasciata* contain high antibacterial activity and can be further be explored for the isolation of its bioactive compound.

## ACKNOWLEDGEMENT

The authors wish to thank the Vice chancellor Dr. V. Raju, Guides and Colleagues of VIT University, Vellore, TN, India for their constant encouragement and providing necessary facilities to carry out this study.

## REFERENCES

1. FAO, Year book of fishery statistics, Food and Agricultural Organisation of the United Nations, Rome, 2006, 98.
2. Fred CT, Mechanisms of antimicrobial resistance in bacteria, The American Journal of Medicine, 119, 2006, 3–10.
3. Chapman GJ, Seaweeds and Their Uses, Methuen and Co. Ltd, London, 1970, 66.
4. Booth E, The manufacture and properties of liquid seaweed extracts, Proc. Int. Seaweed Symp, 6, 1996, 655–662.

5. Rouxel C, Bonnabeze E, Daniel A, Jérôme M, Etienne M, Fleurence J, Identification by SDS PAGE of green seaweeds (*Ulva* and *Enteromorpha*) used in the food industry. *Journal of Applied Phycology*, 13, 2001, 218.
6. Hari S, Garg, Mithlesh Sharma, Dewan S, Bhakuni Birenda N, Pramanik, Ajay K. Bose, An antiviral sphingosine derivative from the green alga *Ulva fasciata*, *Tetrahedron Letters*, 33(12), 1992, 1641-44.
7. Nisizawa K, Noda H, Kikuchi R, Watanabe T, The main seaweeds in Japan. *Hydrobiologia*, 151-152, 1987, 5-29.
8. Chakraborty, Kajal, Lipton AP, Paulraj R, Vijayan KK, Antibacterial labdane diterpenoids of *Ulva fasciata Delile* from southwestern coast of the Indian Peninsula, *Food Chemistry*, 119 (4), 2010,1399-1408.
9. Blunt JW, Copp BR, Munro MHG, Northcote PT, Prinsep MR, Marine natural products. *Natural Product Reports*, 23, 2006, 26–78.
10. Joseph Selvin, Aaron Premnath, Lipton, Biopotentials of *Ulva fasciata* and *Hypnea musciformis* collected from the peninsular coast of India, *Journal of Marine Science and Technology*, 12(1), 2004, 1-6.
11. Sathivel A, Raghavendran HRB, Srinivasan P, Devaki T, Antiperoxidative and anti-hyperlipidemic nature of *Ulva lactuca* crude polysaccharide on D-galactosamine induced hepatitis in rats. *Food and Chemical Toxicology*, 46, 2008, 3262–3267.
12. Gaurav Kumar, Karthik L, Bhaskara Rao KV, In vitro anti-Candida activity of *Calotropis gigantea* against clinical isolates of Candida, *Journal of Pharmacy Research*, 3, 2010, 539-542.
13. Tagg TR, Dajani AS, Wannamaker LW, Bacteriocin of Gram positive bacteria, *Bacteriological Reviews*, 1976, 40722-756
14. Rios JL, Recio MC, Vilar A, Screening methods for natural products with antimicrobial activity: A review of literature, *Journal of Ethnopharmacology*, 23,1988, 127-149
15. Rouxel C, Bonnabeze E, Daniel A, Jérôme M, Etienne M, Fleurence J, Identification by SDS PAGE of green seaweeds (*Ulva* and *Enteromorpha*) used in the food industry. *Journal of Applied Phycology*, 13, 2001, 218.
16. Roberta Paulert, Artur smania, Marciel J, Stadnik, Moacir G Pizzolat, Antimicrobial properties of extracts from the green seaweed *Ulva fasciata delile* against pathogenic bacteria and fungi, *Algological studies*, 2007, 123-130.