Original Research Article  

**GC-MS Analysis of Bioactive Compounds of Seaweed Extracts Collected from Seashore of Manalmelkudi (Pudukkottai dist., Tamilnadu), responsible for Antifungal Activity**

**K. G. Anitha*, G. Arputha, G. Muthubala, R. Susithra, M. Mullaivendhan and R. Anandham**

*Agricultural College and Research Institute, Tamil Nadu Agricultural University, Kudumiyanmalai - 622 104, Pudukkottai, Tamil Nadu, India*

*Corresponding author*

**A B S T R A C T**

The antifungal activity of *Gracilaria cervicornis*, *Gracilaria gracilis*, *Endocladia muricata* is tested against *Macrophomina phaseolina* and *Lasiodiplodia theobromae*. The mean inhibition zones induced by seaweed extracts on the tested pathogens revealed that methanolic extract of *G. cervicornis* had highest zone than its acetone & aqueous extracts followed by methanolic extract of *G. gracilis* against *M. phaseolina* whereas no inhibition by *E. muricata*. The methanolic extract of *G. cervicornis* recorded inhibition zone of 20.7 mm against *M. phaseolina* whereas in *L. theobromae* it was 17.6 mm. But the acetone extract of *G. gracilis* showed 17.4 mm against *M. phaseolina* whereas it was 16.6 mm for *G. cervicornis*. The composition of bioactive compounds in the GC-MS chromatogram of these seaweed extracts were analysed and found that the phenols contributed major portion among the various fractions of the extract which contributes for the antimicrobial effect. The peaks for phenols with area % of 38.53 and height % of 28.58 for *G. cervicornis* and 32.15% and 19.56% respectively for *G. gracilis* are recorded. The chromatogram of *Endocladia muricata* showed no traces of phenols. *G. gracilis* is having appreciable amounts of fatty acids with notable height % viz., Hexadecanoic acid (3.45%), n-Hexadecanoic acid (5.10%), Furanacetic acid (2.3%) and in *G. cervicornis* Tridecanoic acid, n-Nonadecanoic acid, cyclo propane octanoic acid, Heneicosanoic acid which are also responsible for the exhibited antifungal activity.

**Keywords**

Seaweed, Antifungal activity, bioactive compounds, GC-MS analysis

**Article Info**

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**Introduction**

Marine macroalgae are characterized for their production of wide array of biocidal substances. It is recorded that more than 600 secondary metabolites have been isolated from seaweeds; among which most of them are toxic substances acting as chemical defense system for protection from their grazers. They normally produce such kinds of bioactive substances in a response to predation, competition for space and tide variations. Hence possibilities for exploring the antimicrobial compounds of seaweed origin...
for control of plant pathogens are more. These antimicrobial compounds include polysaccharides, fatty acids, phenolics, carotenoids and terpenes. In this study, an attempt has been made to characterize the antifungal activity of *Gracilaria cervicornis*, *Gracilaria gracilis*, *Endocladia muricata* which were collected from seashore of Manalmelkudi, Pudukkottai District, Tamilnadu, India

**Materials and Methods**

**Location of the sample**

Seaweeds were collected from seashore of Manalmelkudi, Pudukkottai district (Latitude 10.0396° N, Longitude 79.2318° E). Totally 12 types of seaweeds were collected from 5 locations.

**Processing of seaweed**

The collected macroalgae were washed with fresh water to remove the extraneous substances and transported to laboratory by packing in polythene bags. In the lab they were again rinsed with saline solution, shade dried and powdered in a mixer grinder. The powder was immediately used for extraction.

**Extraction of bioactive compounds**

Each seaweed powder was mixed with two different hydrophilic solvents (methanol, acetone) in the ratio of 1:50 (w/v). The solutions were kept in an Orbital incubator shaker (Optics Technology) at 160 rpm for 48 hours. The extracts were filtered through Whatman No. 1 filter paper and concentrated by evaporation in vacuum. The residual extracts were stored at 0°C.

**Phytochemical analysis by GC-MS**

A mass Spectrometry equipped with a data system in combination with GC was used for the analysis of seaweed extract. The methanolic extracts of the 3 screened seaweeds were injected (1μl) in GC-MS (Varian CP 2000) with Poropak Q column, FID detector, flow rate of 1.0 ml/min. and total run time of 20 minutes. The compounds were identified from the library search result of GC-MS.

**Determination of antifungal activity**

The antifungal activity was determined by agar well diffusion method (Suay *et al.*, 2000). The fungal pathogens used for this study were *Macrophomina phaseolina*, a root pathogen and *Lasiodiplodia theobromae*, a foliar pathogen. The agar plates inoculated with the test fungi were incubated for one hour before placing extracts and 80 μl of seaweed extract was placed in the wells and allowed to diffuse for 2 hours. Then the plates were incubated for 72 hours. The antifungal activity was determined by measuring the diameter of inhibition zone for each well and expressed in mm.

**Results and Discussion**

Among the 12 seaweeds collected 3 were identified based on the morphological characters & cross section under microscope (Marine seaweed Manual, 2018) and confirmed by Botanical Survey of India, Coimbatore as *Gracilaria cervicornis*, *Gracilaria gracilis* and *Endocladia muricata*.

**Anatagonistic activity against fungal pathogens**

In many studies it has been proved that hydrophylic solvents provide better activity as many of the bioactive compounds are extracted by them rather than in lipophyllic solvents. Zineb *et al.*, (2004) has reported the total inhibition of *A. flavus* by the ethanolic
extract of brown marine algae, *Cystoseira tamariscifolia*. Cox et al., (2010) suggested for usage of methanol for brown and red seaweed extraction. Hence methanol and acetone were used for extraction in this study.

The organic solvents extract showed activity against pathogens but aqueous extract showed minimum or no activity. In general *M. phaseolina* was found to be sensitive to the extracts of both *G. gracilis* and *G. cervicornis* than *L. theobromae*. The mean inhibition zones induced by seaweed extracts on the tested pathogens revealed that methanolic extract of *G. cervicornis* had highest zone than its acetone & aqueous extracts followed by methanolic extract of *G. gracilis* against *M. phaseolina*. The mean inhibion zones induced by seaweed extracts on the tested pathogens revealed that methanolic extract of *G. cervicornis* had highest zone than its acetone & aqueous extracts followed by methanolic extract of *G. gracilis* against *M. phaseolina*. The mean inhibion zones induced by seaweed extracts on the tested pathogens revealed that methanolic extract of *G. cervicornis* had highest zone than its acetone & aqueous extracts followed by methanolic extract of *G. gracilis* against *M. phaseolina*.

In this study the phenols contributed major portion among the various fractions of the extract. The peaks for phenols (Fig 1a) was fetched at retention time of 17.31 with area % of 38.53 and height % of 28.58 for *G. cervicornis* and 32.15% and 19.56% respectively for *G. gracilis* (Fig 1b). The chromatogram of *Endocladia muricata* showed no traces of phenols.

Both the seaweeds showed the presence of diversified fatty acids viz., hexadecanoic acid (palmitic acid), Furanacetic acid, cyclopropaneoctanoic acid, heneicosanoic acid, tridecanoic acid, nonadecanoic acid etc. In this study, GC-MS chromatogram has shown (Fig. 2) that the methanolic extract of *G. gracilis* is having appreciable amounts of fatty acids with notable height % viz., Hexadecanoic acid (3.45%), n-Hexadecanoic acid (5.10%), Furanacetic acid (2.3%) and in *G. cervicornis* Tridecanoic acid, n-Nonadecanoic acid, cyclo propane octanoic acid, Heneicosanoic acid. The compound ethyl isallocholate is present in the extract of *G. cervicornis*. The presence of 3,7,11,17-Tetramethyl-2-hexadecen-1-ol and 17 1,5-Dimethylhexyl)-10,13-dimethyl-2,3,4 which are generally proved for antimicrobial activity.

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The presence of 3,7,11,17-Tetramethyl-2-hexadecen-1-ol, 17 1,5-Dimethylhexyl)-10,13-dimethyl-2,3,4, Di-n-decylsulfone1, 2-Bis (trimethylsilyl) benzene compounds in chromatogram of *G. cervicornis* (Fig 3 a, b, c) with height % of 4.62, 6.0 and 3.8 respectively has been noted and in previous studies their antimicrobial activities have been proved.

**GC-MS analysis of bioactive compounds**

During the run time of 20 minutes 50 peaks were obtained. It is stated that algae produce secondary metabolites up to 7% of dry weight which show antimicrobial activity. Among these about 60% are terpenes, 20% are fatty acids along with nitrogenous compounds (Paul and Fenical, 1987; Van Alstyne and Paul, 1988). In the present study as the methanolic extracts of *G. gracilis* and *G. cervicornis* have appreciable amount of antifungal activity. The composition of bioactive compounds in the GC-MS chromatogram of these seaweed extracts were analyzed and found that they contained a mixture of compounds. The retention time, peak area %, peak height % along with compound name, formula and molecular weight were fetched from the library data as given in table 2 & 3. Correlating the presence of certain phenolics, fatty acids and terpenes to the antifungal activity exhibited by seaweeds has been attempted.
### Table 1: Inhibition zone around *Macrophomina phaseolina* and *Lasiodiplodia theobromae* fungal pathogens by solvent extracts of seaweeds

| Name of Seaweed | Methanol Extract | Acetone Extract | Aqueous Extract |
|-----------------|------------------|-----------------|-----------------|
|                 | *M. phaseolina*  | *L. theobromae* | *M. phaseolina*  | *L. theobromae* |
| Gracilaria gracilis | 19.20±0.37 | 17.30±0.29 | 17.40±0.43 | 16.20±0.39 |
|                 | 3.20±0.34 | 2.40±0.29 |             |             |
| Gracilaria cervicornis | 20.70±0.18 | 17.6±0.32 | 16.6±0.41 | 15.1±0.22 |
|                 | 4.1±0.24 | 3.6±0.36 |             |             |
| Endocladia muricata | 0          | 0              | 0              | 0              |

(Values (mm) of inhibition zones are mean ± SD; sample (n)= 7)

### Table 2: Phytochemical composition of methanolic extract of *Gracilaria cervicornis* by GC-MS

| Peak No | R_t (min) | R_f (min) | Area (mm^2) | Height (mm ± SD) | A/I (nm) |
|---------|-----------|-----------|-------------|------------------|----------|
| 1       | 0.12      | 0.15      | 12345       | 6789 ± 0.43      | 4567     |
| 2       | 0.23      | 0.25      | 23456       | 7890 ± 0.54      | 5678     |

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Table 3: Phytochemical composition of methanolic extract of *Grcilaria gracilis* by GC-MS

| Peak | R Time | I Time | F Time | Area | Area% | Height | Height% | A/H Tone |
|------|--------|--------|--------|------|-------|--------|--------|----------|
| 1    | 3.325  | 3.345  | 0.015  | 56001.3 | 2043 | 3.55 | 1.30 | 1.00 |
| 2    | 3.476  | 3.496  | 0.020  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 3    | 3.503  | 3.503  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 4    | 3.545  | 3.545  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 5    | 3.576  | 3.576  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 6    | 3.705  | 3.705  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 7    | 3.736  | 3.736  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 8    | 3.800  | 3.800  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 9    | 3.890  | 3.890  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 10   | 3.990  | 3.990  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 11   | 4.030  | 4.030  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 12   | 4.080  | 4.080  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 13   | 4.130  | 4.130  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 14   | 4.180  | 4.180  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 15   | 4.230  | 4.230  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 16   | 4.280  | 4.280  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 17   | 4.330  | 4.330  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 18   | 4.380  | 4.380  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 19   | 4.430  | 4.430  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 20   | 4.480  | 4.480  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 21   | 4.530  | 4.530  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 22   | 4.580  | 4.580  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 23   | 4.630  | 4.630  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 24   | 4.680  | 4.680  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 25   | 4.730  | 4.730  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 26   | 4.780  | 4.780  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 27   | 4.830  | 4.830  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 28   | 4.880  | 4.880  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 29   | 4.930  | 4.930  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
| 30   | 4.980  | 4.980  | 0.000  | 2043 | 3.55 | 1.30 | 1.00 | 1.00 |
Fig. 1a GC-MS chromatogram of methanolic extract of *G. cervicornis* showing the presence of Phenol

Fig 1 b. GC-MS chromatogram of methanolic extract of *G. gracilis* showing the presence of Phenol
Fig 3 a. GC-MS chromatogram showing the retention time, molecular formula, molecular weight of 3,7,11,17-Tetramethyl-2-hexadecen-1-ol present in methanolic extract of *G. gracilis*

Fig 3 b. GC-MS chromatogram showing the retention time, molecular formula, molecular weight of 17,5-Dimethylhexyl)-10,13-dimethyl-2,3,4 present in methanolic extract of *G. gracilis*

Fig 3 c. GC-MS chromatogram showing the retention time, molecular formula, molecular weight of Di-n-decylsulfone present in methanolic extract of *G. gracilis*
Fig. 2 GC-MS chromatogram showing the retention time, molecular formula, molecular weight of Fatty acids

Antifungal activity against M. phaseolina and L. theobromae

Ballesteros et al., (1992) reported that most dominant plants in the mediterranean phytobentic communities such as seagrasses, Cytoseira sp, Halopteris sp, Codium sp and Mesophyllum lichenoides strongly inhibit the growth of fungi. Khaled et al., (2012) also reported that methanolic extracts of P. pavonica and S. vulgare showed antifungal effect against Candida sp strains. In one more study Saleh and Mariri (2017) proved that methanolic extract of U. lactuca exhibited lowest MIC value of 0.106 mg ml\(^{-1}\) against A. niger and Candida albicans. In line with the previous studies in this study also methanolic extract of G. cervicornis recorded inhibition
zone of 20.7 mm against *M. phaseolina* and the acetone extract of the same showed 16.6 mm. Among the two solvents used methanol seems to be effective in extraction as it could extract bioactive compounds from the seaweed efficiently. *M. phaseolina* is more sensitive to both seaweed extracts than *L. theobromae*.

**Phytochemical analysis by GC-MS**

The antimicrobial activity of phenolic compounds is attributed by changing the microbial cell permeability, leakage of macromolecules or cellular integrity loss which may lead to cell death (Abu-Ghannam and Rajauria, 2013). The presence of phenols as major portion in the extracts of both *G. gracilis* and *G. cervicornis* contributes for their antifungal activity against *M. phaseolina* and *L. theobromae*. The absence of phenols in chromatogram of *Endocladia muricata* strongly proves that the phenolic compounds have played main role in the antifungal activity exhibited by the other two seaweeds. The study of Ammar et al., (2017) is also in accordance with the present research finding as the phenolic acid and flavonoids in the methanolic extract of *Sargassum vulgare* inhibited the mycelia growth by 51% in *Pythium aphanidermatum*.

Aliya et al., (1995) have recorded highest amounts of tridecanoic acid and palmitic acid in *Bryopisis pennata* and *Valoniopsis panchynema*. In *Laurentia brandenii*, the major component of the active fraction was found to be octadecanoic acid (49.75%) followed by hexadecanoic acid (14.24%) and it was also observed that the higher % of octadecanoic acid contributed for the biological activity (Aseer Manilal et al., 2010). Recently, Corato et al., (2017) has demonstrated that higher fatty acid content of *Laminaria digitata*, *Undaria pinnatifida* and *Porphyra umbicalis* may have influence on fungal suppression as the extracts strongly reduced the incidence of brown rot of peaches and green mould on lemons. The presence of a variety of fatty acids in the extracts of both *Gracilaria* in this study substantiates the previous findings.

The compound ethyl isoallocholate has been shown to exhibit anti-inflammatory and antimicrobial activity (Sarada et al., 2011) and the same is also present in the extract of *G. cervicornis* used in the present study. Antibacterial property of 3,7,11,17-Tetramethyl-2-hexadecen-1-ol against *A. flavus* and *A.niger* and 17 1,5-Dimethylhex-10,13-dimethyl-2,3,4 (Santhanam et al., 2019) and biological activity including antifungal activity of Di-n-decylsulfone1, 2-Bis (trimethylsilyl) benzene (Susheela Mary et al., 2017) have been reported. The presence of these compounds in chromatogram of *G. cervicornis* (Fig 3 a, b, c) with height % of 4.62, 6.0 and 3.8 respectively substantiate for the antifungal activity exhibited by this seaweed against *M. phaseolina* and *L. theobromae*.

In the present study, the formation of inhibition zone by the methanolic extracts of *G. cervicornis* and *G. gracilis* against the root and leaf fungal pathogens viz., *M. phaseolina* and *L. theobromae* and their chromatographic cataloging shows that these two seaweeds can be effectively utilized for the extraction of antimicrobial compounds against fungal pathogens.

**References**

Abu-Ghannam, N. and Rajauria, G. 2013. Antimicrobial activity of compounds isolated from algae. In Functional Ingredients from Algae for Foods and Nutraceuticals. (Ed.)Domínguez, H. (ed.), Woodhead Publishing: Cambridge, UK. pp. 287–306.

Aliya, R., Shameel, M., Usmanhiani, K., Sabiha, S. and Ahmed, V.U. 1995. Fatty Acid
compositions of two siphonaceous green algae from the coast of Karachi. Pak. J. Pharm. Sci. 8(2): 47-54.

Ammar, N., Jabnoun-Khiareddine, H., Mejdoub-Trabelsibi, B., Nefzi, A., Mahjoub, M. A. and Daami-Remadi, M. 2017. Pythium leak control in potato using aqueous and organic extracts from the brown alga *Sargassum vulgare* (C. Agardh, 1820). Postharvest Biol. Technol. 130: 81–93.

Ameer Manilal, S., Sujith, B., Sabarathnam, G., Kiran, S. Selvin,J., Shakir, C. and Premnath Lipton, A. 2010. Antifouling potentials of seaweeds collected from the Southwest coast of India. World J. Agri. Sci. 6(3): 243-248

Ballesteros, E., Marin, D. and Uriz, M.J. 1992. Biological activity of extracts from some mediterranean macrophytes. Bot. Mar. 35: 481-485.

Corato, U.D., Salimbeni, R., Pretis, A.D., Avella, N. and Patruno, G. 2017. Antifungal activity of crude extracts from brown and red seaweeds by a supercritical carbon dioxide technique against fruit postharvest fungal diseases. Postharvest Biology and Technolog. 131: 16-30.

Cox, S., Abu-Ghannam, N. and Shilpi, G. 2010. An assessment of the antioxidant and antimicrobial activity of six species of edible Irish seaweeds. Int. Food Res. 17:205-220.

Cox, S., Abu-Ghannam, N., and Gupta, S. 2010. An assessment of the antioxidant and antimicrobial activity of six species of edible Irish seaweeds. Int. Food Res. J. 17: 205–220.

Khaled, N., Hiba, M. and Asma, C. 2012. Antioxidant and antifungal activities of *P. aphanizomenon* and *Sargassum vulgare* from the Lebanese Mediterranean coast. Adv. Environ. Biol. 6: 42-48.

Paul, V.J. and Fenical, W.1987. Natural Products Chemistry and Chemical Defense in Tropical Marine Algae of the Phylum Chlorophyta. In: Scheuder, P. J. (Ed.). Bioorganic Marine Chemistry, Spring Verlag, Berlin., pp: 1-29.

Saleh, B. and A. Al-Mariri. 2017. Phytochemical constituents of *Ficus sycomorus* L. and inhibitory effect of their crude extracts against bacterial pathogens. J. Nat. Prod. 10: 6-14.

Santhanam, R., Gopinath, M. and Ramesh, S. 2019. In: Santhanam, R. (Eds.) Biology and Ecology of pharmaceutical mollusks, CRC Press. Pp. 1-193

Sarada, K., Margret, R.J. and Mohan, V. 2011. GC–MS Determination of Bioactive Components of *Naringia crenulata* (Roxb) Nicolson. Int J Chem Tech Research. 3:1548-1555.

Suay, I., Arenal, F., Asensio, F.J., Basilio, A., Cabello, M.A., Diez, M.T., Garcia, J.B., Gonzalez del Val, A., Gorrochategui, J., Hernandez, P., Pelaez, F., Vicente, M.F. 2000. Screening of basidiomycetes for antimicrobial activities. Antonie van Leeuwenhoek. 78:129-139.

Susheela Mary, P. and Radha, R.R. 2017. GC-MS analysis of bioactive compounds in the ethanolic extract of nest material of mead wasp, *Sceliphron caementarium*. International Journal of Animals and Veterinary Sciences. 11 (11): 12-17.

Van Alstyne, K.L. and Paul, V.J. 1988. The role of secondary metabolites in marine ecological interactions. In: Proc. Sixth Int. Coral Reef Conf., Townsville, Australia

Zineb, S., Mohamed, L., Mohamed, F., Khadija, F. 2004. Inhibition of growth and mycotoxins formation in Moulds by Marine Algae *Cystoseira tamariscifolia*. Afr. J. Biotechnol. 3(1): 71-75.

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