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Research Article

Antifungal activity of *Caulerpa racemosa* against *Fusarium oxysporum* of *Cucumis sativus*

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Abstract

Seaweed is the largest marine algal community which has numerous beneficial characters. These Seaweeds are extensively studied for their Antimicrobial properties. The present investigation reveals the Antifungal activity of the Marine Macro Algae *Caulerpa racemosa* against the fungal pathogen *Fusarium oxysporum* which cause the Fusarium wilt (Cucumber wilt, foot rot) of Cucumber (*Cucumis sativus*). Cucumber is widely cultivated in India, and it is a valuable cash crop for little farmers. Many different varieties of the plant are traded in the global market. In south India especially in Tamilnadu *Cucumis sativus* species is widely cultivated and is known for its economical and medicinal values.

Keywords: Seaweed, Fusarium wilt, Cucumber, Algae

Introduction

The use of biological agents in controlling the plant pathogens which cause serious disasters on Agricultural crops has turned great scope for biologists in exploring the active agents which have the potential to control such disease causing organisms. Cucumber, *Cucumis sativus*, is a warm season, vining, annual plant in the family Cucurbitaceae grown for its edible cucumber fruit. It is widely cultivated in India, particularly in the southern states. Many different varieties of the plant are traded in the global market. In south India especially in Tamilnadu *Cucumis sativus* species is widely cultivated and is known for its economical and medicinal values. The plant is infected by various microorganism of which *Fusarium oxysporum* is one among them which shows the symptoms such as rotting of seedling stems at soil line; brown lesions on one side of stem; discoloration of tissue inside.

Seaweeds or the Marine Macro algae are the potential resource of bioactive compounds as they are considered to produce a great variety of secondary metabolites characterized by a broad spectrum of biological activities (Cox et al., 2010) with Antimicrobial activities (Del Val et al., 2001) which acts as potential bioactive compounds of interest (Solomon and Santhi, 2008). There have been a number of reports of antibacterial activity from marine plants (Al-Haj et al., 2010) and special attention has been reported for antibacterial and/or antifungal activities related to marine algae against several pathogens (Kolanjinathan and Stella, 2009). The seaweeds living in the sea are constantly exposed to potentially dangerous co-exiting microbes and they have apparently evolved with chemical defense strategies by synthesizing array of secondary metabolites in order to defend against the microbial thread (Kubanek et al, 2003).

Rigorous application of pesticides of chemical origin in agriculture crops caused damage to the environmental state of the agricultural system (Abetz and Young, 1983). The fungicides of biological origin are less toxic which generally act against only the target organism. It is considered to be very effective in little quantities and are decomposable, thereby it becomes eco-friendly.

Materials and Methods

In the present study, effect of *Caulerpa racemosa* occurring along the coastal regions of south India was investigated against *Fusarium oxysporum*. The algal material *was* washed thoroughly with sea water to remove all the unwanted impurities, adhering sand particles and epiphytes. Morphologically distinct thalli of algae were placed separately in polythene bags and were kept in an ice box and brought to the laboratory. Samples were washed thoroughly using tap water to remove the surface salt and then blotted to remove excess water. Then they were air dried under shade in laboratory for 3 days. The shade-dried samples were chopped and pulverized. Each 50 g powdered sample was separately extracted in 500 ml of 1:1(v/v) chloroform: methanol using 1 litre Erlenmeyer conical flask under dark condition. The extracts were pooled and concentrated by using flask evaporator under reduced pressure at 45°C and weighed stored at 0°C. The plant pathogen was F. oxysporum isolates were isolated from C. sativus of diseased plants in suppressive fields located in Southern part of Villupuram District, Tamilnadu, India.

Results

Antifungal efficiency of various solvent extracts of algae *Caulerpa racemosa* are shown in table 1. antifungal activity of various extract of *Caulerpa racemosa* were tested against various micro organism. The methanol extracts showed maximum antibacterial and antifungal activity than petroleum ether and chloroform extracts the zone of inhibition were ranged between 15.1 to 2.8mm against fungal strain. From the study the methanol extract shows promising antifungal activity gainst the fungal strain and its showed maximum activity. The minimum inhibitory concentration of methanol extract was tested against the fungal strains. The 100µg/ml concentration showed inhibitory effect against fungal strain as shown in the table-2. As the concentration increases from 100µg/ml, 500µg/ml, 1mg/ml, 10mg/ml, 50mg/ml, the inhibitory effect also increases proportionality the maximum inhibitory effect absorbed with 50mg/ml of methanol extract. The active principles of algae are responsible for antifungal activity. It is clear that the algae *Caulerpa racemosa* has the potential to control the fungal pathogen *Fusarium oxysporum* which causes the fungal disease to a larger extent.

Table 1: Antifungal activity of seaweed extract of *Caulerpa racemosa* against the fungal pathogen *Fusarium oxysporum* in different extracts

Solvent Extracts	**Zone of Inhibition (mm)***
Pet. Ether Extract	8.38 ± 0.37
Chloroform extract	6.5 ± 0.32
Methanol extract	14.31 ± 0.27

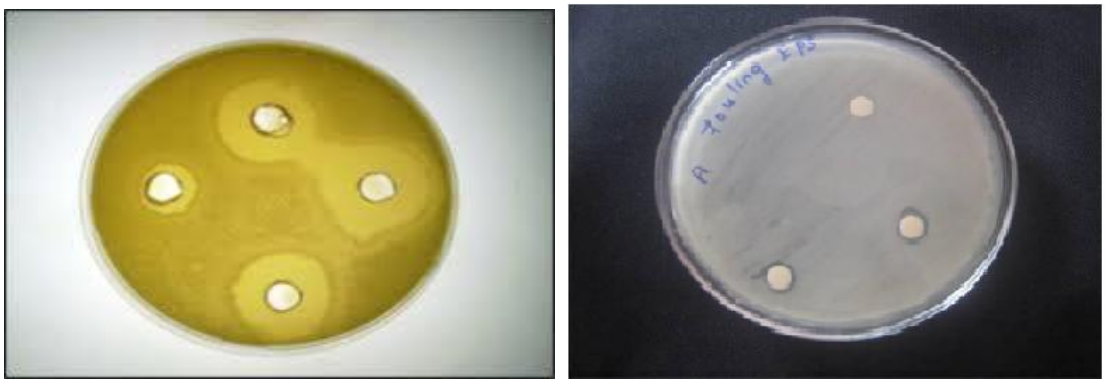
* Zone are Mean ± SD for n=6

Table 2: Minimum Inhibitory Concentration of Methanolic extract

Test pathogen	Zone of Inhibition (mm)					
	100 mcg/ml	500 mcg/ml	1mg/ml	10mg/ml	50 mg/ml	Standard*
Fusarium oxysporum	10	11	11	15	16	19

* Standard for Antifungal – Fusarium Sp (100mcg/ml)

Figure. 1 Antifungal activity of seaweed extract of *Caulerpa racemosa*



Zones of Inhibition

Discussion

Cucumis sativus L. (cucumber) is one of the most important vegetable crops in India and local varieties are susceptible to Fusarium diseases, causing significant crop loss annually. Fusarium root and stem rot is regarded as one of the most devastating diseases in cucurbits affecting cultivations in many countries around the world (Pavlou & Vakalounakis, 2005). The fungus survives as chlamydospores, which come into contact with roots, will germinate to infect the root systems. After infection, the pathogen will colonize the vascular system leading to wilting, and eventually, plant mortality occurs. Seaweed product (Jayaraj *et al*., 2009) based on *Ascophyllum nodosum* is a well known plant growth stimulator, which improves general plant health and enhances plant resistance to nematodes, pests and fungal diseases. As for the effectiveness of the extraction method some studies have shown that methanol extraction yield higher antimicrobial activity than n-hexane and ethyl acetate (Febles CI, etal., 1995): In vitro study of antimicrobial activity in algae (Chlorophyta, Phaeophyta,and Rhodophyta) (Febles CI, *et al*., 1995). It is clear that the use of organic solvents always provides a higher efficiency in extracting antimicrobial active compound (Sreenivasan Sasidharan *et al.*, 2009)

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