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Evaluation of antifungal activity of seaweed extract (*Turbinaria conoides*) against *Fusarium oxysporum*

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Abstract: The purpose of the study was to determine the anti fungal activity of seaweed (*Turbinaria conoides*) extract against root rot pathogen *Fusarium oxysporum.* Seaweed extract was prepared from the species *T. conoides* collected from Rameswaram coastal area of Tamil Nadu during December was used for this study. Different concentrations of the extract *viz*., 5 %, 10 %, 15 % and 20 % was evaluated for their antifungal activity against *F. oxysporum* using poisoned food technique along with control and carbendazim (0.2 %) as check. No mycelial growth (0 cm) was observed in 15 % and 20 % sea weed extract weed extract treated plates even after 6 days of incubation. Though the visible inhibition of mycelial growth was noticed in all the concentrations, the increased concentration of 15 and 20 % had shown 100 % inhibition. So, the lower concentration of 15 % can be best in controlling the *F. oxysporum* fungi. GC-MS analysis of seaweed extract showing the presence of several antimicrobial compounds in seaweeds may be the reason for such inhibition.

Keywords: Antifungal,Carbendazim,*Fusarium oxysporum,Torbinaria conoides*

INTRODUCTION

Vegetables are the most sought after diets in Indian cuisine. Tomato (*Lycopersicon esculentum* Mill. 2n=24), a self pollinated crop is one of the important solanaceous vegetable crops grown widely all over the world because of its special nutritive value and also it's wider spread production. *Fusarium* crown and root rot, caused by the fungus *F. oxysporum* f. sp. *radicis-lycopersici is a serious problem in tomato cultivation.* With no effective chemical treatments, root rot diseases are especially detrimental to these plants. Root rot diseases are soil-borne diseases that are most aggressive after heavy or continuous rainfall or improper irrigation. The diseases infect tomato plants through their root systems, causing symptoms to appear only after the infections have damaged the plants. The adverse impact of long-term use of synthetic chemical fungicides on physico-chemical characters, microflora and their micro-ecology of soil is well researched. Those chemicals lead to soil salinity and sodicity, decimating several soil flora and fauna with major impact on seed germination and growth. Several organic amendments are recommended for amelioration of such adverse conditions.

Arun kumar *et al.* (2005) evaluated the bioactive potential of seaweeds against plant pathogenic bacterium *Xanthomonas oryzae* pv. oryzae which cause blight in rice. Kumar *et al.* (2008) tested crude seaweeds extracts against the phytopathogenic bacterium *Pseudomonas syringae* causing leaf spot disease of the medicinal plant *Gymnema sylvestris*. The seaweeds are economically valuable resources, used as food, fodder, fertilizer and medicine and thus useful to mankind in many ways. Seaweed species are rich in amino acids and bio-plant enhancers and often regarded as underutilized bio-resources. More than 33 species of seaweeds are identified in coastal regions of Tamil Nadu. Many are being used as food, industrial raw materials, cosmetics and therapeutics for centuries.

Prabha (2013) revealed that *Kappaphycus alvarezii* has active secondary metabolites and also exhibited antimicrobial activity against *Aspergillus flavus, Aspergillus fumigates and Candida albicans* mainly in the methanolic extract of *K. alvarezii* and this may be mainly due to the presence of phenolic lipids, terepenes and phlorotannins. Ambika *et al.* (2014) reported that *G. edulis, C. racemosa and S. myricocystum* reduced the fungal mycelial growth of *Alternaria porri* at increased concentrations of 30 %. Pandithurai and Murugesan (2014) reported that extract of *Spatoglossum asperum* showed inhibition of 100 % on mycelial growth of *Aspergillus flavus*, 57.14 % of *Candiada albicans* and 54.75 % of *C. tropicalis.* Renuka *et al.* (2014) reported that 1 % extract of *Chaetomorpha crassa* had inhibitory effect on *Macrophomina phaseolina, Sclerotium rolfsi* and *Pyricularia oryzae*.

MATERIALS AND METHODS

Seaweed species, *Turbinaria conoides* was collected from Mandapam coastal areas and washed thoroughly

with seawater 3-4 times to remove the sand particles, debris and marine epiphytes. Then it was chopped into small pieces and dried under sun for 4 days followed by oven-drying for 24 hours at 60°C. Then, the dried material was coarsely ground. 500 g of the powder was added with 200 ml of acetone and kept overnight after vigourous shaking. Then, the solution was decanted (alcoholic extract) and the residue was mixed with 300 ml of distilled water. The mixture was boiled for 20 minutes and the solution was decanted (aqueous extract). Both aqueous and alcoholic extracts were mixed together and the volume was made upto 500 ml. The solution was considered as 100 % concentrated solution and stored under refrigerated condition at 4^0 C (Ramamoorthy and Sujatha, 2007).

***In vitro* evaluation of fungi toxic effect of SWE on the radial growth of the fungi Poisoned food technique (Grover and Moore, 1962):** The effect of fungicides and plant extracts on the growth of the pathogen was studied using poisoned food technique.

The fungicide and plant extracts were added separately to the autoclaved and melted potato dextrose agar media. The poisoned agar medium was poured into sterilized plates and allowed to solidify. Then the plates were inoculated with the test fungus by placing uniform disc of 9 mm diameter from 4 days old culture grown on potato dextrose agar medium. The diameter of the fungal colony was measured once in 24 h. The medium without fungicides and plant extracts served as control and the mean inhibition percentage was worked out. Three replications were maintained at the laboratory temperature (28 ± 1°C). The per cent inhibition of the growth of the test fungi was calculated by the formula of Vincent (1927).

$$I = \frac{100 \times (C-T)}{C}$$

Where, I = Per cent inhibition of fungal growth; C = Growth in check; T = Growth in treatment

Statistical analysis: The data obtained from different experiments were analysed for the 'F' test of significance following the methods described by Panse and Sukhatme (1999). Wherever necessary, the per cent values were transformed to angular (Arc-sine) values before analysis. The critical differences (CD) were calculated at 5 per cent probability level. The data were tested for statistical significance.

RESULTS AND DISCUSSION

Based on the results obtained, all the concentrations (5 %, 10 %, 15 % and 20 %) of seaweed extract showed considerable inhibition on mycelial growth of *F. oxysporum* (Table 1). But, the increased concentrations of 15 and 20 % showed maximum inhibition of 100 % on even sixth day after incubation (Table. 2). Table 1 showed that the control plates had shown fungal |mycelial growth after 24 hours of incubation onwards. It was lower (0.5 cm) in the initial days and keeps on increasing gradually and grown towards the periphery (7.5 cm) of the Petri plate on seventh day after incubation. The carbendazim treated plates had not shown mycelial growth (0 cm) upto fourth day. But, it started to grow from fourth day onwards and attained 1.5 cm on seventh day with 80 % inhibition over control. 5 % SWE treated plates had not shown mycelial growth upto fourth day and 1.3 cm diameter fungal mycelial growth was notices on fifth day and 3.4 cm diameter of mycelial growth was seen on seventh day with 54.67 % inhibition over control. In 15 % and 20 % treated plates, no occurrence of growth was noticed from first day upto sixth day after incubation with 100 % inhibition over control but 1.7 cm and 0.3 cm diameter fungal mycelial growth was noticed on seventh day in 15 % & 20 % treated plates respectively (Figure. 1). It was revealed that the seaweed extract of 10 % obtained from brown seaweed *Turbinari coinoide* was effective in controlling the growth of *F. oxysporum.* Similar antifungal effect was studied in *Sargassum wightii* by Ambika *et al*. (2014) in onion; in *Spatoglossum asperum* by Pandithurai and Murugesan (2014) in rice; in *Chaetomorpha crassa* by Renuka *et al.* (2014) in rice. The reason may be due to the presence of antiviral, antibiotic, anti-neoplastic, antifouling, antiinflammatory, cytotoxic and antimitotic (Plaza *et al.*, 2003 De Felicio *et al.*, 2010; Peres *et al.*, 2012) substances in sea weeds. Bioactivity of diverse

Table 1. Effect of seaweed extracts against mycelial growth of *F. oxysporum.*

SWE concentration	Mycelial growth (cm)							Mean
	I day	II day	III day	IV day	V day	VI day	VII day	
Control	0.0	0.5	1.7	3.9	6.5	7.1	7.5	3.9
Carbendazim 0.2 %	0.0	0.0	0.0	0.0	0.1	1.2	1.5	0.4
5 %	0.0	0.0	0.0	0.0	1.3	2.8	3.4	1.1
10 %	0.0	0.0	0.0	0.0	0.0	1.5	2.6	0.6
15 %	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.2
20 %	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0
Mean	0.0	0.1	0.3	0.7	1.3	2.1	2.8	
		T			**D**		**TxD**	
SEd		0.00175			0.00189		0.00464	
CD (0.05)		0.00464			0.00377		0.00923	

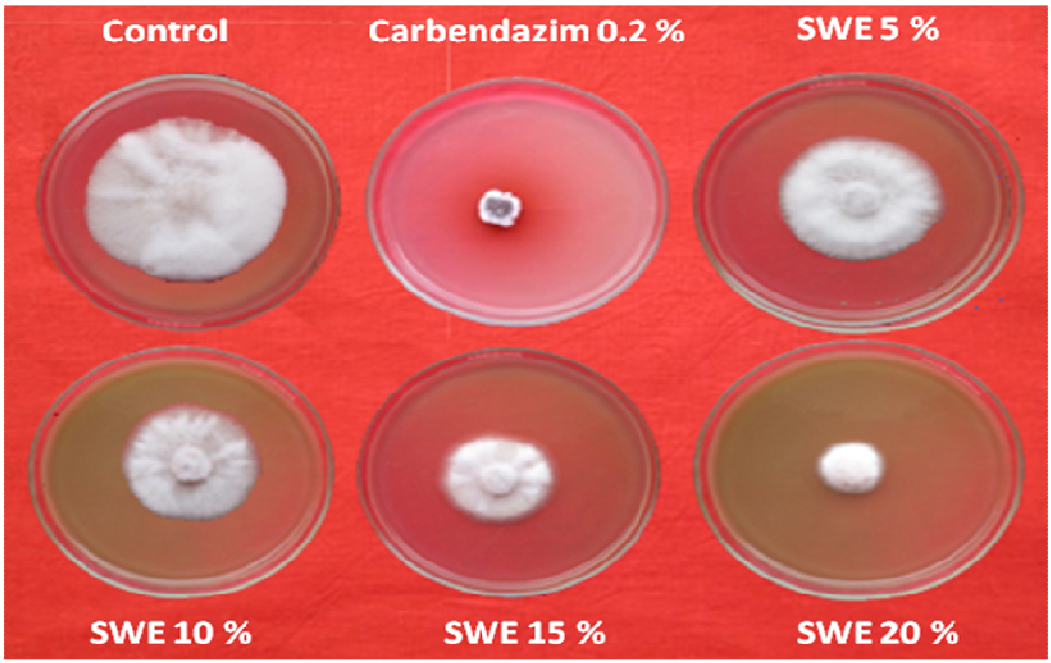

Fig. 1. *Mycelial growth of F. oxysporum in media poisoned with sea weed extract.*

secondary metabolites and other compounds extracted from seaweeds play an important role in prevention of different serious diseases. These biogenic compounds also have antibacterial, antialgal, antifungal properties (Paul and Puglisi, 2004; Bhadury and Wright, 2004). Prabha (2013) revealed that *Kappaphycus alvarezii* has active secondary metabolites and also exhibited antimicrobial activity against *Aspergillus flavus, A. fumigates and Candida albicans* mainly in the methanolic extract of *K. alvarezii* and this may be mainly due to the presence of phenolic lipids, terepenes and phlorotannins.

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