EFFICIENCY OF SEAWEED EXTRACTS FOR THE CONTROL OF SHEATH BLIGHT OF RICE CAUSED BY *RHIZOCTONIA SOLANI* [Kuhn]

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Abstract : The present studies were undertaken to investigate the effect of certain sew weed extracts for the management of Sheath blight under *in vitro* conditions. Two brown and red sea weed species and a green sea weed were tested against *Rhizoctonia solani* under laboratory conditions for spore germination assay. The results revealed that, among the five seaweed extracts tested against *R. solani*, extracts of *Sargassum wightii* [brown seaweed algae]at a concentration 20 per cent was found to be the best in the reduction of spore germination and it was followed by a concentration (20%) of *Dictyota dichotoma* [brown seaweed algae] 20 per cent concentration. The least reduction recorded in *Acanthopora spicifera* [Red seaweed algae]at all concentrations (5, 10, 15 and 20%). The same results were recorded in paper disc and agar well method.

***IndexTerms* – Sheath Blight, Rice, sea weed extract**

I. INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important cereals of the world next to wheat and is consumed by 70% of the world population, particularly in Asia which consumes and produces more than half of total world rice. However, rice production is seriously threatened by various diseases, which causes severe yield loss and most significant economic loss each year. The seed-borne diseases of rice are sheath blight (*Rhizoctonia solani*), stem rot (*Sclerotium oryzae*), brown spot (*Bipolaris oyzae*), sheath rot (*Sarocladium oryzae*), and false smut (*Ustilaginoidea virens*) among which sheath blight of rice has become a major constraint to rice production during the last two decades.

Presently, sheath blight disease management is mainly achieved through systemic fungicides (Pal *et al*., 2005). The resistance gained by pathogen to these systemic fungicides is of concern, thus demanding an evolution of newer fungicides and screening of certain commonly used fungicides before evolving a comprehensive and compatible organic formulations. Seaweeds provide a rich source of structurally diverse and biologically active secondary metabolites. The beneficial effect of seaweed extract application is as a result of many components that may work synergistically at different concentrations, although the mode of action still unknown (Fornes *et al.*, 2002 and Shehata *et al.*, 2011). The stimulative effects of seaweed extract on the plants are well documented. Using of seaweed extract improve Seeds germination, seedling development, increase plant tolerance to environmental stresses (Zhang and Ervin, 2007), and enhance plant growth and yield (Hong *et al*, 2007; Zodape *et al*, 2008; Khan *et al.*, 2009; Craigie, 2011; Manoj Kumar *et al.*, 2012). Therefore, the present studies were undertaken to investigate the effect of seaweed extracts for the management of sheath blight of rice.

MATERIALS AND METHODS

Evaluation of seaweeds extracts against *R. solani in vitro*

The efficacy of the various seaweeds listed in table was tested against *R. solani*

S.No	Scientific Name	Anti micrbial property	Common name	Collected from
1	*Sargassum wightii*	Phenol	Brown seaweed	Kanyakumari
2	*Didtyota dichotoma*	Ethyl acetate	Brown seaweed	Pambam
3	*Ulva reticulate*	Caccamese and azzolina	Green seaweed	Gulf of mannar coast
4	*Gelidiella acerose*	Dimeticne	Red seaweed	Gulf of mannar coast
5	*Acanthopora spicifera*		Red seaweed	Gulf of mannar coast

Preparation of seaweed products

Preparation of crude seaweeds extracts (Vallianayagam *et al.*, 2009)

Each 1 Kg of live, healthy and matured samples of each seaweed (Brown seaweeds, Green seaweeds and Red seaweeds) collected along the Coast of Pamban (Rameswaram (9°14`N; 79°14`E), Kanyakumari, Pondicherry, Velankanni and Gulf of Mannar, Tamil Nadu, India) were washed thoroughly in sea water followed by tap water to remove extraneous particles and epiphytes. 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 for 7 days, thrice in 500 ml of 1:1(v/v) chloroform: methanol using a 1 litre Erlenmeyer conical flask under dark condition. The extract were pooled and concentrated by using a flask evaporator under reduced pressure at 45°C, weighed and stored at 0°C.

Spore germination assay (Macko *et al.*, 1977)

One drop of 5, 10, 15 and 20 per cent seaweed extracts individually were placed in cavity slides and were allowed to air dry. A drop of the spore suspension (1×10^6 spores ml^{-1}) of *R. solani* prepared in sterile distilled water was added to each of the dried marine products and was thoroughly mixed. The prepared cavity slides were incubated in a moist chamber. Three replications were maintained for each treatment. The spore germination was observed and recorded after 48 h and the per cent germination was calculated. The spore suspension prepared in sterile distilled water served as the control.

Paper disc assay (Saha *et al.*, 1995)

Spore suspension of the fungi was prepared from a ten days old culture with sterile distilled water. Seaweed extracts at Various concentrations @ 5, 10, 15and 20 per cent were prepared.Twenty ml of PDA medium was seeded with three ml of sclerotial suspension (1 x 10^6 sclerotia / ml) of the fungus and solidified. Sterile filter paper discs (10mm) were dipped separately in known concentration of treatments and placed equidistantly over the seeded medium. Three replications were maintained. The plates were incubated at 28±2ºC for 48 hr. The inhibition zone of the fungal growth around the treated paper discs was measured and recorded. The paper disc dipped in sterile distilled water served as control.

Agar well method (Thongson *et al.*, 2004)

10 ml of Seaweed extracts @ 5, 10, 15 and 20 % concentrations were added individually to the sterilized potato dextrose agar medium and thoroughly mixed just before plating. Twenty ml of these mixtures individually were immediately poured into sterilized Petri plates and were allowed to solidify. A 9 mm of PDA disc was removed by using a cork borer to form wells; 1 ml of spore suspension was poured into a well. All these were carried out under aseptic conditions. The plates were incubated at 28±2ºC for 10 days. Potato dextrose agar medium without seaweed extracts served as the control. Three replications were

maintained. The radial growth of the colony was measured. The per cent inhibition of the growth was calculated.

Results and Discussion

In vitro evaluation of various seaweed extracts against *R. solani*

Spore germination

Among the five seaweed extracts tested against *R. solani*, extracts of *Sargassum wightii* [brown seaweed algae]at a concentration 20 per cent was found to be the best in the reduction of spore germination (18.50 per cent). It was followed by a concentration (20%) of *Dictyota dichotoma* [brown seaweed algae] 20 per cent concentration recorded 34.00 per cent. The rate of reduction was corroborated with its concentration in case of all the tested seaweeds extracts. *Sargassum wightii* and *Dictyota dichotoma* significantly reduced spore germination than other seaweed products in all the concentrations. *Acanthopora spicifera* [Red seaweed algae]at all concentrations (5, 10, 15 and 20%) recorded the least reduction in spore germination respectively (Table 1).

Paper disc method and Agar well method

Various seaweed extracts were evaluated for the antimicrobial activity by paper disc and agar well method. The leaf extracts of *Sargassum wightii* [brown seaweed algae] at a concentration of 20 per cent concentration was found to be the maximally reduced in both paper disc method and agar well methods and recorded 48.64 and 45.70 per cent inhibition zone respectively. It was followed by a highest concentration (20%) of *Dictyota dichotoma*which recorded 28.20 and 25.94 per cent inhibition zone in paper disc method and agar well method respectively. All the concentrations of *Acanthopora spicifera* [Red seaweed algae]recorded a minimum per cent inhibition zone than all other extracts (Table 1).

Generally, all marine products inhibited the mycelial growth of pathogen in the present study. Of which, *Sargassum wightii* [Brown seaweed algae], *Ulva reticulata* [Green seaweed algae], *Gelidiella acerosa* [Red seaweed algae] @ 20 per cent concentration exhibited the highest level of inhibition of *R. solani*. This statement has been confirmed by several workers. Sultana *et al*., (2007), reported that brown, green and red seaweeds were highly effective against *R. solani in vitro* and *in vivo* conditions. Several workers have reported the efficacy of seaweed extracts against fungal pathogens (Norrie *et al*., 2002; Jayaraj *et al*., 2008). The brown seaweeds show high antifungal activity when compared to red and green algae. The brown seaweeds contain high amount of flavonoid and phenolic compounds which could be the reason for antifungal activity (Ambika and Sujatha, 2014). This may be due to higher levels and early accumulation of phenolics and phytoalexins (Garcia-Mina *et al*., 2004).The above results lends support to the present findings.

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Table 1: Evaluation of various Seaweed extracts against *R. solani* under *in vitro* condition.

S. No	Seaweed extracts	Spore germination(%)					Inhabitation zone (mm)									
							Paper disc method					Agar well methods				
		5%	10 %	15 %	20 %	Mean	5%	10 %	15 %	20 %	Mean	5%	10 %	15 %	20 %	Mean
1	*Sargassum wightii* (Brown seaweed algae)	48.10	41.50	20.00	18.50	32.02[a]	35.00	40.27	46.00	48.64	41.22[a]	29.70	34.63	39.15	45.70	37.29[a]
2	*Dictyota dichotoma* (Brown seaweed algae)	64.70	60.40	51.65	34.00	52.68[b]	20.00	21.40	26.50	28.20	24.02[b]	17.10	20.40	22.10	25.94	21.38[b]
3	*Ulva reticulata* (Green seaweed algae)	79.10	65.10	53.28	44.40	59.72[b]	12.25	14.40	18.70	27.00	18.08[c]	10.55	10.82	15.10	17.00	13.12[c]
4	*Gelidiella acerosa* (Red seaweed algae)	80.00	74.55	62.00	53.20	67.43[c]	12.20	14.20	16.26	19.62	15.54[c]	10.50	10.40	14.00	16.00	12.48[d]
5	*Acanthophora spicifera* (Red seaweed algae)	84.60	76.40	68.38	56.28	71.42[d]	12.00	13.60	16.00	19.50	12.28[d]	10.00	10.20	12.40	14.16	14.86[c]
6	Control	95.00	95.00	95.00	95.00	95.00[e]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

***** Values in the column followed by common letters do not differ significantly by DMRT (P=0.05)