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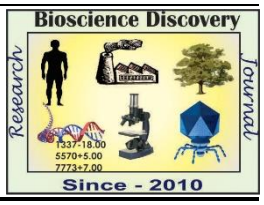

Influence of *Ulva lactuca* L. on Photosynthetic Pigments and Biochemical constituents of *Oryza sativa* L.

Bhimrao J. Patil and Premkumar B. Shivgan*

Department of Botany and Plant protection,Sadguru Gadage Maharaj College, Karad. Dist- Satara. Maharashtra, India. 415 124.
*shivganpb@gmail.com.

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Abstract

The fresh aqueous extracts in the concentrations of 25, 75 and 100% were tested against photosynthetic pigments and Biochemical constituents in *Oryza sativa* L. The seed soaking period was fixed as 5 and 7 hours. The seeds were soaked in different concentrations for 5 and 7 hrs and then allow to germinate in petri plates. The seedlings were used for analysis of photosynthetic pigments and biochemical constituents. The aqueous extract of *Ulva lactuca* L. has influenced photosynthetic pigments, carbohydrates and enzymes in *Oryza sativa* L.as compared to control. The 50% concentration treatment is significantly superior over all other treatments including control. The results of present study indicate that *Ulva lactuca* L. has significant potential as stimulatory agent to enhance growth of *Oryza sativa* L.

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the first leading ancient cultivated crops of the world. In terms of area 55% of the total cultivated land is under rice cultivation. The poor germination and standard establishment of direct seeded rice is a major restriction for achieving an optimal crop growth and better productivity especially under drought stress during emergence (Liu *et al*., 2004). In agriculture, chemical fertilizers have degraded the fertility of soil by making it acidic and rendering it unsuitable for rising crops. The bio-fertilizers based on renewable energy sources are most effective supplement to chemical investment needed for chemical fertilizers. The marine algae are one of the most important marine resources in the world and widely used as human food, animal feed and raw material for many industries. Marine algae are rich source of growth promoting substances (Sylvia *et al.*, 2005). In recent years, the use of natural marine algae emerged as a substitution for conventional synthetic fertilizers (Zodpe *et al*., 2010). At present one of the most promising applications of marine algae is their use as plant bio stimulants. This influence is explained by intent of plant growth-promoting substances such as cytokinins, auxins, gibberellins, abscisic acid, ethylene, polyamines and betaines in algal extracts (Crouch J. van Staden *et al.*, 1993).

The present investigation is based on tested of various treatments of aqoueous extract of *Ulva lactuca* L. on photosynthetic pigments, carbohydrates, proteins and enzymatic activity *Oryza sativa* L.

MATERIALS AND METHODS

The *Ulva lactuca* L. was collected from the coastal area of Hedvi in Guhagar tehsil of Ratnagiri district. The algal sample was washed thoroughly with seawater to remove all the unwanted impurities, adhering sand particles and epiphytes. The sample was placed in polythene bags, kept inside an icebox and transported to the laboratory.

These were washed thoroughly using tap water to remove surface salt and spread on blotting paper to remove excess water. One kilogram of *Ulva lactuca* L. was cut into small pieces and crushed separately with 1-L distilled water and filtered with 4 layered muslin cloth . The filtrate was considered as 100% extract and different concentrations *viz.*, 25, 50 and 75 were prepared using distilled water. Rice variety Sahyadri was selected as a study organism. The seeds of Sahyadri rice were purchased from Rice research institute Karjat, (Raigad district). The algal extract was tested against seed of *Oryza sativa* L. The 200 rice seeds were soaked in algal extracts as 25, 50, 75, 100% and in distilled water for 5 and 7 hrs in beaker. 10 seeds from each concentration and distilled water were placed in each petridish containing wet blotting paper for germination. In this way total three sets were prepared for each treatment. After 96 hrs photosynthetic pigments like chl. a, chl. b, total chl. ,Carotenoids, carbohydrates, total proteins and the enzymes like protease, ATPase and Amylase were estimated by standard methods. The data were analyzed statistically for standard deviation. All the measurements were carried out in triplicates. The mean value of each measurement was noted in observation table.

RESULT AND DISCUSSION

In table 1, it was revealed that different concentrations of *Ulva lacuta* L. extract caused significant stimulatory effect in the photosynthetic pigments of *Oryza sativa* L. The maximum stimulatory effect in photosynthetic pigments was found at 50% concentration in both seed soaking periods. Stimulatory effect is reduces in increasing concentration that is 75 and 100 %. The maximum total chlorophyll content was found 97.42 $mg.100g^{-1}$ in 50% concentration at 5 hrs seed soaking period. The maximum carotenoid content *i. e.* 12.72 $mg.100g^{-1}$ obtained in 50 % concentration. Overall 5hrs seed soaking treatment showed better stimulatory effect than 7hrs treatment. The lower concentration of algal extract increased the chlorophyll content in *Vigna catajung* (Anantharaj and venkateshu, 2001). The seaweed treatment resulted in significant increase in chlorophyll a of forage corn (Partani, 2013). Increased content of total chlorophylls in *Cyamopsis tetragonoloba* L. with seaweed concentrate application (Thambiraj *et al.*, 2012).

Table 2, showed that sugar and starch were maximum *i. e.* 4.84. $100g^{-1}$ and 3.63 in 50% concentration at 7 hrs respectively. The maximum total protein content obtained was 2.98 mg/g in 50% concentration at 7 hrs soaking period. In this way 7hrs seed soaking treatment influenced starch, sugar and protein than 5 hrs treatment. Various species of marine algae found in nature or commercially cultivated contain organic compounds whose activity bear a resemblance to the activity of a cytokinin, auxin and gibrellin (Crouch and Staden, 1993). These compounds were able to stimulate growth due to enhancement of protein synthesis and cell division and mobilization of nutrients needing for growth (Pascale, 1993). The breakdown of starch proceeds by the combined actions of amylase, debranching enzyme (pullulanase like enzyme), amylase and glucosidase in germinated cereal seeds (Zeeman *et al.*, 2007)**.**

In table 3. the maximum ATPase content 0.176 $\Delta OD\ min^{-1}g^{-1}$ was found in 50% concentration at 7 hrs seed soaking period. The maximum protease content 26.35 $h^{-1}g^{-1}$ fresh weight was obtained in 50% concentration at 7 hrs soaking period and the maximum amylase activity 35.16 $min^{-1}g^{-1}$ was obtained in 50% concentration at 5 hrs soaking period. In this way 7hrs seed treatment stimulated ATPase and protease as compared 5hrs treatment and amylase enzyme was increased in 5hrs seed soaking treatment than the 7hrs.

Many workers have already evaluated the stimulatory effect of algal extract on plants such as wheat, rice, bean, peas (Aitken *et al*., 1965). Pawar and Chavan, (2007) reported the effect of leaf leachates of *Eucalyptus globulus*, *Moringa olerifera*, *Parthenium hysterophorus* and *Glycine max* decreased the activity of α-amylase and invertase in germinating seeds of *Sorghum bicolor* (L.) Moench. The leaf leachates of *Gmelina arborea* inhibits the activity of some hydrolytic enzymes amylase, catalase and acid phosphatase in legumes seeds (Ramakrishnan *et al*., 2014). The results of present study indicate that *Ulva lactuca* L. has significant potential as stimulatory agent to enhance growth of *Oryza sativa* L.

Above results showed that enhancement of growth and biochemical constituents of *Oryza sativa* L. plant might be due to the presence of different micronutrients, macronutrients, hormones, trace elements and vitamins in *Ulva lactuca* L. These are essential growth promoting components for biosynthesis of chlorophyll and biochemical might have played a major role in the enrichment of growth and physiology of *Oryza sativa* L. Inhibition in

Table 1. Effect of *Ulva lactuca* L. extracts on photosynthetic pigments in *Oryza sativa* L.

Sr. No.	Conc. of extract %	Seed soaking period in hrs.							
		5				7			
		Chl. b	Chl. a	Total Chlorophyll	Carotenoids	Chl. b	Chl. a	Total Chlorophyll	Carotenoids
1	Control	24.65[a] ± 0.017	50.7[a] ± 0.012	75.36[a] ± 0.026	8.48[a] ± 0.024	4.19[a] ± 0.21	45.1[a] ±0.01	69.47[a] ± 0.020	10.06[a] ± 0.12
2	25	29.62[b] ± 0.014	50.9a ± 0.115	80.55[b] ± 0.097	11.67[bc] ± 0.016	29.75[b] ± 0.02	46.6[a] ± 0.03	76.40[b] ± 0.024	10.60[a] ± 0.023
3	50	34.22[c] ± 0.198	63.6b[c] ± 0.016	97.42[d] ± 0.032	12.48[c] ± 0.08	31.84[c] ± 0.01	58.80[c] ± 0.01	90.63[d] ± 0.17	12.72[b] ± 0.026
4	75	31.12b[c] ± 0.016	58.8[b] ± 0.012	89.96[c] ± 0.024	12.24[c] ± 0.012	30.27[b] ± 0.02	55.65[b] ± 0.03	85.93[c] ± 0.017	12.02[b] ± 0.026
5	100	25.20[a] ± 0.081	53.4[a] ±0.09	79.90[b] ± 0.163	9.16[b] ± 0.016	24.69[a] ± 0.08	46.33[a] ± 0.02	70.98[a] ± 0.057	12.48[b] ± 0.021

Note-Values are Mean±SD., different letters in a single column show statistically significant differences according to Duncan's multiple range test.(P = 0.05) values are in mg.100g^{-1}

Table 2. Effect of *Ulva lactuca* L. extracts on carbohydrates and protein in *Oryza sativa* L

Sr. No.	Conc. of extract (%)	Seed soaking periods in hrs.					
		5			7		
		Sugar	Starch	Total Protein	Sugar	Starch	Total protein
1	Control	1.45[a] ± 0.080	0.62[a] ± 0.08	1.76[a] ± 0.05	1.76[a] ± 0.016	0.31[a] ± 0.018	1.82[a] ± 0.03
2	25	2.44[b] ± 0.08	1.56[b] ± 0.012	2.51[b] ± 0.05	2.92[b] ± 0.016	1.66[b] ± 0.021	2.72[c] ± 0.042
3	50	3.59[c] ± 0.012	2.24b[c] ± 0.012	2.95[c] ± 0.026	4.84[d] ± 0.024	3.63[c] ± 0.025	2.98[d] ± 0.014
4	75	3.24[c] ± 0.012	1.61[b] ± 0.017	2.75[c] ± 0.08	3.94[c] ± 0.035	1.13[b] ± 0.012	2.806[c] ± 0.024
5	100	2.60[b] ± 0.08	1.31[b] ± 0.08	1.67[a] ± 0.40	2.16[b] ± 0.002	0.77[a] ± 0.012	2.060[b] ± 0.035

Note: Values are Mean ± SD., different letters in a single column show statistically significant differences according to Duncan's multiple range test (P = 0.05)

Table 3. Effect of *Ulva lactuca* L. extracts on enzymatic activity *Oryza sativa* L.

Sr. No.	Conc. of extract (%)	Seed Soaking periods in hrs.					
		5			7		
		ATPase	Protease	Amylase	ATPase	Protease	Amylase
1	Control	0.02[a] ± 0.001	4.70[a] ± 0.04	11.7[a] ± 0.04	0.03[a] ± 0.01	5.70[a] ± 0.04	9.92[a] ± 0.016
2	25	0.08[b] ± 0.01	16.95[b] ± 0.08	9.93[a] ± 0.02	0.06[a] ± 0.01	11.40[b] ± 0.02	21.67[bc] ± 0.029
3	50	0.11[b] ± 0.01	22.65[c] ± 0.06	35.16[c] ± 0.02	0.176[b] ± 0.02	26.35[d] ± 0.029	31.74[d] ± 0.029
4	75	0.106[c] ± 0.03	19.09[bc] ± 0.04	33.30[c] ± 0.08	0.143[b] ± 0.01	19.9[c] ± 0.032	20.80[b] ± 0.016
5	100	0.11[b] ± 0.02	17.34[b] ± 0.32	19.89[b] ± 0.016	0.08[a] ± 0.014	17.38[c] ± 0.028	20.54[b] ± 0.037

Note-Values are Mean ±SD; different letters in a single column show statistically significant differences according to Duncan's Multiple range test (P = 0.05)

activity of amylase enzyme leads to reduction in the translocation of sugar into embryo axis which inhibits the growth of plant. It may be suggested that algal extract can be used to improve growth and yield of crops.

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