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BIOACTIVITY OF *Ulva spp*. SOLUBLE POLYSACCHARIDES ON GERMINATION AND GROWTH OF SOME CROP PLANTS.

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ABSTRACT

Seaweed compounds can play an important role in the plant growth promotion and metabolism. We applied two concentrations (5 and 10 mg/ml) of soluble polysaccharides extracted from the green macro algae *Ulva fasciata* and *Ulva lactuca* on germination of *Lupinus termis* seeds. Growth and germination metabolism (amylase, protease activity) were studied. The priming of seeds with *U. fasciata* soluble polysaccharides (5mg /ml) significantly induced the highest enhancing effect on the base of all parameters (seed germination (100 ± 0%), shoot length (9.41 ± 0.361 cm) cm and root length (11.20 ± 1.08 cm), fresh weight (2.446 ± 0.054g) and dry weight (0.461 ± 0.044g); amylase activity (467.346 ± 36 mg reducing sugars / min .g. dr.wt), protease activity(514.062 ± 27 µg amino acids / min .g. dr.wt)).These results suggest that seaweed extracts induce stronger seed germination efficiency and growth parameters and can be recommended to use as organic fertilizer.
Keywords: *Ulva fassciata*, *Ulva lactuca*, soluble polysaccharides, *Lupinus termis, seed germination.*

INTRODUCTION

Seaweeds are one of the most important marine resources of the world. As more than 70% of the world's surface is covered by oceans, the wide diversity of marine organisms offer a rich source of natural products. Marine environment contains a source of functional materials, including polyunsaturated fatty acids, polysaccharides, essential minerals and vitamins, antioxidants, enzymes and bioactive peptides (Kim & Wijesekara, 2010; Pomponi, 1999). Seaweed extracts have been marketed for several years as fertilizer additives and beneficial results from their use have been reported (Booth, 1965), animal feed, human food, growth hormone and raw material for many industries as well (Ramarajan *et al.*, 2012).The major soluble polysaccharides found in marine algae include ulvan of green algae (Campo *et al.,* 2009; Chen *et al.,* 2007). Leguminous plants are important source of protein of human diet. Lupines are among the leguminous plant which has been consumed by people living in many countries, the most abundant variety is *Lupinus termis*. (Enrique *et al*. 1983).

This study aimed to evaluate the promotion effect of seaweeds soluble polysaccharide extracts on L. termis seed germination, metabolism and growth.

MATERIALS AND METHODS

Biological materials: Pure strain of White *Lupine* (*Lupinus termis* Giza 1) seeds was supplied by the Ministry of Agriculture, Field Crop Institute, Agriculture Research Center, Giza, Egypt. Surface sterilization was done with soaking in 0.01 % $HgCl_2$ solution for 3 minutes. They were then washed thoroughly with distilled water.

Experimental design: Seeds were rinsed with sterile water for 15 min. Thereafter, seeds were soaked in soluble polysaccharides (ulvan) (10 mg ml^{-1}, 5mg ml^{-1}) or in water (control) for 4 h at 25°C.

Experiment (1): The germination experiment was conducted as the following:

The same number of seeds (10 seeds) were germinated in Petri dishes (11 cm) lined with two moist sheets of filter papers (Whatman no.1), incubated in dark at 25°C for 5 days; the samples were ten replicates for determination of growth parameters including percent of seed germination, radical length and triplicate for amylase, protease activity.

Experiment (2): Another series of soaked seeds were let to growth in plastic pots (1Kg sand soil) and incubated under continuous illumination at 25°Cfor 7 days ; samples was done at the end of experimental period (7days). Growth criteria of seedlings as shoot and root length, fresh and dry weight (ten replicates) were determined.

Plant growth analysis: Percentage of germination was determined every 24 hours. Dry weight: Plant samples were dried in an oven at about 80°C till constant weight. Amylase and protease enzymes were extracted by Gibbs (1952), Kar and Mishra (1976). The activities of amylase and protease were determined according to the method of Monroe & Preiss (1990) and Anson's (1938) respectively.

Statistical analysis: The results were first subjected to an analysis of variance (ANOVA); a test for significant differences were carried out using SPSS between means at $P\leq 0.05$ was performed using LSD (Snedecor and Cochran, 1980).

RESULTS AND DISCUSSION

The beneficial effects of seaweed extract on seed germination and establishment have been reported in okra (Beckett and van Staden, 1989), beet (Wilczek and Ng, 1982) and lettuce (Moller and Smith, 1999).The effect of different concentrations of the extracted soluble polysaccharides on germination and growth of *Lupinus termis* were studied. The four soluble polysaccharide treatments led to significant increases ($P\leq 0.05$) in all results .The promoting effect of seed priming gives significant increases in seed germination percent (fig. 1). The highest germination percentage (100±0) was observed *U. fasciata 5mg/ml* after 4 days, followed by *U. fasciata 10mg/ml*, *U.lactuca 5mg/ml* and *U.lactuca 10mg/ml* after 5 days.

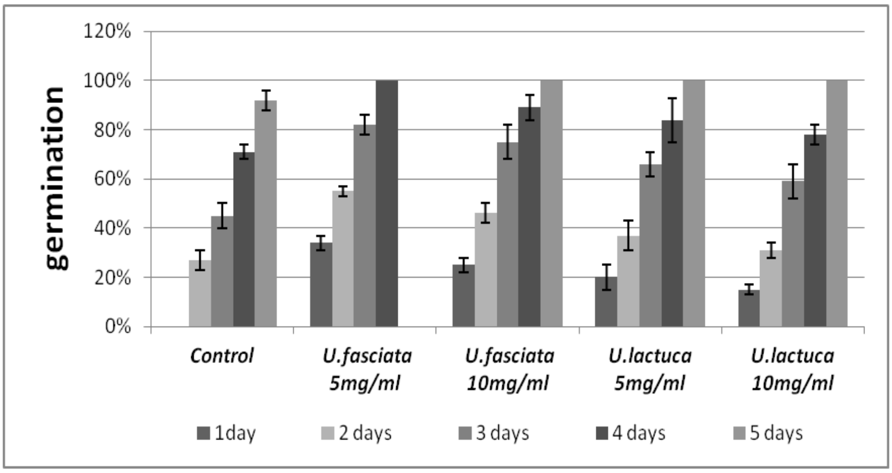

Fig. 1: Effect of seed priming with different concentrations of soluble polysaccharide extracts on germination percentage of *L. termis* germinating seeds.

Concerning radical length, priming with *U. fasciata* soluble polysaccharides (5 mg/ml) induced the highest radical length (fig. 2).

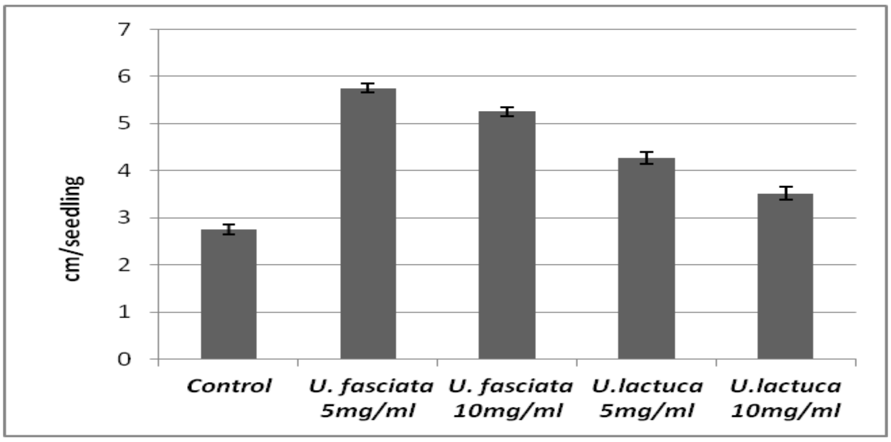

Fig. 2: Effect seed of priming with different concentrations of soluble polysaccharide extracts on radical length of *L. termis* germinating seeds.

The applied di cotyledons of most plant play an important role in supplying the compounds required for initial seedling growth. As soon as the seed germination starts, the storage compounds in the cotyledons, as sugars and proteins are broken down by activation of hydrolytic enzymes. Concerning early stage germination metabolism, the present study ،showed that both amylase and protease activities significantly increased ($p \leq 0.05$)

under the different treatments of priming with soluble polysaccharides (fig. 3 & 4). In relation to control levels, the highest increase in both enzymes activity was attributed to the effect of *U. fasciata 5 mg / ml* soluble polysaccharide extract.

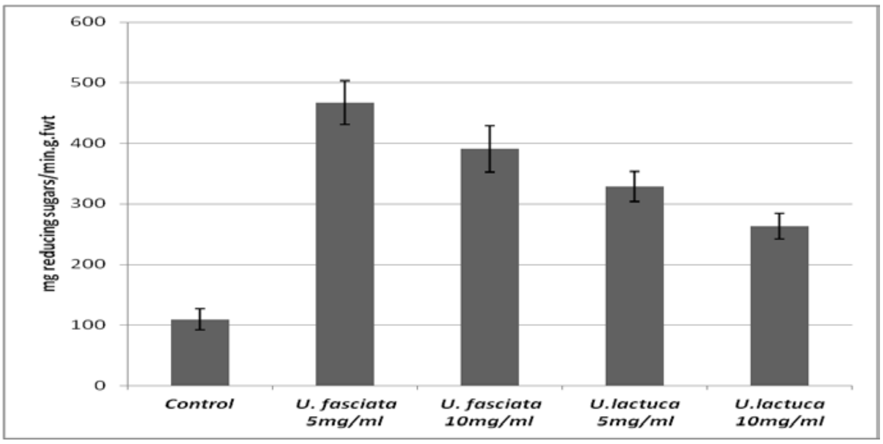

Fig. 3: Effect of seed priming with different concentrations of soluble polysaccharide extracts on amylase activity of *L. termis* germinating seeds.

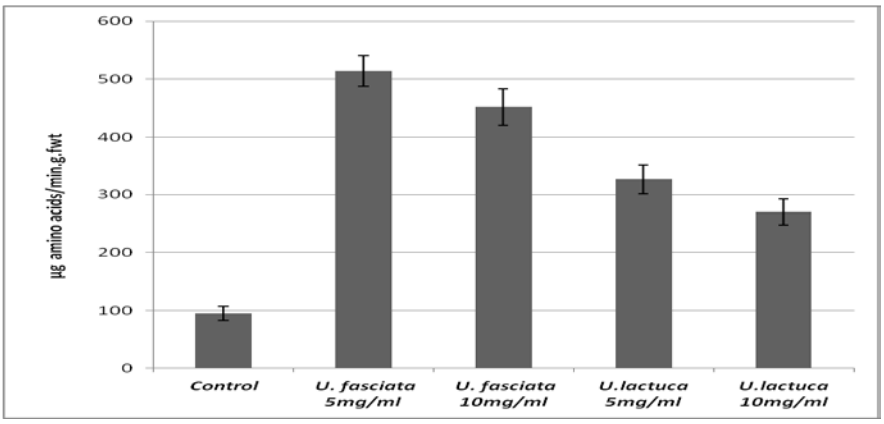

Fig. 4: Effect of seed priming with different concentrations of soluble polysaccharide extracts on protease activity of *L. termis* germinating seeds

Seaweed extracts are known to enhance seed germination and plant growth (Venkataraman Kumar et al., 1993; Sekar et al., 1995). They have been also shown increase in nutrient uptake from soil (Ramarajan et al. 2012). The present results are in accord with that of Bukhari and Unttawale, 1978, whom found that the promotive effect of the seaweed dilute extracts were more effective than the concentrated extracts. In this context, seaweed extracts reported to improve seed germination in several species such as

Table beet (Wilczek and Ng, 1982), Lettuce (Moller and Smith, 1999) , Faba bean (El-Sheekh and El-Saled, 2000) and fenugreek (Sabale and Pise, 2010).

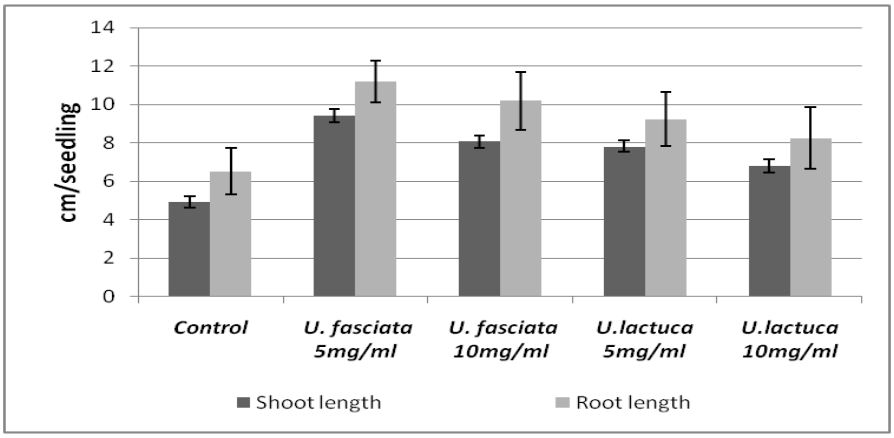

Fig. 5: Effect of seed priming with different concentrations of soluble polysaccharide extracts on shoot and root length of *L. termis* germinating seeds

Pretreatment of priming *L. termis* seeds with different concentrations of soluble polysaccharide extracts led to significant increases ($P \leq 0.05$) comparing with control, in response to shoot and root length, fresh and dry mass (fig. 5& 6). These results were in good harmony with those obtained by Kavipriya et.al., 2011, whom reported that seaweed extracts stimulate *Vigna radiate* seed germination and growth parameters. Thirumaran *et.al*., 2009 , whom reported that seaweed extracts stimulate *Cyamopsis tetragonaloba* seed germination and growth parameters.

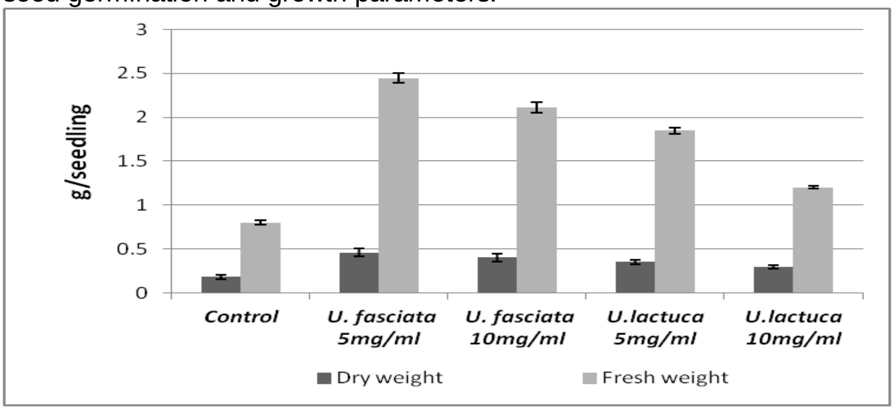

Fig. 6: Effect of seed priming with different concentrations of soluble polysaccharide extracts on dry and fresh weight of *L. termis* germinating seeds.

These results could be related to the soluble polysaccharide extracts, which may play important role in enhancement of the biosynthesis of enzyme protein, enzyme activation and/or membrane permeability.The use of seaweed extract as an organic biostimulant is fast becoming a conventional practice in agriculture and horticulture crops (Ramarajan *et al*. 2012).

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النشاط الحيوي لعديدات التسكرالذائبه للاولفا على إنبات ونمو بعض نباتات المحاصيل

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مركبات الأعشاب البحرية تلعب دورا هاما في نمو النبات وتعزيز عملية التمثيل الضوئى . تمت دراسة تأثير تركيزات (5 و10 مليجرام / مالليلتر) من عديدات التسكر الذائبه المستخلصة من نوعين من طحلبى الاولفا على إنبات بذور الترمس ونموها ونشاطها الأيضى (انزيمى الاميلز والبروتيز) . هذا وقد اسفرت النتائج ان المعامله بخمسه مليجرام / مالليلتر من عديدات التسكر قد أظهرت أعلى تاثير معنوى على كل المعايير المقاسه مثل إنبات البذور و طول الساق وطول الجذر و الوزن الرطب والوزن الجاف وغيرها . وتخلص هذه الدراسه الى انه يمكن التوصية باستخدا م عديدات التسكر كسماد عضوى للنباتات الاقتصاديه .

قام بتحكيم البحث

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