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Effect of Liquid Extract from *Turbinaria conoides* on Growth Parameters and Germination of *Arachis hypogaea*

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Abstract
The products of seaweed liquid extracts (SLE) are receiving intense attention as bio-stimulant in integrated crop nutritional applications. In the present study, the effect of the SLE of brown seaweed *Turbinaria conoides* was evaluated at different concentrations (control, 5, 10, 15, 20 and 25%) on germination and growth parameters (root length, shoot length, total fresh weight and total dry weight) of *Arachis hypogaea*. Liquid extract of *T. conoides* was found effective in stimulating germination and growth of the plant in the low concentration. This investigation has revealed that the low-level concentration of SLE (5%) has been enhanced the germination and growth parameters of the test plant than control and maximum seed germination (100%) of *A. hypogaea* was achieved in 5% concentration. The highest shoot length (4.62cm), root length (2.42cm), fresh weight (1.82g) and dry weight (0.88g) were recorded in the plants which treated with concentration of SLE. Highest (25%) concentration of SLE has been stunt the growth germination of the test plant.

Keywords
Seaweed liquid extract, *Turbinaria conoides*, Seed germination, *Arachis hypogaea*

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INTRODUCTION
Seaweeds, a marine macro alga which comprises broad range of bioactive compounds (amino acids, vitamins, cytokinins, auxins, abscisic acid and other growth promoting substances) to improve plant growth and soil fertility [1]. Chemical agriculture has made adverse impact on soil health and microbes. Biofertilizers are considered as boon for agriculture to meet fertility of soil and nutrient requirement of crops [2]. Sivasankari et al. [3] has revealed that the value of seaweeds as a fertilizer was not only due to nitrogen (N), phosphorus (P) and potash (K) content, but also the presence of trace elements and metabolites.

These products are currently applied to crops for beneficial effects attributed to the presence of natural plant growth hormones like cytokinins, auxins and also other plant biostimulants such as betaines, polyamines, oligosaccharides which improve plant resistances and tolerances to

environmental, disease and insect stresses [4]. It was also found that the seaweed liquid extract (SLE) enhances growth of roots and shoots, number of leaves, flowers and fruits, maturity time and yield [5]. Seaweed extract as an organic biostimulant is conventional practice in agriculture and horticulture crops and commercial use of SLE obtained from seaweeds is successfully used as for several crops [1]. Recent researchers have proved that using SLE as biofertilizer will give better results on seed germination and plant growth than chemical fertilizer [6, 7, 8]. Moreover, the SLE is an excellent source of major elements such as Sodium (Na), Phosphorous (P), Potassium (K) and Magnesium (Mg) as well as many micronutrients which are required for normal growth of plants. The intend of the present study is to investigate the effect of SLE prepared from *Turbinaria conoides* on germination and growth of *Arachis hypogaea* (Ground nut).

MATERIALS AND METHODS

Collection of samples

The seaweed *T. conoides* was collected from Mandapam (9° 16' 53.74" N and 79° 75.66'E) Gulf of Mannar. It has been handpicked and washed thoroughly with seawater to remove all the impurities, sand particles and epiphytes. The collected seaweed samples were transported to laboratory and washed with tap water to remove salt on the surface. The processed seaweed was spread on blotting paper to remove excess water and shade dried at room temperature. The dried seaweed is finally pulverized in the commercial grinder and powdered seaweed samples were used for further analysis.

Preparation of SLE

The SLE is has been developed based on the modified method of Ramarao [9]. The crude seaweed powder was added with distilled water in the ratio of 1:20 (w/v) and autoclaved at 80°C for 40 minutes. The extract was filtered through double layered cheese cloth. The filtrate was considered as 100% SLE and stored at 4°C. From this, different concentrations (5, 10, 15, 20 and 25%) were derived by adding distilled water.

Phytochemical analysis

Phytochemical screening of the SLE were carried out by using the standard procedures described by Harbone [10] for alkaloids, sugars, proteins, aminoacids, sterols, quinones, coumarins**,** tannins, carboxylic acid, phenols and flavanoids.

Properties of SLE

The physical properties of the SLE from *T. conoides* such as colour, odour, and pH were measured.

Seed treatment

The SLE was prepared with different concentrations 5, 10, 15, 20 and 25%. *Arachis hypogaea* seeds (10 seeds per concentration) were placed on top of the Whatmann NO.5 filter paper suspended with with 5ml of each different SLE at 25°C for 16 hrs in the dark. Seeds treated with water kept as control and triplicates of ten seeds were used for each concentration.

Analysis of growth parameters

Arachis hypogaea from each treatment were randomly drawn for various analysis. The growth parameters including germination percentage, fresh and dry weight, roots length and shoot length were calculated. Foliar application was done in once in three days for the test plants up to seven days [11].

Germination test

Arachis hypogaea seeds were subjected to seed treatment at different concentrations of SLE and observed for germination. Germination was noted at different concentration at regular time intervals in duplicate [12].

Root and Shoot Length

Arachis hypogaea seeds treated with SLE were analyzed for growth measurements in duplicate manner. Shoot length was measured from collar region to the tip of the shoot of plant. Similarly, root length was measured from collar region to the tip of the primary root [12].

Fresh and Dry Weight

Germinated plants were washed with distilled water and it was blotted with blotting paper to check the fresh weight of the plant. It was then shade dried to obtain the dry weight of the sample [12].

Results

Phytochemical analysis

The result of phytochemical analysis of SLE of *T. conoides* was shown in (Table 1). The SLE *T. conoides* showed the presence of alkaloids, sugars, proteins, aminoacids, sterols, quinones, coumarins**,** tannins, carboxylic acid, phenols and flavanoids.

Table 1 Phytochemical analysis of SLE

No.	SLE	Alkal	Sug	Pro	Ster	Quin	Tan	Carbo	Phen	Fla	Coum
1.	***T. conoides***	+	+	+	+	+	+	+	+	+	+

+ =Presence, - = Absence; Alkaloids: Alkal, Sugar: Sug, Proteins: Pro, Sterols: Ster, Quinone: Quin, Tannins: Tan, Carboxylic Acids: Carbo, Phenols: Phen, Flavanoids: Fla, Coumarins: Coum

Physico chemical characteristics of SLE

The physico chemical properties of the brown seaweed *T. conoides* has been analyzed and presented in the Table 2. The SLE was brown in colour, has odour smell and p^H was recorded as 6.85.

Table 2 Physical parameters of SLE

No	Parameters	Characteristics
1.	Colour	Brown
2.	Odour	Fermented odour
3.	P^H	6.85

Table 3 Percentage of seed germination *A. hypogaea*

No	Concentration (%)	% of germination
1.	5	100
2.	10	96.5
3.	15	93.33
4.	20	86.66
5.	25	80
6.	Control	86.66

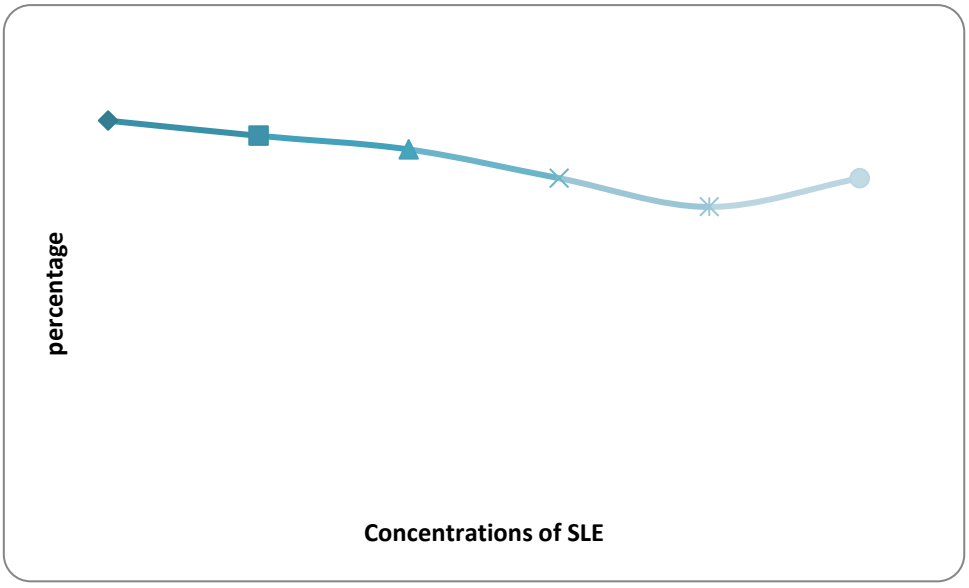

Fig. 1. Percentage of germination of *A. hypogaea*

Table 4 Growth parameters of *A. hypogaea* using SLE with control

Conc. (%)	Shoot length (Cm)	Root length (Cm)	Total fresh weight (g)	Total dry weight (g)
5	4.62	2.42	1.82	0.88
10	2.26	2.32	1.66	0.54
15	1.74	1.42	1.56	0.43
20	1.28	0.50	1.02	0.31
25	1.14	0.30	1.11	0.28
Control	1.66	0.22	1.19	0.30

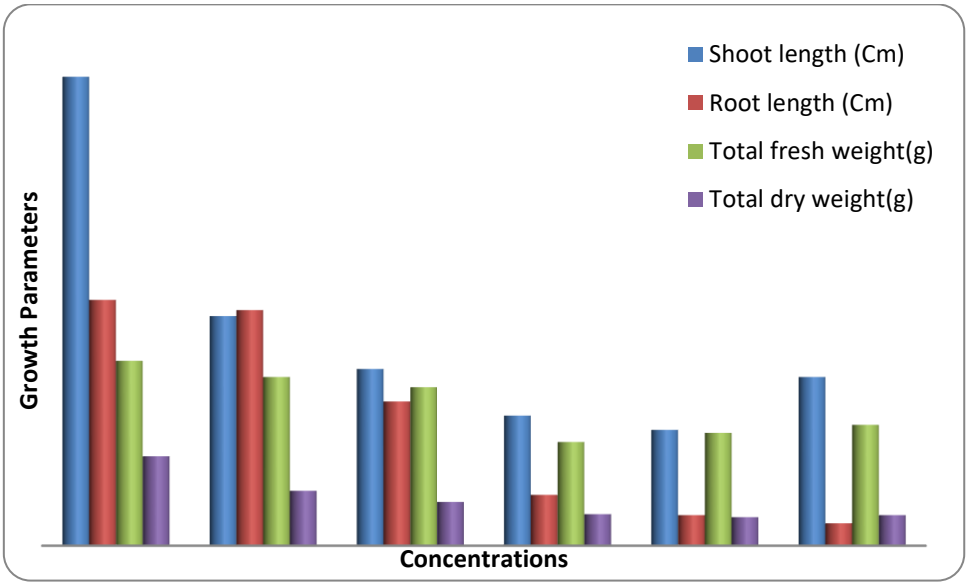

Fig. 2. Plant growth parameters of *A. hypogaea* using SLE with control

The brown seaweed extract was found in effective in increasing germination and the growth of the plant in the low level of SLE (5% conc.). Maximum seed germination of *A. hypogaea* was observed in low conc. (5% conc.) of SLE and minimum germination rate was reported at high conc. (25% conc.) and control. The highest shoot length (4.62 cm), root length (2.42 cm), fresh weight (1.82 g), dry weight (0.88 g) were recorded in the plants with low conc. of SLE. The SLE treatment increased the growth parameters when compared to the control.

DISCUSSION

The present study revealed that the foliar application using SLE from *T. conoides* exhibits promising effects on germination and growth characteristics of the test plant *A. hypogaea.* Seaweed liquid extracts were found superior than chemical fertilizer because of the presence of high levels of organic matter [13]. Report of the present study has shown similarity with the earlier report on the promotional effect of *Zizypus mauratiana* with crude extract of seaweed. Similar growth promoting effects were observed in banana, potato, oranges, ground nut, bhendi, tomato, okra and cow pea [14]. The present study clearly reveals that the SLE shows great promise as SLE hence seaweeds comprise appreciable quantity of plant growth promoting regulators.

Liquid extracts obtained from seaweeds are successfully used as foliar sprays which promote both seed germination and plant growth effectively at low concentrations. Similar results had been recorded by Stephenson [15] with the macroalgae extract of *Ascophyllum* sp. in plant maize. Dhargalkar and Untawale [16] found that the lower concentration of SLE was increased the germination rate of Chilli and Turnip. Temple and Bomke [17] also evidenced that the foliar application of SLE had increased the yield of bean by 25%, and early yield of greenhouse cucumber was observed by Passam et al. [18].

From the present study the growth promotions were recorded in both germination and growth parameters of the plants which treated with minimum concentration (5%) of SLE where as these growth parameters get decreased at higher concentration treatment (25%) and followed by control. The presence of phytohormones in seaweeds specially cytokinins might be the reason for these growth promotion effect [19] and our present findings are coincided with previous studies in SLE of *Dictyota dichotoma* in Abelmoscus esculentus [20], SLE of *Stoechospermum marginatum* in *Cyamopsis tetragonoloba* [21], SLE of *Kappaphycus alvarezii* in *Lycopersicon esculentum* [22] and SLE of *Padina pavonica* in *Vigna radiata* [23].

CONCLUSION

The present study recorded the germination and growth parameters of the *A. hypogaea* which treated with minimum concentration (5%) of SLE shows potent results. Similarly, growth parameters get decreased at higher concentration (25%) of SLE. It may due to the bioactive metabolites present in the SLE of *T. conoides,* which promote the growth and

germination in lower concentration and inhibit at higher concentration owing to overload of nutrients.

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