



Effect of extracts of blue green alga *Oscillatoria* sp. in seed germination of mung bean

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Abstract

Algae are known to contain bioactive compounds. These bioactive compounds have certain effects on seed germination and growth of plants. Algae and algal products are being used worldwide to increase plant growth and yield. In present research work role of blue green alga *Oscillatoria* sp. in seed germination of mung bean (*Vigna radiata* (L.) Wilczik) have been studied in detail by preparing extracts in different solvents. The alga was collected in bulk and in pure form from Buteenath dam, located in Ambajogai tehsil area of Beed district in Maharashtra. Algal extracts were prepared in different solvents such as cold water, hot water, acetone, methanol, ethanol and chloroform. Higher percentage of seed germination with maximum shoot length and root length was observed in hot and cold water extracts. Mung bean seeds treated with extracts of *Oscillatoria* sp. shows stimulatory effects in seed germination with increase in shoot length and root length. Effective biostimulants can be produced from *Oscillatoria* sp. for better germination and growth of plants. Use of algae in seed germination and plant growth is ecofriendly practice in sustainable agriculture development.

Keywords: algal extracts, seed germination, mung bean

Introduction

Algae are rich source of structurally novel and biologically active compounds. The bioactive compounds present in algae are protein, lipids, carbohydrate, vitamins, free amino acids, organic acids, pigments, minerals, enzymes, toxins, antibiotics and growth regulators. Bioactive compounds which are present in algae improves seed germination, seedling development and increases tolerance to environmental stress and influences plant growth. Moreover bioactive compounds present in algae enhances all physiological reactions that lead to good growth of plant (Fayza and Zenaib, 2008) [2]. Fouly et.al. (1992) [3] and Mahmood (2001) [15] observed that algae contains high percentage of macronutrients, considerable amount of micronutrients and amino acids. Due to high content of bioactive compounds human being using algae, since historical period as food, fodder and fertilizers. Algae and algal products are being used worldwide to increase plant growth and yield. Use of algae in agriculture is an environment friendly and safe practice. In present century use of algae in agriculture has become a modern concept in sustainable agriculture development.

In India work on use of algal extracts in seed germination has been started in 1964 by Gupta. He studied accelerated germination in paddy seeds treated with algal extracts. He observed that paddy seeds treated with extracts of *Scytonema hofmanni*, *Fischrella mucicola* and *Nostoc* sp. germinated much better than normal untreated seeds. Gupta and Kusumlata (1964) [6], Gupta and Shukla (1967) [7] worked on algal growth promoting substances and their role in seed germination. Rice seeds soaked in blue green algal extracts shows enhancement in germination. Gupta and Shukla (1969) [8] used water and other extracts of *Phormidium faveolarum* and *Phormidium tenue* in germination of rice seeds which shows marked seed germination. Pendurand (1987) [17] screened 113 strains of cyanobacteria to study their effect on germination and

growth of rice. Nanda et.al. (1999) [16] Observed that extracts of *Westiellopsis prolifica* accelerates germination of pumpkin and cucumber seeds. Venkataraman et.al. (1993) [22] studied effect of seaweed extracts on seed germination and seedling growth of green gram and black gram. Adam (1999) [1] worked on effect of extracts of *Nostoc muscorum* on seed germination of sorghum, wheat and maize. He observed enhancement in seed germination and nitrogen compound in selected crops. Pingle and Abhang (2007) [18] studied effect of fresh water algal extract on seed germination of vegetable crops. Kamble (2008) [11] worked on role of algal extracts in seed germination of sorghum, mothbean and sesamum. Senger et. al. (2010) [20] studied effect of cyanotoxin produced by *Microcystis aeruginosa* on seed germination of *Vigna radiata*. Cynotoxin present in aqueous extract delayed seed germination and length of radical decreased as the concentration of extract increased. Shriamatri (2011) [21] observed effect of extract of *Anabaena vaginicola*, *Nostoc* sp. And *Nodularia harveyana* on seed germination of squash, tomato and cucumber. Germination of presoaked seeds with extracts was faster as compared to seed soaked in distilled water as control. Rosalaba et. al. (2013) [19] studied stimulatory effect of seaweed extracts on tomato seedlings growth. Ganpathy et.al. (2013) [4] observed effect of *Ulva reticulata* on seed germination of *Vigna radiata*. Jadhav and Borkhade (2015) [9] studied effect of cold water, hot water and methanol extracts of algal biomass on seed germination of wheat. Mahadik and Jadhav (2014, 2015 and 2020) [12, 13, 14] extensively worked on effect of extracts of *Cladophora crispata* and *Chara fragilis* on mung bean and of *Spirogyra jugalis* on tomato. Jadhav and Mahadik (2022) [10] studied stimulatory role of blue green alga *Synechococcus aeruginosus* in seed germination of sunflower seeds. The main objective of present research work was to study effect of extracts of blue green alga *Oscillatoria* sp. on seed germination. Blue green alga *Oscillatoria* sp. was collected

in pure form and used for making algal extracts in different solvents. Mung bean (*Vigna radiata* (L.) Wilczek) is a legume crop mostly cultivated throughout the world. India is the largest Mung bean producing country in the world. Mung bean is commonly grown legume crop in Maharashtra. Algal extracts in different solvents of *Oscillatoria* sp. were used for germination of mung bean seeds.

Materials and methods

Collection of algal material and preparation of fine powder

Blue green alga *Oscillatoria* sp. is abundantly found in Buttenath dam of Beed districts in Maharashtra. Alga was collected in bulk in the month of July 2022 and identified by microscopic observation. After identification algal material was washed thoroughly with fresh water to remove unwanted impurities, epiphytes and adhering sand particles and mud. Algal material was dried in shade at room temperature for four days which is followed by oven drying at 40°C for 8 hours. Dried algal material was ground to a fine powder and stored in air tight bottles.

Preparation of algal extracts in different solvents

Algal extracts in different solvents such as cold water, hot water, acetone, methanol, ethanol and chloroform were prepared. For the preparation of cold water extracts 1 gm of fine algal powder was taken in 100 ml conical flask. 25 ml cool sterile distilled water added to it, flask plugged with cotton and kept it overnight. Next day it has been filtered through Whatman filter paper No.1 and coloured filtrate obtained and used for soaking of seeds. Hot water extracts was obtained by taking 1 gm. of fine algal powder in 100 ml conical flask. 50 ml sterile distilled water added to it and boiled for 10 to 15 minutes, cooled it and filtered. Filtrate obtained used for soaking of seeds. Extract in acetone was prepared by taking 1 gm of fine algal powder in 100 ml conical flask. 20 ml acetone added to it and flask was plugged with cotton and kept overnight in cool and dry place. The volume was restored and content were centrifuged to collect maximum supernatant. The content was filtered through Whatman filter paper No.1 and filtrate was allowed to dry at room temperature. 20 ml of sterile distilled water was added to it and used for soaking of seeds. In similar way algal extracts in different solvents were prepared separately.

Treatment of seeds with algal extracts

Healthy seeds of mung bean were obtained from authorised seed distributor. To avoid microbial contamination, selected seeds were surface sterilized with 0.1% HgCl₂ solution. Surface sterilized 10 seeds were soaked in algal extracts for 4 hours. Seeds soaked in water served as control. The soaked seeds were placed on moist germinating paper for germination in sterilized petriplates. Percent germination, root length and shoot length of seedlings were measured after 7 days of incubation at room temperature.

Results and discussion

Effects of extracts of *Oscillatoria* sp. on seed germination of mung bean shows encouraging results. The results have been summarized in Table 1. In control 60% seeds were germinated with 2.6 cm shoot and 2.4 cm root length. Cold water Cold water extracts showed 80% germination with 4.8

cm shoot length and 6.7 cm root length. In hot water extract seed germination was 90% with 4.9 cm shoot length and 7.2 cm root length. Treatment with methanol and chloroform extracts shows 70% seed germination with 2.1 cm shoot length and 4.2 cm root length. Almost similar results were obtained with remaining solvents. Aqueous extracts of *Oscillatoria* sp. shows promising results in mung bean seed germination. Similar kind of results were obtained by Kamble (2008) [11] and Mahadik and Jadhav (2020) [14]. Pingle and Abhang (2007) [18] found that aqueous extracts *Nostoc* and *Lyngbya* increases shoot and root length of tomato, chili and fenugreek. Jadhav and Borkhade (2015) [9] and Jadhav and Mahadik (2022) [10] reported similar kind of observations while studying effect of algal extracts on seed germination of wheat and sunflower.

Table 1: Effect of different solvent extracts of *Oscillatoria* sp. in seed germination of mung bean seed.

Sr. No.	Solvent used for the preparation of algal extract	Percentage of seed germination	Shoot Length cm	Root Length cm
1	Cold water	80	4.8	6.7
2	Hot Water	90	4.9	7.2
3	Acetone	60	2.1	3.7
4	Methanol	70	2.2	4.2
5	Ethanol	40	0.7	1.2
6	Chloroform	70	2.2	4.2
7	Control	60	2.6	2.4



Fig 1: Microphotograph of *Oscillatoria* sp.



Fig 2: Fine powder of *Oscillatoria* sp.



Fig 3: Preparation of algal extracts in different solvents.



Fig 4: Effect of algal extracts in seed germination of Mung bean.

Conclusion

Hence it is concluded that mung bean seeds treated with aqueous extracts of *Oscillatoria* sp. shows enhancement in seed germination with increase in root and shoot length. It is observed that blue green alga *Oscillatoria* sp. contains growth promoting substances which stimulates seed germination. It is a potential alga for production of effective biostimulants. This ecofriendly practice can be recommended to farmers for attaining better germination and growth. Use of algae in seed germination and plant growth is promising in sustainable agriculture development.

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