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Evaluation of cyanobacterial extracts for seed germination property on *Oryza sativa*, *Helianthus annuus* and *Hibiscus esculuntus*

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ABSTRACT

About 20 species of cyanobacteria were isolated from various *Oryza sativa* fields in Karur dist. After purification all the organisms were verified for their ability to enhance seed germination in *Oryza sativa*, *Helianthus annuus* and *Hibiscus esculuntus*. Among the 20 species *Oscillatoria annae* showed maximum germination ability in all the three plant seeds. The germination % ranged between 85-95% in all the plants. Thus from our study we recommend *Oscillatoria annae* to be considered as a serious contender in the field of plant growth promoting hormones which is cost effective and pollution free. © 2008 Trade Science Inc. - INDIA

KEYWORDS

Cyanobacterial extract;
Seed germination property;
Oryza sativa;
Helianthus annuus;
Hibiscus esculuntus.

INTRODUCTION

Cyanobacteria are a diverse group of prokaryotes with oxygenic photosynthesis, which is similar to that in algae and higher plants. Cyanobacteria excrete a great number of substances that influence plant growth and development. These microorganisms have been reported to benefit plants by producing growth promoting regulators, vitamins, amino acids, polypeptides, antibacterial, antifungal substances and polymers, especially polysaccharides that improve soil structure and exoenzyme activity. *Nostoc muscorum* isolated from *Oryza sativa* L. fields were reported with auxin activity and characters similar to indole acetic acid^[1]. Malliga and Viswajith^[2] have also reported the growth promoting property of basal application of *Phormidium* sp. BDU5

on varying plants. Though many of the cyanobacteria have growth promoting ability, the reports on seed germination ability of cyanobacteria is few. Thus in our study we have screened 20 cyanobacteria obtained from paddy fields to identify the cyanobacteria with the best seed germinating ability on three different seeds of *Oryza sativa*, *Helianthus annuus* and *Hibiscus esculuntus*.

EXPERIMENTAL

Collection of cyanobacterial samples

The cyanobacterial samples were collected from various *Oryza sativa* L. field in Thanthonimalai, Karur District, Tamil Nadu.

Isolation

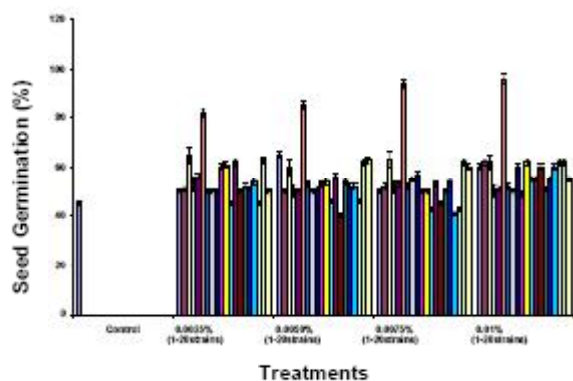


Figure 1: Effect of cyanobacterial extract on seed germination of *Oryza sativa* L

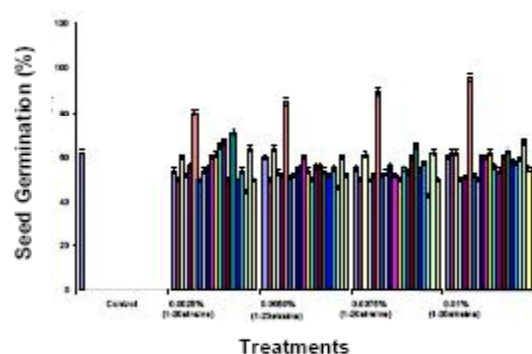


Figure 2: Effect of cyanobacterial extract on seed germination of *H. esculentus* L

BG11 medium^[3] was used for isolation, identification and mass cultivation of cyanobacteria.

BG11 medium was prepared and sterilized at 121^oC at 15lbs for 15minutes. Cyanobacteria were isolated and purified by spread plate technique. One gram of cyanobacterial mat was homogenized and diluted in 100ml (considered as 10⁻²) of stock. From the stock one ml of cyanobacterial suspension was taken and it was transferred to 9ml of sterilized medium from 10⁻³ to 10⁻⁸ respectively. From each dilution 1ml was transferred and spread using L-rod on solidified BG11 agar medium in petriplates and incubated under controlled condition.

Culture maintenance and induction of auxin

Cyanobacterial cultures were maintained in BG-11 medium at 25±2^oC under 1500 lux light intensity with 14/10 D/L cycle for 7 to 15 days. For auxin production 10mg/100ml of tryptophan (precursor) was incorporated in BG11 medium^[4].

Cyanobacterial extract preparation

Known amount of dried cyanobacterial strains were taken and ground with required amount of distilled water. Extraction was repeated until the cyanobacterial culture turned white residue. Then the extract was filtered through Whatman No.1 filter paper and the culture filtrate was dried for three days. Finally the dried extract was prepared at various concentrations for seed germination.

Seeds

Paddy(*Oryza sativa* L. -IR 20), Lady's finger (*Hibiscus esculentus* L. -Pusa), and Sunflower (*Helianthus annus* L. -Ankur) seeds were obtained from Department of Agriculture, Tamil Nadu Agriculture University, Madurai, Tamil Nadu, India.

Seed germination study

The dried cyanobacterial extract prepared at various concentrations (0.0025%, 0.0050%, 0.0075% and 0.01%) was applied to the seeds of the selected plants like *O. sativa*, *H. esculentus* and *H. annus* and the seeds were exposed to sunlight for 8hr and it was kept at room temperature for 24 to 48 hours^[5]. The efficient cyanobacterial strain was selected based on the influence of germination ability.

Identification of the organism showing maximum germination ability

The organism showing maximum seed germination ability was subjected to identification till species level by microscopy. Based on the characters^[6] the identification of selected cyanobacterial strain was identified.

RESULTS AND DISCUSSION

Screening of cyanobacteria from the rice fields revealed that majority of the organisms belonged to the *Phormidium* sp. (11) followed by *Oscillatoria* sp. (8) and *Anabaena* sp. (1). Comparing the germination ability of the 20 strains all the organisms showed better response than the control i.e., water. When compared to the germination percentage by water (40-50%) majority of the organisms showed higher induction of 50-65% (Figures 1-3). The response by the most of the organisms was constant in all the three plant seeds. Among the 20 strains used strain number 6 showed higher germination % ranging from 80-95%. This or-

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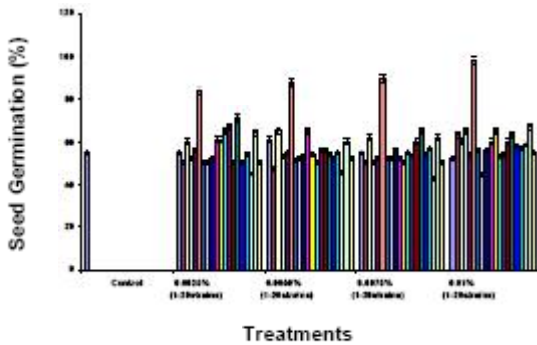


Figure 3: Effect of cyanobacterial extract on seed germination of *H.annus* L

ganism showed higher germination in all the three plant seeds. Figures 1-3 clearly indicates that strain number 6 possessed the maximum seed germination inducing ability. The blue green algae like *Microcystis*, *Anabaena*, *Nostoc* and *Oscillatoria* produce a variety of secondary metabolites such as nitrogen containing compounds, polyketides, lipopeptides, cyclic peptides and many others^[7,8]. Above mentioned earlier reports significantly supported our study on seed germination ability by cyanobacteria.

Since strain number 6 showed maximum seed germination ability identification was performed by microscopy. Order-Ostacales, Family-Oscillatoriaceae, Genus-*Oscillatoria*, Species-*annae*. These findings revealed that *Oscillatoria annae* gave a high seed germination induction in *O.sativa*, *H.annae* and *H.esculentus*. *O.annae* may provide a cost-effective and pollution free seed germination strategy. Thus in our future study we will be focussing on the identification of the compound responsible for the induction of germination.

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