

# Plant Growth Promoting Activity of Novel Isolated Bacteria

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## ABSTRACT

This study aimed to evaluate the plant growth-promoting activity of novel bacteria isolated from the phyllosphere of *Parthenium* in fenugreek seeds. The phyllosphere of plants is a rich source of diverse microorganisms that can promote plant growth and health. In this study, we isolated and identified novel bacteria from the phyllosphere of *Parthenium*, a common weed plant, and tested their plant growth-promoting activity in fenugreek seeds. The isolated bacteria were screened for various plant growth-promoting traits, including phosphate solubilization, nitrogen fixation, and indole acetic acid (IAA) production. The results showed that some of the isolated bacteria exhibited significant plant growth-promoting activity in fenugreek seeds, as evidenced by increased shoot and root length, fresh and dry weight, and chlorophyll content. Furthermore, the bacteria also showed a significant increase in the level of IAA production, indicating their potential as biofertilizers for sustainable agriculture. Our findings suggest that the phyllosphere of *Parthenium* can be a promising source of novel plant growth-promoting bacteria that can be used to enhance crop productivity and reduce the reliance on chemical fertilizers.

## INTRODUCTION

Fenugreek is a clover-like herb native to the Mediterranean region, southern Europe, and western Asia. Its seeds, which smell and taste like maple syrup, have been used in cooking and as medicine. Fenugreek is used as an ingredient in spice blends and a flavoring agent in foods, beverages, and tobacco. Fenugreek extracts are also used in soaps and cosmetics. In North Africa, Asia, and southern Europe, fenugreek was traditionally used for diabetes and to increase milk supply in women who were breast feeding. Today, fenugreek is promoted as a dietary supplement for diabetes, menstrual cramps, and other conditions and to stimulate milk production during breastfeeding. Fenugreek is believed to be safe in the amounts commonly found in foods. Its safety in larger doses is uncertain. It should not be used by children as a supplement. Potential side effects of fenugreek include diarrhea, nausea, and other digestive tract symptoms and rarely, dizziness and headaches. Large doses may cause a harmful drop in blood sugar. Fenugreek can cause allergic reactions in some people. Cases of liver toxicity have been reported in people taking fenugreek alone or in combination with other herbs. Fenugreek is commonly consumed in foods. But there isn't enough reliable information to know if fenugreek is safe when taken in larger amounts. An unusual body and urine odor has been reported after drinking fenugreek tea. This doesn't seem to be harmful, but it could be confused with a condition called "maple syrup urine disease."



Fig 1.1 Fenugreek seeds  
(*Trigonella foenum-graecum*) Fig 1.2 *Parthenium* Weed

The phyllosphere is the total above-ground surface of a plant when viewed as a habitat for microorganisms. The phyllosphere can be further subdivided into the caulosphere, phylloplane, anthosphere, and carposphere. The phyllosphere refers to the aerial or above ground parts of plants colonized by microbial communities, the rhizosphere is the microbial communities inhabiting the root surface and soil zone around the root and endosphere is the microbial communities residing within plant tissues.

*Parthenium hysterophorus*, an annual weed growing aggressively in disturbed habitats of semi-arid environments. It is found in dense stands along roadsides, riverbanks, railway lines, streams, on wasteland, agricultural land and pastures (Photo 1-3). The weed has a number of characteristics that contribute to successful invasiveness: tolerance of a wide range of soil types; adaptability to different environments including drought; allelopathic (has chemicals that inhibit growth of other plants); early flowering (can be as little as 4 weeks after germination); produces many seeds (15,000-25,000 per plant); seeds have long viability, and easily dispersed by wind, animals, machinery and vehicles. From sea level to 2500 msl. This alien weed is believed to have been introduced into India as contaminants in PL 480 wheat (Public Law 480 passed in 1954 to give food grains to developing countries for eliminating starvation and malnutrition) imported from the USA in the 1950s. Presently, this invasive weed is widely prevalent in India (Singh et al. 2008). Approximately two million hectares of land in India have been infested with this herbaceous menace (Dwivedi et al. 2009).

Plant growth-promoting bacteria (PGPB) are beneficial microorganisms that can enhance plant growth and development by several mechanisms such as nutrient acquisition, phytohormone production, and disease control. In recent years, researchers have been isolating novel PGPB from various plant parts including the phyllosphere, which is the above-ground part of plants that includes leaves, stems, and flowers. One such study isolated bacteria from the phyllosphere of the *Parthenium* plant and tested their growth-promoting activity on fenugreek seeds.

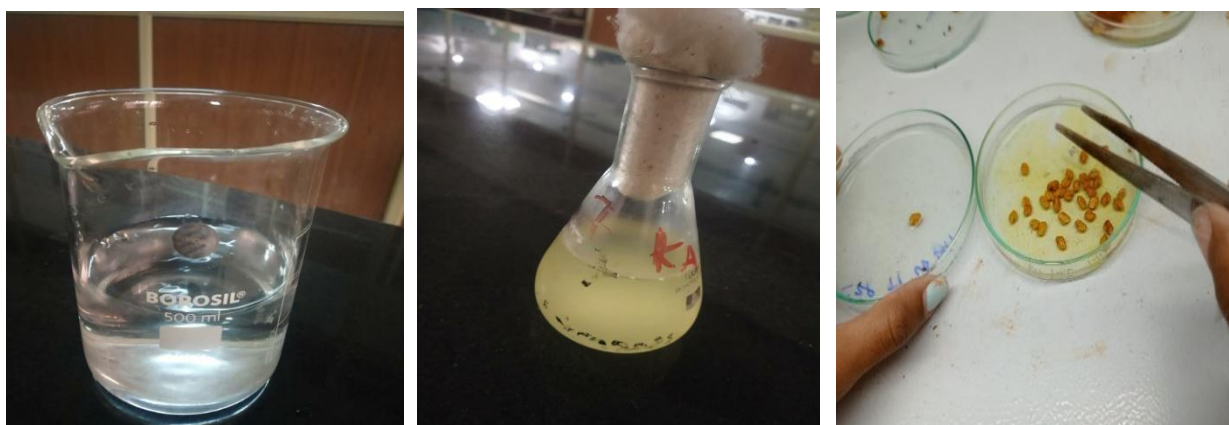
## MATERIALS AND METHODS

### Isolation And Screening:

Isolation and identification of novel bacteria from the phyllosphere of the *Parthenium* plant. Screening of the isolated bacteria for their plant growth-promoting properties, including nitrogen fixation, phosphate solubilization, and production of plant hormones. Evaluation of the potential of the selected bacteria to promote the growth and development of country fenugreek seeds under *in vitro* conditions. Comparison of the growth-promoting effects of the selected bacteria with those of untreated seeds are the steps possible

### Seed Germination:

Seeds of fenugreek for each isolate were taken in sterile beakers (25 seeds per isolate). Seeds were surface sterilized and treated with bacterial cell suspension. For pot experiments, soil was sterilized by autoclaving twice for axenic growth. The seeds treated with inoculum (25 seeds per isolate) were sown in plastic pots and incubated in plant growth chamber at  $25 \pm 2^\circ\text{C}$  at the photoperiod of 18/6 h. Growth parameters in terms of germination percentage, shoot length, shoot biomass, root length and root biomass, will be recorded after 3-weeks.



(a)

(b)

(c)

**Fig.3. Seed Sterilization Process (a) Sodium Hypochloride, (b) 24 hrs old Culture (c) Seed after the sterilization soaked in the culture for 10 mins**

### RESULTS

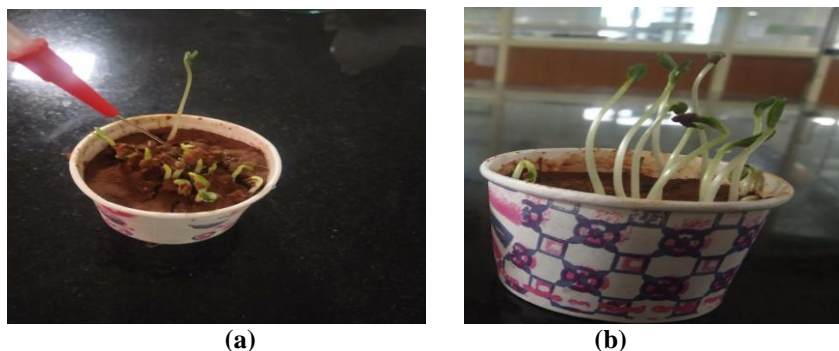


Fig4 (a) Treated seed after one week and (b) Treated seed after 2 week.

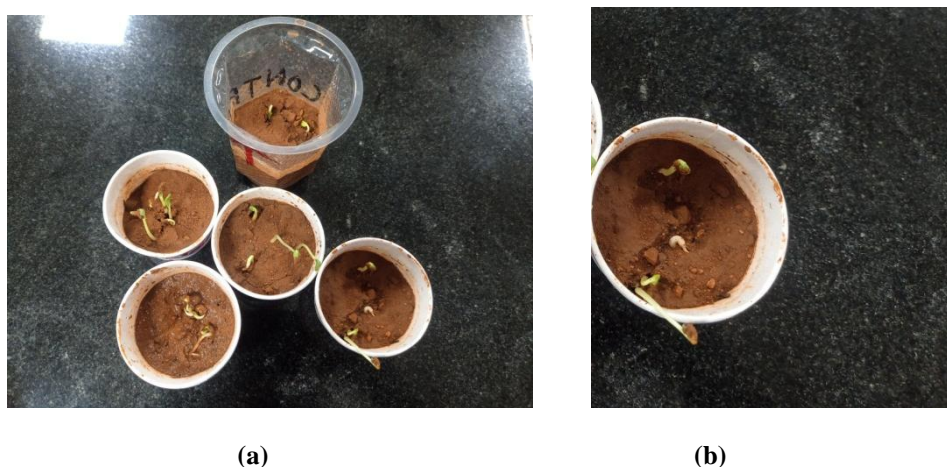


Fig 5. (a) Untreated Seed after one week (b) untreated seed after 2 week.

### CONCLUSION

As the results shown from some of the isolated bacteria exhibited significant plant growth-promoting activity in fenugreek seeds, as evidenced by increased shoot and root length, fresh and dry weight, and chlorophyll content. Fenugreek is an important medicinal and culinary herb, and its growth can be enhanced by the application of PGPB. This study will be extended with other crop seed varieties with other isolates.

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