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Endophytic Bacteria Associated with Barley

Aisha Parween, Vidyanath Jha

L. N. Mithila University Darbhanga

Abstract: ***Plants are the major source of carbohydrates for the heterotrophic microorganisms on earth. Plants even makes use of diverse compounds to interact and form associations with often mutualistic beneficial bacteria. On the other hand bacteria possess a wide range of metabolic properties that may modulate plant growth. Bacteria living inside plants i. e. bacterial endophytes might intimately interact with cells of the host taking up secreted metabolites and releasing plant growth promoting (PGP) compounds. Plant roots are important hosts to beneficial microorganisms including mycorrhizal fungi, rhizobia bacteria, and endophytic fungi. Endophytic bacteria live symbiotically with the plant and in turn helping the plant in number of ways. Different endophytic bacteria were isolated from the parts of the plant. On the basis of the morphological and biochemical characterization of the endophytes as well as 16S rRNA sequencing technique they are identified as Bacillus subtilis, kellebsilla and Pseudomonas present in root tissue.***

Keywords: Endophytes Bacillus subtilis, Pseudomonas 16s rRNA, Enzymes, PGP

1. Introduction

The majority of biologically active compounds exist in plants, although they are also abundant in microorganisms and other areas where life exists. This coexistence is important to the further understanding of how biology impacts life and how the balance between organisms remains important. The microorganisms that make a relationship endosymbiosis with the plants wherever plants receive an ecological relation the most of the presence of dependent bacteria (Quispel, 1992). The study was carried out to identify endophytic bacteria associated with barley plant.

Cropping season

It is grown as rabi crop in the winter season by planting in September - October in Andhra Pradesh Karnataka and Tamil Nadu and as summer irrigating crop by planting in January - February in Bihar, Karnataka and Andhra Pradesh.

Table: Recommended varieties of barley for Bihar

State	Season	Varieties	Remarks
Bihar	Kharif (June - September)	BR 407, RAU8, VL149	For North Bihar

Chemical Composition

Barley cultivars vary wide in their chemical composition due to differences in genotype, growing setting and the and therefore conjointly the interaction between the pair of traditional barley typically consists of 60% – 70% starch per dry matter (dm), creating starch the foremost thick constituent and located principally within the reproductive structure. Consequent main constituents are total fiber starting from 11% – 34% and macromolecule 10% – 20%; of total fiber 3% – 20% is soluble dietary fiber with 5% – 10% β - glucan counting on the cultivar. Different constituents are 2% – 3% free lipids and 1.5 – 2.5% minerals. Barley also contains other elements as well as variety of antioxidants and phenoplast compounds.

Nitrogen fixation by endophytes

In 1986, Brazilian scientists (Cavalcante and Dobereiner, 1988) [5] discovered in the sugarcane stem N2 - fixing endophytic bacteria called *Gluconacetobacter diazotrophicus*. Their pioneering work was confirmed by other scientists in USA, UK, and Germany and led to the identification of two other N2 - fixing endophytes, *Herbaspirillum seropedica*e and *H. rubrisubalbicans (*Boddey *et al.*, 1995) [4]. Endophytic diazotrophs seem to constitute only a small proportion of total endophytic bacteria (Ladha *et al*,.1997; Martínez *et al.*, 2003) [32, 38]. Such microbes include *Azospirillum lipoferum, Klebsiella pnemoniae* and *Azorhizobium caulinadans (*Schloter *et al.*, 1994) [48].

Endophytic bacteria are found in legume nodules as well. In red clover nodules, some species of *rhizobi*a were found, including *Rhizobium (Agrobacterium) rhizogenes*, in addition to *R. leguminosarum bv. trifolii*, which is the normal clover symbiont (Sturz *et al.*, 1997) [52]. Inside wheat, *Klebsiella sp*. strain Kp342 fixes N2 (Iniguez *et al.*, 2004) [22].

During a survey in Tamil Nadu with sugarcane varieties, four isolates belonging to the genus *Burkholderia* was studied. *Burkholderia vietnamiensis* was found more active in reducing acetylene than the others (Govindarajan *et al.*, 2006) [15]. Jha and Kumar (2007) [26] isolated and characterized endophytic diazotrophic bacteria from a semi - aquatic grass (*Typha australis*) which grows luxuriantly with no addition of any nitrogen source.

Antibiotics

Antibiotics are natural compounds produced by microorganisms as secondary metabolites to kill or inhibit other microorganisms. *Streptomyces sp*. are such organisms which produce about 80% of the total antibiotics (Sathiyaseelan and Stella 2011; Thenmozhi and Krishnan 2011) [47, 57]. Endophytic *Streptomyces* sp. LJK109 isolated from *Alpinia galangal* root produces 3 - methylcarbazoles which is major anti - inflammatory component and also suppresses macrophage production of the inflammatory mediators NO, PGE2, TNF - α, IL - 1β, IL - 6 and IL - 10 in a dose - dependent manner (Taechowisan *et al.*2012) [54] The majority of endophytic bacteria like other bacteria produce different kinds of antibiotics.

Ecomycin, pseudomycins and kakadumycins are some of the novel antibiotics produced by endophytic bacteria (Christina *et al.*2013) [7]. *Pseudomonas viridiflava*, an epiphyte or

endophyte of the leaves of many grasses produced ecomycin, an antibiotic which is used for the treatment of skin, eye, gut, respiratory and urinary tract infections. Endophytic *Streptomyces sp*. isolated from *Aucuba japonica* and *Cryptomeria japonica* produced two new novobiocin analogs and cedarmycins respectively. A new naphthoquinone antibiotic, alnumycin was also isolated from the endophytic *Streptomyces sp*. from *Alnus glu tinosa*.

2. Conclusion

The present investigations were undertaken to find out the presence of bacterial endophytes in root of barley plant. By using nutrient agar and selective medium (YMA and Picovasky'smedium). Different endophytes were isolated from root tissue of the plant.

Endophytes are a promising source of many bioactive and drugs but till date the potential of endophytes has not been analyses fully. More sincere work need to be done in this field to completely assess the ability of endophytes to produce different compounds. Also, there is a need to find out the ways in which these compounds can be extracted efficiently from the plants. This will not only pave the path of using these endophytes as inexhaustible source of some crucial compounds but also ensure better productivity of crop plants.

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