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Study of Effect of Plant Growth Hormone Auxin on the Growth of Bacteria

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Abstract: *Auxin is a growth hormone found in plants. It's is used by plants for growing. It has antimicrobial properties too, found in young plants for growing. Various bacteria promote plant root growth in the rhizosphere, as a measure of securing and enlarging their ecological niche. These interactions are mediated by plant growth regulators (PGRs) such as auxin, and indole-3-acetic acid (IAA) is one of the physiologically active auxins. In this study, we isolated an unusual bacterial strain from food process waste with high efficiency and demonstrated its effects on plant rooting and early-stage growth.*

Keywords: Plant growth regulators (PGRs), Indole-3-aceticacid (IAA), early stage growth, root growth in rhizosphere

I. INTRODUCTION

Matki: Moth beans or Matki is a staple legume in various cuisines across India, often consumed either as a sprout or in the cooked form. Quite popular in the Maharashtrian cuisine, Moth beans are also known as mat bean, dew bean or Turkish gram. These tiny beans oblong in shape, available in brown, reddish brown and green colours are rich in protein and go with the botanical name Vigna aconitifolia.

Moong:Moong bean (Vigna radiata L.) is an important pulse consumed all over the world, especially in Asian countries, and has a long history of usage as traditional medicine. It has been known to be an excellent source of protein, dietary fiber, minerals, vitamins, and significant amounts of bioactive compounds, including polyphenols, polysaccharides, and peptides, therefore, becoming a popular functional food in promoting good health. The mung bean has been documented to ameliorate hyperglycemia, hyperlipemia, and hypertension, and prevent cancer and melanogenesis, as well as possess hepatoprotective and immunomodulatory activities. These health benefits derive primarily from the concentration and properties of those active compounds present in the mung bean. Vitexin and isovitexin are identified as the major polyphenols, and peptides containing hydrophobic amino acid residues with small molecular weight show higher bioactivity in the mung bean. Considering the recent surge in interest in the use of grain legumes, we hope this review will provide a blueprint to better utilize the mung bean in food products to improve human nutrition and further encourage advancement in this field.

Chana:Chickpea is a cool season legume crop grown world-wide as a food crop. The seed is the main edible part ofthe plant. It is also called garbanzo gram or Bengal gram. It ranks third (FAO, 2008) among the foodlegumes after beans and pea. More than 50 countries are reported to grow chickpea; 22 cultivate more than20,000 ha,and 19 cultivate 10,000 to 20,000 ha. Major chickpea-producing countries are: India (65% of annual production),Pakistan(10%), Turkey (7%), Iran (3%),MyanmarMexico (1.5%) and Australia (1.5%)(FAO, 2008).Chickpea is a cheap and important source of proteinfor those people who cannot afford animal protein or who are largely vegetarian. Furthermore, chickpea isalso a good source of minerals (calcium, phosphorus, magnesium, zinc and iron), unsaturated fatty acids,fibre and β-carotene). Chickpea alsoplays an important role in maintaining soil fertility by fixing nitrogen at rates of up to 140 kg/ha/year (Flowers et al., 2010).Therefore, this crop requires relatively low inputs ofnitrogen as it derives 70% of its N through symbioticNitrogen fixation and benefits other cereal crops asWell. Chickpea contributes a significant amount of residual nitrogen to the soil andadds organic matter thereby improving soil health and fertility.

The phytohormone auxin (from the Greek "auxein," meaning to grow) regulates a whole repertoire of plant developmental processes, as documented in previous articles on this topic. Perhaps less well known is the fact that some microorganisms also produce auxin (Costacurta and Vanderleyden 1995; Patten and Glick 1996). In their interaction

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with plants, these microorganisms can interfere with plant development by disturbing the auxin balance in plants. This is best documented for phytopathogenic bacteria like *Agrobacterium* spp. and *Pseudomonas savastanoi* pv. *savastanoi*, causing tumors and galls, respectively (Jameson 2000; Mole et al. 2007), and plant growth promoting rhizobacteria (PGPR) such as *Azospirillum* spp. that impact on plant root development (Persello-Cartieaux et al. 2003; Spaepen et al. 2007a). The term rhizobacteria refers to the fact that their numbers are highly enriched in the rhizosphere, i.e., the narrow band of soil that surrounds the root (Hiltner 1904; Smalla et al. 2006; van Loon 2007). Of more recent date is the observation that auxin (indole-3-acetic acid or IAA) is a signaling molecule in some microorganisms (Spaepen et al. 2007a). Bringing these data together, it follows that auxin can have a major impact in microorganism-plant interactions. This is the main theme addressed in this article. Finally, the recent finding that auxin signaling in plants is also part of the *Arabidopsis* defense response against a leaf pathogen (Navarro et al. 2006) is discussed in relation to bacterial IAA synthesis.

Auxin as A Microbial Signal Molecule:

Changes in bacterial gene expression under the influence of IAA were first described for the *ipdC* gene of *A. brasilense* (see earlier discussion, positive feedback regulation of IAA synthesis). In the phytopathogen *A. tumefaciens*, it was shown that IAA is a signal molecule because *vir* gene expression is inhibited by IAA (by competing with the phenolic plant signal for interaction with the VirA/G system). This control mechanism is proposed as a signal for *A. tumefaciens* indicating that plant transformation (transfer and expression of T-DNA) was successful (Liu and Nester 2006). In a follow-up study, microarray analyses revealed that addition of IAA represses the *vir* regulon and *chv* genes of *A. tumefaciens*, and that most of these changes are also induced by the addition of salicylic acid. Expression of a gene encoding an ABC-type transporter, probably involved in the uptake of IAA, was found to be specifically up-regulated by IAA (Yuan et al. 2008).

In the yeast *Saccharomyces cerevisiae*, the addition of IAA to the culture medium stimulates adhesion and filamentation (inducing invasive growth), and a cell-surface protein encoded by *FLO11* is involved in these changes (as supported by the increase of *FLO11* transcription). At higher IAA concentrations, cell growth is arrested. Transcript profiling revealed a YAP-1 (fungal-specific transcriptional activator involved in pleiotropic drug resistance) binding site in the promoter of IAA-regulated genes; interestingly, a *yap1-1* mutant was found hypersensitive to IAA, suggesting that YAP-1 is a key mediator in the auxin response in yeast. It is postulated that IAA at plant wound sites can serve as a cue for yeast and fungi to sense and adapt to the plant environment (Prusty et al. 2004). In *Escherichia coli*, it was found that IAA-induced cells are more resistant to different stress agents, probably by the enhanced formation of trehalose, lipopolysaccharides, exopolysaccharides, and biofilm. In the presence of IAA, expression of genes encoding cell envelope components and proteins involved in the adaption to adverse conditions are induced (Bianco et al. 2006a). Further expression studies revealed that genes involved in the tricarboxylic acid cycle, glyoxylate shunt, and amino acid biosynthesis are up-regulated in the presence of IAA. In addition, increased activity of several enzymes in the central metabolism was shown (Bianco et al. 2006b).

The question can be addressed whether IAA as an effector molecule for bacterial gene expression is related to indole as a signaling molecule. Indole is well known as a communication signal in *E. coli* (Lee and Lee 2010) and is studied in relation to quorum sensing (Walters and Sperandio 2006; Lee et al. 2007). Indole controls biofilm formation in *E. coli* and *Vibrio cholerae* (Di Martino et al. 2003; Mueller et al. 2009). In a recent study (Lee et al. 2010), it was shown that indole-3-acetonitrile (an auxin) decreased biofilm formation of *E. coli* 0157:H7 and *Pseudomonas auruginosa* virulence. This could be linked with specific effects of IAN on gene expression. However, in cases in which IAA has been found as an effector in bacterial gene expression, no such effect was observed with indole, indicating that auxin effects on bacterial gene expression are distinct from the well-known indole signaling.

II. MATERIAL AND METHODOLOGY

2.1 Materials Sample

Day 1: Mong, chana, matki were soaked overnight and then removed it from water and tied with muslin cloth.

Day 2: 1. Extracted the germinated root from the legumes.

2. Then it was pasted in mortar and pestle.

3. Transferred it in 3 different dilution tubes

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Requirements:

1. Micropipettes, spreader
2. Chana,moong,matki
3. Sterile agar plates.
4. Alcohol
5. Culture:E.Coli and S.aureus.
6. Mortar and pestle
7. Cork borer.

2.2 Methods

AGAR WELL DIFFUSION METHOD:A cork borer is also used to punch holes on an agar plate and to perform well diffusion assays in microbiology to study bioactivity. Agar well diffusion method is widely used to evaluate the antimicrobial activity of microbial extracts. Similarly, to the procedure used in disk-diffusion method, the agar plate surface is inoculated by spreading a volume of the microbial inoculum at desired concentration is introduced into the well. Then agar plates are incubated under suitable conditions depending upon the test microorganism. The antimicrobial agent diffuses in the agar medium and inhibits the growth of the microbial strain tested.

2.3 Methodology

1. Take the germinated white part of seed of each moong, matki and chana.
2. Prepare slurry by using mortal pestle, add distilwater.
3. Transfer it to three different test tubes.
4. Take nutrient a gar plates, inoculate bacteria i.e. S. aureus and E. coli, by spread plate technique.
5. Allow organisms to grow for few minutes.
6. Make wells by cork borer,
7. Add the prepared slurry in the wells,
8. And then incubate for 24 hours at 37°C.
9. Observe the results

III. OBSERVATION

Auxin showed clear zone of inhibition, around the well of moong, matki and chana.

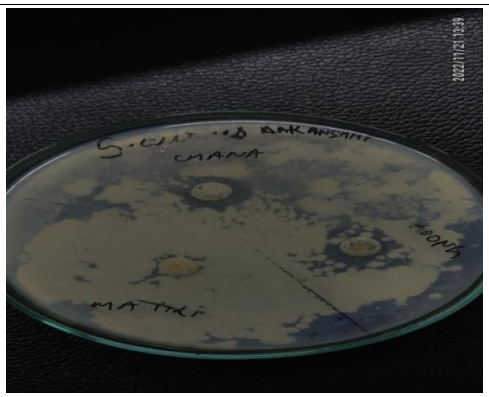

Fig.1. Auxin's effect against S. aureus bacteria

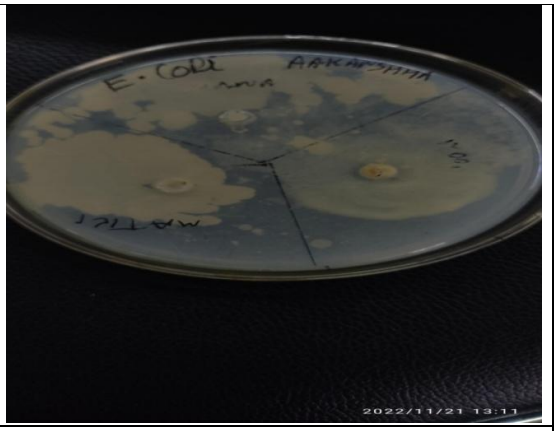

Fig. 2. Auxin's effect against E. Coli bacteria

IV. RESULT

After incubation, zone of inhibition was observed around the well of each samples.Auxins showed visible zone of inhibition in both the agar plates under the used bacteria Escherichia.coli and S.aureus.

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V. CONCLUSION

We conclude that auxin extracted from chana gives positive result against S. aureus. Whereas, the auxin extracted from moong gives positive result against E. coli.

VI. BIBLIOGRAPHY

Auxin is involved in many processes of nodule formation by rhizobia in legume plants, such as founder cell specification (auxin transport inhibition mainly by flavonoids), nodule initiation and differentiation (auxin accumulation), vascular bundle formation, and nodule numbers (long distance auxin transport). Because many rhizobia are capable of producing IAA via different pathways, it is assumed that bacterially produced auxin can alter the auxin balance inside the plant. In addition, rhizobia can also indirectly influence the auxin homeostasis by interfering with plant auxin transport

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