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SOIL ANTAGONISM

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Microbial interaction and types

Microorganisms interacts with each other and can be physically associated with another organism in a variety of ways. Microbial interaction may be positive such as mutualism, proto-cooperation, and commensalism or may be negative such as ammensalism (antagonism), parasitism, predation or competition.

Antagonism

Antagonism is a negative relationship between organisms, so that one organism benefits at the expense of another. The first population which produces inhibitory substances are unaffected or may gain a competition and survive in the habitat while other population get inhibited. This chemical inhibition is known as antibiosis. They secrete a potent enzyme which destroys other cells by digesting their cell walls and degrade the cellular material as well as released protoplasmic material serves as a nutrient for the inhibitor organism. For example, Aspergillus has an antagonistic effect on *Penicillium* and *Cladosporium*. *Trichoderma* has an effect on actinomycetes. *Pseudomonas* show antagonism on *Cladosporium.* Such organism may be of great practical importance since they often produce antibiotics which effect the normal growth processes.

Why is microbial antagonism important?

Microbial antagonism provides a competitive advantage for the antagonistic compound producer. The antagonistic microorganisms play a role in soil suppressiveness, the soil has been seen as a reservoir of potential biological control agents (Alabouvette, Claude & Steinberg, Christian.2007). The antagonistic substances not harm the producer. The reason is that some microbes produce antibiotics against a different class of microbes, therefore, the antibiotic attacks the proper target but does not affect the homologous host enzyme. The effect of antagonists on pathogens is a continuum, ranging from stimulation, through no inhibition, to inhibition of one or several pathogens. The antagonists isolated were mostly *Bacillus subtilis, B. megaterium,* and *Streptomyces* spp., with occasional *B. cereus, B. pumilus, B. polymyxa, B. badius, Pseudomonas putida,* and *P. fluorescens* (Broadbent P 1971; Crawford, D L *et al*.1993).

Major antagonistic microbes in soil

1. **Bacillus sp.**

Bacillus amyloliquefaciens, *Bacillus subtilis,* and *Paenibacilluspolymyxa* frequently found in soils, are considered safe for use in the environment and with mammals (Stabb et al., 1994, Zhao et al., 2015). They produce antagonistic activities against several fungal and bacterial pathogens, and can persist in the plant for higher protection (Krebs et al., 1998, Ben Abdallah et al., 2015). Their antagonistic activities were frequently related to the production of secondary metabolites with antibiotic properties most of them have been characterized as dipeptides or cyclic peptides with low molecular weight (Imen, Afif Ben 2016).

2. **Psudomonas sp.**

The genus Pseudomonas is known for its metabolic versatility and genetic plasticity, encompassing pathogens as well as antagonists (Zengerer V 2018). Certain members of the P. fluorescens have been shown to be potential agents for the biocontrol which suppress plant diseases by protecting the seeds and roots from fungal infection. They are known to enhance plant growth promotion and reduce severity of many fungal diseases (Hoffland et al. 1996, Wei et al. 1996). The suppression of soil-borne pathogens by pseudomonads is mainly linked to their secretion of secondary metabolites, such as phloroglucinols, phenazines, pyoluteorin, pyrrolnitrin, and hydrogen cyanide (Haas and Défago, 2005). Haas and Défago (2005) also described an antimicrobial effect by the extracellular diffusible siderophorepyoverdine, which lends the pseudomonads their fluorescence. Siderophores of this type may function as contingent antibiotics and contribute to disease suppression by depriving pathogens of iron.

3. **Streptomyces sp.**

Actinomycetes, especially *Streptomyces* spp., become a valuable biological control resource due to their preponderant abilities to produce various secondary metabolites with novel structure and remarkable biological activity (Yang, Zhang, Li 2019). Actinomycetes of the genus *Streptomyces* are well known for their ability to suppress growth of a wide variety of fungal pathogens (Taechowisan et al., 2003a; Trejo-Estrada et al., 1998a). Streptomyces species have been used extensively in the biological control of several phytopathogenic fungi (El-Raheem et al., 1995).

Methods and Materials

Soil samples were collected from vellayani, Trivandrum.These samples were placed in the pre-sterilized polythene bags, sealed and transported to the laboratory for further bacteriological analysis.
In the present study, soil samples were collected from inorder to isolate the soil microbes and then checking its antagonistic properties with other microbes.

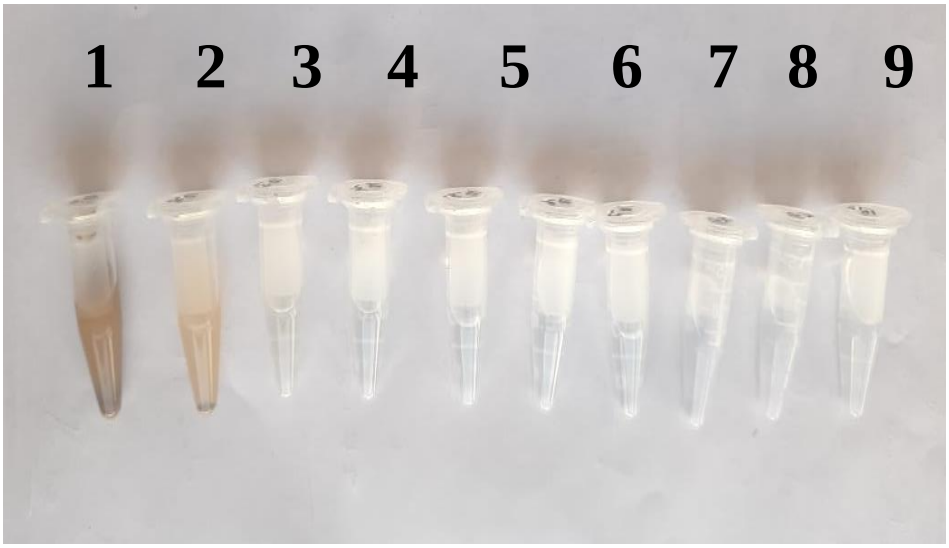

Figure no. 1: Serial dilution of soil sample for the isolation of soil microbes

1- 1: 10 dilution, 2- $1:10^{-2}$ dilution, 3- $1:10^{-3}$ dilution, 4- $1:10^{-4}$ dilution, 5- $1: 10^{-5}$ dilution, 6- $1:10^{-6}$ dilution, 7- $1:10^{-7}$ dilution, 8- $1:10^{-8}$ dilution, 9- $1:10^{-9}$ dilution, 10- $1:10^{-10}$ dilution.

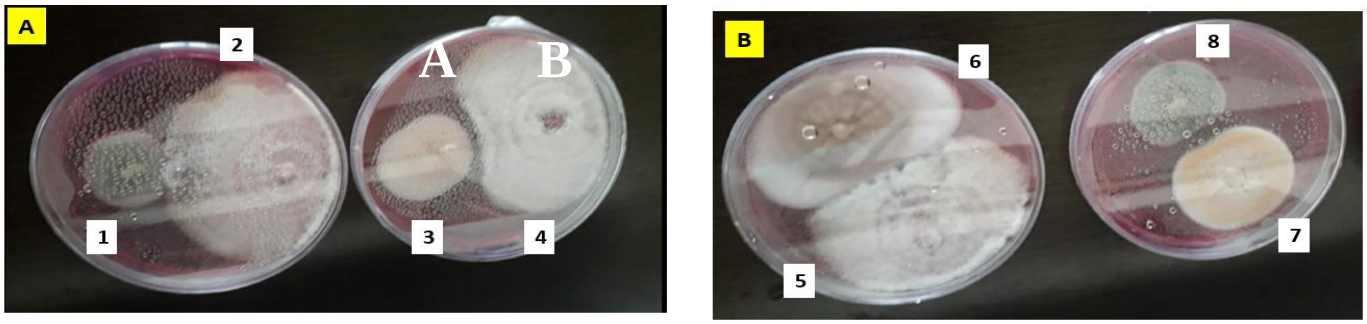

Figure no. 2: Antagonistic activity check.

Zone of inhibition is observed between 3 & 4 in A and 7 & 8 in B indicating - that their antagonistic activity between them, no zone of inhibition observed between 1 and 2 in A 5 and 6 in B – indicating that there is no antagonistic activity between them

Conclusion

In the present study, the objective was to isolate the soil microbes and to check the antagonistic activity of the isolated organisms. Soil samples were collected from rhizosphereinorder to isolate the organism, serially diluted and plated on a selective media namely Rose-Bengal agar. The plates were checked for colonies of different colour and colony morphologies and are then carefully inoculated on one half of freshly Rose-Bengal agar plate for characterizing their antagonistic activity.

In order to find the antagonistic activity of the soil microbes, selected colonies were inoculated on Rose-Bengal agar plates and incubated to determine the zone of inhibition between them. It was observed that some of the isolated colonies possessed antagonistic activity by exhibiting a zone of inhibition between them. Also, some of the isolated colonies do not show any zone of inhibition indicating that they have no antagonistic activity. So those possessing antagonistic activity can be used in the preparation of Biofertilizer mix along with some commonly used biocontrol agent like *Beauveriabassiana* there by leads to increase in yield and productivity of crops.

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