

Effect of rhizobacterial inoculation on rhizosphere microflora of ashwagandha cv. JAWAHAR 20

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ABSTRACT

Rhizobacteria from different medicinal plants viz., *Withania somnifera*, *Coleus forskohlii* and *Vinca rosea* grown in different parts of Tamil Nadu were isolated and characterized. Under pot culture conditions the rhizosphere population of *Azospirillum*, *Azotobacter*, phosphate solubilizing bacteria and *Pseudomonas* increased up to 120 days after inoculation and then declined. Witnessed increase in the population of respective inoculants due to biofertilizer inoculation offers more scope for plant growth promotion.

Key words: Rhizosphere population, Ashwagandha

INTRODUCTION

In India, the use of several medicinal plants to cure specific ailments is in vogue from ancient times. The indigenous systems of medicine namely Siddha, Ayurveda and Unani have been in existence for several centuries. The WHO has estimated that over 80 per cent of the world population meets their primary health care needs through traditional medicine (Lambert, 1997). Ashwagandha is used as a tonic in geriatrics, being efficacious in relieving hand and limb tremors of people at old age (Atal *et al.*, 1975). It has been equated to ginseng (*Panax ginseng*) of China and is popularly known as the "Indian Ginseng". The most important pharmacological use of ashwagandha is as adaptogen with antistress antioxidant, antitumor, anti-inflammatory, mind boosting and has rejuvenating properties (Singh *et al.*, 1990). Studies on the rhizobacterial population in the rhizosphere region and testing the suitability of the isolated rhizobacteria as seed and soil inoculant will be highly useful in improving the productivity and quality of this commercially important medicinal plant.

MATERIALS AND METHODS

A pot culture experiment was conducted at the Department of Agricultural Microbiology, TNAU, Coimbatore to study the effect of combined inoculation of rhizobacteria on growth, yield and quality of ashwagandha (var. Jawahar 20). The rhizobacterial isolates viz., *Azospirillum lipoferum*-AAs-11, *Azotobacter*-AAz-3, *Bacillus*-APb-1 and *Pseudomonas fluorescens*-APs-1 were prepared as carrier based inoculants as described earlier and used for this study. The pots were filled with potting mixture (soil + sand + FYM) and the rhizobacteria treated seeds were sown at 25 seeds per pot and finally 5 seedlings were maintained. The experiment was conducted in completely randomized block design with three replications.

The populations of *Azospirillum*, *Azotobacter*, phosphate solubilizing bacteria and *Pseudomonas* in ashwagandha rhizosphere were estimated following standard procedures at 30 days interval upto 180 DAI by using nitrogen free semisolid malate medium for *Azospirillum* (Dobereiner and Day, 1975), Waksman's No. 77 medium for *Azotobacter* (Allen 1953), Pikovskaya's medium for phosphate solubilizing bacteria (Pikovskaya, 1948) and King's B medium for *Pseudomonas* (King *et al.*, 1954). The population was expressed as cfu g⁻¹ of oven dry soil.

RESULTS AND DISCUSSION

Population of *Azospirillum* in ashwagandha rhizosphere

In various treatments, *Azospirillum* population increased upto 120 DAI and then declined. The results revealed that population of *Azospirillum* was maximum (78.33 x 10⁵ cfu g⁻¹) on 120 DAI in the rhizosphere of ashwagandha receiving all the inoculants (Table 1).

Population of *Azotobacter* in ashwagandha rhizosphere

On 120th day, the *Azotobacter* population was maximum (67.33 x 10⁵ cfu g⁻¹) in the combined inoculation of all the organisms (AAs-11, AAz-3, APb-1 and APs-1) followed by the treatment receiving the *Azotobacter*-AAz-3, *Bacillus*-APb-1 and *Pseudomonas fluorescens*-APs-1 (63.66 x 10⁵ cfu g⁻¹). Among the individual inoculants, *Azotobacter* inoculation resulted in higher rhizosphere population than others when compared to individual inoculants and uninoculated control (Table 2).

Population of phosphate solubilizing bacteria in ashwagandha rhizosphere

Inoculation of all the four rhizobacterial isolates recorded higher population of phosphate solubilizing bacteria in the rhizosphere soil on 120 DAI (59.33 x 10⁵ cfu g⁻¹) when compared to uninoculated control (10.66 x 10⁵ cfu g⁻¹) as well as other treatments (Table 3).

Population of *Pseudomonas* in ashwagandha rhizosphere

Inoculation of rhizobacterial isolates either alone or in different combinations increased the rhizosphere population of *Pseudomonas* upto 120 days. Among the various treatments, combined inoculation of all the organisms recorded higher population than other treatments at all the stages of sampling. Maximum population (88 x 10⁵ cfu g⁻¹) was recorded in this treatment on 120 DAI. The uninoculated control recorded the minimum rhizosphere population of *Pseudomonas* at all the growth stages (Table 4).

The establishment of introduced rhizobacteria in rhizosphere is essential to obtain desired effect on the growth and yield of crop plants. Migration of beneficial rhizosphere bacteria towards their respective host plants provides an important ecological advantage. Also, species of rhizobacteria with poor survival in soil should reach the root environment for their survival (Rovira, 1969). Root colonization by beneficial bacteria (active/passive attachment to the root surface of inoculated bacteria) is fundamental for increased plant productivity (Burdman *et al.*, 2000 and Mehnaz *et al.*, 2001).

In the present study rhizosphere of inoculated plants recorded higher rhizobacterial population. The favourable condition in that area might have supported the proliferation of the introduced rhizobacterial isolates. The population of microorganisms is normally more in the rhizosphere than in soil away from plant roots due to the greater availability of carbon and other nutrients. Plant root exudates serve as a major nutrient for microbial colonization (Lynch and Whipps, 1990). Since rhizobacteria are able to utilize the root exudates effectively, they are able to colonize the rhizosphere region in large numbers than in the near by soil. In the present study the survival of rhizobacteria was found to be more in the presence of root exudates of ashwagandha plants as evidenced by survival studies under controlled conditions in Jensen's nutrient solution. This explains the

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