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RESEARCH ARTICLE

EFFECT OF RHIZOBACTERIAL INOCULATION ON THE GERMINATION AND VIGOUR INDEX OF ASHWAGANDHA (*Withania somnifera* Dunal)

***Rajasekar, S. and Nathiya, G.**

Department of Microbiology, Sribharathi Arts and Science College for Women, Kaikkurichi, Pudukkottai, Tamilnadu, India

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ABSTRACT

The indigenous systems of medicine namely Siddha, Ayurveda and Unani have been in existence for several centuries. The major lacuna in the cultivation of *Withania somnifera* is non-availability of standard agro techniques to increase the yield and quality. It is obvious that without clear understanding on the cultivation *Withania somnifera* of, the use of various chemicals and in organics may deteriorate the quality of the products. Novel solutions for plant growth enhancement are required to increase the yield and quality of and to reduce the *Withania somnifera* burden on our resources and environment. A pot culture experiment was conducted Department ofl Microbiology Sribharathi Arts and Science College for Women, Kaikkurichi, Pudukkottai, Tamilnadu, India., to know the effects of inoculants, diazotrophs like *Azospirillum*, and *Azotobacter on* seed germination *and vigour index of Withania somnifera.*

Key words: Ashwagandha, Rhizobacteria, Germination ,Vigour Index.

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INTRODUCTION

Ashwagandha (*Withania somnifera* Dunal.), a traditional medicinal plant is cultivated in different parts of Tamil Nadu. Because of its medicinal value and alkaloid content there is a great demand for the crop leading to an intensification of its cultivation. The knowledge on the use of various agrotechniques to increase the yield and quality of ashwagandha is inadequate. The rhizobiocoenosis is an important biological process that plays a major role in satisfying the nutritional requirement of these crops.

- Screening the isolates of PGPB for their efficiency to improve plant growth traits.
- To study the effect of inoculation of various rhizobacteria on growth, yield and quality of ashwagandha.
- To formulate a suitable microbial consortium for ashwagandha.

MATERIALS AND METHODS

Preparation of Seeds: The seeds were treated with the individual and combined rhizobacterial liquid inoculants (5 ml 10^{-1} seeds) and shade dried for 30 min.

Corresponding author: **Rajasekar, S.**
Department of Microbiology, Sribharathi Arts and Science College, for Women Kaikkurichi, Pudukkottai, Tamilnadu, India.

The treated seeds were placed in plastic cups filled with sterile sand and incubated at 28±1°C at 95% relative humidity. Shoot length, root length and germination per cent were recorded at 30th day after sowing and vigour index was calculated by the procedures suggested by Abdul-Baki and Anderson (1973).

Vigour index = Germination per cent x Plant height

Estimation of seeds germination

The germination per cent of seeds inoculated with rhizobacteria was higher than uninoculated control. Combined inoculation of all the four isolates (*Azotobacter*-AAt-13, *Azospirillum lipoferum*-AAz-1, *Bacillus*-APb-19, and *Pseudomonas fluorescens*-APf-5) resulted in maximum germination (86.66 per cent) when compared to other combinations. The combined inoculation of *Azospirillum lipoferum*-AAz-1, *Azotobacter*-AAt-13, *Bacillus*-APb-19 and *Pseudomonas fluorescens*-APf-5 also showed maximum vigour index of 502.62 when compared to uninoculated control and single inoculations. (Table-1).

RESULTS AND DISCUSSION

Production plant growth promoting substances by the rhizobacteria have been found to increase the root length and root biomass (Khalid *et al*., 2004) and this better developed root system may increase the mineral uptake in plants. In the present investigation, the inoculation of rhizobacteria enhanced the growth and yield parameters of ashwagandha.

Table 1. Effect of rhizobacterial inoculation on the germination and vigour index of ashwagandha seedlings under sterile conditions

Treatments	Days for germination of ashwagandha	Germination per cent	Vigour Index
T_1 – *Azospirillum* (AAz-1)	10.00	78.33	281.98
T_2 – *Azotobacter* (AAt-13)	10.00	72.66	217.98
T_3 –*Bacillus* (APb-19)	10.00	71.33	202.52
T_4 – *Pseudomonas* (APf-5)	9.00	75.66	242.11
T_5 – T1 + T2	9.00	80.00	312.00
T_6 – T1 +T3+T4	9.00	83.33	408.31
T_7 – T2 +T3+T4	9.00	82.66	388.50
T_8 – T1+T2+T3	9.00	80.33	345.41
T_9 – T1+T2+T3+T4	9.00	86.66	502.62
T_{10} – Uninoculated control	11.00	69.33	175.00
SEd		0.81	
CD (P=0.05)		1.71	

Inoculation with various rhizobacteria enhanced the germination and proliferation of root system and this might be due to the production of IAA and GA by these organisms. In the present investigation, the inoculation of rhizobacteria enhanced the growth and yield parameters of ashwagandha. Inoculation with various rhizobacteria enhanced the root elongation and proliferation and this might be due to the production of IAA and GA by these organisms. The inoculated PGPR strains usually have been found to increase the root length and root biomass (Yan *et al.,* 2003; Chakraborty *et al*., 2003; Pal *et al.,* 2003 and Khalid *et al*., 2004) and this better developed root system may increase the mineral uptake in plants. The present study indicated higher shoot and root length, dry matter, yield and alkaloid content of ashwagandha, when the mixed inoculant of *Azospirillum, Azotobacter, Bacillus* and *Pseudomonas* was applied**.** The free-living plant growth-promoting rhizobacteria (PGPR) can be used in a variety of ways to increase the plant growth. The addition of PGPR increased the germination rate, root growth, leaf area, chlorophyll content, magnesium content, nitrogen content, protein content, hydraulic activity, tolerance to drought, shoot and root weights, and delayed leaf senescence which reflected in higher grain yield (Lucy *et al.*, 2004).

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