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EFFECT OF BIOINOCULATION OF *RHODOBACTER CAPSULATUS* KU002 ON TWO RICE VARIETIES OF INDIA

Ramchander Merugu*, M.P.Pratap Rudra, S.Girisham and S.M.Reddy

Department of Biochemistry*, MG University, Nalgonda
Microbiology, Kakatiya University, Warangal, India.
Department of Biochemistry, Osmania University, Hyderabad.
Corresponding author: rajumerugu01@rediffmail.com*

ABSTRACT: In our continuing studies on the potential application of phototrophic bacteria we have tried to investigate the effects of inoculation of phototrophic bacteria on the growth and nitrogen levels in two varieties of rice namely Mashuri and Erramallelu. Mashuri variety was comparatively more responsive to the inoculation of phototrophic bacteria. Increase in shoot length of both the varieties of rice could be recorded. Nitrogen percentage showed a marked increase in both the rice varieties tested. Potential of phototrophic bacteria as a biofertiliser is discussed in this communication.

Keywords: Rhodobacter capsulatus, Erramallelu, Mashuri, Nitrogen

INTRODUCTION

Biofertilisers, more commonly known as microbial inoculants, are artificially multiplied cultures of certain soil organisms that can improve soil fertility and crop productivity. Anoxygenic phototrophic bacteria are the major groups of microorganisms existing in paddy soils and contribute significantly to soil fertility (Hable and Alexander, 1980). Elbadry et al. (1999) have demonstrated beneficial effect of *Rhodobacter capsulatus* on four rice varieties in hydroponic cultures. Application of freeze dried purple non sulphur bacterium *Rhodobacter sphaeroides* resulted in improvement in the fruit quality of tomato fruit (Kondo, 2006). In continuation of our work on exploring the biotechnological potentials of this group of organisms (Merugu et al, 2007, 2010a, 2010b, Vasavi et al., 2008) we have investigated the use of these bacteria as biofertilisers. Moreover, no report is present on the application of this group of bacteria as biofertilisers in Indian rice varieties. Therefore, in the present investigation suitability of anoxygenic phototrophic bacteria as a biofertiliser was assessed.

MATERIAL AND METHODS

The phototrophic bacteria were isolated from the leather industry effluent samples by enrichment techniques by inoculating into the medium and incubated anaerobically in the light (2000 lux). Bacteria thus isolated were identified with the help of cultural characteristics (colour, size and shape), carbon and nitrogen requirement, vitamin requirements, absorption spectra analysis, bacteriochlorophylls and carotenoids. Identification keys provided in Bergey's manual of systematic bacteriology (1994) was adopted. Paddy seeds of two different varieties *Erramallelu* and *Vijayamashuri* were procured from Regional Agriculture Research Center, Warangal. The seedling growth unit was made up of two parts. The upper part composed of a plastic cup of 7cm diameter and 9.2 cm height with a pored bottom. This part supports the germinating seed and the aerial growth parts of rice seedling.

The lower part was a 650 ml glass vessel with a mouth longer than the base of the plastic cup. At the start of the experiment the two parts of the unit were sterilized separately. The glass vessel and the plastic cups were sterilized with help of ethanol. Thereafter, the plastic cup was tightly placed over the mouth of glass vessel so that the solution level reached the rice plants continuously. The germinated paddy seeds were transferred aseptically to the upper part. The bacterial cells which were collected at the experimental phase were washed with sterilised distilled water and were suspended in BP media except that NH_4Cl was omitted, the culture thus grown were then centrifuged at exponential phase and the cell pellets were washed twice with sterilised distilled water and then was used as inoculum for the experiment.

Paddy seeds of approximately similar size were surface sterilised with a 0.1% mercuric chloride solution for 1 min followed by washing thoroughly with several changes of sterile distilled water and allowed to germinate on nutrient agar medium in petri dishes for 3 days at 30ºC in the dark. Ten contaminant free, uniformly germinated seeds were aseptically transferred to sterilized growth assemblies containing 600 ml of the sterile nutrient solution with or without nitrogen. The final volume of the solutions in the growth assembly was sufficient to cover the paddy seeds. The experiment comprised four treatments for paddy variety namely nutrient solution, nitrogen free nutrient solution, inoculated nutrient solution and uninoculated nitrogen solution. The plants were grown in a cabinet under natural light in conditions at 27±2°C at day and 20±2°C at night. The water lost through evaporation and transpiration was replaced by sterile distilled water. Measurement of the growth parameters of paddy seedling were recorded on 5,10,15 and 20 days. After emergence, shoot height and root length were recorded. At the end of 20th day experimental period, the plants were removed gently form the assemblies and washed in distilled water to remove all the visible bacterial cells. The shoot and root portion were separated and the growth measurements were taken. The plants in each treatment were pooled for nitrogen determined by Kjedahl techniques.A sample of 20 g was placed in 800 ml of distilled water and 1ml of liquid paraffin and few glass beads were added during distillation. Then 100 ml of each of $KMnO_4$ and 2.5 % NaOH solution added. The contents in the kdjedhal assembly were distilled and liberated ammonia was collectedin 250 ml flaks containing 20 ml of boric acid solution with mixed indicator.

$$\text{'N' content (Kg/ha)} = \frac{\text{Titre value x } 0.0014\text{x } 2.24\text{x}10^{6}}{\text{Weight of the sample}}$$

RESULTS AND DISCUSSION

Inoculation with *Rb.capsulatus* caused a marked increased in the nitrogen percentage in roots of both the rice varieties tested (table 1). *Mashuri* variety was comparatively more responsive to the inoculation of phototrophic bacteria. Significant increases in shoot length were recorded. On the other hand, root elongation decreased but an increase in number of new roots was more from the crown. A 27.67 % increase in the shoot length was seen in *Mashuri* variety under nitrogen inoculated plants. Similarly, *Erramallelu* variety also showed an increase upto 5.5 % in shoot length. Percentage of nitrogen fixed was increased by 26.8% in the *Mashuri* variety while increase of 20 % was seen in *Erramallelu* variety. Dry weights of both the plants showed an increase upto 27.8 % and 38.4 % in both the rice varieties of *Erramallelu* and *Mashuri*. Similar observations were made by Elbadry and Elbanna (1999) when working with four different rice varieties. The present studies show the possibility of application of phototrophic bacteria as biofertilisers for rice plants.

Table 1: Effect of Rhodobacter capsulatus inoculation on shoot length, root length, dry weight and N (%) of rice varieties

Inoculation	Nitrogen		Erramallelu			Mashuri	
		Height	Dryweight	N(%)	Height	Dryweight	N(%)
		(cm)	(mg plant)		(cm)	(mg plant)	
Shoot length							
U	—	12.8	6.8	0.68	10.4	6.2	0.82
I	—	18.6	8.8	0.96	16.2	8.5	0.98
U	+	17.3	11	1.1	20.2	12.4	1.18
I	+	19.7	12.2	1.2	22.4	13.8	1.34
Root length							
U	—	8.8	7.2	0.71	9.1	7.8	0.88
I	—	7.8	7.6	0.8	7.3	7.4	1.02
U	+	5.8	7.8	0.94	7.8	6.4	1.3
I	+	5.2	8.8	1.05	6.8	5.8	1.42

N(%) = Percentage of Nitrogen U= Uninoculated, — N = No nitrogen, I = Inoculated, N= Nitrogen supplemented plants

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