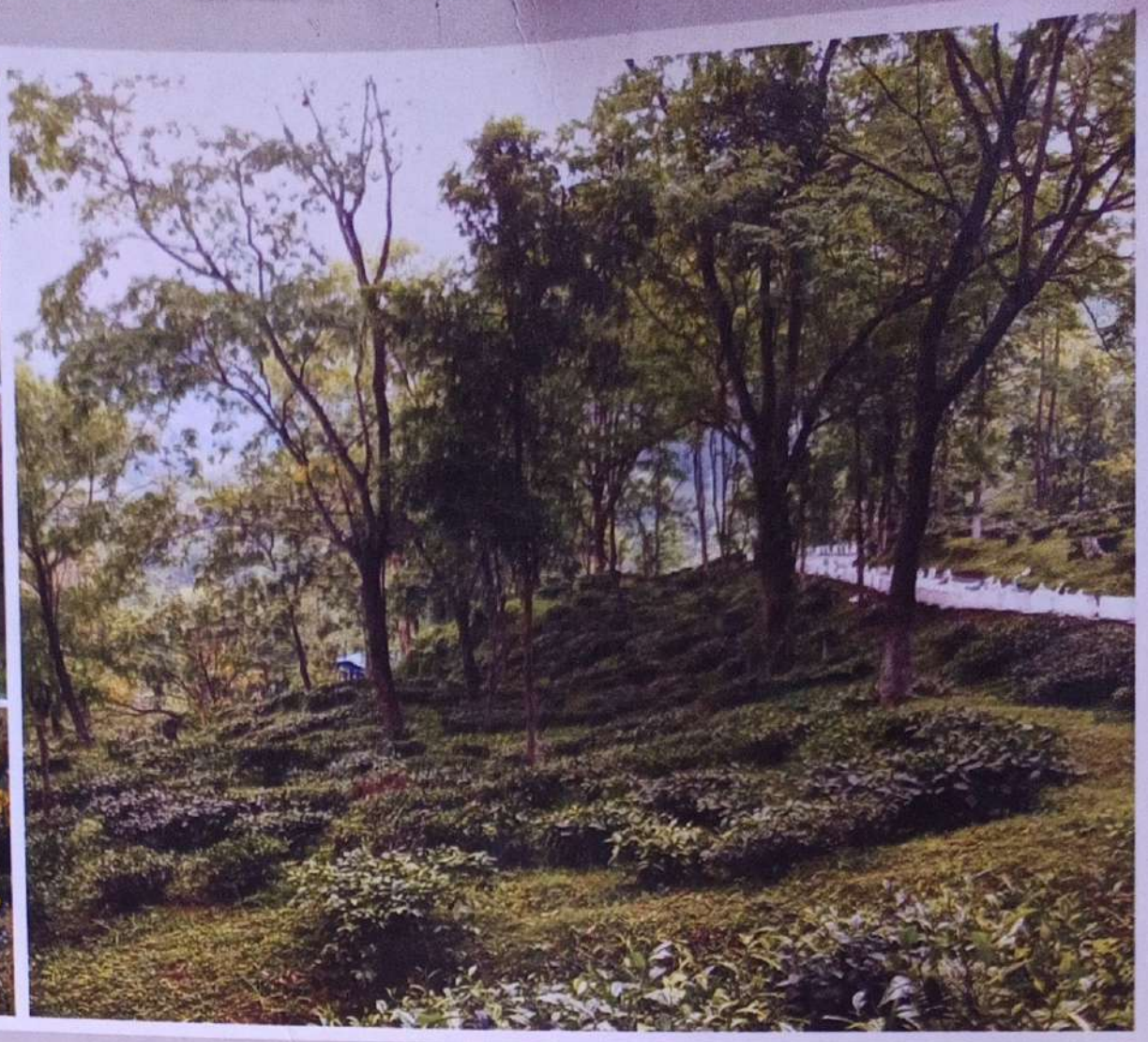
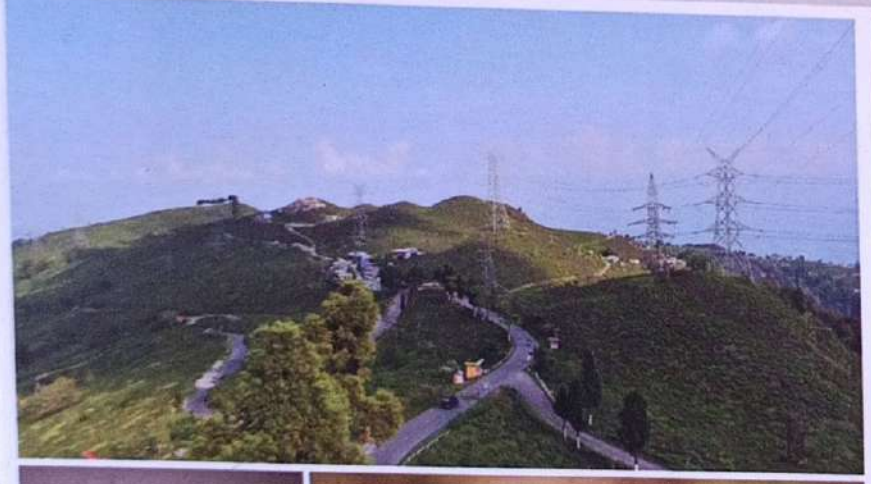


RESEARCH IN EMERGING FIELDS OF BIOLOGICAL SCIENCE

(MULTIDISCIPLINARY ASPECT)



EDITOR: DR. TARUN KUMAR MISRA, M. SC, PHD, AIC (INDIA)

(FIRST EDITION 2023)

CONTENTS

आनन्दो ब्रह्मेति व्यजानात्। आनन्दाध्येव खल्विमानि भूतानि जायन्ते। आनन्देन जातानि जीवन्ति। आनन्दं प्रयन्त्यभिसंविशन्तीति।सैषा भार्गवी वारुणी विद्या। परमे व्योमन्प्रतिष्ठिता।स य एवं वेद प्रतितिष्ठति। अन्नवानन्नादो भवति। महान्भवति प्रजया पशुभिर्ब्रह्मवर्चसेन अहान् कीर्त्या॥

.....**Taittiriya Upanishad- Petal 9**

CHAPTER- 13

Physiological characterization of indigenous *Rhizobium* strains from common bean root nodules of North Bengal and Sikkim

Ritu Rai[1, 2*] and Arnab Sen[2]

[1]Department of Botany, Parimal Mitra Smriti Mahavidyalaya, Jalpaiguri-735221, West Bengal, India

[2]Molecular Cytogenetics Laboratory; Coordinator, BioInformatics Facility, Dept. of Botany, University of North Bengal, Raja Rammohanpur, Siliguri-734013, West Bengal, India

*Correspondence: ritu7rai@gmail.com

"The secret to getting ahead is getting started".....Mark Twain

Abstract

Rhizobium, a type genus of the family Rhizobiaceae is considered the best known beneficial plant-associated bacteria because of its importance in the nitrogen fixation occurring during its symbiosis with the legumes. The genetic diversity and taxonomy as well as their plant–bacteria molecular interactions of these microorganisms have been extensively studied over the last twenty years because of their ecological and economical importance. The present study covered large area of North Bengal and Sikkim to characterize the French bean associated *Rhizobium* microsymbiont based on their tolerance level for different abiotic stresses. The physiological characterization revealed that the *Rhizobium* strains showed some amount of variations in response to the different stresses. All the strains grew in 1% NaCl but variations in growth occurred as concentration of the salt increased. However, growth of the strains decreased at 4% NaCl, although some of the strains showed some amount of growth even at such high concentration. Maximum growth of all the strains were obtained at 30°C while the growth decreased with the increase and decrease in temperature. However, some of the strains showed a good amount of growth at 10°C, 20°C and 40°C as well. The growth of the studied strains was found to be the maximum in pH 7 compared to 4 and 9. A statistically significant result based on the growth of strains at different concentration of heavy metals were obtained by 't- test' at a p value of less than or equal to 0.001. In this experiment cobalt (Co) was found to be the most toxic of the heavy metal and lead (Pb), the least potent inhibitor to the *Rhizobium* growth.

Keywords: Biological nitrogen fixation, abiotic stress, tolerance level, heavy metal, *Rhizobium*

Introduction

Biological nitrogen fixation (BNF) is the mechanism of reduction of atmospheric dinitrogen to a metabolically active form catalyzed by nitrogenase enzymes exclusively by microorganisms and is directly proportional to agricultural sustainability (Bohlool *et. al.*, 1992). Annually approximately 2.5 x 10^{11} kg NH_3 is fixed from the atmosphere by biological nitrogen fixation (Cheng, 2008).