Chapter 2

Objectives

2.1 Objectives

1. **Cloning *Escherichia coli* DH10B y-glutamate cysteine ligase (YbdK) in rhizobia to enhance glutathione synthesis in rhizobia.**

- Cloning *Escherichia coli* DH10B ybdk gene in pBBR1MCS2 vector and transformation of *Sinorhizobium fredii* NGR 234 & *Sinorhizobium meliloti* (NAIMCC-B-00863)

- Monitoring the production of glutathione by wild type and genetically modified rhizobium [*Sinorhizobium fredii* NGR 234 & *Sinorhizobium meliloti* (NAIMCC-B-00863)]

2. **Determining the effect of rhizobia overproducing glutathione on fenugreek seedling exposed to abiotic stress**

- Investigating the effect of genetically modified *Sinorhizobium fredii* NGR 234 & *Sinorhizobium meliloti* (NAIMCC-B-00863) on the growth of fenugreek seedlings in Arsenic contaminated soil.
- Investigating the effect of genetically modified *Sinorhizobium fredii* NGR 234 & *Sinorhizobium meliloti* (NAIMCC-B-00863) on the growth of fenugreek seedlings in Cadmium contaminated soil.
- Investigating the effect of rhizobial consortium on the growth of fenugreek seedlings in Arsenic & Cadmium contaminated soil.

3. **Exploring the ability of genetically modified rhizobia to produce nanoparticles to combat heavy metal stress.**

- *Invitro* synthesis of cadmium sulphide nanoparticles by PGPRs used in this study.
- Characterization and comparison of cadmium sulphide nanoparticles produced by wild type and GMO bacteria.