

List of Figures

Fig. 1.1 Schematic overview of beneficial role endophytic microbes in plant growth promotion, disease suppression and its biotechnological potential	4
Fig. 1.2 Factors influencing endophyte diversity in plants	5
Fig. 1.3 Barriers to be crossed by endophytes for colonization plant stem and root	9
Fig. 1.4 Regulation of nitrogen fixation process between host plant and bacteria.	14
Fig. 1.5 Schematic representation of the induction of defense related gene expression in plants upon challenge with PGPB or pathogens.....	23
Fig. 2.1 Plasmid map of plasmid pHC60 containing GFP gene	42
Fig. 2.2 16S rRNA DGGE community fingerprints of endophytic bacteria from <i>Poaceae</i> plants detected by SYBR green staining.	46
Fig. 2.3 Phylogenetic distribution of endophytic bacterial isolates	50
Fig. 2.4 Dendrogram showing phylogenetic relationship of diazotrophic endophytic bacterial isolates from <i>Poaceae</i> plants using 16S rRNA gene partial sequences.....	51
Fig. 2.5 Diazotrophic nature of endophytic bacterial isolates confirmed by <i>NifH</i> gene amplification.	52
Fig. 2.6 Antagonistic effect of <i>Streptomyces</i> spp. against <i>R. solani</i>	53
Fig. 2.7 Distribution of plant growth promoting (PGP) traits in diazotrophic endophytes isolated from <i>Poaceae</i> family plants.	55
Fig. 2.8 Endophytic colonization of <i>gfp</i> tagged bacteria detected by confocal microscopy in roots of 7 d old wheat plants.	57
Fig. 2.9 Principle component analysis of diazotrophic endophytic bacterial isolates on wheat plant growth promotion.....	61
Fig. 3.1 Dual culture plate analysis of <i>Streptomyces</i> spp. against <i>M. oryzae</i> B157. (.....	75
Fig. 3.2 Antifungal activity of <i>Streptomyces</i> spp. supernatant and ethyl acetate extract against the <i>M. oryzae</i> B157.....	75
Fig. 3.3 Antifungal activity of <i>Streptomyces</i> spp. against fungal pathogen <i>R. solani</i> . (.....	75

Fig. 3.4 Amplification of <i>phl</i> gene in <i>Streptomyces</i> sp. SS8.	76
Fig. 3.5 Detection of <i>Streptomyces</i> spp. colonization in the interior tissue of wheat and sorghum plants.	78
Fig. 3.6 Plant growth promotion and protection by <i>Streptomyces</i> spp. in rice (A), sorghum (B), wheat (C) plants.	80
Fig. 3.7 Quantitative real time PCR analysis to determine the induction of plant defense gene expression by <i>Streptomyces</i> spp. in healthy and pathogen challenged.	84
Fig. 3.8 Disease development in unbacterized and bacterized rice plants challenged with <i>M. oryzae</i> B157.	84
Fig. 4.1 Biosynthesis pathway of DAPG	93
Fig. 4.2 Gene cluster for biosynthesis of 2, 4-DAPG from <i>P. fluorescens</i>	93
Fig. 4.3 Restriction map of pJET1.2 cloning vector map	96
Fig. 4.4 Restriction map of pUCPM18Gm vector	97
Fig. 4.5 Restriction endonuclease digestion of pJET 1.2 clone containing <i>phlD</i> gene with KpnI and BamHI and PCR amplification of <i>phlD</i> gene.	102
Fig. 4.6 Restriction endonuclease digestion of pJET 1.2 containing <i>phlACB</i> gene clusters with BamHI and PCR gene amplification.	103
Fig. 4. 7 Restriction endonuclease digestion of pAJK1.1 plasmid with KpnI and BamHI to confirmation the presence of <i>phlD</i> gene.	103
Fig. 4.8 Restriction endonuclease digestion patterns of pAJK1.2a and pAJK1.2b isolated from transformants of <i>Pseudomonas</i> sp. WS5.	104
Fig. 4.10 Detection of PG production in <i>Pseudomonas</i> sp. WS5.	105
Fig. 4.11 Red color pigment production in plate and broth by <i>Pseudomonas</i> sp. WS5 transformants carrying pAJK1.2 plasmid	106
Fig. 4.12 Detection of DAPG produced by wild type standard and recombinant strains.	108
Fig. 4.13 Quantitative 2,4- Diacetylphloroglucinol production by wild type and recombinant strains of <i>Pseudomonas</i> spp.	108

Fig. 4.14 Antagonistic effect of extracts from <i>phlDABC</i> overexpressing recombinant strains of <i>Pseudomonas</i> sp. WS5 and <i>Pseudomonas</i> protegens Pf-5 on fungal pathogens.....	109
Fig. 4.15 Visualization of endophytic colonization of <i>gfp</i> tagged <i>Pseudomonas</i> sp. WS5 in wheat plants by confocal laser scanning microscopy.....	110
Fig. 4.16 Study of plant growth promotion and disease suppression by <i>Pseudomonas</i> sp. WS5 wild type and 2,4- DAPG producing recombinant strains inoculating in sorghum, wheat and rice plants.	112
Fig. 4. 17 Quantitative real time PCR analysis of defense related genes in rice plants colonized by endophytic <i>Pseudomonas</i> sp. WS5 and its 2,4-DAPG producing recombinant derivative against rice pathogen <i>M. oryzae</i> B157.	117
Fig. 4.18 Study of the disease development in rice plants during <i>M. oryzae</i> B157 infection in control plants and plants bacterized with <i>Pseudomonas</i> sp. WS5 or its 2,4-DAPG producing transformants.....	117
