## CONTENTS

	Title				
Abstract			i-iii		
Decla	Declaration by the candidate				
Certij	Certificate of the Supervisor				
Ackno	Acknowledgment				
Conte	Contents				
List o	f Tables		xiv		
List o	List of Figures				
List o	List of Abbreviations and Symbols				
СНАР	CHAPTER 1				
INTRODUCTION AND REVIEW OF LITERATURE					
1.1	Introdu	iction	1-2		
1.2	Objecti	ives of this study	3-4		
1.3	Review	v of the literature	4-8		
	Bibliography				
CHAPTER 2			15-42		
ISOLA	FION 8	& CHARACTERIZATION OF R. SOLANACEARUM			
F1C1 A	NTAGO	DNISTIC BACTERIA FROM TOMATO SEEDLINGS			
		HEIR EFFECT IN CONTROL OF BACTERIAL WILT			
		EEDLINGS	1.7		
2.1	Abstrac		15		
2.2	Introduction		15-18		
2.3	Materials and Methods		18-26		
	2.3.1	Bacterial strains, growth media and culture conditions	18		
	2.3.2	Germination of tomato seedlings	18-19		
	2.3.3	Isolation of tomato seedlings endophytic bacteria	19		
	2.3.4	Screening for <i>in vitro Ralstonia solanacearum</i> antagonistic activity	20		

	2.3.5	Interaction among the five R. solanacearum F1C1	21	
		antagonistic endophytes		
	2.3.6	Effect of all the twenty-one isolates on tomato seedlings	21-22	
	2.3.7	2.3.7 Characterization of the bacterial isolates		
		2.3.7.1 Molecular Identification of the Isolates by 16S	22-23	
		rDNA amplification and sequencing		
		2.3.7.2 Cellulase assay	23	
		2.3.7.3 Twitching motility study	24	
	2.3.8	In vivo bio-control assay of Pseudomonas putida N4T	24-25	
		against F1C1 in tomato seedlings		
	2.3.9	In vivo antagonistic activity of the endophytes against F1C1	25-26	
		infection in tomato seedlings		
2.4	Results	5	26-35	
	2.4.1	Bacteria isolated from tomato seedlings exhibits R.	26-28	
		solanacearum F1C1 antagonistic activity in vitro		
	2.4.2	Identification of all the bacterial isolates	28-29	
	2.4.3	Cellulase activity and twitching motility	29-30	
	2.4.4	Bio-control assay using P. putida N4T and effect of water	30-32	
		in F1C1 root inoculation		
	2.4.5	In planta bio-control assay of the five endophytes using	33-35	
		mix-inoculation		
2.5	Discuss	sion	36-39	
	Bibliog	graphy	39-42	
CHAP	TER 3		43-67	
CHARA	CTERI	ZATION OF PSEUDOMONAS PUTIDA N4T AND		
STUDY	OF ITS	S EFFECT IN CONTROL OF BACTERIAL WILT IN		
GROW	N-UP TO	OMATO PLANTS AND IN BRINJAL SEEDLINGS		
3.1	Abstrac	ct	43	
3.2	Introdu	iction	43-45	
3.3	Materia	als and Methods	45-53	
	3.3.1	Bacterial strains, growth media, and culture conditions	45-46	

	3.3.2	Germination of Tomato and Brinjal seedlings	46-47
	3. 3. 3	Competent cells preparation of P. putida N4T	47
	3. 3. 4	Creation of GFP tagged <i>P. putida</i> N4T and its colonization study in tomato seedlings and grown-up tomato plants	47-48
	3. 3. 5	Co-localization study of N4T with F1C1 in tomato seedlings	48-49
	3.3.6	Bio-control efficacy of N4T against F1C1 infection in grown up tomato plants	49
	3.3.7	Study of N4T colonization in brinjal seedlings	50
	3. 3. 8	Bio-control efficacy of N4T against F1C1 infection in brinjal seedlings	50
	3. 3. 9	Hypersensitivity response test of P. putida N4T	51
	3. 3. 10	Creation of gacA mutant of P. putida N4T	51-52
	3. 3. 11	Antibacterial activity of <i>gacA</i> mutant of <i>P. putida</i> N4T against F1C1 and C10	52
	3. 3. 12	Inhibition of C10 by N4T in the presence of F1C1	53
3.4	Results		53-61
	3. 4. 1	P. putidaN4T can colonize the internal tissues of tomato	53-55
	3. 4. 2	<i>P. putida</i> N4T could reduce the symptoms of bacterial wilt caused by <i>R. solanacearum</i> F1C1 in grown-up plants	55-56
	3. 4. 3	P. putida N4T can colonize brinjal seedlings as well	56-57
	3. 4. 4	Efficacy of <i>P. putida</i> N4T in protection of brinjal seedlings against F1C1 infection	57-58
	3. 4. 5	<i>gacA</i> gene of <i>P. putida</i> N4T plays a role in the inhibition of C10 but not in F1C1	59-60
	3. 4. 6	The inhibition of C10 by N4T was increased in presence of F1C1	60-61
3.5	Discussio	on	61-63
	Bibliogra	aphy	64-67

CHAPTER 4							
GENOME SEQUENCE ANALYSIS AND COMPARATIVE							
PHYLOGENOMICS OF PSEUDOMONAS PUTIDA N4T							
4.1	Abstrac	68					
4.2	Introdu	Introduction					
4.3	Materia	70-75					
	4.3.1	Bacterial Growth and DNA Extraction	70-71				
	4.3.2	Preparation of 2 x 150 Paired-End (PE) Libraries	71				
	4.3.3	Cluster generation and sequencing	71				
	4.3.4	De novo Assembly of N4T genome	72				
	4.3.5	N4T Genome Annotation and Analysis	72-73				
	4.3.6	Comparative Gene Content Analysis of N4T using	73-75				
		EDGAR					
4.4	Results		76-84				
	4.4.1	General features of N4T Genome	76				
	4.4.2	Secondary metabolite biosynthesis gene clusters	76-78				
	4.4.3	Association of <i>P. putida</i> N4T with plants	78-80				
	4.4.4	Phylogenetic analysis of Pseudomonas strains	81				
	4.4.5	Phylogenetic analysis by ANI and AAI	81-82				
	4.4.6	Core genome V/S Pan genome analysis	83-84				
4.5	Discuss	ion	84-85				
	Bibliog	raphy	86-91				
CHAPTER 5							
SUMMARY AND FUTURE DIRECTION							
APPENDICES							
LIST OF PUBLICATIONS			143-144				