Table of content

S.No.	Contents	Page
1.	Declaration by student	i
2.	Certificate by the supervisor	ii
3.	Certificate for plagiarism	iii
4.	Antiplagiarism software (as suggested by UGC/Turnitin) report of Ph.D. thesis (certified by Dean Research)	
5.	Certificate of successful completion of viva-voce of Ph.D.	iv
6.	Undertaking for submission of Ph.D. thesis	v
7.	Acknowledgements	vi-viii
8.	List of figures	xiii-xv
9.	List of tables	xvi
10.	Abbreviations	xvii-xix
11.	**Introduction (Chapter 1)**	1-11
12.	**Review of literature (Chapter 2)**	12-50
	2.1. Food for nutritional security: Finger millet (*Eleusine coracana*)	14-17
	2.2. Global production of finger millet	17-23
	2.2.1. Finger millet production in India	20-23
	2.3. Finger millet grain's nutritional profile	23-29
	2.3.1. Carbohydrate	26
	2.3.2. Protein content	26-27
	2.3.3. Fat content	27-28
	2.3.4. Micronutrients	28
	2.3.5. Phytochemicals	28-29
	2.4. Finger millets health benefits	29-33
	2.4.1. Anti-oxidant properties	29-30
	2.4.2. Antidiabetic Characteristics	30-31
	2.4.3. Anti-hyperlipidemic and cardio-protective properties	31
	2.4.4. Combating gastrointestinal diseases	31-32
	2.4.5. Anti-carcinogenic properties	32
	2.4.6. Anti-microbial properties	33

2.4.7.	Osteoporosis prevention	33
2.5.	Micronutrients in soil: Global status	33-41
2.5.1.	Micronutrient deficiency in India	35
2.5.2.	Causes of soil micronutrient (Zn/Fe) deficiencies	35-37
2.5.3.	Iron deficiency in soil: Effects on plants and human health	37-39
2.5.4.	Zinc deficiency in soil: Effects on plants and human health	39-41
2.6	Biofortification of staple crop to alleviate human malnutrition: microbial approach	41-43
2.7	Endophytes: emerging component of microbe-mediated biofortification of Fe and Zn	43-50
2.7.1.	Sequestration and mobilization of iron and zinc for plant uptake via bacterial endophytes	47-50
13.	**Materials and methods (Chapter-3)**	51-71
3.1.	Isolation of bacterial endophytes from finger millet	51-52
3.2.	Screening of efficient iron and zinc-solubilizing bacterial endophytes	52-53
3.3.	Plant growth endorsing potential of iron and zinc solubilizing bacterial endophytes	53-58
3.3.1.	IAA estimation	53-54
3.3.2.	HCN production	54-55
3.3.3.	Ammonia excretion	55
3.3.4.	Siderophore production	55-57
3.3.5.	Phosphate solubilization	57
3.3.6.	Organic acid production	58
3.4.	Measurement of extracellular enzyme	58-60
3.5.	Environmental stability of zinc solubilizers	60-61
3.6.	Identification of selected iron and zinc solubilizers	62-67
3.6.1.	Morphological characterization of the endophytes	62-63
3.6.2.	Biochemical characterization of the endophytes	63-66

	3.6.3.	Molecular characterization of endophytic bacteria	66-67
	3.7.	Effect of bacterial endophytes on Seed germination	67-68
	3.8.	Plant experiment	68-70
	3.8.1.	Growth parameters	70
	3.8.2.	Analysis of nutrients	70
	3.9.	Statistical analysis	71
14.	**Results (Chapter 4)**		72-110
	4.1.	Isolation of bacterial endophytes from finger millet	72
	4.2.	Screening of efficient iron and zinc-solubilizing bacterial endophytes	73-76
	4.3.	Plant growth endorsing potential of iron and zinc solubilizing bacterial endophytes	76-83
	4.3.1.	Synthesis of IAA	76-77
	4.3.2.	Synthesis of HCN	78
	4.3.3.	Synthesis of Ammonia	78-79
	4.3.4.	Synthesis of siderophore	79-80
	4.3.5.	Solubilization of Phosphate	80-81
	4.3.6.	Production of Organic acid	83
	4.4.	Extra cellular enzyme production	83-86
	4.5.	Stress tolerance potential of selected bacterial endophytes	86-87
	4.6.	Identification of selected iron and zinc solubilizers:	88-96
	4.6.1.	Morphological and biochemical characterization of the endophytic isolates	88-90
	4.6.2.	Molecular characterization of promising isolates	90-96
	4.7.	Seed germination	97-100
	4.8.	Pot experiment for Plant growth and micronutrient (Fe/Zn) solubilization and accumulation	101-111
	4.8.1.	Plant growth parameters	100-104
	4.8.2.	Zinc content in finger millet grains	104-106
	4.8.3.	Zinc content in finger millet shoot and root	106-107
	4.8.4.	Iron content in finger millet grains	108-109
	4.8.5.	Iron content in finger millet shoot and root	109-110

4.8.6. NPK content in finger millet grains 110-111
15. Discussion (Chapter-5) 112-124
16. Conclusion (Chapter-6) 125-128
17. Summary (Chapter-7) 129-137
18. References (Chapter-8) 138-161
19. Appendices 162-165
20. List of publications 166
21. Full length published paper 167-190
22. Certificates of conferences 191-192