
Content

CHAPTER 1: BACTERIAL LIFE IN SEA ICE.....	1
1.1 INTRODUCTION	1
1.2 SEA ICE FORMATION AND STRUCTURE: HABITATS FOR MICROORGANISMS	2
1.3 BACTERIAL PRODUCTION IN SEA ICE	4
1.4 BIODIVERSITY OF SEA-ICE MICROBIAL COMMUNITIES (SIMCO).....	7
1.4.1 Assessing bacterial diversity.....	7
1.4.2 Cultivation-based investigation of SIMCO.....	8
1.4.3 Molecular phylogenetic analysis of SIMCO	11
1.4.4 Sea ice bacteria and biogeographic studies	13
1.5 MOLECULAR BIOLOGY OF SEA ICE BACTERIA	15
1.5.1 Plasmids and viruses.....	15
1.6 LOW TEMPERATURE ADAPTATIONS.....	17
1.6.1 Cryoprotectant and osmolytes.....	17
1.6.2 Membrane alterations.....	18
1.6.3 Enzymes	19
CHAPTER 2: DIVERSITY OF BACTERIA ISOLATED FROM ARCTIC SEA ICE AND SEAWATER AND THEIR COLD-ACTIVE HYDROLYTIC ENZYMES.....	25
2.1 HETEROTROPHIC BACTERIA IN SEA ICE	25
2.2 MATERIAL AND METHODS	27
2.2.1 Collection of samples.....	27
2.2.2 Enrichment, isolation and cultivation.	27
2.2.3 16S rDNA amplification.....	28
2.2.4 ARDRA.....	29
2.2.5 Sequencing and phylogenetic analysis.....	29
2.2.6 Sequences of organisms used for phylogenetical trees	30
2.2.7 Enzyme assay.....	33
2.3 RESULTS.....	35
2.3.1 Isolation and 16S rDNA sequence analysis of isolates	35
2.3.2 Alpha-subdivision Proteobacteria.....	38
2.3.3 Gamma-subdivision Proteobacteria.....	40
2.3.4 Cytophaga-Flexibacter-Bacteroides	43
2.3.5 Gram-positive branch.....	44
2.3.6 Growth patterns of the new isolates	48
2.3.7 Screening for cold-active enzymes.....	49

2.4	DISCUSSION.....	53
2.4.1	Does the cosmopolitan species exist?.....	53
2.4.2	Community structure	54
2.4.3	Psychrotolerant microorganisms dominate in sea water	55
2.4.4	Cold-active biopolymer degrading enzymes	55
2.4.5	Enzymatic activity at the freezing point of water	56
2.5	CONCLUSION.....	57
CHAPTER 3: <i>PSYCHROMONAS ARCTICA</i> SP. NOV., A NOVEL PSYCHROTOLERANT, BIOFILM-FORMING BACTERIUM ISOLATED FROM SPITZBERGEN, ARCTIC		59
3.1	NOVEL BACTERIAL STRAINS FROM ARCTIC ENVIRONMENTS	59
3.2	MATERIAL AND METHODS	61
3.2.1	Source of organisms, isolation and cultivation	61
3.2.2	Phenotypic characterization.....	61
3.2.3	Fatty acids analysis.....	62
3.2.4	Plasmid preparation.....	63
3.2.5	RAPD and ERIC comparison	63
3.2.6	G+C contents of genomic DNA and DNA-DNA hybridization.....	63
3.2.7	16S rDNA amplification and sequencing	64
3.2.8	Phylogenetic analysis.....	65
3.3	RESULTS AND DISCUSSION.....	66
3.3.1	Enrichment and Isolation.....	66
3.3.2	ERIC and RAPD analysis	66
3.3.3	Plasmid profile	67
3.3.4	DNA base composition and phylogenetic analysis	68
3.3.5	Morphology	70
3.3.6	Cellular fatty acid composition	71
3.3.7	Physiological characteristics.....	72
3.3.8	Description of <i>Psychromonas arctica</i> sp. nov.	76
SUMMARY.....		77
ZUSAMMENFASSUNG		79
REFERENCES		81