

## TABLE OF CONTENTS

<b>Resumen general</b> .....	<b>1</b>
<b>General abstract.</b> .....	<b>3</b>
<b>Chapter 1</b> .....	<b>5</b>
<b>1. General Introduction</b> .....	<b>5</b>
1.1 <i>Functional symbiosis</i> .....	5
1.2 <i>Can endosymbiotic bacteria explain the invasiveness of an aphid pest?</i> .....	5
1.3 <i>Endosymbiont's Manipulation.</i> .....	6
1.4 <i>Study system: the grain aphid.</i> .....	7
1.5 <i>The problem: How the success of <i>Sitobion avenae</i> is explained? The role of endosymbionts.</i> .....	8
1.6 <i>References.</i> .....	9
<b>Hypothesis</b> .....	<b>15</b>
<b>Objectives</b> .....	<b>15</b>
<b>2. Chapter 2</b> .....	<b>16</b>
<b>Title</b> .....	<b>16</b>
<i>The genetic diversity of invasive and native populations of <i>Sitobion avenae</i>.</i> .....	16
2.1 <i>Abstract:</i> .....	16
2.2 <i>Introduction</i> .....	17
2.3 <i>Materials and Methods</i> .....	18
2.3.1 <i>Aphid sampling</i> .....	18
2.3.2 <i>DNA extraction and microsatellite amplification</i> .....	19
2.3.4 <i>Data analysis</i> .....	19
2.3.4.1 <i>Multilocus genotypes</i> .....	19
2.3.4.2 <i>Bayesian population genetic analysis.</i> .....	20
2.3.4.3 <i>Genetic relatedness in Chilean and French populations.</i> .....	20
2.3.4.5 <i>Spatial and temporal variation of genetic diversity</i> .....	20
2.4. <i>Results</i> .....	21
2.4.1. <i>Diversity of multilocus genotypes.</i> .....	21
2.4.2 <i>Population structure</i> .....	23
2.4.1 <i>Phylogenetic relatedness</i> .....	23
2.4.2 <i>Genetic diversity within populations</i> .....	25
2.4.3 <i>Spatial and temporal genetic differentiation among populations</i> .....	29
2.5 <i>Discussion</i> .....	32
2.5.1 <i>Genetic diversity of introduced and native populations of <i>S. avenae</i>.</i> .....	32
2.5.2 <i>Multilocus genotypes relatedness.</i> .....	33
2.5.3 <i>Spatial and temporal genetic diversity.</i> .....	33
2.6 <i>Conclusions</i> .....	34
2.7 <i>References.</i> .....	35
<b>3. Chapter 3</b> .....	<b>40</b>

<i>Spatial and temporal secondary endosymbionts distribution in native and introduced populations of Sitobion avenae</i> .....	40
3.1 Abstract.....	40
3.2 Introduction .....	41
3.3 Materials and Methods .....	42
3.3.1 Aphid Sampling .....	42
3.3.2 MLG determination and facultative endosymbiont screening. ....	42
3.3.3 Data analysis.....	44
3.4 Results .....	44
3.4.1 Secondary endosymbiont frequencies.....	44
3.4.2 Spatial and temporal distribution of facultative endosymbionts. ....	44
3.4.3 Frequent MLGs and secondary endosymbionts. ....	46
3.5 Discussion.....	48
3.5.1 Secondary endosymbiont diversity and frequencies. ....	48
3.5.2 Spatial and temporal distribution of secondary endosymbionts. ....	49
3.5.3 MLGs and secondary endosymbionts.....	50
3.6 Conclusions .....	51
3.7 References.....	52
<b>4. Chapter 4</b> .....	<b>57</b>
<i>Intraspecific diversity and antibiotic susceptibility of secondary endosymbionts in Sitobion avenae</i> .....	57
4.1 Abstract.....	57
4.2 Introduction .....	58
4.3 Materials and methods .....	59
4.3.1 Aphids lineages.....	59
4.3.2 Characterization of <i>R. insecticola</i> and <i>H. defensa</i> strains. ....	60
4.3.3 Elimination of facultative endosymbionts .....	60
4.3.4 Effects of the elimination of facultative endosymbionts .....	62
4.3.5 Data analysis.....	62
4.4 Results .....	63
4.4.1 Intraspecific diversity of facultative endosymbionts .....	63
4.4.2 Antibiotic treatments.....	63
4.4.2.1 <i>Regiella insecticola</i> elimination .....	63
4.4.2.2 <i>Hamiltonella defensa</i> elimination.....	64
4.4.3 Survival to the antibiotic treatments .....	65
4.4.4 SE elimination effect on life-history traits. ....	66
4.5 Discussion.....	67
4.5.1 Intraspecific diversity of SEs. ....	67
4.5.2 Antibiotic treatments success .....	68
4.5.3 Effect of SE elimination .....	68
4.6 Conclusions .....	69
4.7 References.....	69
<b>5. Chapter 5</b> .....	<b>73</b>
<i>Spatial and Temporal Variation in the Aphid–Parasitoid Interaction under Different Climates</i> .....	73
5.1 Abstract.....	73

5.2 Introduction .....	74
5.3 Materials and Methods .....	75
5.3.1 Sampling Sites and Climates .....	75
5.3.2 Aphids and Parasitoids Samplings .....	77
5.3.3 Aphid Bacterial Endosymbionts .....	77
5.3.4 Data Analysis .....	77
5.4 Results .....	78
5.4.1 Registered Temperatures in the Field.....	78
5.4.2 <i>Sitobion avenae</i> Density .....	79
5.4.3 Parasitoid Composition .....	81
5.4.4 Parasitism Rate.....	82
5.4.5 Composition of Facultative Endosymbionts .....	83
5.5 Discussion.....	84
5.5.1 Factors Shaping Spatial and Temporal <i>Sitobion avenae</i> Populations.....	84
5.5.2 Parasitoid Assemblage .....	86
5.5.3 Spatial and Temporal Changes in Parasitism Rate .....	86
5.5.4 Facultative Endosymbionts .....	88
5.6 Conclusions .....	89
5.7 References.....	89
<b>6. General conclusions .....</b>	<b>97</b>
<b>7. Appendices .....</b>	<b>99</b>
7.1 <i>Correa et al. Manuscript in preparation</i> .....	99
7.2 <i>Supplementary material (Chapter 2)</i> .....	113
7.3 <i>Supplementary material (Chapter 4)</i> .....	116
7.3 <i>Scientific Publications</i> .....	121
7.3 <i>Congresses attendance</i> .....	121
7.4 <i>Teaching</i> .....	122
7.5 <i>Internships</i> .....	122