

SUMMARY

Figure list.....	19
Table list.....	21
GENERAL INTRODUCTION.....	23
Preamble.....	25
What future for plants? Crops in a changing climate.....	26
1. Impact of abiotic factors on plant physiology	26
1.1 Carbon dioxide concentration.....	26
1.2 Temperature.....	27
1.3 Combined effects of CO ₂ and temperature	28
2. Impact of abiotic factors on the emission of VOCs by plants	29
2.1 Carbon dioxide concentration.....	29
2.2 Temperature.....	30
2.3 Combined effects of CO ₂ and temperature	30
Impact of climate change on aphids, their partners and their predators.....	31
1. Host location behavior.....	31
1.1 Description	31
1.2 Climate change	32
2. Infestation of plants by aphids.....	32
2.1 Climate change	33
3. Interactions between aphids and their natural enemies	33
3.1 Climate change	34
4. Interactions between aphids and their mutualistic partners.....	35
1. Abstract	35
2. Introduction	36
3. General observations	38
4. Effect of climate change on aphid population dynamics.....	40
5. Effect of climate change on aphid behavior and mobility	42

6. Effect of climate change on honeydew production	43
7. Effect of climate change on chemical communication	45
8. Concluding remarks.....	47
9. Acknowledgments	48
References	49
OBJECTIVES	67
PLANT VOLATILOME UNDER CLIMATE CHANGE AND ITS INTERACTION WITH APHIDS: FROM LOCATION TO INFESTATION.....	73
Introduction to Chapter III	75
Elevated CO₂ and temperature modify plant volatile profile without cascade effect on aphid host location behavior	76
1. Abstract.....	76
2. Introduction	76
3. Material and methods	78
3.1 Climatic conditions.....	78
3.2 Plants and insects rearing.....	78
3.3 Volatile collection.....	79
3.4 Volatile analysis	79
3.5 Plant location by aphids.....	80
3.6 Statistical analyses	82
4. Results	82
4.1 Identification of the volatile organic compounds emitted by the tested plants.....	82
4.2 Plant host location by aphids	88
5. Discussion.....	89
The combined effect of elevated temperature and carbon dioxide concentration on the volatile profile of aphid-infested plants	92
1. Abstract.....	92
2. Introduction	93

3.	Material and methods	94
3.1	Climatic conditions.....	94
3.2	Plant and insect rearing	94
3.3	Volatile collection	94
3.4	Volatile analyses.....	95
3.5	Statistical analyses.....	96
4.	Results	96
4.1	<i>V. faba</i> volatile profile under temperature and CO ₂	96
4.2	<i>V. faba</i> BVOCs total emission under temperature and CO ₂	97
4.3	<i>V. faba</i> emission of each compounds under temperature and CO ₂	98
5.	Discussion	101
	References	104
	GLOBAL WARMING IMPACTS ANT'S BEHAVIORS AND THEIR MUTUALISTIC INTERACTION WITH APHIDS	111
	Introduction to Chapter IV	113
	Towards more intimacy: elevated temperature enhances ant-aphid relationship.....	114
1.	Abstract	114
2.	Introduction	114
3.	Material and methods	117
3.1	Insect rearing	117
3.2	Tested temperatures.....	117
3.3	Experimental setup	118
3.4	Behavioral observations	118
3.5	Dynamics of collective exploration and foraging.....	118
3.6	Ant-aphid interactions	119
3.7	Statistical analyses.....	119
4.	Results	120
4.1	Dynamics of collective exploration and foraging.....	120

4.2 Ant-aphid interactions	125
5. Discussion.....	131
5.1 Impact of elevated temperature on the ants' behavior	132
5.2 Impact of temperature on the aphids	133
6. Acknowledgements	135
References	136
EFFECT OF CLIMATE CHANGE ON APHID HONEYDEW: IMPLICATIONS FOR APHID-ANT MUTUALISM AND NATURAL ENEMIES.....	143
Introduction to Chapter V	145
The combination of temperature and CO₂ impacts the production and sugar composition of aphid honeydew	146
1. Abstract.....	146
2. Introduction	146
3. Material and methods	148
3.1 Tested conditions	148
3.2 Experiment set-up.....	149
3.3 Plant and insect rearing.....	149
3.4 Quantification of honeydew produced.....	149
3.5 Analysis of Honeydew composition	149
3.6 Statistical analyses	150
4. Results	151
4.1 Honeydew production.....	151
4.2 Honeydew sugar analyses.....	152
5. Discussion.....	154
5.1 Honeydew production.....	154
5.2 Sugar composition of honeydew	155
5.3 Potential consequences for aphid mutualistic interactions with ants....	157
Elevated CO₂ concentrations impact the semiochemistry of aphid honeydew without having a cascade effect on an aphid predator	159

1. Abstract	159
2. Introduction	159
3. Materials and Methods	160
3.1 Plants and Insects	160
3.2. Honeydew Collection	161
3.3. Quantification of Honeydew	161
3.4. Identification and Estimated Quantity of Honeydew Semiochemicals	162
3.5. Behavioral Experiment	162
3.6. Statistical Analyses.....	163
4. Results	164
4.1. Quantification of Honeydew	164
4.2. Honeydew Semiochemical Analysis	164
4.3. Behavioral Experiments	166
5. Discussion	167
6. Conclusions	168
Acknowledgments	169
References	170
GENERAL DISCUSSION	181
1. Aphid-plant and predators' interactions	184
2. Honeydew composition and its consequences on multiple interactions.	188
3. Conclusion.....	193
4. Future prospects	195
References	197
SCIENTIFIC COMMUNICATIONS	207
Peer-reviewed publications	207
Published articles.....	207
Articles under submission / in preparation	207
Scientific communications	208
International scope.....	208

National scope	208
ANNEX 1	209
Climate change impacts on chemical communication.....	209
1. Abstract.....	209
2. Introduction	209
3. Impacts of climate change on chemical communication in different realms 211	
3.1 The terrestrial realm.....	211
3.2 The freshwater realm	213
3.3 The marine realm.....	215
4. Different systems – same trend?.....	217
5. Potential implications and ways of mitigation.....	219
6. Conclusions and future research directions	220
References	221