

**Name of Candidate : Angel Roshdy Abd-El-Said Attia Degree : Ph.D.**

**Title of Thesis : Ecological and biological studies on the vine mealybug, *Planococcus ficus* (Signoret) and its associated parasitoids**

**Supervisors : Emeritus Prof.Dr. K.T. Awadallah, Prof.Dr. Abdel-Aziz M.A. Ibrahim and Prof.Dr. Mona H. Tawfik**

**Department :Economic Entomology and Pesticides**

**Branch : Economic Entomology**

**Approval**

### ABSTRACT

The pseudococcid *Planococcus ficus* (Signoret) became a serious pest for vineyards, especially in the newly reclaimed areas. Ecological and biological studies have been conducted on this pest, together with its associated parasitoids. Three varieties of grape; Ruby Seedless, Muscat Alex. and Queen were chosen for study during the period from April 1st 1998 to April 1st 2000. Two ways of supporting (Telephone System and Spanish Parron System) were also considered on the Ruby Seedless variety. The experimented three varieties are susceptible to infestation, irrespective the support system used. *P. ficus* infests all parts of the vine in case of Ruby Seedless, while in the other two varieties, trunks and roots are only infested. The three encyrtid parasitoids, *Clausenia josefi*, *Leptomastix dactylopii* and *Leptomastidea abnormis* were secured associated with the pest *P. ficus*; all are solitary and endoparasitic species. *C. josefi* is the most dominant one. The two hyperparasitoids *Prochiloneurus aegyptiacus* and *Chartocerus subaeneus* were secured associated with the primary parasitoids; affecting badly the role played by such primary parasitoids against the vine mealybug *P. ficus*.

The biology of the encyrtid parasitoids *Neoplatycerus palestinensis* (reported for the first time in Egypt during the present work) and *Clausenia josefi* (the dominant parasitoid of *P. ficus*) were achieved. Certain biological aspects on the host *P. ficus* was also investigated.

K-T. Awadallah

## CONTENTS

	Page
<b>1. INTRODUCTION</b>	1
<b>2. LITERATURE REVIEWED</b>	4
2.1- Ecological Studies	4
2.1.1- On the mealybug as a host	4
2.1.1.1- On <i>Planococcus ficus</i>	4
2.1.1.2- On <i>Planococcus vitis</i> (Niedielski)	9
2.1.1.3- On <i>Maconellicoccus hirsutus</i> (Green)	10
2.1.1.4- On <i>Pseudococcus maritimus</i> (Ehrhorn)	10
2.1.2- On the mealybug parasitoids	12
2.1.2.1- On <i>Planococcus ficus</i>	12
2.1.2.2- On <i>Planococcus vitis</i>	13
2.1.2.3- On <i>Maconellicoccus hirsutus</i>	14
2.2- Biological Studies	14
2.2.1- On the host of genus <i>Planococcus</i>	14
2.2.2- On the parasitoids	17
2.2.2.1- On <i>Clausenia josefi</i>	17
2.2.2.2- On the related encyrtid parasitoids	18
a) On <i>Leptomastix dactylopii</i> Howard	18
b) On <i>Leptomastidea abnormis</i> (Girault)	20
c) On <i>Anagyrus</i> spp.	21
d) On <i>Aenasius</i>	24
e) On <i>Coccidoxenoides</i>	25
2.2.3- Hyperparasitoids	26
<b>3. MATERIALS AND METHODS</b>	28
3.1- Seasonal abundance and ecological factors	28
3.2- Biological experiments of the vine mealybug, <i>Planococcus ficus</i>	30
a- Effect of temperature	30
b- Host plant suitability	31
3.3- Biological experiments of the encyrtid parasitoids, <i>Neoplatycerus palestinensis</i> (Rivnay) and <i>Clausenia josefi</i> Rosen	29
3.3.1- Rearing the vine mealybug, <i>Planococcus ficus</i> (Signoret)	33

**CONTENTS : Cont'd.**

	<b>Page</b>
3.3.2- Rearing the encyrtid parasitoids, <i>N. palestinensis</i> and <i>C. josefi</i>	33
3.3.3- Biological experiments on <i>N. palestinensis</i> :	35
a) Effect of temperature	35
b) Host stage suitability	36
c) Fecundity and longevity	36
d) Duration of the immature stages	37
3.3.4- Biological experiments of <i>C. josefi</i> :	38
a) Host stage suitability	38
b) Fecundity and longevity of <i>C. josefi</i>	39
<b>4. RESULTS AND DISCUSSION</b>	<b>40</b>
<b>PART I</b>	<b>40</b>
<b>Ecological Studies</b>	<b>40</b>
4.1- Population dynamics of the vine mealybug and its associated parasitoids	40
4.1.1- Population dynamics of <i>P. ficus</i> and its parasitoids in <i>V. vinifera</i> var. Ruby Seedless, that supported by Telephone System	40
4.1.1.1- Population dynamics of <i>P. ficus</i>	40
a- On trunks	42
b- On leaves	45
c- On bunches	47
d- On left bunches	49
e- On Roots	50
4.1.1.2- Population dynamics of <i>P. ficus</i> parasitoids	51
a- On trunks	51
b- On leaves	55
c- On trunks	57
d- On left bunches	58
4.1.1.3- Hyperparasitoids	58
4.1.1.4- Conclusion	59
a- On trunk	61
b- On leaves	61

## CONTENTS : Cont'd.

	Page
c- On bunches	61
d- On left bunches	62
e- On roots	63
f- Hyperparasitoids	63
4.1.2- Population dynamics of <i>P. ficus</i> and its parasitoids on <i>Vitis vinifera</i> var. Ruby Seedless supported by Spanish Parron System	74
4.1.2.1- Population dynamics of <i>P. ficus</i>	74
a- On trunks	74
b- On leaves	76
c- On bunches	78
d- On left bunches	79
e- On roots	80
4.1.2.2- Population dynamics of <i>P. ficus</i> parasitoids	81
a- On trunks	82
b- On leaves	84
c- On bunch	86
d- On left bunches	87
e- On roots	87
4.1.2.3- Hyperparasitoids	87
4.1.2.4- Conclusion	88
a- On trunks	88
b- On leaves	90
c- On bunches	90
d- On left bunches	91
e- On roots	92
f- Hyperparasitoids	92
4.1.3- Population dynamics of <i>P. ficus</i> and its parasitoids on <i>Vitis vinifera</i> var. Queen supported by Spanish Parron System	103
4.1.3.1- Population dynamics of <i>P. ficus</i>	103
a- On trunks	103
b- On roots	105



**CONTENTS : Cont'd.**

	<b>Page</b>
4.1.3.2- Population dynamics of <i>P. ficus</i> parasitoids	106
a- On trunks	106
b- On roots	108
4.1.3.3- Hyperparasitoids	108
4.1.3.4- Conclusion	108
a- On trunks	108
b- On roots	109
c- Parasitoids	109
d- On roots	110
e- Hyperparasitoids	110
4.1.4- Population dynamics of <i>P. ficus</i> and its parasitoids on <i>Vitis vinifera</i> var. Muscat Alex. supported by Spanish Parron System	119
4.1.4.1- Population dynamics of <i>P. ficus</i>	119
a- On trunks	119
b- On roots	120
4.1.4.2- Population dynamics of <i>P. ficus</i> parasitoids	121
a- On trunks	121
b- On roots	122
4.1.4.3- Hyperparasitoids	122
4.1.4.4- Conclusion	122
a- On trunks	122
b- On roots	123
c- Parasitoids	124
d- On roots	124
e- Hyperparasitoids	124
4.1.5- The effect of certain weather factors on the population of the pseudococcid <i>P. ficus</i> on Ruby Seedless variety supported by either Telephone or Spanish Parron System	137
4.1.5.1- Effect on the host	137
4.1.5.1.1- Supported by Telephone System	137
a- Effect of maximum and minimum temperatures	137
b- Effect of relative humidity	138

**CONTENTS : Cont'd.**

	<b>Page</b>
c- Effect of dewpoint	138
d- Effect of wind speed	139
4.1.5.1.2- Supported by Spanish Parron System	139
a- Effect of maximum and minimum temperatures	139
b- Effect of relative humidity	140
c- Effect of dewpoint	141
d- Effect of wind speed	141
4.1.5.2- Effect of <i>Planococcus parasitoids</i>	142
4.1.6- The effect of grape variety on the population and its associated parasitoids	145
4.1.7- Effect of supporting sytem on counts of <i>P. ficus</i> and its associated parasitoids	146
General Conclusion	150
Recommendations	156
<b>PART II</b>	157
<b>Certain Biological Aspects on the Vine Mealybug, <i>Planococcus ficus</i> (Signoret)</b>	157
2.1- Effect of temperature :	157
a- On the mealybug progeny	157
b- On the sex ratio among progeny	158
c- On the developmental stages of <i>P. ficus</i> female	159
d- On the percents of hatching and female nymphal mortality	164
e- On the developmental stages of <i>P. ficus</i>	169
2.2- Effect of host plant	173
a- On the mealybug progeny	175
b- On the sex ratio among progeny	175
c- On the developmental stages of <i>P. ficus</i> female	175
d- On the developmental stages of <i>P. ficus</i> male	175
e- On the percents of hatching and female nymphal mortality	177

**CONTENTS : Cont'd.**

	<b>Page</b>
2.3- The effect of temperatures (20, 25 & 30°C) and host plant (sprouted potato tubers and pumpkin fruits at 30°C) used for rearing <i>P. ficus</i> was investigated by using life table parameters	179
2.3.1- Effect of temperature on the :	182
a- Net reproductive rate ( $R_0$ )	182
b- Life cycle	182
c- The intrinsic ( $r_m$ ) and the finite ( $\exp.r_m$ ) rates of increase	182
d- Population doubling time $[(\ln^2)/r_m]$	182
<b>PART III</b>	
	189
<b>Biological Studies on the Encyrtid Parasitoids</b>	
<b><i>Neoplatycerus palestinensis</i> (Rivnay) and</b>	
<b><i>Clausenia josefi</i> Rosen</b>	
	189
3.1- Biological studies on the encyrtid parasitoid, <i>Neoplatycerus palestinensis</i> (Rivnay)	189
3.1.1- Effect of temperature :	189
a- On the mean number of parasitoid progeny, development and sex ratio	189
b- On the total developmental period of the parasitoid	190
c- On the sex ratio of the parasitoid	191
3.1.2- Host stage suitability for breeding <i>Neoplatycerus</i>	192
a- Mean number of progeny	192
b- Total developmental period	195
c- Sex ratio	196
d- The relationship between the size of parasitoid <i>N. palestinensis</i> and the age of its host <i>P. ficus</i>	196
3.1.3- Fecundity and longevity	200
3.1.4- Duration of immature stages of <i>N. palestinensis</i> deposited in adult female of <i>P. ficus</i>	202

**CONTENTS : Cont'd.**

	<b>Page</b>
3.2- Certain biological aspects on the encyrtid parasitoid <i>Clausenia josefi</i> Rosen	226
3.2.1- Host stage suitability for rearing <i>Clausenia</i>	226
a- Number of progeny	226
b- Total developmental period of <i>C. josefi</i>	227
c- Sex ratio of <i>C. josefi</i>	230
3.1.2- Fecundity and longevity of <i>C. josefi</i>	230
a- Fecundity and longevity of fertilized females	230
b- Fecundity and longevity of virgin females	231
<b>5. SUMMARY</b>	<b>239</b>
<b>6. REFERENCES</b>	<b>256</b>
<b>7. ARABIC SUMMARY.</b>	