SEASONAL FLUCTUATION OF THE PARASITE COMPLEX OF *PULVINARIA TENUIVALVATA* (NEWSTEAD) (HEMIPTERA: COCCIDAE) ON SUGAR CANE IN GIZA EGYPT

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Abstract

The seasonal of the parasite complex of the red-striped soft scale, *Pulvinaria tenuivalvata* (Newstead), in Egypt was studied. Sugarcane (*Saccharum officinarum* L.) leaves infested by the soft scale were collected weekly from untreated fields in Atfieh region at Giza govenorate, Middle Egypt, from September 1999 to February 2000 and from September to December in 2001 and 2002. The highest rate of parasitism was recorded in 2001 (55.8%) whilst during 1999-2000 and 2002 those values were 43.5% and 37%, respectively. Eight species of primary parasitoids (Hymenoptera), i.e. *Coccophagus semicircularis* (Förster) and *Coccophagus obscurus* (Förster) (new record) (Aphelinidae), *Metaphycus flavus* (Howard), *Metaphycus citricola* Annecke & Mynhardt (new record) *Microterys nietneri* (Motschulsky), *Parechthrodryinus coccidiphagus* (Mercet) (new record), *Comperia alfieri* (Mercet) (new record) and *Diversinervus elegans* Silvestri (Encyrtidae) and six hyperparasitoids (Hymenoptera), i. e. *Pachyneuron muscarum* L. (Pteromalidae) , *Marietta leopardina* Motschulsky (new record) and *Ablerus chionaspidis* (Howard) (= *A. greatheadi* Annecke & Insley) (new record) (Aphelindae), *Mahencyrtus comara* (Walker) (new record), *Cerapterocerus mirabilis* Westwood (new record) and *Cheiloneurus* sp. (Encyrtidae) were identified. Ratios between primary and secondary parasitoids collected were 99: 1 (1999-2000), 94: 6 (2001-2002) and 96: 4 (2002-2003). *M. flavus* and *M. citricola* seem to be the most promising parasitoids to be used as biocontrol agents against the red-striped soft scale on sugarcane in Egypt. The former species was more abundant between late October and early March in 1999- 2000 and during mid and late September till mid- February in 2001-2002 and 2002- 2003; in the same period, the most abundant hyperparasitoid was *P. muscarum*. Competition between primary parasitoids species resulted in a decrease of *M. flavus* and *C. semicircularis* collected during 1999-2000 to 2002-2003; probably their activity was replaced by that of *M. citricola* whose rate of parasitism increased from 12.5% to 31.9% in the same

period. However, the general increase of hyperparasitism recorded during 1999-2000 to 2002-2003 could have played a role in the decrease of *M. flavus* and *C. semicircularis*. In 2001-2002 and 2002-2003, *P. coccidiphagus* represented 4% of the primary parasitoids emerged. The parasitic activity of *M. nietneri* had a peak (9%) in 2001-2002, opposed to 2% recorded in the two other seasons. *D. elegans* and *C. alfieri* as well as *C. obscurus* emerged only in a few numbers in different seasons. Competition between secondary parasitoids species resulted in a general decrease of *M. leopardina* (about 15%) and in an increase of *P. muscarum* (10%) during the second season. Their activity was somewhat replaced by that of *Cheiloneurus* sp., who dominated in 2002- 2003.

INTRODUCTION

Pulvinaria tenuivalvata (Newstead) (Hemiptera: Coccidae), the red-striped soft scale, has become a major pest of sugarcane in Egypt. It attacks leaves causing a major reduction in yield due to depletion of sap, production of honeydew and growth of sooty moulds, with a dramatic reduction of photosynthesis and respiration. Recently, a total of five primary parasitoids (Hymenoptera) were collected from this pest in different parts of Egypt, i. e. *Coccophagus semicircularis* (Förster) (Aphelinidae), *Metaphycus flavus* (Howard), *Microterys nietneri* (Motschulsky) and *Diversinervus elegans* (Encyrtidae) in Middle Egypt, *Coccophagus scutellaris* (Dalman) and *Coccophagus semicircularis* in Upper Egypt with two hyperparasitoids *Pachyneuron muscarum* L. (Pteromalidae) and *Cheiloneurus* sp. (Encyrtidae) (El-Serwy, 2001-2002 and Hendawy *et al.*, 2002). The first three species attack preferentially females of *Pulvinaria* than nymphs and the rates of parasitism recorded in different regions of Middle Egypt ranged from 6%- 33% to 44.7%- 50.5%.

Despite of the intensive application of insecticides in Upper Egypt, the distribution of the scale increased annually. In order to achieve a sustainable control of this pest, we started a study of its parasites complex to select putative agent of biocontrol to be used in the epidemic region.

MATERIAS AND METHODS

Fields infested by *P. tenuivalvata* were selected at Atfieh (east of the Nile, 80 km south Cairo). Weekly samples were taken from it from September, 25th, 1999 to February, 5th, 2000 and from September, 11th to December, 18th in 2001 and 2002. Each sample consisted of three hundred different instars stages of the red-striped soft scale that were selected at random on infested leaves, examined and assigned at one of the following class: unparasitized, parasitic holes, adult parasitoid (alive or dead),

immature parasitoid. After examination, all infested leaves were placed in plastic bags to allow the emergence of all parasitoids. After emergence, they were identified, classified as primary parasitoids or hyperparasitoids and counted.

RESULTS AND DISCUSSION

During the growing seasons of sugarcane in this study, there was a marked fluctuation in the rate of parasitism of *Pulvinaria tenuivalvata* (Newstead). The mean rate ranged from 37% (2002- 2003) to 43.5% (1999- 2000) while the peak, 55.8% recorded in season 2001-2002. Parasitoid activity started at a low rate (5.3%) during late September 1999 and continued till early February 2000. Two peaks (76.2%, 98.7%) were recorded in mid-November and late December of the same year. In 2001 and 2002, rates of 15.4% and 17.6% were observed on early September, reaching peaks of 84.9% and 87.2% in the fourth and third weeks of October in 2001 and 2002, respectively. In both years, parasitoid activity continued until mid- December and reached its maximum of 96% by the third week of November in 2001, whilst declined to 65.1% by late November in 2002.

A- Primary parasitoids

Eight primary parasitoids species (Hymenoptera: Chalcidoidea) i.e. *Coccophagus semicircularis* (Förster) and *Coccophagus obscurus* (Förster) (new record) (Aphelinidae), *Metaphycus flavus* (Howard), *Metaphycus citricola* Annecke & Mynhardt (new record), *Microterys nietneri* (Motschulsky), *Parechthrodryinus coccidiphagus* (Mercet) (new record), *Diversinervus elegans* Silvestri and *Comperia alfieri* (Mercet) (new record) (Encyrtidae) were identified.

Table 1 shows that the species of primary parasitoid collected in more than one season presented a fluctuating activity. Only four species emerged in all seasons, these species were:

1- *M. flavus*

This was the dominant species that represented about 83.8%, 60.6% and 56.4% of the total number of primary parasitoids emerged in the three seasons, respectively Table 1. Wasps emerged from late October till early March during 1999-2000 with a peak in mid- January Fig. 1 a. In the two following seasons *M. flavus* started its activity on mid and late September and continued until the third and the second weeks of February in 2001- 2002 and 2002- 2003, respectively. In these two

seasons the peaks of its activity were recorded in late December and during the third week of October respectively.

2- *C. semicircularis*

This species emerged with a constant percentage (13%) in the first two seasons, but declined to 6% in the third one Table 1. Emergence started during different weeks of September in the three seasons followed by a similar trend of emergence until early January Fig. 1 b. A distinct peak was attained on mid- October in 2001 and 2002 and a week later in 1999.

3- *M. nietneri*

This parasitoid represented 9.1% of the total number of primary parasitoids emerged in 2001- 2002, but declined to 2.4% and 1.6% in 1999- 2000 and 2002-2003 Table 1. Its emergence started at early November and continued till early February reached the peak on late November in 1999- 2000 Fig. 2a. An earlier emergence was observed in the two following seasons (late September). However, during 2001-2002 emergences of this parasitoid delated till the third week of December reached the peak at mid-October whilst in 2002-2003 *M. nietneri* was recorded at early February with a peak of activity at mid- January.

4- *C. obscurus*

A few individuals of this species emerged from early December to early January in 1999- 2000 Table1 and Fig. 2b. It appeared earlier (mid-October) in the following two seasons and continued until late of November.

Three species emerged in the last two seasons. These were:

1- M. citricola

This species represented 12.5% and 31.9% of the total number of primary parasitoids collected during 2001-2002 and 2002-2003 seasons Table 1. It was emerged in huge numbers at mid-October, but decreased gradually until late December in 2001 Fig. 3a. In 2002- 2003, wasps appeared a month earlier and reached a peak a week after than in the previous season. However, during this season the emergence period continued until mid-February.

2- *P. coccidiphagus*

This parasite represented about 4% of the total number of primary parasitoids emerged in the last two seasons Table 1. In 2002-2003, emergence lasted from mid-October to mid-January with a peak at late October Fig. 3a. Pattern of emergence was basically the same during 2001-2002, but parasitoids appeared a week later and the peak was observed by the third week of November.

Two species, i.e . *C. alferi and D. elegans*, emerged only once during late September to early October and late November to late January in 1999- 2000 respectively Table 1.

B- Secondary parasitoids (hyperparasitoids)

Six secondary parasitoids species (Hymenoptera: Chalcidoidea) i. e . *Marietta leopardina* Motschulsky (new record) and *Ablerus chionaspidis* (Howard) (= *A. greatheadi* Annecke & Insley) (new record) (Aphelinidae), *Cerapterocerus mirabilis* Westwood (new record), *Mahencyrtus comara* (Walker) (new record) and *Cheiloneurus* sp. (Encyrtidae) as well as *Pachyneuron muscarum* L. (Pteromalidae) were identified.

Data in Table 2 show that the number of hyperparsitoids emerged was highly variable during the three seasons sampled in this study. In 1999- 2000, only 3 species were collected. *P. muscarum* was the most abundant species, represented 72.9% of the total number of hyperparasitoids emerged from late October to mid- March Fig. 4a followed by *M. leopardina* (23.7% of total hyperparasitoids) emerged during mid-February to late March and followed by a very little number of *Cheiloneurus* sp. In 2001- 2002, *M. leopardina* dropped to 8.9%, whereas *P. muscarum* increased to 83% with collections that started in early and mid-October and continued till the third week of December and January, respectively Fig. 4 b. In 2002- 2003, *P. muscarum* sharply decreased to 13.5%, whilst *M. leopardina* remained at the same percentages (9.7%) and followed the same pattern of emergence as that recorded during the preceeding season Fig. 4 c. In fact, the most abundant species of hyperparasitoid during this season was an unidentified species of *Cheiloneurus* (68.8%) emerged between late September and late November. Two other species, i.e. *C. mirabilis* and *A. chionaspidis* emerged in a few numbers during the third week of October to early January in the last two seasons Table 2. Finally, *M. comara* appeared in a few numbers from the second half of October to late December and mid- January in 2002- 2003 and 2001-2002, respectively.

DISCUSSION

Parasitism rate of red-striped soft scale showed a high fluctuation during the seasons sampled in this study. The highest rate was recorded in 2001- 2002 season. Parasitic activity started at late September and lasted till early February during 1999-2000 whilst during the other two seasons it started early in September and continued until mid- December. Ratios between primary and secondary parasitoids emerged were 99: 1 (1999-2000), 94: 6 (2001-2002) and 96: 4 (2002-2003). primary and secondary . A high variation of parasitic activity both in terms of number of parasitoids and duration of their emergences was observed especially for species collected during more than one season. *M. flavus* was the dominant species represented about 64% of the total number of primary parasitoids emerged in this study. In all seasons, its emergence period lasted about 4 month and started late October (1999-2000) or mid (2000-2001) and late September (2002-2003). In the family Aphelinidae, the most abundant species was *C. semicircularis* representing 10.7% of the total parasitoids collected with emergences starting earlier, after or during the same period as *M. flavus*. In any case, collections of this species extended until February in all seasons. Both these species are reported as parasitoids of *Saissetia oleae* (Olivier), *Coccus hesperidum* L. and *Pulvinariella mesembryanthemi* (Vallot) (Coccidae) in France (Panis, 2001). El-Serwy (2001- 2002), reported that *C. semicircularis* and *M. flavus* were the most abundant parasitoids on females and nymphs of *P. tenuivalvata* at Al-Aiat and Atfieh in Giza govenorate in Middle Egypt. The reproductive capacity of soft scale females parasitized by *C. semicircularis* was reduced of about 39% and there was a reduction of about eight days in the oviposition period in respect to unparasitized soft scales. On the other hand, this species was found in a few numbers (at Nagh-Hammadi) as it was *Coccophagus scutellaris* (Dalman) (at Luxor) in Qena govenorate that is the main cultivated area in Upper Egypt (Hindawy *et al.*, 2002). Competition between *M. flavus* and *C. semicircularis* resulted in a decrease of both species emergences from 1999-2000 to 2002-2003 seasons; their activity was probably replaced by that of *M. citricola* whose emergence rate increased from 12.5 % to 31.9% in the same period. However, *P. coccidiphagus* could played a role in this competition with about 4% of parasitoid

collected in the last two seasons. Minor species in this complex were *C. obscurus* emerged in less than 1% in all seasons, and *M. nietneri* that had a peak of 9% in 2001- 2002, but accounted for about 2% in the two other seasons. *C. alferi* and *D. elegans* emerged in a few numbers only during the first season. The former species belongs to a genus reported as parasitic in coackroach egg cases. Thus, our record of *C. alfieri* from a soft scale is a complete novelty and appears as a new case of morphoparasitism. Secondary parasitoids showed high fluctuations during the seasons as did primary ones. The dominant species was *P. muscarum* with about 60% of total parasitoids emerged in all seasons. Other hyperparasitoid species collected during the three seasons of this study were *M. leopardina* and an undetermined species of *Cheiloneurus*. Competition between these species resulted in a decrease of *M. leopardina* and in an increase of *P. muscarum*. In the last season, *P. muscarum* activity was probably replaced by *Cheiloneurus* sp. (about 69%). The hyperparasitoid complex was completed by small collections of *A. chionaspidis* (less 1%) and *C. mirabilis* (2-3%). The peak of activity recorded for *Cheiloneurus* sp. and *P. muscarum* resulted in a decrease of primary parasitoids at early and late November in 2002-2003 and 2001-2002 seasons, respectively. It has been reported that in the competition among the hyperparasitoids attacking *M. flavus* in *Coccus hesperidum*, *Marietta javensis* (How.) misplaced completely *Cheiloneurus paralia* (Wlk.) in six weeks and *P. muscarum* in eight weeks, however, *Cheiloneurus* misplaced *Pachyneuron* in 20 weeks (Kfir *et al.*, 1983).

Finally, it has to be noted that during this study *Marietta leopardina* has been collected in percentages sensibly higher than those reported for cogeneric species on different scale insects. For example, *M. connecta* Compere only reached 5.5% of total hyperparasitoids when reared on primary parasitoids of *Ceroplastes destructor* Newstead (Coccidae) (Wakgari and Giliomee, 2001 Abd-Rabou, 2003).

In conclusion the two species of *Metaphycus- M. flavus* and *M. citricola* seem to be the most promising parasitoids to be used as biocontrol agents against the red-striped soft scale in Egypt, given that many species of this genus are used worldwide in biocontrol programmes (Guerrieri and Noyes, 2000).

REFERENCES

1. Abd-Rabou, A. 2003 . Host range and distribution of *Marietta leopardina* (Hymenoptera: Aphilindae), a hyperparasitoid of hemipterous and hymenopterous insect in Egypt. Egypt. J. Agric. Res., 81 (2): 555-562.

2. Guerrieri, E. and J. S. Noyes 2000. A revision of European species of the genus *Metaphycus* Mercet (Hymenoptera: Chalcidoidea, Encyrtidae), parasitoids of scale insects (Homoptera: Coccoidea). Systematic Entomology *25*: 147-222.

3. El-Serwy, S. A. 2001- 2002. Ecology, biology and natural enemies of the red-striped soft scale ،*Pulvinaria tenuivalvata* (Newstead) (Hemiptera : Coccidae), a pest of sugarcane in Egypt . Bull. Ent. Soc. Egypt, 79: 13- 35.

4. Hindawy, A. S ،.M. E. El-Metwally and S. A. Abd El-Samea 2002. Scientific note : *Coccophagus scutellaris* (Dalman) (Hymenoptera: Aphelinidae), a new record parasitoid attacking sugar-cane soft scale insect *Pulvinaria tenuivalvata* (Newstead) in Egypt. Egypt. J. Agric. Res., 80 (1): 219-222.

5. Kfir, R., D. Rosen and H. Podoler 1983. Laboratory studies of competition among three species of hymenopterous hyperparasites. Ent. Exp. Appl., 33 (30): 320- 328.

6. Panis, A. 2001. Hymenopteran parasitoids of *Saissetia oleae* (Olivier) (Hemiptera: Coccidae) and associated insects in southern France. Zool. Agr. Bachic. Ser II, 33 (3): 417-425.

7. Wakgari, W. M. and J. H. Giliomee 2001. Potentials and prospects of the integrated pest management of *Ceroplastes destructor* Newstead (Hemiptera, Coccidae) in citrus orchards in South Africa. Boll. Zool. Agr. Bachic. Ser II, 33 (3): 443-453.

Table 1. Primary parasitoids emerged during 1999-2000, 2001- 2002 and 2002- 2003 sugarcane growing seasons

Family and species	1999- 2000		2001- 2002		2002- 2003		Total	
	No.	%	No.	%	No.	%	No.	%
Aphelinidae								
Coccophagus semicircularis (Förster)	1043	12.9	2159	13.3	753	6.0	3955	10.7
Coccophagus obscurus (Förster)	50	0.6	31	0.2	57	0.4	138	0.4
Encyrtidae								
Metaphycus flavus (Howard)	6783	83.8	9802	60.6	7095	56.4	23680	64.2
Metaphycus citricola Annecke & Mynhardt	0		2026	12.5	4015	31.9	6041	16.4
Microterys nietneri (Motschulsky)	197	2.4	1475	9.1	203	1.6	1875	5.1
Parechthrodryinus coccidiphagus (Mercet)	0		690	4.3	464	3.7	1154	3.1
Diversinervus elegans Silvestri	7	0.1	0		0		7	-
Comperia alfieri (Mercet)	13	0.2	0		0		13	0.1
Total	8093		16183		12609		36853	

Table 2. Secondary parasitoids emerged during 1999-2000, 2001- 2002 and 2002- 2003 sugarcane growing seasons.

Family and species	1999- 2000		2001- 2002		2002- 2003		Total	
	No.	%	No.	%	No.	%	No.	%
Aphelinidae								
Mariettaleopardina Motschulsky	28	23.7	91	8.9	53	9.7	172	10.2
Ablerus chionaspidis (Howard) (= *A.greatheadi* Annecke& Insley)	0		3	0.3	4	0.7	7	0.4
Encyrtidae								
Cerapterocerus mirabilis Westwood	0		21	2.0	18	3.3	39	2.3
Cheiloneurus sp.	4	3.4	0		377	68.8	381	22.6
Mahencyrtus comara (Walker)	0		59	5.8	22	4.0	81	4.8
Pteromalidae								
Pachyneuron muscarum L.	86	72.9	847	83.0	74	13.5	1007	59.7
Total	118		1021		548		1687	

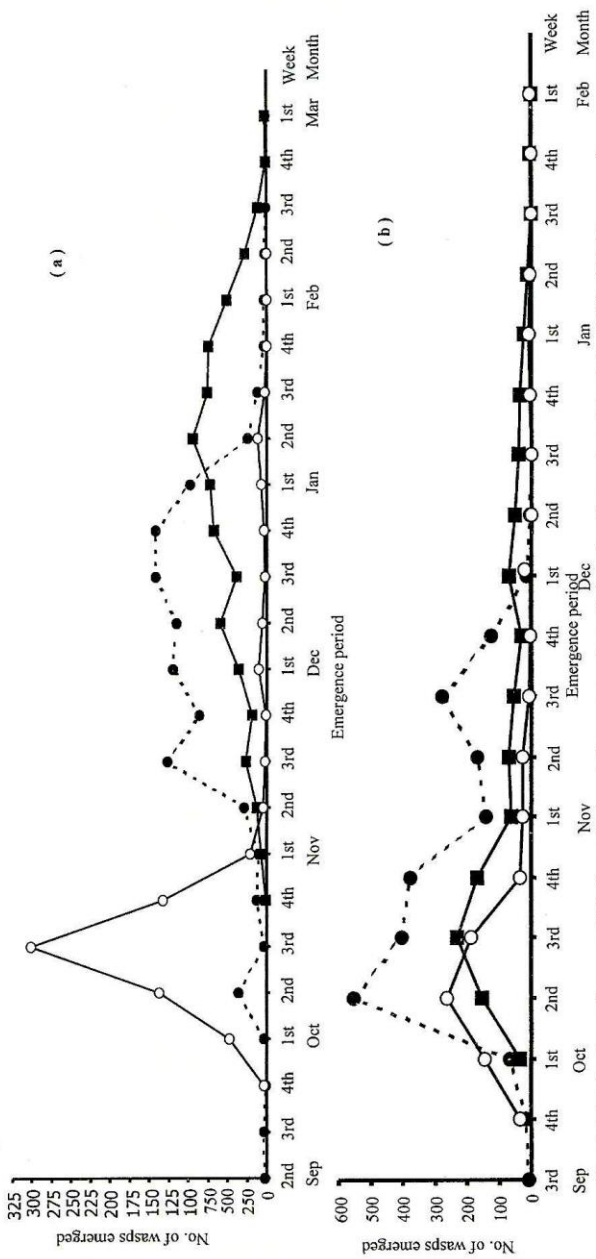

Fig. 1. Distribution of emerged *M. flavus* (a) and *C. semicircularis* (b) during September- March in 1999- 2000 (—■—), 2001- 2002 (- - ● - -) and (—○—) 2002- 2003.

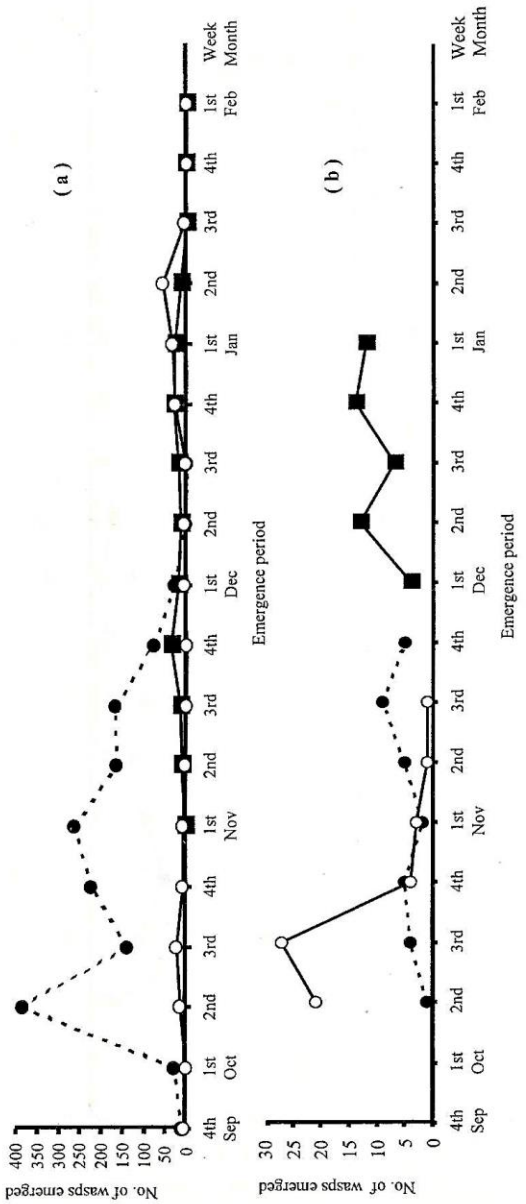

Fig. 2. Distribution of emergences of *Microterys nietneri* (a) and *Coccophagus obscurus* (b) during September- February in 1999- 2000 (—■—), 2001- 2002 (- - -● - - -) and 2002- 2003 (—○—).

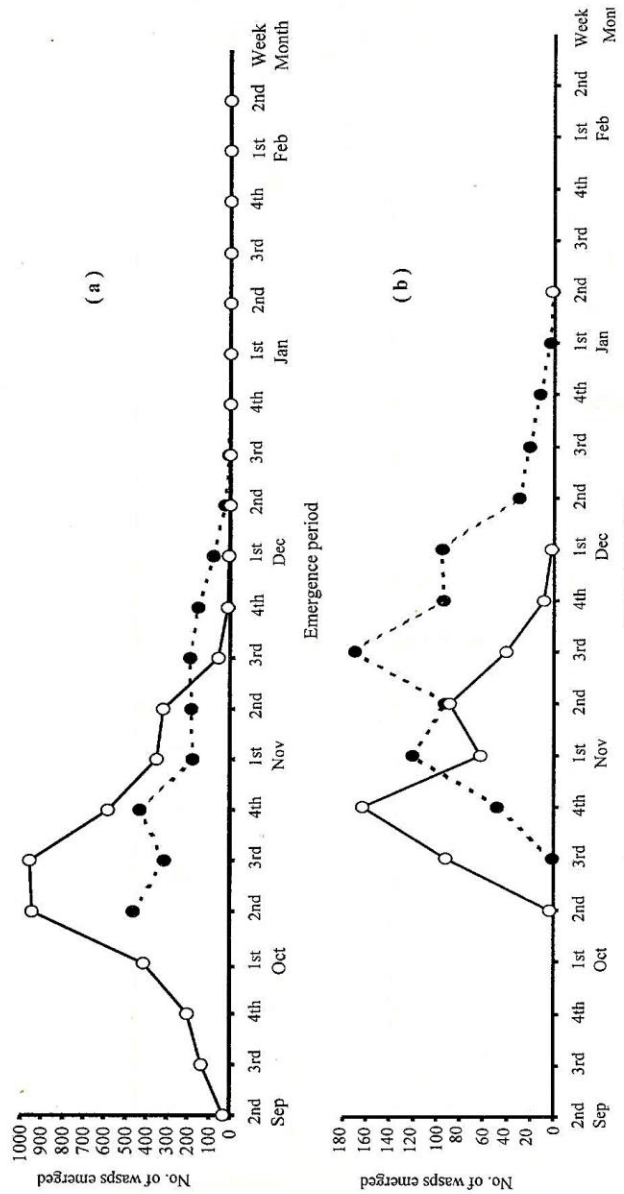

Fig. 3. Distribution numbers of emerged *Microterys citricola* (a) and *Parechthrodryinus coccidiphagus* (b) during September- February in 2001- 2002 (- - ● - -) and 2002- 2003 (—○—).

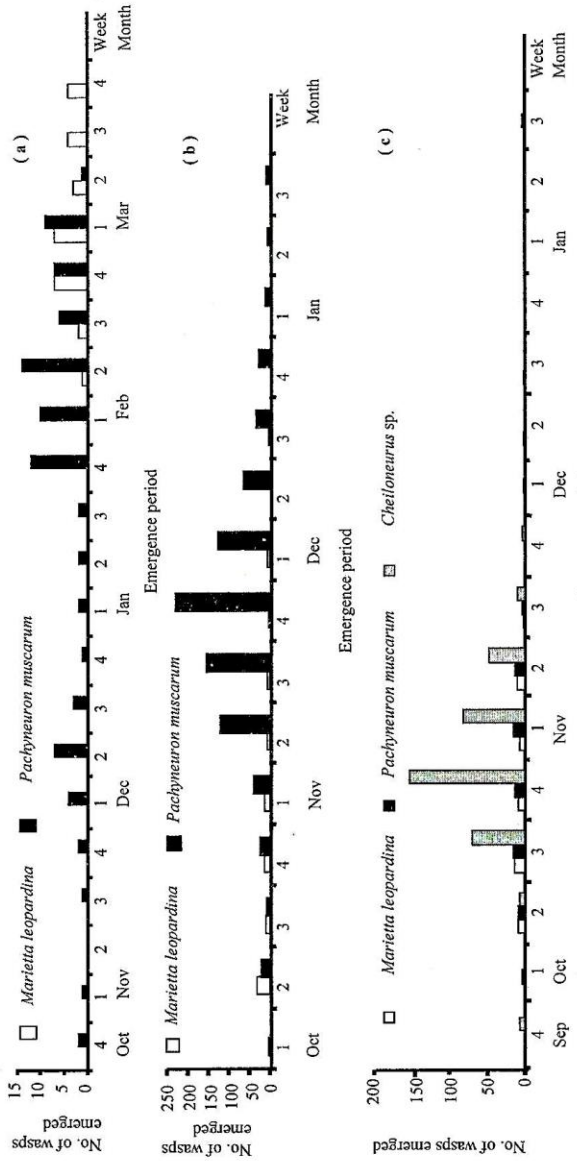

Fig. 4. Distribution of emergences of hyperparasitoids *Marietta leopardina*, *Pachyneuron muscarum* and *Cheiloneurus* sp. during September- March in 1999- 2000 (a), 2001- 2002 (b) and 2002- 2003 (c).

التغيرات الموسمية لمعقد طفيليات ا لحشرة القشرية الحمراء الرخوة *PULVINARIA TENUIVALVATA* (NEWSTEAD) على القصب فى الجيزة بمصر.

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تم دراسة المتغيرات الموسمية للتطفل والمكونات الطفيلية للحشرة القشرية الحمراء الرخوة (Newstead) *Pulvinaria tenuivalvata* في مصر. جمعت أوراق مصابة أسبوعيا من حقول قصب سكر غير معاملة في منطقة أطفيح بمحافظة الجيزة من سبتمبر ١٩٩٩ إلي فبراير ٢٠٠٠ وخلال سبتمبر إلى ديسمبر في عامي ٢٠٠١ و ٢٠٠٢. وتشير النتائج المتحصل عليها إلى أن أعلى نسب التطفل (٥٥،٨%) سجلت في عام ٢٠٠١ بينما انخفضت إلي (٤٣،٥%) في موسم ١٩٩٩- ٢٠٠٠ و (٣٧%) في عام ٢٠٠٢. تم تعريف ٨ أنواع من الطفيليات الأولية من رتبة غشائية الأجنحة وهى :

(Förster) *Coccophagus semicircularis* و (Förster) *Coccophagus obscurus* (تسجيل جديد) من عائلة (Aphelinidae) و(Howard) *Metaphycus flavus* ، Annecke *Metaphycus citricola* & Mynhardt (تسجيل جديد) ، (Motschulsky) *Microterys nietneri* ، *Parechthrodryinus coccidiphagus* (Mercet) (تسجيل جديد) ، (Mercet) *Comperia merceti* (تسجيل جديد) و Silvestri *Diversinervus elegans* من عائلة (Encyrtidae) .

وكذلك ٦ أنواع من الطفيليات الثانوية من نفس الرتبة هي:

L. *Pachyneuron muscarum* من عائلة (Pteromalidae) *Marietta leopardina* Motschulsky، (تسجيل جديد) و (Howard) (= *A. greatheadi* Annecke & Insley) *Ablerus chionaspidis* (تسجيل جديد) من عائلة (Aphelinidae) و Westwood *Cerapterocerus mirabilis* (تسجيل جديد) ، (Walker) *Mahencyrtus comara* (تسجيل جديد) و sp. *Cheiloneurus* من عائلة (Encyrtidae) .

بلغت نسب الطفيليات الأولية إلي الثانوية ٩٩ : ١ ، ٩٤ : ٦ و ٩٦ : ٤ في مواسم ١٩٩٩- ٢٠٠٠ ، ٢٠٠١- ٢٠٠٢ و ٢٠٠٢- ٢٠٠٣ علـى التـوالي. يعتبـر النوعـان *M. flavus* و *M. citricola* من أنشط الطفيليات والتي يمكن استخدامها في المكافحة الحيوية ضد تلك الآفة على القصب في مصر. والنوع الأول هو الأكثر شيوعا وتواجد مابين أواخر أكتوبر إلي أوائل مارس في موسـم ١٩٩٩- ٢٠٠٠ وكذلك خلال منتصف وأواخر سبتمبر وحتى منتصف فبراير في موسـمي ٢٠٠١- ٢٠٠٢ و ٢٠٠٢- ٢٠٠٣. كما تواجد معه الطفيل الثانوي الأكثر شيوعا *P. muscarum*. أتضح من الدراسة أن التنافس بين أنواع الطفيليات ألاولية يؤدى إلي نقص في أعداد النوعان *M. flavus* و *C. semicircularis* التي جمعت خلال ١٩٩٩- ٢٠٠٠ إلي ٢٠٠٢- ٢٠٠٣. ويتوافق قلة أعدادها مع زيادة نسبة تواجد الطفيل *M. citricola* من ١٢،٥% إلي ٣١،٩% في تلـك المـدة. كمـا تلعـب الطفيليات الثانوية دورا هاما عند ارتفاع أعدادها خلال ١٩٩٩- ٢٠٠٠ إلي ٢٠٠٢- ٢٠٠٣ الـى نقص أعداد كلا من النوعان *M. flavus* و *C. semicircularis* . ويمثل النوع *P. coccidiphagus* ٤% من الطفيليات الأولية الخارجة في موسمي ٢٠٠١- ٢٠٠٢ و ٢٠٠٢- ٢٠٠٣. أما الطفيل *M. nietneri* فتصل ذروة نشاطه (٩%) في موسم ٢٠٠١- ٢٠٠٢ مقارنـة ب (٢%) المسـجلة فـي الموسمين الآخرين. بينما تتواجد الأنـواع الأخـرى وهـى *C.alfieri*، *D. elegans* و *C.obscurus* بأعداد قليلة حيث تخرج في المواسم المختلفة. ويؤدى التنافس بين أنواع الطفيليات الثانوية إلي نقص عام (حوالي ١٥%) في النوع *M. leopardina* وزيادة (١٠%) للنوع *P. muscarum* خلال الموسم الثاني. بينما يقل نشاطهما في موسم ٢٠٠٢- ٢٠٠٣كنتيجة لإحلال النوع السائد *Cheiloneurus* sp.