SURVEY AND DYNAMICS OF NATURAL ENEMIES OF THE MEDITERRANEAN BLACK SCALE, *SAISSETIA OLEAE* (HOMOPTERA: COCCIDAE) IN EGYPT

ABD-RABOU SHAABAN[1], ADEL A. HAFEZ[2] AND HODA BADARY[1]

1 Plant Protection Research Institute, Agricultural Research Centre, Dokki, Giza, Egypt.

2 Department of Plant Protection, Faculty of Agriculture, Moshtohor, Zagazig University, Benha branch.

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Abstract

Twenty nine natural enemies were associated to this pest (11 parasitoids and 18 predators). Population dynamics of recorded five hymenopterus parasitoids [*i.e. Metaphycus bartletti* Annecke & Mynhardt, *M. flavus* (Howard), *Microterys flavus* (Howard), *Diversinervus elegans* (Silvestri) and *Scutellista cyaneae* (Mots.)] were studied in a Northern Coast site during 1998-1999 and 1999-2000. *M. bartletti* was the most effective parasitoid of *Saissetia oleae* on olive trees with maximum rates of parasitism of 23.0 and 24.5% during 1998-1999 and 1999-2000, respectively.

The population dynamics of 6 predators were studied at the same site. Two peaks were recorded annually for *Chilocorus bipustulatus* L., Chrysoperla carneae (Stephens), *Coccinella undecimpunctate* (L.), *Orius* sp., and *Scymnus syriacus* Mars. *Exochomus flavipes* Thrum and *Orius* sp., were recorded at low populations throughout the two considered years, respectively.

INTRODUCTION

Natural enemies of the Mediterranean black scale, *Saissetia oleae* have an effective role in controling this pest (Abd-Rabou, 1999a). Natural enemies of *S. oleae* attracted many research workers all over the world [*e.g.* Priesner & Hosny (1940), Annecke (1964), Rosen (1967), Argyriou & Katsoyannos (1977), Lal & Naji (1980), El-Agamy *et al.* (1994) and Abd-Rabou (1998 & 1999a)].

The aim of this study was to survey and to study the population dynamics of the natural enemies attacking *S. oleae* at a North West Coast site of Egypt.

MATERIAL AND METHODS

1. Survey of natural enemies of *Saissetia oleae* in Egypt: Survey of *S. oleae* parasitoids and predators were conducted at different locations which represent different Egyptian governorates. That was carried by random collection of leaf and twigs samples infested with *S. oleae* from different plants that were brought to the laboartory for examination. Parasitoids, hyperparasitoids and predators were isolated and identified.

First, second and third nymphal instars, non-gravid and gravid females of *S. oleae* were collected from different host plants from different localities in Egypt during different months of the year (over three years 1998, 1999 and 2000). Random samples of leaves and twigs were collected and placed separately in paper bags, then transported to the laboratory for examination to determine the natural enemies associated with *S. oleae.*

Natural enemies were identified by mounting adult natural enemies specimens in Canda balsem and cards according to Noyes (1982).

2. Population dynamics of some natural enemies of *Saissetia oleae:* One location was chosen for this study, at Northern Coast. Relative population densities of parasitoids and predators were estimated throughout the period which extended from 1 April 1998 to 15 March 2000. Half-monthly counts were made on 150 leaves and 75 twigs collected randomly from nine olive trees.

At Northern Coast (150 km west of Alexandria), also nine olive trees were selected for studying the population dynamics of *S. oleae* natural enemies. No chemical control treatments were applied to these trees for several years ago and during the period of study. Half-monthly samples were collected from April, 1998 to March, 2000. Each sample consisted of 150 leaves and 75 twigs (20 cm long), collected randomly from the nine trees. Predators were counted and recorded directly on these samples in the field. Samples were transferred to the laboratory in polyethylene bags for examination under a stereomicroscope. After being examined, samples were kept in carton cylindrical containers (15 cm long and 15 cm diameter) covered with fine muslin cloth, until the emergence of all parasitoids that were counted and recorded.

RESULTS AND DISCUSSION

1. Survey of natural enemies of the Mediterranean black scale, *Saissetia oleae*

- **Survey of parasitoids:** The collected parasitoids and hyperparasitoids, Table 1 were identified as follows.

- **Survey of predators associated with *S. oleae*:** The collected predaceous species were identified and reported in Table 2. Concerning the natural enemies of *S. oleae*, it was observed that very little was known on the natural enemies of *S. oleae* in Egypt prior to the studies of Priesner and Hosny (1940), who recorded three parasitoids and one predator. Abd-Rabou (1998 & 1999a) recorded three parasitoids attacking *S. oleae [i.e. Metaphycus flavus* Howard, *M lounsburyi* (Howard) and *M. zebratus* (Mercet)]. In the present work, eleven parasitoids were recorded on *S. oleae.* Ten of them were recorded as primary parasites, (one of them as a new record in Egypt, *i.e. Microterys flavus*). Others were *Coccphagus lycimnia, Metaphycus helvolus, Metaphycus flavus, Paracerapterocerus africanus and Alaptus* sp. and one hyperparasitoid, *Maritta leopardina*, Table1. On the other hand, nineteen predators were recorded here for the first time in Egypt on *S. oleae*, Table 2.

2. Population dynamics of some natural enemies of *Saissetia oleae*

- Population dynamics of *S. oleae* parasitoids at North Coast site

***Metaphycus bartletti* Annecke & Mynhardt:** This species was previously recorded by Abd-Rabou (2001) associated with *S. oleae* in Egypt. Rate of parasitism by this parasitoid on olive trees, averaged 10.8 and 11.2% during the two years 1998-1999 and 1999-2000, respectively, Figs. 1 and 2.

Table 1. Survey of hymenopterous parasitoids attack *Saissetia oleae* in Egypt :

Family	Species	Type of parasitizm
Aphelinidae	*Coccphagus lycimnia* (Walker)	Primary parasite
	Marietta leopardina Mot.	Hyperparasite
Encyrtidae	*Baeoanusia* sp.	Primary parasite
	Diversinervus elegans Silvestri	Primary parasite
	Metaphycus bartletti (Annecke & Mynhardt)	
	M. flavus (Howard)	Primary parasite
	M. helvolus (Compere)	Primary parasite
	M. zebratus (Mercet)	Primary parasite
	Microterys flavus (Howard)*	Primary parasite
	Paracerapterocerus africanus Girault	Primary parasite
Mymaridae	*Alaptus* sp.	Primary parasite
Pteromalidae	*Scutellista cyaneae* (Mot.)	Primary parasite

* First record in Egypt.

Table 2. Survey of predators associated with *Saissetia oleae* in Egypt:

Order	Family	Species
Coleoptera	Coccinellidae	*Chilocorus bipustulatus* L. *
		Clitostethus arcuatus Rossi *
		Coccinella undecimpunctata L. *
		Cryptolaemus montrouzieri Mulsant*
		Exochomus flavipes Thrum. *
		Rhizobius littura Fab. *
		Rodalia cardinalis Muls. *
		Scymnus interruptus Goiz*
		S. syriacus Mars. *
		Scymnus sp. *
		Selethorus sp. *
Diptera	Syrphidae	*Syrphus corollae* Fab. *
		Syrphus sp. *
		Xanthogramma aegyptium Wied*
Hemiptera	Anthocoridae	*Orius laevigatus* Fieb*
		Orius sp. *
Neuroptera	Chrysopidae	*Chrsoperla carneae* (Stephens) *
		Chrsopa septempunctata Wesm. *
	Steaphilinidae	*Paedrus alffierii* Koch. *
	Phloeothripidae	*Haplothrips andresi* Priesner *

* First record in Egypt.

***Metaphycus flavus* Howard:** This species was recorded by Priesner & Hosny (1940) associated with *Coccus hesperidum* L., *Pulvinaria floccifera* (Westwood), *P. guajava* and *S. oleae* on *Cycas revoluta* in Delta and Upper Egypt. The percentages of parasitism by this species at Northern Coast site on *S. oleae* averaged 3.7 and 5.8% during the two years of investigation, respectively. Maximum rates of parasitism reached 12.3 and 15% during mid August, 1998 and early of September, 1999, respectively, Figs. 1 and 2.

***Microterys flavus* (Howard):** This species was recorded here for the first time associated with *S. oleae* in Egypt. Rate of parasitism averaged 0.8 and 2.4% during the two years, respectively, Figs. 1 and 2. Maximum rate of parasitism reached 3.4 and 8.0% during mid Nov. 1999 and early Nov., respectively. *Mi. flavus* is a widely distributed parasitoid of various soft scale insects. It has been recorded in North America, North and South Africa, the Far East, Australia, New Zealand, Europe and around the Mediterranean Basin (Annecke, 1964 and Rosen, 1967).

***Diversinervus elegans* (Silvestri):** This species was recorded by Priesner & Hosny (1940) associated with *S. oleae*, *P. floccifera* and *C. hesperidum* in Egypt. Data in Figs. 1 and 2 showed that rates of parasitism by this species in Northern Coast site on *S. oleae* on olive averaged between 0.3 and 2.4% during the two years under investigations. Maximum parasitism rates was attained during early July, 1998 and mid of July, 1999 which represented by 6.2 and 8.3%, respectively. This primary parasitoid was first recorded from Eritrea and Southern Africa, (Annecke, 1964). It is found to be a common parasitoid of *S. oleae* and a rare parasitoid of the hemispherical scale, *S. coffeae* (Walker) on olive (Rosen *et al.*, 1971).

***Scutellista cyaneae* (Mots.):** This parasitoid was recorded in Egypt by Priesner and Hosny (1940) associated with *Ceroplastes africans* on *Acacia nilotica*, *Albizzia lebbek*, *Ficus carica also Parasaissetia nigra* on *Ficus sycamorus* and *S. coffeae* on olive in Lower and Upper Egypt. Recorded parasitism rates, Figs. 1 and 2 averaged 2.0 and 3.5% during the two years, respectively. Maximum rates of parasitism was estimated to be during mid June, 1998 and early June 1999 as 5.5 and 11.1%, respectively. Rosen (1967) found it often to be the dominant parasitoid of the Florida wax scale, *Ceroplastes floridensis* Comstock and an abundant parasitoid of *S. oleae* and a very rare parasitoid of the fig wax scale *Ceroplastes rusci* (L.) on citrus.

It can be concluded that the present work indicated that *M. bartletti* is an effective parasitoid on *S. oleae* on olive trees with maximum parasitism rates of 23.0 and 24.5% during 1998-1999 and 1999-2000, Figs. 1 and 2. Consequently, it can be said that, the parasitoid *M. bartletti* is the most effective parasitoid in controlling *S. oleae* on olive trees in Northern Coast.

- Population dynamics of Predators

Data illustrated in Figs. 1 and 2, show the population fluctuation of predators belonging to Hemiptera, Coleoptera and Neuroptera insect orders.

***Chilocorus bipustulatus* L.:** Two peaks per year were recorded annually for *C. bipustulatus*, Figs. 1 and 2 in the first year. The 1st peak (31 individuals/sample) was recorded on June 15th and the second peak (21 individuals/sample) on March 15th. While, in the second year, this predator was common from April to June and from Jan. to March. Abd-Allah (1988) mentioned that numbers of *C. bipustulatus* were generally low during winter and summer months. The current results agree with Metwally (1993) who reported two peaks per year for this predator.

***Chrysoperla carneae* (Stephened):** Figures 1 and 2, showed the

abundance of this chrysopid species during the two successive years, 1998-1999 and 1999-2000. Two peaks of *C. carneae* were recorded in mid June represented by 31 and 53 individuals/sample, respectively. Abd-Rabou (1999 b) observed the important role of C. carneae in controlling some of homopterous insects.

***Coccinella undecimpunctate* (L.):** The abundance of this species was recorded in Figs. 1 and 2 during the two successive years. Results showed that this predator had two peaks represented by 19 and 12 individuals for the first year and 29 and 11 for the second years. This predator assumed as basis for supporting biological control of different insect (Abd-Rabou, 1999b).

***Exochomus flavipes* Thrum.:** The coccinellid predator, *E. flavipes* was recorded at low population throughout the two considered years. However, its density was almost similar all over the two years. Argyriou and Katsoyannos (1977) recorded this predator as a natural enemy of scale insects in different localities of the world.

***Orius* sp.:** Average numbers of this species was recorded during the two years as 37 individuals/sample in first year and 55 individuals/sample in the second year.

***Scymnus syriacus* Mars.:** The data of the dynamics of this species shown in Figs. 1 and 2 indicated that this coccinellid predator had one peak per year. Average numbers of this species were 29 individuals/sample in first year and 39 individuals in the second year.

This finding agree with that data obtained by Abd-Allah (1988) and Metwally (1993) who recorded two peaks of *S. syriacus*. Lal & Naji (1980) and El-Agamy *et al.* (1994) reported that *S. syriacus* was found feeding on scale insects.

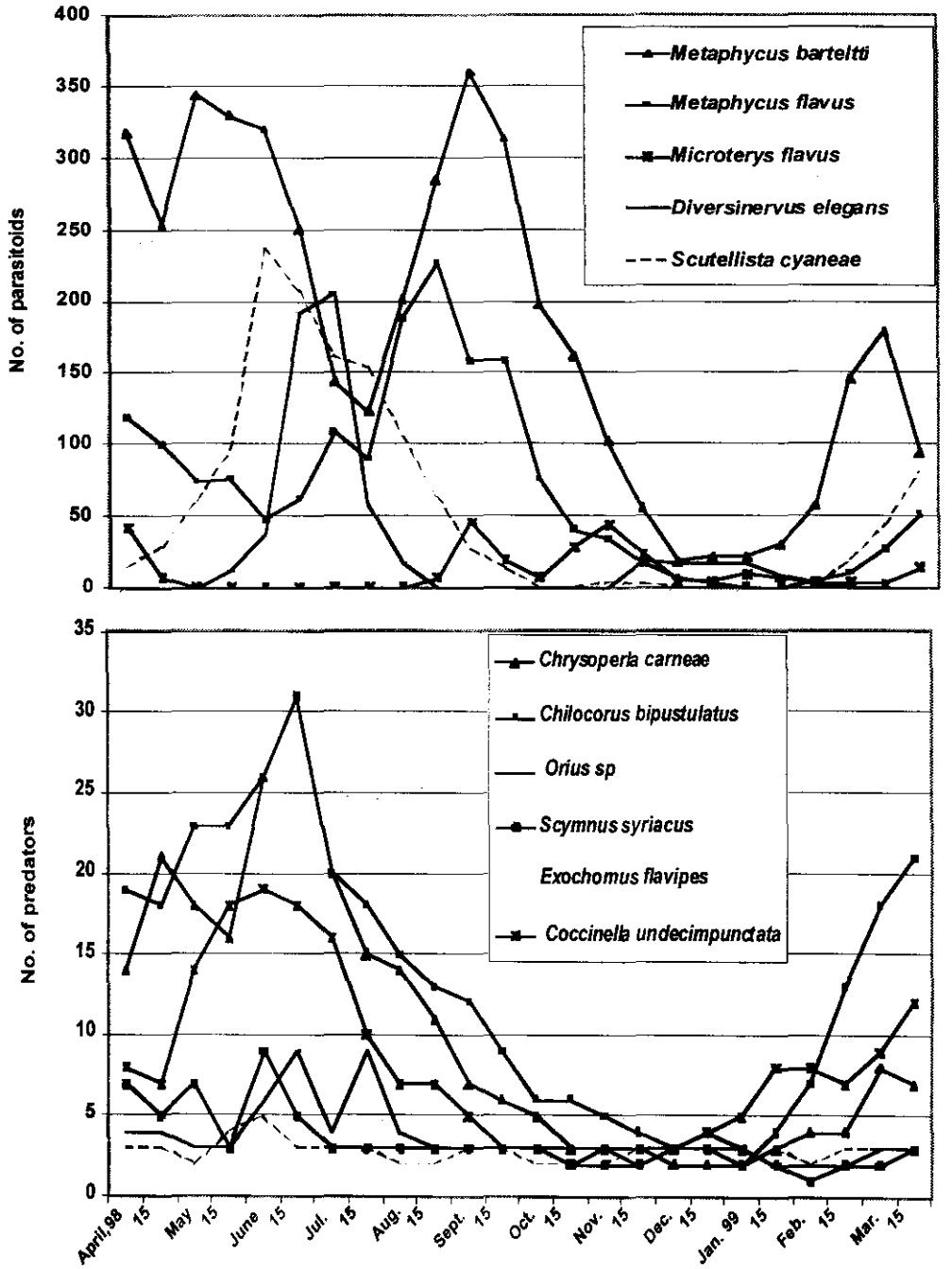

Fig. 1. Half-monthly counts of different parasitoids and predators of *Saissetia oleae* on olive trees during 1998-1999.

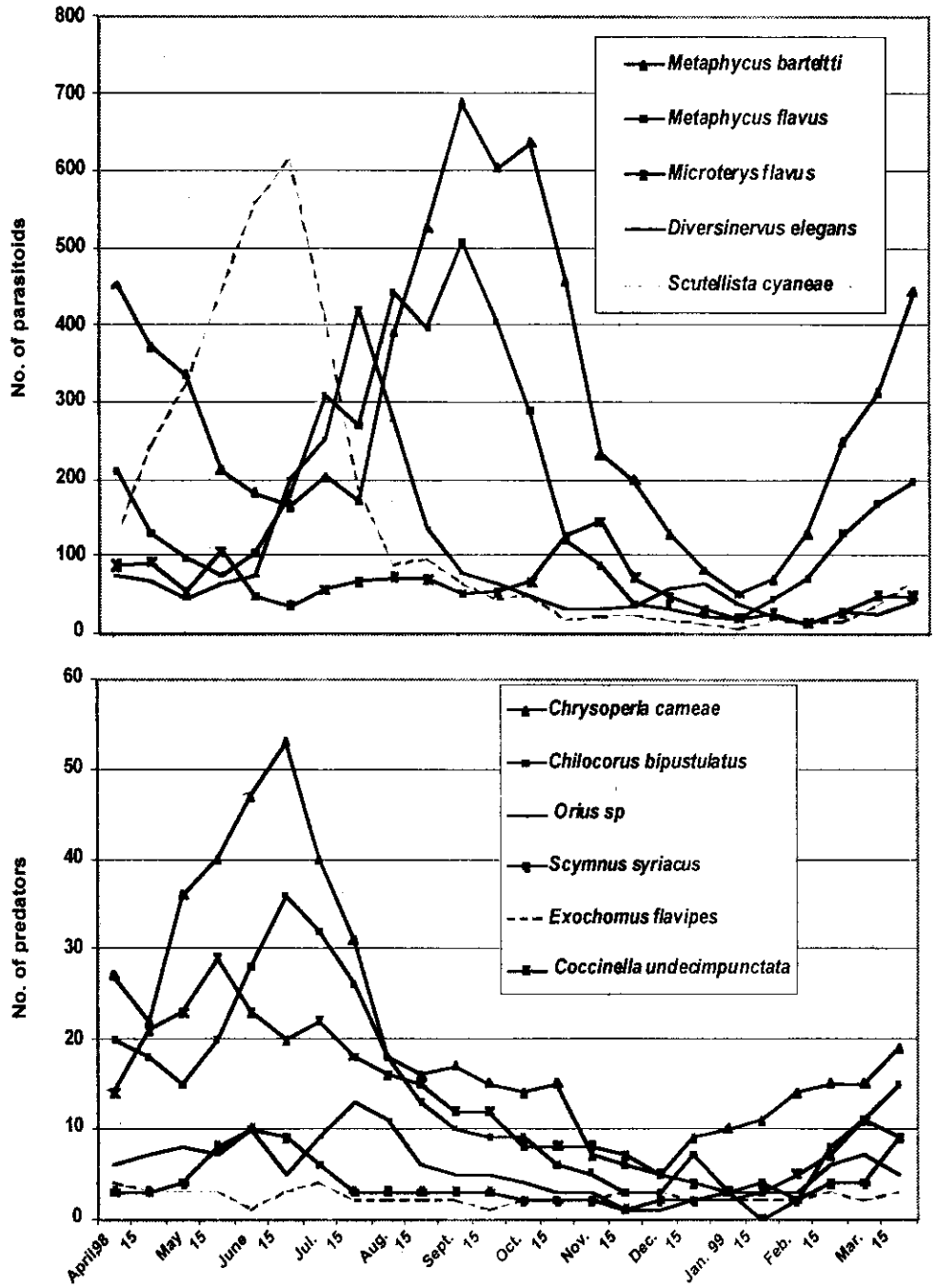

Fig. 2. Half-monthly counts of different parasitoids and predators of *Saissetia oleae* on olive trees during 1999-2000.

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الحصر والتوزيع الموسمي للأعداء الحيوية لحشرة البحر المتوسط القشرية الرخوة في مصر

شعبان عبد ربه[1]، عادل عبد الحميد حافظ[2]، هدي بداري[1]

١ معهد بحوث وقاية النباتات ، مركز البحوث الزراعية، الدقي ، الجيزة
٢ قسم وقاية النبات ، كلية الزراعة بمشتهر ، جامعة الزقازيق

في هذه الدراسة تم تجميع هذه الآفة من علي ٢٧ عائل نباتي تتبع ٢٢ فصيلة من ٢٨ موقع في ١٨ محافظة كما تم حصر ٢٩ أعداء حيوية (١١ طفيل حشري و١٨ مفترس حشري) مصاحب لهذه الآفة.

وقد أوضحت النتائج أن هناك ٢٢ نوع من العوائل النباتية لهذه الحشرة تسجل لأول مرة في مصر وكذلك تم تسجيل ١٩ مفترس وطفيل واحد لأول مرة في مصر مصاحبة لهذه الآفة.

كما تم دراسة التغير الموسمي في تعداد الخمسة أنواع من الطفيليات المصاحبة لهذه الآفة وهي *Metaphycus bartletti* Annecke & Mynhardt, *Metaphycus flavus* (Howard), *Microterys flavus* (Howard), *Diversinervus elegans* (Silvestri), *Scutellista cyaneae* (Mots.)في الساحل الشمالي خلال ١٩٩٨-١٩٩٩ و ١٩٩٩-٢٠٠٠ .

ولقد أتضح من هذه الدراسة أن الطفيل *M. bartletti* كان من الطفيليات المؤثرة علي حشرة *S. oleae*علي الزيتون وأن أعلي نسبة تطفل قد وصلت الي ٢٣ و ٢٤,٥ خلال عامي الدراسة. ولذلك يمكن ان توصي باستخدامه في المكافحة البيولوجية لهذه الآفة.

كما تم دراسة السير العددي لستة أنواع من المفترسات المصاحبة لهذه الآفة في الساحل الشمالي خلال ١٩٩٨-١٩٩٩ و ١٩٩٩-٢٠٠٠.

ولقد أوضحت النتائج أن هذه المفترسات

(*Chilocorus bipustulatus L., Chrysoperla carneae (Stephens), Coccinella undecimpunctate (L.), Exochomus flavipes Thrun, Orius sp., Scymnus syriacus Mars.)* لها قمتين سنويا.

وأن الأنواع *Exochomus flavipes* Thrum and *Orius* sp., كانتا أعدادها قليلة خلال سنتي الدراسة.