

## ANALYTICAL REVIEW OF THE MAIN ARTHROPOD PESTS AND NATURAL ENEMIES ASSOCIATED WITH DATE PALM TREES IN EGYPT

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(Manuscript received 15 August 2007)

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### Abstract

In Egypt, approximately 140,000 feddan were cultivated by more than nine millions of date palm trees which produced more than 750,000 tons of dates every year. Date palm trees were infested by several insect pests and mites. An extensive review of date palm arthropod pests and associated natural enemies was established by using the available publications. The main recovered subjects were the faunistic surveys, biological, ecological studies, seasonal population trends, damage and yields loss caused by the main date palm arthropod pests. The arthropod pests recovered in association with date palm trees were represented by 40 species belonging to 32 genera, 24 families and 6 orders. These six orders were represented by Orthoptera, Isoptera, Homoptera, Coleoptera, Lepidoptera and Diptera. The main recovered species belonging to these orders were: *Macrotoma palmata* (Fabricius), *Rhynchophorus ferrugineus* Olivier, *Arenipsea sabella* (Hampson), *Ommatissus binotatus lybicus* De Berg, *Parlatoria blanchardii* (Targ.), *Phonopate frontalis* (Fabricius), *Batrachydra amydraula* Myerick, *Ephestia (Cadra) calidella* (Guenee), *Ephestia (Cadra) cautella* Walker, *Ectomyelois (myelois) ceratonia* Zellar and *Virachola (Deudorix) livia* (Klug.). On the other hand, 22 mite genera were recorded in association with fruits, leaves, dry dates and in the soil around date palm trees. The recovered natural enemies were represented by 12 predatory species belonging to 12 genera. However, the recovered parasitoid species were belonging to 7 genera.

**Key words:** Analytical review, Arthropod pests, Date palm trees, Mites, Natural enemies,

### INTRODUCTION

Approximately nine millions of date palm trees are grown in Egypt. They cultivated in an area of about 140,000 feddan and produced more than 750,000 tons of dates every year. These trees are mainly concentrated in Aswan, Sharkia, Behira, New Valley, Fayoum, Giza, Minia, Damietta, Qalyobia and Dakhalia were 909929, 894318, 751298, 714100, 645756, 455834, 410963, 409709, 85464 and 65422 trees, respectively, were estimated in 1998 by Horticultural Research Institute (ARC) (Sharaf El-Din, 1999). Date palm trees were infested by several insect pests and mites, which cause a severe damage and yield loss in the field and storage. This manuscript is

established to give a beam of light on the main obtained results of the available Egyptian investigations concerned with the date palm arthropod pests and their associated natural enemies.

## MATERIALS AND METHODS

Extensive review of the date palm arthropod pests and their associated natural enemies was made by the writer. Publications dealing with faunistic surveys, annotated taxonomic lists, seasonal population trends, biological, parasitoid and predation studies were of special interest. The main source of domestic publications were the Bulletin of Entomological Society of Egypt, Journals of certain agricultural colleges, conferences and approved theses and dissertations at different college and institutional libraries.

## RESULTS AND DISCUSSIONS

A partial taxonomic list of phytophagous insect pests recovered in association with date palm trees in Egypt was presented in Table (1). The recovered insect pests was represented by 40 species belonging to 32 genera, 24 families and 6 orders. It is apparent that, Orthoptera, Isoptera, Homoptera, Coleoptera, Lepidoptera and Diptera were only the six orders that are contained insect species associated with date palm trees in Egypt. Order Orthoptera represented by one species (one genus), Isoptera by one species (one genus), Homoptera by 9 species (9 genera), Coleoptera by 16 species (12 genera), Lepidoptera by 11 species (7 genera) and Diptera by 2 species (2 genera). The obtained informations indicated that Homoptera, Coleoptera and Lepidoptera are relatively rich in the number of species represented.

The obtained data indicated that most of investigators concerned with the economic pests such as: *Macrotoma palmata* (Fabricius), *Rhynchophorus ferrugineus* Olivier, *Arenipses sabella* (Hampson), *Ommatissus binotatus lybicus* De Berg, *Parlatoria blanchardii* (Targ.), *Phonapate frontalis* (Fabricius), *Batrachedra amydraula* Meyrick, *Ephestia calidella* (Guenee), *Ephestia cautella* Walker, *Ectomyeloides (Myeloides) ceratoniae* Zeller and *Virachola (Deudorix) livia* (Klug).

On the other hand, 22 mite genera were recorded in association with fruits, leaves, dry dates and in the soil around date palm trees (Table 2). The recovered natural enemies were represented by 12 predatory species belonging to 12 genera, while, the recovered parasitoid species were belonging to 7 genera (Table 3). The obtained data were discussed and the date palm insect pests were arranged according to the part of infestation.

## **I - Truck's and bunches pests**

### **1. *Macrotoma palmata* Fabricius**

**(Coleoptera : Cerambycidae)**

The sunt borer *M. palmata* is widely distributed in Egypt. Helal *et al.* (1986) studied its egg stage, oviposition site, incubation period, effect of temperature and relative humidity, threshold of egg development and egg hatchability. Toxicity of some insecticides was also studied.

### **2. *Rhynchophorus ferrugineus* Olivier**

**(Coleoptera : Curculionidae)**

The red palm weevil *R. ferrugineus* is the major destructive pest for several palms in different countries. El-Gabry (1996) stated that the first record of this insect pest in Egypt was in 1992. Amongst the (IPM) control programs, Heikal (2001) isolated the fungus *Beauveria bassina* from infected cadaver adults of *R. ferrugineus* and used it as a biological control agent. The pathogenicity of the isolated fungi was evaluated throughout dermal and oral infections on the 6<sup>th</sup>, 4<sup>th</sup> and 2<sup>nd</sup> larval instars. The effect of this strain on biological parameters of this insect pest was also studied.

### **3. *Phonapate frontalis* (Fabricius)**

**(Coleoptera : Bostrichidae)**

Informations about *Phonapate frontalis* in Egypt are very scarce. Sharaf El-Din (1999) studied the effect of temperature and relative humidity on *P. frontalis* populations. He found that the main period for emergence occurred in summer and autumn seasons. The infestation percentage of this pest reach 45.2% at Minia Governorate, Upper Egypt.

### **4. *Arenipses sabella* (Hampson)**

**(Lepidoptera : Pyralidae)**

Many authors recorded *A. sabella* among the date pests in Egypt, as follows: in Aswan (Hammad *et al.*, 1966c), in Sinai (Michael, 1967) and in New Valley (Saleh, 1974). The infestation with *A. sabella* appeared in date bunches early in the season (March). The first sign of damage was observed in April in the fallen dates (Saleh, 1974). Ali *et al.* (1993b) evaluated the population dynamics of *A. sabella*. Also, they determined the percentage of infestation on fallen dates and those remaining on palm trees throughout winter. The maximum infestation rates were obtained in December and the lowest rates were recorded in March. Control measures including burning of infested palm, collecting fallen dates, dry leaves and removing old fibers could successfully reduced the total infestation by 53.3% in the next fruiting season. On the other hand, the use of date-bunches isolators significantly limited date infestation by *A. sabella* (Ali *et al.*, 2002).

**5. Ommatissus binotatus lybicus De Berg****(Homoptera : Tropiduchidae)**

The dūbas bug *O. binotatus* was recorded for the first time as a serious insect pest attacking young date palms at Bahria Oases, Egypt by Hussain and Ali (1996). It was found to attack all green parts of the palm except fruits. Eggs, nymphs and adult stages were observed in the field on green pinnae particularly on the upper surface. When weather temperature is high, insects apparently migrate to the heart of young palms. Symptoms of infestation, life history and population dynamics of this species during 1995/96 are given. Its occurrence was found to continue from late March to late November with two annual generations.

**6. Parlatoria blanchardii (Targ.)****(Homoptera : Diaspididae)**

The seasonal abundance of *P. blanchardii* have been studied in Bahria Oases and Giza region by Hussain (1996). The obtained results indicated that the pest had 3 generations / year in both areas. The maximum and minimum size of scales/leaflets were determined in the two regions. Eraki (1998) indicated that *P. blanchardii* had 4 peaks of infestations in early of March, June, September and December. The biggest peak was in early December. Amongst the Naturally Occurring Biological Control Agents (NOBCA), Abd-Rabou and Hendawy (2000) identified three primary aphelinid parasitoids that attack this pest at El-Arish and El-Ayat regions. These parasitoids were: *Aphytis pohoenicis* De Bach and Rosen, *Encarsia citrina* (Craw.) and *Pteroptrix* sp.

**II- Fruits pests****1. Batrachedra amydraula Meyrick****(Lepidoptera : Cosmopterigidae)**

The lesser date moth *Batrachedra amydraula* Meyrick received attention of researchers as a pests of date palm fruits in different parts of the world. Several investigators studied this insect pest in Egypt as follows: In Sinai (Michael, 1967), in the New Valley (Saleh, 1974 and Sayed and Ali, 1995), in Bahria Oases (Ali *et al.*, 1993a).

The damage percentage caused by this insect pest was studied by Gharib (1968). He stated that each larva damaged on the average 3-5 fruits causing them to fall prematurely, the larvest attack occurred then when the fruits were almost of the same size of hazelnut and about 20-70% of the damaged fruits were lost. On the other hand, the corresponding population density and the degree of infestation of *B. amydraula* was studied by Ali *et al.* (1993a) in Bahria Oases. The obtained results ensure that this pest could develop into 2-3 generations annually according to the

prevailing environmental conditions. They clear that the degree of infestation was considerably higher in fallen dates than on date bunches.

Unsufficient studies were established to use biocides and insecticides to control this pest. Eissa *et al.* (1986) studies, revealed that the significancy and the potential of 1-2 sprays with organophosphorus compounds at fortnight intervals, increasing date yield. The timing of application of certain organophosphates versus a biocide to control *B. amydraula* infesting date palm fruits in the New Valley have been studied by Sayed and Ali (1995). They used two applications, the first during pollination and the second two weeks later were sufficient to control this pest. All insecticides performed significantly better results than the biocide Delfin. Spraying during pollination was the best timing resulted in the lowest infestation. Also, a week before pollination was better than 1 or 2 weeks after pollination.

## **2. *Ephestia (Cadra) calidella* (Guene)**

### **(Lepidoptera : Pyralidae)**

Gough (1917, 1918) stated that the growing dates were never attacked by larvae of *E. calidella*, only fallen date fruits were liable to be infested. Semi dry dates were preferred than dry ones for egg laying. The larvae occupied the space between the stone and flesh of the fruit. In addition, the same pest didn't attack the Saidi dates until it had fallen off the fruiting stem. On the other hand, Radwan *et al.* (1986) evaluated the percentage of infestation of *E. calidella* on the fallen and the remaining dates on palm trees throughout winter. Results indicated that about 40.7% of the total collected dates in December were heavily infested, while infestation degree throughout the following months gradually was relatively low. The fluctuations in the population density of *C. calidella* larvae showed a strong correlation in the infestation of dates.

## **3. *Ephestia (Cadra) cautella* Walker**

### **(Lepidoptera : Pyralidae)**

The first appearance of *E. cautella* infested date fruits in Egypt was recorded by Gaugh (1913). He noticed its larvae attacked the dates when half-ripped. Hammad *et al.* (1966a) recorded this pest species in Bahria, Kharga, Dakhla and Siwa Oases. Eissa and Abdel Salam (1986) studied the egg, larval, pupal and adult stage of *E. cautella*. The incubation period of the egg stage was different in winter, spring and summer.

Fouad (1999) reported that the almond moth *E. cautella* completed its life cycle successfully on mature and full mature dates "Tamr", while it failed to develop on the premature dates. The shortest mean duration of the egg, larval, pupal and adult stage were recorded on full mature dates. In addition, *E. cautella* females can discriminate between the contents of sealed packages to determine suitable oviposition site.

**4. *Myelois (Ectomyelois) ceratonia* Zeller****(Lepidoptera : Pyralidae)**

Shafik (1938) recorded this pest in Siwa, Egypt. Hammad *et al.* (1966c) stated that *E. ceratoniae* infested semi-dry and dry dates in Egypt, which was collected from "Frihi" dates of Siwa Oasis.

**5. *Virachola (Deudorix) livia* (Klug.)****(Lepidoptera : Pyralidae)**

In a field experiment conducted in Kharga Oasis in the New Valley, Saleh and Hosny (1982) determined the effect of destroying the pods of *Acacia* trees (Fam. Leguminosae), on the infestation of the date fruits by the pomegranate butterfly *Virachola livia*. The results showed that satisfactory protection of date fruits could be achieved by collecting and burning the *Acacia* pods towards the end of September. The infestation of this pest was zero % in both green *Acacia* pods and date fruits on bunches in the following season.

In the last decade many investigators surveyed the date palm trees insect pests in several regions in Egypt. El-Sherif *et al.* (1998) surveyed the insect pests attacking date palm trees at Al-Arish region, Northern Sinai. The most dominant and economically important pests were the scale insect (*Parlatoria marlattii*), the mealy bug (*Dysmicoccus brevipes*) and the lesser date moth (*Batrachedra amydraula*). Abul-Fadl (2001) surveyed *Arenipses sabella*, *Batrachedra amydraula*, *Virachola livia*, *Ephestia cautella*, *E. calidella* and *Ectomyelois ceratonia* all over Siwa Oasis. He surveyed also the natural enemies (predators and parasitoids) associated with the forementioned date palm pests. Interaction between surveyed parasitoid species on different date fruits pests and host-parasitoid relationship has been also, studied.

Ali *et al.* (2003a) make an assessment of semi-dry and dry date infestation by different insect pests including *Ephestia calidella* and *E. cautella* during 1998 and 1999 seasons. Monthly averages of date infestation during storage different according to kind of stored dates, storage period and stores circumstances. In the case of semi-dry dates, *E. calidella* occurred from December to May and composed 29.5% of the total insect populations. However, *E. cautella* was found from April to July and constituted 7.9% of the total insect populations. In the case of dry dates *E. calidella* forming 23.7% of the total insect infestation while *E. cautella* forming 3.9%.

Amongst the investigators concerned with the Integrated Pest Management (IPM) of date palm trees pests, Ali *et al.* (2002) evaluated an integrated control program including mechanical, chemical insecticides, agricultural practices and biological product treatments against insect pests of date palms under field conditions in El-Bahria Oases, (Giza) Governorate. Orchard sanitation and pruning of palms were

highly effective in protecting palms and dates against *Batrachedra amydraula* infestation, while use date-bunches isolators significantly limited date infection by *Arenipses sabella* and *Ephestia calidella*.

Ali *et al.* (2004) release the egg parasitoid *Trichogramma evanescens*(West.) (Hymenoptera : Trichogrammatidae) in date palm fields at El-Bahria Oases, to suppress the date palm insect pests. Results revealed a significant efficacy of this parasitoid for controlling insect pests of date palms. Infestation with *Arenipses sabella* was reduced by 35.6-62.4% while date infested with *Batrachydra amydraula* was reduced by 58.2%. Infestation rates of dates infested with *Coccotrypes dactyliperda*, *Deudorix livia* and *Ephestia calidella* were also diminished by 31.5, 80 and 45%, respectively.

Table 1. A partial list of phytophagous insect pests associated with date palm trees in Egypt

Order & Family	Scientific name	Reference(s)
Orthoptera		
Acrididae	<i>Schistocerca gregaria</i> (Forskål)	El- Sherif <i>et al.</i> (1998), Abd El-Razik (2000)
Isoptera		
Rhinotermitidae	<i>Psammotermis hypostoma</i> (Desneux)	El- Sherif <i>et al.</i> (1998)
Homoptera		
Tropiduchidae	<i>Ommatissus binotatus lybicus</i> Fieber	Hussain and Ali (1996) Ali <i>et al.</i> (2002)
Issidae	<i>Ascaropus palmarum</i> Horvath	Ali and Hussain (1996), Ali <i>et al.</i> (2002), El-Sharkawy <i>et al.</i> (2002), Mohamed <i>et al.</i> (2002)
Coccoidae (Asterolecaniidae)	<i>Asterolecanium phoenicis</i> Rao	Ezz (1972), Eraki (1998)
Diaspididae	<i>Chrysomphalus ficus</i> (Ashmead) <i>Florinia linderæ</i> Takagi	Abd-Rabou (1997) Eraki (1998)
	<i>Parlatoria blanchardii</i> (Targ.)	Salama (1972), Saad (1981), Abdel-Salam (1993), Hussain (1996), Abd El-kareim and Awadalla (1998), El-Sherif <i>et al.</i> (1998), Eraki (1998), Abd El-Razik (2000), Ali <i>et al.</i> (2002)
Phoenococcidae	<i>Phoenicococcus marlatti</i> Cockrell	El-Sherif <i>et al.</i> (1998), Eraki (1998)
Pseudococcidae	<i>Dysmicoccus brevipes</i> (Cockrell)	El-Sherif <i>et al.</i> (1998),Abd EL-Razik (2000)
Margarodidae	<i>Icerya aegyptiaca</i>	Ali <i>et al.</i> (2002)
Coleoptera		
Scarabaeidae	<i>Oryctes elegans</i> Fell . <i>Phyllognathus exeavatus</i> Forster	Ali <i>et al.</i> (2002) El-Sherif <i>et al.</i> (1998), Abd EL- Razik (2000)
Anobiidae	<i>Lasioderma serricome</i> F. <i>Enneadesmus trispinosus</i> Olivier	Omar (1971), Abdul-Wahab and Eissa (1986) Abd-Allah and Tadros (1995a,b,c), El-Sherif <i>et al.</i> (1998), Abd El-Razik (2000)
Bostrychidae	<i>Enneadesmus ferficula</i> Frm <i>Enneadesmus obstusedentatus</i> Lesne <i>Phonapate frontalis</i> (Fabricius)	Sharaf El-Din (1999) Sharaf El-Din (1999) El-Sherif <i>et al.</i> (1998), Abd El- Razik(2000), Ali <i>et al.</i> (2002)
Nitidulidae	<i>Carpophilus dimidiatus</i> (F.) <i>Carpophilus hemipterus</i> (Linne)	Omar (1971), Abdul-Wahab and Eissa (1986) Omar(1971),Abdul-Wahab and Eissa (1986), Ali <i>et al.</i> (2002)

Table 1. Continued

Order & Family	Scientific name	Reference(s)
Cucujidae(Silvanidae)	<i>Oryzophilus surinamensis</i> (Linne)	Omar (1971), Abdul-Wahab and Eissa (1986)
Tenebrionidae	<i>Tribolium castaneum</i> Hbst.	Omar (1971), Abdul - Wahab and Eissa (1986)
	<i>Tribolium confusum</i> Duv.	Omar (1971), Abdul - Wahab and Eissa (1986)
Cerambycidae	<i>Macrotoma palmata</i> Fabricius	Moustafa (1977), El-Sebay (1984), Helal <i>et al.</i> (1986)
	<i>Pseudophilus testaceus</i> Gahan	Ali <i>et al.</i> (2002)
Curculionidae	<i>Rhynchophorus ferrugineus</i> Olivier	Saleh and Gohar (1993), El- Garhy (1996), Saleh <i>et al.</i> (1996), Abd-Allah and Al-Khatri (1999) Heikal (2001)
Scolytidae	<i>Coccotrypes dactyliperda</i> (Fabricius)	Willcocks (1914), Omar (1971), Abdul-Wahab and Eissa (1986), El-Sherif <i>et al.</i> (1998) , Abd El- Razik (2000)
Lepidoptera		Ali <i>et al.</i> (2002).
<i>Elachistidae</i>	<i>Stathmopoda auriferella</i> (Walker)	Hammad <i>et al.</i> (1966c), Hussain (1980), Abdul-Wahab and Eissa (1986), Ali <i>et al.</i> (1993 b).
Cosmopterigidae	<i>Batrachedra amydraula</i> Meyrick	Michael (1967), Gharib (1968) Eissa <i>et al.</i> (1986), Badr <i>et al.</i> (1990), Ali <i>et al.</i> (1993a), Sayed and Ali (1995), Abd El-Razik (2000), Abul - Fadl (2001), Ali <i>et al.</i> (2002)
		Kaschef <i>et al.</i> (2002)
		Hammad <i>et al.</i> (1966c), Michael (1967), Saleh(1974), Ali <i>et al.</i> (1993a), El-Sherif <i>et al.</i> (1998), Abd El-Razik (2000), Abul-Fadl (2001), Ali <i>et al.</i> (2002), Kaschef <i>et al.</i> (2002)
Pyralidae(=Phycitidae)	<i>Arenipses sabella</i> (Hampson)	Gough (1917 , 1918), Shafik (1938), Shafik and Hilmy (1938), Saleh (1974), Radwan <i>et al.</i> (1986)
	<i>Ephestia</i> spp.	



Table 1. Continued

Order & Family	Scientific name	Reference(s)
Lycaenidae	<i>Ephestia calidella</i> (Guenee)	Gough (1913, 1917, 1918), Hammad <i>et al.</i> (1966 a) Omar (1971), Omar <i>et al.</i> (1973), Hussain (1980), Abdel-Salam and El-Saeedy (1982), Abdul-Wahab and Eissa (1986), Radwan <i>et al.</i> (1986), Ali <i>et al.</i> (1993b),
Diptera		Abul-Fadl (2001), Ali <i>et al.</i> (2002), Kaschef <i>et al.</i> (2002).
Drosophilidae	<i>Ephestia cautella</i> Walker (= <i>Cadra cautella</i> (Walker) )	Gough (1913, 1917), Hammad (1966), Hammad <i>et al.</i> (1966b), Omar (1971), Kamel <i>et al.</i> (1976), Hussain (1980), El-Saeedy (1981), Abdel – Salam and El-Saeedy (1982), Eissa and Abdel-Salam (1986), Eissa (1993), Fouad (1994, 1999), El-Sherif <i>et al.</i> (1998), Abd El-Razik (2000), Ali <i>et al.</i> (2002), Kaschef <i>et al.</i> (2002)
	<i>Ephestia elutella</i> Guen.	Hussain and Mohamed (1995).
	<i>Ephestia figuliella</i> Gergsan	Omar (1971), Abdul-Wahab and Eissa (1986)
	<i>Ephestia kuehniella</i> Zell <i>Myelois</i> sp.	Abdul-Wahab and Eissa (1986). Shafik (1938)
	<i>Ectomyelois</i> ( <i>Myelois</i> ) <i>ceratonia</i> Zeller	Shafik (1938), Hammad <i>et al.</i> (1966c), Hussain (1980), Abdul- Wahab and Eissa (1986), Ali <i>et al.</i> (1993b), Abul-Fadl (2001), Ali <i>et al.</i> (2002), Kaschef <i>et al.</i> (2002)
Tephritidae	<i>Plodia interpunctella</i> (Hubner)	Omar (1971), Abdul-Wahab and Eissa (1986)
	<i>Virachpla livia</i> (Klug.)	Gough (1913), Saleh ----- Hosny (1982), Eissa <i>et al.</i> (1986), Abul- Fadl (2001), Ali <i>et al.</i> (2003b), Kaschef <i>et al.</i> (2002),
	<i>Drosophila melanogaster</i> Meigen.	El-Sherif <i>et al.</i> (1998),Abd El-Razik (2000), Ali <i>et al.</i> (2002)
	<i>Ceratitis capitata</i> (Wied.)	Ali <i>et al.</i> (2002)

Table 2. Mite species reported to have a habitate and / or association with date palm in the scope of ecological studies

Mite species	Habitat	Reference(s)
<i>Agistemus exertus</i> (Stigmaeidae)	Fruits &	Saleh and Abdel -
<i>Ameroseius aegypticus</i> El-Badry (Mesostigmatid mite)	Leaves Soil	Hamid (1986)
<i>Blattisocius keegani</i> (Ascidae)	Dry date	Saleh and Abdel - Hamid (1993)
<i>Caloglyphus berliese</i> Michael (Acarid mite)	Soil Soil	Kawther(1983), Saleh <i>et al.</i> (1986)
<i>Camasellodes</i> sp. (Mesostigmatid mite)	Soil	Saleh and Abdel -
<i>Epilohamannia</i> sp. (Orbatid mite)	Soil	Hamid (1993)
<i>Epilohamannia cylindrica</i> Berlese (Orbatid mite)	Soil Fruits &	Saleh and Abdel - Hamid (1993)
<i>Hypoaspis</i> sp. (Mesostigmatid mite)	Leaves	Saleh and Abdel -
<i>Iolina</i> sp. (Iolinidae)	Soil	Hamid (1986)
<i>Lasioseuseus zaheri</i> Nasr (Mesostigmatid mite)	Fruits & Leaves	Saleh and Abdel - Hamid (1993)
<i>Oligonychus</i> sp. (Tetranychidae)	Fruits &	Saleh and Abdel -
<i>Ololaelaps</i> sp. (Laelapidae)	Leaves	Hamid (1993)
<i>Oppia</i> sp. (Orbatid mite)	Soil	Saleh and Abdel -
<i>Oribatula</i> sp. (Orbatid mite)	Soil	Hamid (1986)
<i>Oribatula tadrosi</i> (Orbatid mite)	Soil	Saleh and Abdel - Hamid (1993)
<i>Parrolorryia bakeri</i> Zaher and El-Bagoury (Prostigmatid mite)	Fruits & Leaves Soil	Saleh and Hosny (1979)
<i>Phytoseius plumifer</i> (Phytoseiidae)	Dry date	Saleh and Abdel -
<i>Protogamaselles denticus</i> Nasr (Mesostigmatid mite)	Soil Soil	Hamid (1986) Saleh and Abdel - Hamid (1993)
<i>Pyemoted hertsii</i> (Pyemotidae)	Fruits &	Saleh and Abdel -
<i>Rhizoglyphus robini</i> Clapared (Acarid mite)	Leaves	Hamid (1986)
<i>Scutacarus evansi</i> Soliman and Kandeel (Prostigmatid mite)	Soil	Saleh and Abdel -
<i>Tetranychus</i> sp. (Tetranychidae)	Fruits & Leaves	Hamid (1993)
<i>Tydeus</i> sp. (Prostigmatid mite)	Dry date	Saleh and Abdel -
<i>Tydeus californicus</i> (Prostigmatid mite)		Hamid (1993)
<i>Tyrophagous putrescentiae</i> Schrank (Acaridae)		Saleh and Abdel - Hamid (1993) Saleh and Abdel - Hamid (1993) Kawther(1983), Saleh <i>et al.</i> (1986) Saleh and Abdel - Hamid (1993) Saleh and Abdel - Hamid (1993) Saleh and Abdel - Hamid (1986) Saleh and Abdel - Hamid (1993) Saleh and Abdel - Hamid (1986) Kawther (1983), Saleh and Abdel-Hamid (1986, 1993), Saleh <i>et</i> <i>al.</i> (1986)

Table 3. A partial list of entomophagous natural enemies associated with date palm insect pests

Host and / or prey	Parasitoid and / or predator		Status	Scope of study	Reference(s)
	Order and Family	Scientific name			
<i>Chrysomphalus ficus</i> (Ashmead)	Hymenoptera Aphelinidae	<i>Encarsia citrina</i> (Craw)	Parasitoid	Ecology	Abd-Rabou (1997)
		<i>Aphytis</i> sp.			
		<i>Aphytis phoenicis</i> DeBch & Rosen			
		<i>Encarsia citrina</i> (Craw)			
	Coleoptera Coccinellidae	(= <i>Aspidiotiphagus citrinus</i> (Craw.))	Parasitoid	Ecology	Abd Rabou and Hendawy(2000)
		<i>Pteroptrix</i> sp.	Parasitoid	Ecology	
		<i>Coccinella septempunctata</i>	Predator	Ecology	
Staphylinidae	<i>Scymnus punctillum</i> Ws.	Predator	Ecology	Abd Rabou and Hendawy(2000)	
	<i>Pharoscyrnus varius</i> Kirsol	Predator	Ecology		
	<i>Vedalia cardinalis</i>	Predator	Ecology		
	<i>Atheta</i> sp.	Predator	Ecology		
<i>Phoenicococcus marlatti</i> Cockerll	Coleoptera Coccinellidae	<i>Vedalia cardinalis</i>	Predator	Ecology	Eraki (1998)
<i>Batrachedra amydraula</i> Meyrick	Hymenoptera Ichneumonidae	<i>Hymenobsamina</i> sp.	Parasitoid	General	Michael (1967)
<i>Ephestia cautella</i> Walker	Hymenoptera Braconidae	<i>Bracon brevicornis</i> Wesmael	Parasitoid	Biology	Temerak (1983) Temerak (1984 a,b)
	Acarina	<i>Bracon hebetor</i> (Say) <i>Pyemotes hertsii</i>	Parasitoid	General	
Immature stages of date fruit pests	Neuroptera Chrysopide	<i>Chrysoperla carnea</i>	Predator	Biology	Kaschef <i>et al.</i> (2002)
	Hemiptera Anthocoridae	<i>Orius albidipennis</i>	Predator	Biology	Kaschef <i>et al.</i> (2002)
		<i>Orius laevigatus</i> <i>Xylocoris flavipes</i>	Predator Predator	Biology Biology	Kaschef <i>et al.</i> (2002) Kaschef <i>et al.</i> (2002)
Miscellaneous recorded natural enemies	Dermoptera Labiduridae	<i>Labidura riparia</i>	Predator	Control	Ali <i>et al.</i> (2002)
	Dictyoptera Mantidae	<i>Sphodromantis bimaculata</i> (Burm.)	Predator	Control	Ali <i>et al.</i> (2002)
	Neuroptera Chrysopide	<i>Chrysoperla carnea</i>	Predator	Control	Ali <i>et al.</i> (2002)
	Myrmeleontidae	<i>Cueta variegata</i>	Predator	Control	Ali <i>et al.</i> (2002)
		<i>Palpares cephalotes</i>	Predator	Control	Ali <i>et al.</i> (2002)

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## دراسات مرجعية على الآفات الرئيسية و الأعداء الحيوية من مفصليات الأرجل التي تصاحب نخيل التمر في مصر

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يزرع في مصر حوالي ٩ ملايين نخلة من نخيل التمر في مساحة تقدر بأكثر من ١٤٠ ألف فدان و التي تنتج أكثر من ٧٥٠ ألف طن من التمر سنويا. و تصاب نخيل التمر بمصر بعدد من الآفات الحشرية و الحلم. و لقد أجري حصر مرجعي مكثف لكل ما أتيح التحصل عليه من مراجع تتناول الحديث عن مفصليات الأرجل و الأعداء الحيوية المصاحبة لها و التي تتواجد على نخيل التمر بمصر. و قد تم تغطية عديد من الموضوعات و التي تناولت الحصر النوعي لآفات النخيل الحشرية و الدراسات الحيوية و البيئية التي أجريت عليها و تذبذبات الأعداد و الضرر و الفقد في المحصول الذي تسببه تلك الآفات الحشرية. و من خلال الحصر المرجعي أمكن تسجيل ٤٠ نوعا حشرياً تهاجم نخيل التمر تتبع بدورها ٣٢ جنسا و ٢٤ عائلة تتبع ٦ رتب. هذه الرتب تمثلت في رتب مستقيمة الأجنحة، متساوية الأجنحة، متجانسة الأجنحة، غمدية الأجنحة، حرشفية الأجنحة، و ثنائية الأجنحة. أما أهم الأنواع الحشرية التي تم مناقشة الدراسات التي أجريت عليها بالتفصيل فقد تمثلت في حفار ساق النخيل، سوسة النخيل الحمراء، دودة العراجين، بق الدوباس، الحشرة القشرية المدرعة، حفار سعف النخيل، دودة البلح الصغرى (الحميرة)، دودة البلح الكبرى، دودة البلح العامري، دودة ثمار الخروب و أبو دقيق الرمان. و من جهة أخرى فقد تم تسجيل ٢٢ نوعا من الحلم تتواجد على الأوراق و الثمار الغضة و الجافة و أيضا في التربة حول الأشجار. أما الأعداء الحيوية فقد سجل منها ١٢ نوعا تتبع ١٢ جنسا من المفترسات كما تم تسجيل ٧ أجناس من الطفيليات التي تصاحب مفصليات الأرجل التي تهاجم نخيل التمر بمصر.

**الكلمات الدالة:** الآفات من مفصليات الأرجل، الحلم، الأعداء الحيوية، دراسات مرجعية،

نخيل التمر.