

TRUE SPIDERS INHABITING DATE PALM VARIETIES WITH  
SPECIAL REFERENCE TO THE BIOLOGICAL ASPECTS OF  
*THANATUS ALBINI* REARED ON RED PALM WEEVIL,  
*RHYNCHOPHORUS FERRUGINEUS* IN EGYPT

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**ABSTRACT:** *This article was conducted to survey true spiders inhabiting three varieties of date palm in Egypt, as well as the biological aspects of Thanatus albinus, Audouin, (Araneae: Philodromidae) on larvae of red palm weevil, Rhynchophorus ferrugineus, Olivier, (Coleoptera : Curculionidae) to know the possibility of control the larvae of red palm weevil by the spider T. albinus as a biological control method. Date palm fruits of Samani variety was chosen from El-Beheira Governorate represented soft date variety and Siwi variety used as semi-dried variety from Fayoum Governorate while Apremy variety was the dried fruits variety tested from Aswan Governorate. Also, Menoufia, Cairo, Gharbia, Sharkia, Dimetta, Giza, Fayoum, Beni-Sweief, Menia and Aswan Governorates were chosen for study the abundance of spiders in stores. The date palm fruits were collected and identified during the study period from October 2016 till September 2017. The obtained results which conducted on different date palm varieties indicated that the soft and semi dried varieties harbored many of spiders and these spiders obviously decreased in the dried varieties. The obtained data indicated also that the most abundant families were Philodromidae and Salticidae on leaves and Miturgidae, Hersilidae and Lycosidae associated with fruits in the field and on stored date fruits. The biological aspects of the T. albinus reared on the larvae of the red palm weevil, R. ferrugineus at 25 ± 2 °C and 60 ± 5 % RH indicated that the life cycle of the tested spider was 169.87 ± 5.29 and 148.73 ± 3.37 days for female and male, respectively. The food consumption of both female and male was 491.83 ± 46.81 and 310.35 ± 47.76 larvae of the red palm at the same pervious conditions, respectively.*

**Key words:** *true spiders, date palm, red weevil, biological control.*

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## INTRODUCTION

True spiders are fascinating animals that appeared on the earth during the carboniferous geological era, about 300 million years ago. Spiders live in different habitats, in arid regions and wet lands, in low lands and mountains, in cold tundra and in hot equatorial regions, moreover spiders are predators at all. In Egypt spiders are one of the more diverse arthropod taxa, ranking as seventh grade in global diversity, which makes them a fascinating group to study (Agnew, *et al.*,

1985 , Coddington, 1986, Barrin and Litsinger 1995). The Egyptian spider fauna still incompletely known due to scarcity of studies on this group especially in Upper Egypt.

In Egypt spiders are found to be predators on insects and mites, which cause damages for many agricultural crops. The predacious habits of spiders are beneficial in the control of different pests. In Egypt, Hussein, 1999, El-Erksousy, 2000 studied the seasonal abundance and activity patterns of spider

fauna in some vegetable fields in Menoufia, Nile Delta. Spiders belongs to order : Araneae are among one of the most rich groups of terrestrial animals, included more than 45,000 spider species belonging to 114 families described so far and many thousands still awaiting discovery and description (World Spider Catalog, 2015). In Egypt, there are 40 families belonging to 193 genera and 385 species (El-Hennawy, 2002, 2006, 2010). Furthermore, Ibrahim, *et al.*, 2012 surveyed true spiders in wheat, cotton and maize fields, in Egypt.

The date palm fruits contain high ratio of sugars more than 75 % of their weight, so it can be regard as the most important fruits containing heat energy. Many important industries have been initiated on them and are considered the main income of many inhabitants. Date palm fruits produced in Egypt are considered the best date fruit varieties, which can be exported to foreign markets provided that the product qualities are most satisfactory, being free of pest infestation and residues of pesticides. The date palm infested in any of its stages by many of pests (insects and mites) and diseases which make this crop is not desirable and not quality and quantity satisfies. To avoid the hazard use of different chemical pesticides, the recent researches all over the world oriented toward using new approaches for saving the date palm fruits from any harmful sources by using biological control methods including true spiders.

Nowadays, more than 38432 true spider species belonging to 3542 genera in 110 families were identified, Plantnich (2004). In Egypt, El-Hennawy (2002) listed 385 different spider species in Egyptian fauna belonging to 40 families. Survey of different spiders associated with date palm in the field and store in Egypt is very rare, Sallam and Yassin (2005) and Sallam *et al.*, (2007).

As for the biology of spiders, Foelix (2011) stated a book on the biology of spiders. In addition, Mohamed and Salam (2003) studied the biology of the true spider, *Thomisus spinifer* Cambridge (Thomisidae: Araneae), El-Erksousy (2003) studied the biology of the spider, *Theridion egyptium* Fawzy & El-Erksousy when reared on *Spodoptera littoralis* larvae. In addition, El-Erksousy, *et al.*, 2006 determined the Biological aspects of the spider, *Steatoda triangulosa*, Walkckenare reared on larvae of *Spodoptera littoralis* ,Boisd. Furthermore, El-Erksousy, *et al.*, 2002 examined the use of the spider, *Theridion egyptium* sp.n. as biological control agent against cotton aphid, *Aphis gossypii* Glover, recently, Obuid-Allah *et al.* (2015) conducted a study on the ecology of spiders at Qena governorate, Egypt, furthermore, Ahmad and Heikal (2016) studied the biological characteristics of the spider, *Theridion spinitarse* O. Pickard-Cambridge, 1876 (Araneae: Theridiidae) in Egypt.

The red palm weevil, *Rhynchophorus ferrugineus* (Olivier) (Coleoptera: Curculionidae) is the most serious pest to palm where its distribution was registered around the world in about 39 countries and differs also inside the same country. Females of the red palm weevil emerged from its cocoon after completed it sexual organs looking for male and mates. Females lay its eggs on the crevices, roots, offshoots, inside old emerged holes, and caves made by previous infestation. Female last about 2-3 months and placed from 150-250 eggs singly. Female makes a small grubs by its snout in the tissue and laid its eggs covered with cement material. The resulting larvae of chewing grubs on the fiber ducts (larva doses not eat cellulose but feed on the sap) the sap come up and fermentation happen due to contamination with micro organisms and may come outside the tree by more larval

activity due to continuous feeding cavities full of eating fibers and sap come outside the tree with special smell and brownish color. In the severally infested trees the stem of palm shown empty and fill with mixture of all stages and boring products. Mostly over lapping generation happen inside one tree. If infestation happens in the head of the tree, toppling occurred. When extensive infestation happen, tree stated to be dray then the adult emergence occur and weevils started to attack new trees (El-Sebay, 2000).

So, this article was conducted to study the survey and the abundance of different spiders inhabiting three varieties of date palm in Egypt, as well as the biological aspects of *Thanatus albini* on larvae of red palm weevil, *Rhynchophorus ferrugineus* in Egypt as a safe method to control the larvae of the red palm weevil biologically by the spider *T. albini* (Audouin).

## MATERIALS AND METHODS

### 1- Regions and date palm fruit varieties:

Date palm fruits of Samani variety was collected from El-Beheira Governorate represented soft date variety and Siwi variety was used as semi-dried variety from Fayoum Governorate, while Apremy variety was the dried fruits variety which was collected from Aswan Governorate.

### 2- Survey study:

The date palm fruits were collected during the study period from October 2016 till September 2017 in different Egyptian habitats in field and store for survey and identification of the collected spiders. El-Beheira Governorate was represented the soft variety (Rashid region) (Samani variety), Fayoum Governorate for semi-dry variety (Siwi variety) and Aswan Governorate for dried variety (Apremy variety). Also, Menoufia,

Cairo, Gharbia, Sharkia, Dimetta, Giza, Fayoum, Beni-Sweief, Menia and Aswan Governorates were chosen for study the abundance of spiders in date palm stores.

The different spiders were collected by handing sorting method using small sieves. The collected samples were conducted monthly during the surveying period. The surveyed spiders were kept in glass vials containing ethyl alcohol 70 % and droplets of glycerin.

### 3- Identification of collected spiders:

The identification of the collected adult females of spiders were identified depending on the epigynal plate, but in case of males, the palp anatomy is an important factor for identification based on the systems of Petrunkevitch (1939), Kaston (1978) and El-Hennawy (1990).

### 4- The biological aspects of the spider, *Thanatus albini*:

The biological aspects of the spider, *Thanatus albini* was studied at Plant Protection Research Institute Station, Qaluobia governorate on the larvae of the red palm weevil, *R. ferrugineus*. Eggs of *R. ferrugineus* were collected and maintained at  $25\pm 2^{\circ}\text{C}$  and  $60\pm 5\%$  RH until hatching, then the newly hatching larvae reared on semi artificial diets contains 1 kg of sweat potatoes ,250 g carrot, 20 g glucose ,4 g agar ,250 g cereals, vitamin B (1mg) and vitamin D (0.2 mg), these components dissolved in half liter water (El-Sebay, *et al.*, 2003) in special cages, leaves changed gradually when needed to obtain the larvae of red palm weevil, which used as a prey for *T. albini*. The spiderlings and adult stages of *T. albini* were collected at Qaluobia governorate from date palm trunks where can be getting a lot numbers of spider stages were collected, then transferred to the laboratory to identify. Adult males and

females were isolated together in a glass tube 20 cm long and 0.5 cm in diameter, then closed with a cotton piece. After matting, the female were observed daily until laying their egg sac and hatching of the eggs to obtain the immature stages of this predator. Each spiderling was isolated separately in test tube with prey individuals and gave some individuals and noticed till reaching to adult stages. Number of consumed larvae were estimated during each stage of *T. albini*, as well as the duration of each stage.

## RESULTS AND DISCUSSION

### 1-Survey of true spiders in field and stores:

The obtained data in Table (1) indicated that there were five spider species associated with both leaves and fruits of date palm as follows: *Philodromus* sp (Philodromidae), which was found with high numbers on Samani variety leaves and absent from the rest of other varieties. Also, *Theyene imperialis* belonging to family Salticidae was collected from the leaves of all tested varieties and from the fruits of Apremy variety, while *Cheiracanthium* sp. (Miturgidae) was collected on leaves and fruits of Samani variety only. As for, family Hersilidae, the identification of the collected specimens was not complete because the available individuals were

immature stages (spiderlings) with rare numbers on Samani and Apremy fruits, but the family Lycosidae was represented in this study by *Hogna ferox* as adult stages. The results also showed that the collected families of Philodromidae, Salticidae and Lycosidae were recorded with high numbers on leaves of Samani variety only and this may be due to the kind of the associated pests which may be play an important role on the kind of the collected spider. The obtained results were similar to that obtained by Thang, *et al.*, (1990) and Sallam and Yassin (2005).  
2-Survey of different spiders on date palm fruits in stores:

This study was conducted to investigate the different spiders associated with the palm fruits in stores.

The obtained data in Table (2) indicated that there were five spider species, two species only were identified to species level as *Hogna ferox* (Lycosidae), *Thomisus spinifer* (Thomisidae), two species only were identified to genus level in this study, *Erigone* sp. (Linyphiidae) and *Uloborus* sp. (Uloboridae), and all the spiders were collected with rare number or moderate, while the individuals of the family Hersilidae in this study were immature stages (spiderlings), so identification of them was impossible.

Table (1): Occurrence of spiders collected from date palm trees in the field and stores

Family	Species	Stage	Variety					
			Apremy		Siwi		Samani	
			fruits	leaves	fruits	leaves	fruits	leaves
Philodromidae	<i>Philodromus</i> sp.	Adult	-	-	-	-	-	+++
	<i>Thanatus albini</i>	Adult	+	++	+	+++	+	+++
Salticidae	<i>Theyene imperialis</i>	Adult	+	+	-	+	-	+++
Miturgidae	<i>Cheiracanthium</i> sp.	Adult	-	-	-	-	+	++
Hersilidae	unknown	Immature	+	-	-	-	+	-
Lycosidae	<i>Hogna ferox</i>	Adult	+	+	+	-	+	-

+ = rare (1 – 3) individuals ++ = moderate (4-9) individuals +++ = high (more than 9 individuals)

***True spiders inhabiting date palm varieties with special reference to .....***

**Table (2): Survey of true spiders on Apremy variety fruits in stores at different regions.**

Region	Family	species	Stage	Abundance
Giza, Gharbia, Menoufia and Beheira	Lycosidae	<i>Hogna ferox</i>	Adults	+
Menoufia, Beni -Sweief, Menia and Gharbia	Thomisidae	<i>Thomisus spinifer</i>	All stages	++
Sharkia and Dimetta	Linyphiidae	<i>Erigone sp.</i>	Adults	++
Fayoum	Hersilidae	unknown	Immatures	+
Cairo and Gharbia	Uloboridae	<i>Uloborus sp.</i>	Immatures	+

+ = rare (1 – 3) individuals ++ = moderate (4-9) individuals

Also, from the obtained data, it was noticed that the geographical localities were highly affected the occurrence of different species, where *Hogna ferox* and *Thomisus spinifer* were found in many regions than other species and this show the importance of geographical regions in spider distribution and abundance. The obtained results were confirmed by those obtained by Sallam *et al.* (2007) where they found 17 families on date palm in Rashid region of Egypt on all parts of the plants, where the most important collected families were Agelinidae, Theridiidae and Lycosidae.

**3- Biological aspects of *Thanatus albini* spider reared on red palm weevil larvae:**

**3.1. Feeding behavior:**

The adult and immatures of the spider, *T. albini* closed slowly to the prey and moved around the prey for a few seconds then caught it between its chelicerae, then embedded its chelicerae in the prey body which was partially injured, and this was repeated several times.

**3.2. Mating:**

The virgin female stayed feeding for an average of 12.5 days before mating, after that female were transported to the male rearing container, where male started to come close to the female in a

relative movements for about 2-3 minutes, then climbed on her back for a while, then descended female raised her body laterally, then male move under her, clasped all her appendages beneath her body. The ventral side of male body was facing the female ventral side, and then copulation occurred for 2-3 minutes. During this process, male was without any motion, then moved for 5-10 second several times. After a short time from the first mating, the male repeated the mating process but from the other side of female body. The mating process took about 10-15 minutes.

**3.3. Oviposition and eggs incubation:**

The gravid females of the predator spider, *T. albini* which reared on red palm weevil larvae were laid its eggs in sacs, and each one contained 25-30 egg. The mean incubation periods were  $18.0 \pm 0.81$  and  $17.66 \pm 0.69$  days for female and male, respectively. Eggs were yellowish in color; almost spherical then became darker before hatching. The spiderlings stayed together before getting out from the egg sac. The newly hatched spiderlings did not feed for about 3 hours, and before the end of each spiderling stage individual rested for about 3 hours before the emergence of the following stage.

**3.4. Developmental stages of *Thanatus albini* reared on red palm weevil larvae:**

The obtained results in Table (3) showed that the mean egg incubation period was lasted 18.0 and 17.66 days for female and male, respectively, at  $25 \pm 2^\circ\text{C}$  and  $60 \pm 5\%$  RH. The duration of different spiderlings of female from 1<sup>st</sup> spiderling to the 7<sup>th</sup> averaged 25.00, 22.60, 22.13, 21.35, 20.13, 20.33 and 20.26 day, respectively, while those of male were lasted 22.80, 20.80, 19.46, 10.40, 19.66, 19.13 and 19.00 days, respectively. The total duration of male life cycle (egg + immatures) was shorter than that of female, averaging 148.73 and 169.87 days, respectively.

**3.5. Food consumption of *T. albini* fed on *R. ferrugineus* larvae :**

The obtained results in Table (4) revealed that the seven spiderlings stages of the spider *T. albini* female consumed an averages of 79.85, 99.57, 89.50, 61.35, 48.64, 70.92 and 42.00 larvae of the red palm weevil, *R. ferrugineus*, respectively, while male spiderlings consumed 33.80, 66.71, 42.00, 53.64, 27.28, 44.92 and 42.00 larvae of the red palm weevil, *R. ferrugineus*, respectively. Thus, during the life cycle of the female, spiderlings consumed  $491.83 \pm 46.81$  larvae of *R. ferrugineus*, while along male stage, spiderlings consumed  $310.35 \pm 47.76$  larvae.

From the obtained results, it can be concluded that the tested spider may be considered one of the successful bio control agent that play an important role in controlling this pest.

Table (3): Duration of different stages of the spider, *Thanatus albini*, Audouin fed on the red palm weevil, *Rhynchophorus ferrugineus* at  $25 \pm 2^\circ\text{C}$  and  $60 \pm 5\%$  RH.

Developmental stages	Duration (days)	
	Female $\pm$ SE	Male $\pm$ SE
Egg incubation period	18.00 $\pm$ 0.81	17.66 $\pm$ 0.69
1 <sup>st</sup> spiderling	25.00 $\pm$ 1.03	22.80 $\pm$ 1.10
2 <sup>nd</sup> spiderling	22.60 $\pm$ 1.08	20.80 $\pm$ 1.20
3 <sup>rd</sup> spiderling	22.13 $\pm$ 1.54	19.46 $\pm$ 0.80
4 <sup>th</sup> spiderling	21.35 $\pm$ 1.02	10.40 $\pm$ 1.01
5 <sup>th</sup> spiderling	20.13 $\pm$ 1.20	19.66 $\pm$ 1.29
6 <sup>th</sup> spiderling	20.33 $\pm$ 1.29	19.13 $\pm$ 1.14
7 <sup>th</sup> spiderling	20.26 $\pm$ 1.18	19.00 $\pm$ 0.73
Life cycle	169.87 $\pm$ 5.29	148.73 $\pm$ 3.37

Table (4): Food consumption of *Thanatus albini*, Audouin fed on larvae of the red palm weevil, *Rhynchophorus ferrugineus* at  $25 \pm 2^\circ\text{C}$  and  $60 \pm 5\%$  RH.

Spiderling stages	Average no of larvae consumed by <i>T. albini</i> stages	
	Female $\pm$ SE	Male $\pm$ SE
1 <sup>st</sup> spiderling	79.85 $\pm$ 6.65	33.80 $\pm$ 9.98
2 <sup>nd</sup> spiderling	99.57 $\pm$ 8.70	66.71 $\pm$ 9.50
3 <sup>rd</sup> spiderling	89.50 $\pm$ 6.78	42.00 $\pm$ 5.55
4 <sup>th</sup> spiderling	61.35 $\pm$ 1.42	53.64 $\pm$ 0.50
5 <sup>th</sup> spiderling	48.64 $\pm$ 6.98	27.28 $\pm$ 5.38
6 <sup>th</sup> spiderling	70.92 $\pm$ 7.85	44.92 $\pm$ 8.40
7 <sup>th</sup> spiderling	42.00 $\pm$ 8.43	42.00 $\pm$ 8.45
Life cycle	491.83 $\pm$ 46.81	310.35 $\pm$ 47.76

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العناكب الحقيقية المتواجدة على مختلف اصناف النخيل مع الإشارة الى المظاهر  
البيولوجية للعنكبوت *Thanatus albini* المرى على سوسة النخيل الحمراء  
*Rhynchophorus ferrugineus* في مصر

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الملخص العربى

أجريت هذه الدراسة بغرض حصر العناكب الحقيقية المتواجدة على ثلاثة أصناف من البلح فى بعض محافظات مصر حيث تم جمع عينات من أوراق وثمار البلح ومخازن التمر (البلح الجاف) لمدة عام كامل من اكتوبر ٢٠١٦ حتى سبتمبر ٢٠١٧ وقد أسفرت النتائج التى تم الحصول عليها نتيجة عملية الحصر على مختلف أنواع النخيل من الأصناف الجافه وشبه الجافه واللينه فى مصر الى وجود عدد كبير من انواع العناكب المختلفه والتي تنتمى الى عائلات مختلفه على انواع البلح اللينه بينما إنخفضت تلك الاعداد على الانواع الجافه والنصف جافه ، كما بينت الدراسة أن الأنواع التابعه لعائلات *Lycosidae* ، *Salticidae* ، *Philodromidae* وجدت على الأوراق فى الحقل ، بينما وجدت الأنواع التابعه لعائلات *Miturgidae* ، *Hersilidae* على الثمار فى الحقل وكذلك ثمار البلح بالمخازن ، ويرجع ذلك الى سهولة إصابة الثمار اللينه بالافات المختلفه بينما الثمار الجافه والنصف جافه تكون أقل إصابه بالافات.

كما أظهرت نتائج الدراسة البيولوجية للعنكبوت *Thanatus albini* عند التغذية على يرقات سوسة النخيل الحمراء *Rhynchophorus ferrugineus* أن متوسط فترة حضانه البيض كانت ١٨.٠ ، ١٧.٦٦ يوم لكل من الأنثى والذكر على التوالي. كذلك وجد ايضا ان متوسط دورة حياة الذكر كانت ١٤٨.٧٣ يوم وهى أقل من متوسط دورة حياة الأنثى التى استغرقت ١٦٩.٨٧ يوم. لوحظ ايضا من الدراسة كفاءة استهلاك كلا من أنثى وذكر العنكبوت ليرقات سوسة النخيل الحمراء حيث وجد أن متوسط الاستهلاك الكلى لأنثى وذكر العنكبوت كانت ٤٩١.٨٣ و ٣١٠.٣٥ يرقة على التوالي. من النتائج السابقة، يوصى البحث بإمكانية استخدام العنكبوت المفترس *Thanatus albini* فى برامج المكافحة الحيوية لسوسة النخيل الحمراء.

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