

Biological Studies on the True Spiders *Cheiracanthium isiacum* O. Pickard-1874 (Arachnida: Araneida: Eutichuridae) in Egypt.

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ABSTRACT

The present are pesiments were conducted to study the biological aspects of the true spider *Cheiracanthium isiacum* O.P. under laboratory codeition . Individuals of *Cheiracanthium isiacum* O. Pickard-, 1874. Was collected from citrus trees in Aswan governorate, Egypt. it was fed and reared on adults of the two-spotted spider mite, *Tetranychus urticae*, vinegar fly, *Drosophila melanogaster* and stored grain worm moth, *Ephestia kuehniella*. This species was found on citrus trees and on the ground and reared (during the period between 5 of February and 25 July 2016) . Incubation period lasted on average of 17.0 days at $28 \pm 2^{\circ}\text{C}$ and 60-70% R.H. There were 5 spiderling instars before reaching adult male and 6 instars before reaching adult female. The total period of spiderlings was shorter for male (57.3 days) than female (88.5 days). Adult longevity and life span were shorter for male than for the female. The pre- oviposition period was 9.0 days while the oviposition period averaged 65.4, days and the post- oviposition period lasted on average of 46.4 days.

INTRODUCTION

All spiders are predaceous, feeding mostly on insects and, often, other spiders Nentwig (1987). Until recently, all spiders were presumed to be exclusively predaceous, relying solely on the protein of prey for their survival, growth, and reproduction. Orb weaving spiderlings, however, coincidentally eat and benefit from the pollen grains that land in their webs, which they eat to recycle (Smith and Mommsen (1984)). It is important to study the different ecological aspects of the spiders to maximize their important role as biological control agents (Ghabbour *et al.* (1999)). Spiders may have an important buffer effect for insects, during the early development of an insect population, when growth is exponential (Ghabbour *et al.* (1999)). Many spiders adapted to the available food supply by eating more prey when it is abundant; this maximal energy up take allows the spiders not only grow but also to mature more quickly) Word and Lubin (1993)). Individuals of *C. isiacum* family Eutichuridae, recorded on different plants in several governorates in Egypt, They always found on the middle of trees and they live in association with different insects and mites infesting orchards. In Egypt, the biology of *Cheiracanthium jovium* Denis, 1947 under different temperatures, relative humidity, and prey were studied by Rahil (1988) Mohafez (2006) Reared *Cheiracanthium isiacum* O.P.-Cambridge, 1874 under laboratory conditions, $26-28^{\circ}\text{C}$ and 60-70% R.H. The food consumption of different spiderling instars reaching adult . The period of all stars were recorded. Family Eutichuridae is one of the big families of spiders. It includes 344 species of 12 genera, distributed all over the world Platnick (2017).

MATERIALS AND METHODS

The present espesiments were conducted at the laboratory belonging to Faculty of Agriculture - El-Azhar Uni. Under laboratory condition. Adult females and gravid female spiders of *Cheiracanthium isiacum* were collected from citrus trees in Aswan governorate and reared under laboratory conditions, $28 \pm 2^{\circ}\text{C}$ and 60-70%R.H. (during the period btween 5 February - 25 July 2016) in Aswan governorate, Egypt. For making pure culture from spider species; adult females were collected and placed in translucent plastic cell (3 cm diameter and 5 cm high), supplied with prey, kept to room temperature and lift until deposit their egg. For individual rearing, newly hatched

spider lings were transferred singly to rearing cell. Each was sup-plied with a known number of prey during each investigation. The number of food capacity were counted, recorded and replaced by fresh ones. The types and number El-Azhar Uni. Under laboratory condition of preys different from stage to others. Newly hatched spiderlings fed on the prey until molting the first, then isolated singly in a smaller cell (1 x 5 cm). Spider re-taint cells were examined every two days. Experiments were con-ducted at room temperature with average $28 \pm 2^{\circ}\text{C}$ and 60-70%R.H.

1. Rearing of prey:

The red-spider mite, *Tetranychus urticae*: Individuals of plastic trays full of soil and sandy 1:1 at room temperature with average $28 \pm 2^{\circ}\text{C}$ and 60-70%R.H. Nymphs were picked daily, counted and introduced to the spider as food.

Rearing stored grain worm moth, *Ephestia kuehniella*: Stored grain worm moth were collected from stored grain and flour and kept with bran flour in glass jars (20 cm height and 12.5 cm diameter) covered with muslin cloth cultured under room temperature.

Rearing to provide a suitable environment for reproduction and introduced to the spider as food. Method used to collect the Drosophila fly, *Drosophila melanogaster* the drosophila flies gathered on that rotten fruit. A polluted medium of a mixture of bran, yeast and little water. The flies speared on this mixture to lay their eggs inside the medium. This mixture is carried to rearing boxes and lift until the eggs hatch to produce many insects. When, the suitable food (10g powder milk + 10ml sugary liquid + little cotton is put inside the Petri dish in the rearing boxes to provide a suitable environment for fly reproduction.

3. Statistical analysis

The biological data aspects of the true spider were subjected to means and standard deviation (SD), using SAS program (SAS 1988).

RESULTS AND DISCUSSION

1. Habit and behavior

Individuals of the Eutichuridae spider, *Cheiracanthium isiacum* was found in high or moderate numbers on citrus trees in Aswan Governorate, Egypt. The individuals of this spider were noticed to inhabit the low level of the orchard trees, vegetable crops and field crops live in-group with association different insects and mites infesting the orchard trees, vegetable crops and field crops.

2. Feeding behavior

The spiders feed on living stages of Tetranychoid mites. It watches the prey, comes close, suddenly catches the prey from the anterior part of the body between its chelicerae, imbedding the chelicerae in prey, and then begins to suck its body contents. The feeding on the prey takes about 4 minutes. After swelling the spider abdomen becomes inflated and the attacking spider usually rests for few minutes before attacking another prey. It was noticeable that the spider kills prey numbers more than the number, which feeds on [10]. Under laboratory conditions, the spiders were reared on the two-spotted spider mite, *Tetranychus urticae*, Aphids, *Aphis gossypii*, the vinegar fly, *Dorsophila melanogaster*, and Stored grain worm moth, *Ephestia kuehniella*. If the predator watched another prey, it hunts on it to collect some prey together. The spider used its mouthparts in sucking the prey contents. When the first spiderling became full grown, it stopped feeding before moulting to the second spiderling which had the longest period,

3. Moulting

In general, the moulting process must to be happened during the developmental stage improving according the increasing in body size due to the cuticle did not expanded. In case of spider the abdomen extends because of its soft cuticle. When the spiderling full-grown it stops feeding and resting for a period lasted about one to three hours.

After the resting period pass the spiderlings make a twisting movement and longitudinal lateral split happened in the old integument along the lateral sides, of the body. The spider got rid of its old one skin through twisting movements to separate the old skin from the new one. Then the spider withdraws its mouthparts and legs outside from the old skin and the new spiderling crawling leaving the exuvia. Thus, moulting process lasting about 30-35 minutes. After the moulting process happen, the individuals stopped moving for about one hour until the new integument dry, then moving searching for its prey.

Spiderlings emerge from the egg sac after incubation period of 17 days. The spiderlings moult 5 times to reach adult male and 6 times to reach adult female (Table 2).

4. Mating behaviour

Mating is very important for *Cheiracanthium isiacum* reproduction, as unmated female could not lay any eggs. after the last moult, female was ready for copulation, the virgin female after moulting begins to feed until introducing the male into the glass tube containing the female. Pre courtship in the male typically constructs the sperm web soon after final molt or after mating. The sperm web, a small, thin, rectangular hammock, usually is constructed inside a resting cell which is a tubular structure built beneath a curled leaf or in some other protected spot in nature. In the laboratory the resting cell is usually built in an angle or corner of the container. This cell is about 5 to 6 mm in diameter and approximately 25 mm long and may be open at one or both ends or completely enclosed. The female stays without moving for minutes and also male. Courtship begins to stimulate around the female, the male moves slowly around the glass tube towards the female, courtship take few minutes, female stopped moving, the male moves towards her and move his right

pedipalp to reach the epigynum the mating process continued for about 20 minutes the male move away from the female for few minutes and approached again moving the left pedipalp to reach her epigynum then the male move away. Copulation period ranged between 25-40 minutes.

The male cleaned his right palpal organ for about one minute then he repeated the copulation with the same female using the left palpal organ. Courtship and mating are doubtless a continuum of a single series of reflexes, and to describe them separately is a matter of convenience only. In this discussion, mating behavior is considered as the activity that ensues between the time the pair assumes its characteristic copulatory position and the time when they separate. (fig.1)

5. Oviposition

Oviposition occurred during the night or just at dawn in each of the times.. Adult female of the true spider species *Cheiracanthium isiacum* requires a pre-oviposition period before depositing egg sacs. The average period was 9.0 days under laboratory conditions $28 \pm 2^\circ\text{C}$ and 60-70 % R.H. Female usually stopped feeding for a day before starting oviposition and devoted her effort to web silky webbing by her spinnerets. The female preferred to deposit her eggs in groups inside an egg sac. Number of deposited egg sacs per mated female was 4.8 egg sac during her oviposition period under laboratory conditions $28 \pm 2^\circ\text{C}$ and 60-70%R.H.). The female covered each egg sac with another layer of dense silky webbing and seemed to be semispherical. The oviposition period was 65.4 days while, the post-oviposition period was 46.4 days under laboratory conditions $28 \pm 2^\circ\text{C}$ and 60-70%. R.H. (Table 1). Total number of eggs average of 120 eggs. The egg is spherical, white when newly deposited then, changes gradually to yellow before hatching. The female was observed to embrace and guard her eggs during the incubation period except during feeding times.

6. Incubation period

Incubation period of eggs ranged from 16 to 24 days with the mean of 17.0 days at $28 \pm 2^\circ\text{C}$ and 60-70% R.H. Table (-1-).

Table 1. Duration of different immature stages of *Cheiracanthium isiacum* when fed on different prey under laboratory conditions $28 \pm 2^\circ\text{C}$ and 60-70%R.H.

Stages	Prey	Duration of different stages (in days)	
		Female Mean \pm S.D.	Male Mean \pm S.D.
Incubation period	-----	17.00 \pm 1.85	17.00 \pm 1.85
First spiderling	<i>T. urticae</i>	12.6 \pm 2.39	10.8 \pm 2.5
2 nd spiderling	+	19.3 \pm 2.82	14.8 \pm 1.7
3 rd spiderling	<i>D. melanogaster</i>	12.3 \pm 1.67	8.5 \pm 1.3
4 th spiderling	<i>D. melanogaster</i>	13.9 \pm 2.36	11.8 \pm 2.4
5 th spiderling	+	14.8 \pm 3.28	12.0 \pm 0.8
6 th spiderling	<i>E. kuehniella</i>	15.8 \pm 2.05	00
Total immature	-	88.5 \pm 4.50	57.3 \pm 3.1
Life cycle	-	109.3 \pm 5.28	86.7 \pm 2.9
Longevity	<i>D. melanogaster</i>	120.8 \pm 4.68	58.3 \pm 3.93
Life span	+	230.0 \pm 6.26	121.0 \pm 5.32
	<i>E. kuehniella</i>		

Hatched spiderlings crawled outside the transparent egg shell, ecdysis cuticle was observed inside the egg shell and referred as incomplete stages Foelix (1996).

7. Development

All stages from the paralarva to the adult are separated by a molting process. Growth occurs only during a molt that is between two consecutive stages, and thus takes place in graduated steps Foelix (1996).

After incubation period, which lasted an average of 17.0 days under laboratory conditions ($28 \pm 2^\circ\text{C}$ and 60-70%R.H.), hatching occurred then spiderlings crawled outside leaving behind the transparent egg shell inside the webbed egg sac. The male and female of *Cheiracanthium isiacum* pass through six and seven spiderling stages, respectively before reaching adult (Table 2). Each of these spiderlings when full-grown and before changing to the subsequent one passes through a resting period for about one to two hours during which the individual ceases feeding then moulting occurs. The first spiderling stage lasted 12.6 & 10.8 days for normal female and male, respectively. When this stage became full-grown it stopped feeding before moulting to the second spiderling stage, which lasted 19.3 & 14.8 days for female and male, respectively to be full-grown when fed on adult stage of the spider mite *T. urticae*, *Drosophila melanogaster*. Thus, the second stage ceased feeding then moulted and changed to the third spiderling stage, which lasted 13.9 & 8.5 days for both sexes, respectively when fed on adult stage of *Drosophila melanogaster*, *Ephestia kuehniella*. After that, the 3rd spiderling moulted and changed to the fourth spiderling stage, which lasted 13.9 & 11.8 days for both sexes, respectively. Similar functions occurred in the following spiderling developmental stages from the 5th to the 6th for female and development to male to the 5th which fed on adults of *Ephestia kuehniella*, and *Drosophila melanogaster* their durations are (14.8, 15.8) female and (12.0) for male, respectively. The obtained results agree with those obtained by Rahil (1988), Rakha *et al.* (1999), Mohafez (2006).

Table 2. Female longevity and fecundity of spider *Cheiracanthium isiacum* when fed on different prey under laboratory conditions ($28 \pm 2^\circ\text{C}$ and 60-70% R.H.).

Parameters	Mean	\pm S.D.
Pre-oviposition/ days	9.0	\pm 2.45
Oviposition/ days	65.4	\pm 3.46
Post-oviposition/ days	46.4	\pm 3.25
Mean of female egg sacs	4.8	\pm 0.86
Total average number of eggs/female	120.0	\pm 6.40

8. Longevity

Adult longevity also differed according to sex. Generally, male lived for a shorter period than female. Adult male longevity was 58.3 days; while that of female 120.8 under laboratory conditions ($28 \pm 2^\circ\text{C}$ and 60-70%R.H.) (Table 2). When feeding on mobile stages of *E. kuehniella*, and *D. melanogaster* during adult spiders consumed and average of 52.1 and 114.6 individuals for male and female, individuals, respectively.) shows the number of eggs sac deposited per female per with an average of 4.8 eggs/egg sac during the oviposition period, while the total average number of eggs/female from the egg sacs was 120 eggs.

9. Life span

The life span average of *Cheiracanthium isiacum* lasted 230.0 and 121.0 days for female and male, respectively.

10. Efficiency of the spider *Cheiracanthium isiacum* on different prey consumption

During the biological studies of the true spider *Cheiracanthium isiacum* adult stages of each of two-spotted spider mite, *Tetranychus urticae*, , vinegar fly, *Dorsophila melanogaster*, and stored grain worm moth, *Ephestia kuhniella*. were used main source of food. *T. urticae* was offered for feeding the first and second spiderling stages; while *Dorsophila melanogaster* and, *Ephestia kuehniella* was used for the all stages until reached adult (3rd & the 4th to the 6th) spiderling stages, whereas, *Dorsophila melanogaster* and *Ephestia kuehniella*. were used for feeding the 5th to the 6th spiderling stages. The spider attacks the prey from the anterior part of the body and turns than once before sucking its body contents. The first stages male and female consumed an average of 140.1 and 114.5 spider mite, the vinegar fly individuals, respectively. While, the second spiderling stages female and male consumed an average of 159.8 and 143.8 spider mite, the vinegar fly individuals, respectively (Table 3). The third and fourth female spiderling stages consumed an average of 52.1 and 114.6 *Dorsophila melanogaster* and *Ephestia kuehniella* individuals, respectively (Table 3). On the other hand, the third and fourth male spiderling stages consumed an average of 48.0 and 111.5. *Dorsophila melanogaster* and *Ephestia kuehniella*, respectively (Table 3). The fifth and sixth female's spiderling stages, fed on 75.1 and 86.4 adult stages of *Dorsophila melanogaster* and *Ephestia kuehniella*, respectively. On the other hand, the fifth spiderling of male fed on 58.0 adult stages of *Dorsophila melanogaster* and *Ephestia kuehniella*, respectively (Table 3). The obtained results agree with those obtained by Sallam (1996), El-Sebaay (2003), Mohafez (2004), Ahmed (2012), Rashwan (2017).

Table 3. Food consumption of the spider, *Cheiracanthium isiacum* under laboratory conditions $28 \pm 2^\circ\text{C}$ and 60- 70%R.H.).

Stages	Prey	Female	Male
		Mean \pm S.D.	Mean \pm S.D.
1 st spiderling	<i>T. urticae</i>	140.1 \pm 4.88	114.5 \pm 4.0
2 nd spiderling	+	159.8 \pm 5.06	143.8 \pm 4.8
	<i>D.melanogaster</i>		
3 rd spiderling	<i>D. melanogaster</i>	52.1 \pm 5.59	48.0 \pm 3.6
4 th spiderling		114.6 \pm 3.74	111.5 \pm 1.3
5 th spiderling	+	75.1 \pm 4.22	58.0 \pm 3.6
6 th spiderling	<i>E. kuehniella</i>	86.4 \pm 4.75	00

CONCLUSION

This study provides baseline information for some biological aspects of *Cheiracanthium isiacum* when fed on preys with flexible developmental strategy keeps them as important but not glorious biological control agents. The biology of *Chiracanthium isiacum* was examined in 458 individuals reared from about 1,200 specimens collected or produced in the laboratory. Seventy-six specimens were reared from egg to maturity, and two complete laboratories- bred generations were observed. Data and observations encompassed the rate of development, life cycle, reproductive potential and behavior, as well as the influences of certain biotic and abiotic factors on these

processes. tolerated a wide range of temperature and humidity conditions. Its rate of development was accelerated at higher temperatures, but its survival rate was greater under conditions of fluctuating temperatures. The survival rate was improved when relative humidity was above 50 percent. Specimens that received a varied diet showed an accelerated growth rate and a higher survival rate than those fed a diet of *Drosophila melanogaster* exclusively. Newly hatched spiderlings were observed feeding on *T. urticae*. The present work is carried out to focus on some biological aspects of this species which collected from different orchards in Aswan Governorate.

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Cheiracanthium isiacum O. Pickard-Cambridge 1874, (Arachnida: دراسة تاريخ حياة النوع) *Araneida: Eutichuridae* في مصر

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العناكب كغيرها من المفترسات تتغذى على الفرائس من الحشرات ومفصليات الأرجل. تم جمع الافراد من النوع *Cheiracanthium isiacum* من اشجار الموالح في محافظة اسوان, مصر. تم تغذيتها وتربيتها على الافراد البالغه من العنكبوت الاحمر, الدروسوفيلا وفراشة الحبوب المخزونه. تم العثور على هذه الأنواع من على أشجار الموالح وعلى الأرض وتربيتها في الفترة من (٥ فبراير - ٢٥ يوليو ٢٠١٦). تم الاحتفاظ بالنوع *C. isiacum* في عبوات بلاستيكية شفافة (٤ سم × ٦ سم ارتفاع) مع تزويدها بالفرائس للتغذية. استغرقت فترة الحضانة: ١٧.٠ يوم تقريبا عند ٢٨ ± ٢ درجة حرارة مئوية و ٦٠-٧٠٪ رطوبة نسبية. وكانت فترة ما قبل وضع البيض ٩ أيام تقريبا، في حين أن فترة وضع البيض ٦٥.٤ يوما تقريبا، فترة ما بعد وضع البيض تقدر ٤٦.٤ يوم تقريبا. كان هناك ٥ انسلخات قبل الوصول الى طور بالنسبه للذكور و ٦ انسلخات قبل الوصول إلى البلوغ بالنسبة للإناث. كانت الفترة الإجمالية من الافراد الغير بالغة أقصر للذكور (٥٧.٣ أيام) و الإناث (٨٨.٥ أيام). فترة طول عمر البالغين وفترة طول العمر كانت أقصر للذكور من الإناث.