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NOTES ON THE LIFE HISTORY AND BEHAVIOUR OF THE CRAB SPIDER *THOMISUS ONUSTUS* (WALCKENAER, 1805) (ARANEAE: THOMISIDAE)

By

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ABSTRACT: The study included the life history and behaviour of *Thomisus onustus* (Walckenaer, 1805) family Thomisidae, which was collected from El-Zaranik Protectorate, North Sinai Governorate, and Egypt. Mating behaviour, deposited egg, the period of development, life span, also, the feeding behaviour and food consumption were studied. Males reached maturity after 6 spiderling instars (189.09±4.59 days), while females after 7 spiderling instars (219.10±4.22 days). Different prey types (two-spotted spider mite *Tetranychus Urticae* Koch, Drosophila fly *Drosophila melanogaster* the fruit fly *Ceratitis capitata* (Wide.) and the house fly *Musca domestica* were used as main sources prey. The study revealed that the spider consumed high number of prey during the 6th instar period with an average of 373.64 & 396.67 prey for male and female respectively when feeding on mixture of the fruit fly *C. capitata* , and the house fly *Musca domestica* together.

INTRODUCTION

Family Thomisidae is one of the most important families of spiders. It includes 2101 species belong to 173 genera distributed all over the world (Platnick, 2010). Three species of genus *Thomisus* Sundevall, 1933 are recorded from Egypt among 25 species of 10 genera of Thomisidae in Egypt (**El-Hennawy**, 2002a, 2002b &2006). In a recent study on the feeding strategy of a crab spider, ***Diaea*** sp. (Araneae: Thomisidae),the study revealed that *Diaea* prey, principally in the head and thorax, and injects the total amount of venom it uses to immobilize prey within 15 s of the prey being captured. *Diaea* injects a larger volume of venom into larger prey, which demonstrates that this species can regulate the amount of venom injected. *Diaea* usually feeds from two sites on the prey—initially the head, then the posterior abdomen (**Pollard**, 2009). Initial

responses of naïve individuals to critical environmental stimuli provide important information about the innate contribution to behavior, and subsequent responses to the same stimuli may show the role of experience in mediating those initial responses. The choice of hunting sites is a vital decision at all stages of the life cycle for sit-and-wait predators such as *Misumena*. In their initial tests these spiderlings remained more frequently on goldenrod (*Solidago* spp.) flowers than on green or yellow goldenrod buds, a preference they retained through tests run on 5 consecutive days. Individuals on green and yellow buds shifted sites more quickly and frequently than those from flowers, and made most of these moves to flowers, which attracted many more prey than did buds. These differences were not affected by age, energetic condition, or loss of information over the period of the experiment (**Morse, 2002).**

Thomisus onustus (Walckenaer, 1805) was recorded from El-Zaranik, Kom Osheem, Ras El-Barr, Siwa Oasis, southern Sinai and Wadi El-Raiyan (**El-Hennawy, 2002a**). The only study about *T. onustus* was in Israel, (**Levy, 1970**). This study revealed that there are differences between males and females, in the length of the developmental period up to maturity, excluded the possibility that siblings could mate in nature. Females maintain a stable cycle of one year, whereas the males show a change in the length of their developmental cycle, according to the phase from which they originate. The variance, which occurs among spiderlings, concerning the number of moults and the length of the different instars is, discussed. *T. onustus* is a polyphagous predator, with representatives of four arthropod orders found in its diet. The primary food of *T. onustus* was Diptera and Hymenoptera, which collectively accounted for 94.2% of total prey. Worker ants constituted about one-fifth of the prey, suggesting that *T. onustus* is a myrmecophagic spider (**Huseynov**, 2007). There are no studies on *T. onustus* in Egypt until now, while the only published study was about *Thomisus spinifer* Cambridge, 1802, by **Mohamed and Sallam** (2004). Therefore, this study aims to throw some light upon the biological aspects of the thomisid spider species, *Thomisus onustus* Cambridge as one of the aspects important and common to determinate its role as biocontrol agent of different pests.

MATERIALS AND METHODS

Members of *Thomisus onustus* were found among the wild plants at El-Zaranik protectorate, North Sinai. They were collected from these habitats by beating net method. This species does not make any webbing

on plants as nests for living, thus female preferred to deposit its egg sac in hidden places. The two-spotted spider mite *Tetranychus urticae* Koch, vinegar fly, *Drosophila melanogaster*, adult of fruit fly *Ceratitis capitata* (Wiedemann) and adult of house fly *Musca domestica* Linnaeus, were used as prey for this species. For rearing this species, several collected adult females were placed in a translucent plastic container cells (3 cm. in diameter and 5-cm. length). Females were supplied with prey and kept in an incubator at 25 ± 1°C and 60-70% R.H. to deposit their eggs. For individual rearing, the newly hatched spiderlings were kept solitarily to rearing in plastic containers under laboratory conditions. Each one was supplied with a known number of adult of the two-spotted spider mite *T. urticae* as prey for the first spiderling; while *D. melanogaster*, adult fly as prey for the second to the fourth spiderlings; adult of fruit fly *C. capitata* and adult of house fly *M. domestica* for the fifth spiderling until the rest stages. Spider individuals were examined daily and the consumed prey individuals were replaced by fresh ones. Emerging females were allowed to mate and left singly for oviposition. The experiment begin with 35 individuals, 32 of them reached to adult and the rest died before reaching mature. The biological aspects and behaviour of different spiderlings of species were conducted. The life cycle, longevity and life span duration were determined based on 5 replicates for both male and female.

RESULTS AND DISCUSSION

Mating behaviour:

Mating is very important for *T. onustus* reproduction. Unmated female did not lay any eggs. The virgin female was fed about one hour before introducing the male into her glass jar. The display of male during courtship is very important to stimulate the female before copulation. In this species, copulation took place without any silk structure. During this period, they fed vigorously on fruit fly and house fly adults. After that, the female ceased feeding and moving to allow the male to ride on her back in the same direction, then the male turned around to let his anterior to face the posterior of the female. In this position, the male caught the female with his legs, then moved his anterior region to face the ventral surface of the female and inserted his right palpal organ in her genital opening and copulation occurred. Copulation period lasted about 30 minutes. The male cleaned his right palpal organ for about one minute then repeated the copulation with the same female using his left palpal organ.

Duration of *T. onustus*

Egg sac and incubation period:

The laid egg sac spherical in shape, bright in color at first and became dark before hatching. The eggs inside egg sac were circular and yellow in colour at the beginning and became darker before hatching. After incubation period, which lasted an average of 21 days at 25°C and 60-70 % R.H., Sixty individuals were hatched and emerged from the egg sac through a round pore at the tip of the egg sac, 35 of them were reared under laboratory conditions.

Spiderlings:

The obtained spiderlings hatched and stayed inside the egg sac for 1-2 days before emerging out of it. They were able to move and to feed on prey. During rearing 35 spiderlings of *T. onustus*, 3 individuals died before reaching maturity, 32 individuals reached to the adult stage (21 females and 11 males). The spiderlings passed through 6 instars for males and 7 instars for females during their development, (Table 1). In general, male spiders require moults or instars fewer than females to reach maturity **Foelix (1982)**. This phenomenon seems essential to present a good chance for mating.All of males became adult after six moults except one male reached to the adult stage after 5 moults. Most females (100 %) reached maturity after seven moults; the longest duration was that of the 6^{th} instar for both male and female (57.27±3.88, 60.05±3.92). The shortest instar was the 3^{rd} for both male and female (10.82±1.17, 10.76±1.57). Total immature stages averaged 168.09±4.59 and 197.81±3.17 days per male and female respectively.

In this respect, **Levy** (1970) observed that the male of *T. onustus* passed through 3-5 instars while a few obtain after six instars and the female passed through 6-9 instars. During this study, the 1^{st} instar was fed on the adult of the two-spotted spider mite, *T. urticae*. The 2^{nd} to 4^{th} instars were fed on adult drosophila fly, *D. melanogaster*. The 5^{th} to 7^{th} instars were fed on the adult of fruit fly, *C. capitata* and the adult of *M. domestica*.

Table (1): Life cycle of *Thomisus onustus* when fed on different diets

Developmental Stage	Duration (Days)							
	Male				Female			
	Min	Max	Mean	S.D	Min	Max	Mean	S.D
Incubation Period	21				21			
1st Instar	22	26	23.91	1.64	21	26	23.67	1.68
2nd Instar	11	15	13.00	1.41	11	17	13.48	1.84
3rd Instar	9	13	10.82	1.17	9	15	10.76	1.57
4th Instar	20	30	24.91	3.81	23	34	27.05	3.77
5th Instar	33	41	37.09	3.62	30	40	32.19	3.42
6th Instar	48	61	57.27	3.88	55	68	60.05	3.92
7th Instar	-	-	-	-	31	41	37.00	3.45
Total Spiderlings	160	175	168.09	4.59	190	200	197.81	3.17
Life cycle	181	196	189.09	4.59	210	226	219.10	4.22
Longevity	53	65	55.55	3.24	78	95	78.86	4.78
Life Span	240	256	246.09	4.13	295	315	299.95	4.92

Life Span:

Male life span lasted 246.09 days; while average female life span stayed 299.95 days. **Foelix** (1982) reported that most spiders of temperate regions do live only one year; but some may live for two. Generally, female spiders have longer life expectancy, and most males die shortly after mating.

Fecundity:

Table (2) shows the number of eggs deposited per female per with an average of 55.4 eggs/egg sac during the oviposition period, while the total average of eggs from the egg sacs was 303±6.71 eggs with an of average 5 egg sacs per/ female , which was always 5 mm in diameter for each..

Mohamed and **Sallam (2004)** investigated the biology of the spider species, *Thomisus spinifer* and stated that the average number of eggs was 74.6.

Table 2: Fecundity of *Thomisus onustus* female when fed on different preys.

Developmental period of female	Mean	S.D.
Pre-oviposition (days)	15.6	4.89
Oviposition (days)	31.4	3.51
Post-oviposition (days)	63.2	5.36
Total average of eggs per egg sac	55.4	6.19
Average of female's egg sacs	5	0.71
Total average of eggs	303	6.71

Longevity:

Adult longevity also differed according to sex. Generally, males lived for a shorter period than females. Male adulthood averaged 55.55 ± 3.24 days while female longevity averaged 78.86 ± 4.78 days (Table 1).**Vogelei** and **Greissl** (1989). Studied the spiderlings of *Thomisus onustus* (Arachnida, Thomisidae) were thus kept on different diets. There was a significant difference in survival rate between spiderlings that were starved or fed on pollen, "nectar", or Drosophila. The results showed that pollen and nectar could be a source of energy for spiders for an extensive period. This demonstrates another way in which spiders may survive starvation when insect prey is lacking and thus ensure the survival of a whole population. **Mohamed and Sallam (2004)** mentioned that the longevity of thomsiid spider, *T. spinifer* averaged 42.0 and 135.2 days for male and female, respectively, when fed on adult fly of *C. capitata.*

Oviposition:

Adult female required a pre-oviposition period averaged 15.6 days. The female usually stops feeding for 5 days before laying eggs and devoted her effort to web a silky webbing by her spinnerets. The female preferred to deposit her eggs in groups inside an egg sac. The egg is spherical, white when newly deposited then changed gradually to light yellow before hatching. The female was observed to embrace and guard her egg sac during the incubation period except during feeding periods. Number of deposited egg sacs per mated female ranged from four to six, with an average of five egg sacs during whole oviposition period, which averaged 31.4 days at 25°C. The female covered each egg sac with another layer of dense silky webbing and seemed to be semispherical. The post-oviposition period averaged 63.2 days at 25°C & 60-70 % R.H. (Table 2).

Sex ratio:

During one generation of *T. onustus* mated female deposited eggs which gave males and females in a ratio of 1.3: 2.2 for both sexes and this differed that of *T. spinifer* which was 1: 1 **(Mohamed and Sallam, 2004)**.

Feeding behaviour and food consumption:

The spider attacked the mite from the anterior part of the body and turns the prey more than once before sucking its contents, while attacked the other flies from the junction between head and thorax then sucked its contents. During the study of food consumption of *T. onustus*, different spiderling instars and adults were fed on various prey (The two-spotted spider mite *T. urticae*, *D. melanogaster*, adult of both fruit fly *C. capitata* and house fly *M. domestica* (Feeding rate: every two days). The first instar of spiderlings was fed on the adult of *T. urticae* with an averaged of 100.73 and 101.52 for male and female, respectively. The second, third and fourth instars of spiderlings were fed on the adult fly of *D. melanogaster* with an averaged of (57.82 & 60.05), (65.27 & 68.00), and (168.64 & 170.48) for male and female. Fifth to sixth instars of spiderlings were fed on both adult fly of *C. capitata* and *M. domestica* together with an averaged of (191.36 & 199.95) and (373.64 & 396.67) for male and female, while the female seventh instar consumed an averaged of 253.73 prey of the above mentioned prey. Total of consumed prey by different spiderling instars is tabulated in Table (3).

Table (3): Food consumption of *Thomisus onustus* when fed on different diets

Developmental Stage	Prey	Number of consumed individuals of prey							
		Male				Female			
		Min	Max	Mean	S.D	Min	Max	Mean	S.D
1st Instar	Spider mite *T. urticae*	95	105	100.73	3.29	100	115	101.52	3.53
2nd Instar	Drosophila fly *D. melanogaster*	55	60	57.82	2.52	55	70	60.05	4.13
3rd Instar		65	72	69.27	2.20	60	72	68.00	3.66
4th Instar		155	170	168.64	4.52	165	180	170.48	3.50
5th Instar	Fruit fly *C. capitata* & *M. domestica*	186	200	191.36	4.43	196	215	199.95	3.80
6th Instar		370	380	373.64	3.93	390	400	396.67	3.98
7th Instar		-	-	-	-	250	265	253.78	4.83
Total Spiderlings		956	969	961.31	4.05	1250	1265	1252.65	3.89

Gelman *et al.*, (2006) studied the predatory preferences of the spider *Misumenops pallidus* (Araneae: Thomisidae) on potential insect prey, particularly regarding agro ecosystems pests. Two tests were done under natural laboratory conditions: simultaneous presentation of prey (n= 215) and alternative prey test (n= 45). The spiders preferred insects that were mobile, small, without defensive glands and with thin exoskeletons. According to the amount of prey consumed, the authors established four predation levels: high (> 55 %, on adult *Drosophila melanogaster* flies); intermediate (30 % -55% on the defoliator larvae of *Rachiplusia nu* and adult heteropterans: *Horciasinus argentinus* and Halticus spegazzinii); and low (10 %- 30% on the chrysomelids *Colapsis* sp. and *Diabrotica speciosa*). The pentatomid *Piezodorus guildinii*, the curculionid *Naupactus* sp. and the aphid *Acyrthosiphom pisum* were not accepted as food. Once the spider captured a prey item it did not accept another, independently of prey item species (82% of trials).

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الملخص العربي

ملاحظات حول تاريخ الحياة و سلوك العنكبوت

(ARANEAE: 1805) *THOMISUS ONUSTUS* (WALCKENAER, THOMISIDAE)

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تم دراسة تاريخ حياة و سلوك العنكبوت *Thomisus onustus* (Walckenaer, 1805) الذي تم تجميعه من محمية الزرانيق من محافظة شمال سيناء. تضمنت الدراسة ملاحظة سلوك التزاوج ووضع البيض و النمو و مدة و فترة حياة الطور الكامل و كذلك سلوك و معدل الافتراس.من خلال دراسة دورة حياة النوع تمر الذكور بستة اطوار عنكبوتية (١٨٩,٠٩ ± ٤,٥٩ يوما) بينما تمر الأنثى بسبعة اطوار عنكبوتية (٢١٩,١٠ ± ٤,٢٢يوما) حتى الوصول إلى الطور البالغ. تم استخدام العديد من الفرائس (الطور البالغ من اكاروس *T. urticae* وذبابة الخل *Drosophila melanogastar* وذبابة الفاكهة *Ceratitis capitata* الذبابة المنزلية *Musca domestica* كمصادر رئيسة للتغذية أثناء التربية. أظهرت النتائج ان اعلي معدل افتراس كان في الطور السادس بمعدل ٣٧٣,٦٤و ٣٩٦,٦٧ فريسة لكل من الذكر و الانثي على التوالي عند التغذية على خليط من ذبابة الفاكهة و الذبابة المنزلية.