

REARING OF *Uloborus walckenaerius* Latreille, 1806 (ARANEAE: ULOBORIDAE)**Gihan M. E. Sallam^{***}, M. F. Hassan^{*}, A. M. H. Mabrouk^{*} & Nabawya M. A. Sweilem^{**}**^{*}Department of Zoology and Agriculture Nematology, Faculty of Agriculture, Cairo University, Giza, Egypt^{**}Plant Protection Research Institute, Agriculture Research Center, Dokki, Giza, Egypt[#]corresponding author: gihansallam@gmail.com**ABSTRACT**

Uloborus walckenaerius Latreille, 1806 (Family Uloboridae) was reared on two preys. The individuals of this species were collected from Mango trees, Menofia governorate, Egypt. Biological aspects were studied in an incubator conditions (22-24°C and 60-70% R.H.). Life cycle of males and females averaged 112.1±3.0 & 160.4±4.3 days after 4 and 5 spiderlings for males and females when fed on the hatching larvae of cotton leaf worm, *Spodoptera littoralis* while averaged 117.6±3.2 & 188.3±4.2 days when fed on the first and second larval stage of *S. littoralis*, respectively.

Keywords: *Uloborus walckenaerius*, life cycle, cotton leaf worm, *Spodoptera littoralis*, biological aspects, food consumption.

INTRODUCTION

Spiders are an important group of animals. They occur in all terrestrial ecosystems with many species and individuals, contribute considerably to the biodiversity of a habitat and as predatory organisms, they exert an important regulatory function. Spiders are therefore a very important indicator group for the quality of a habitat.

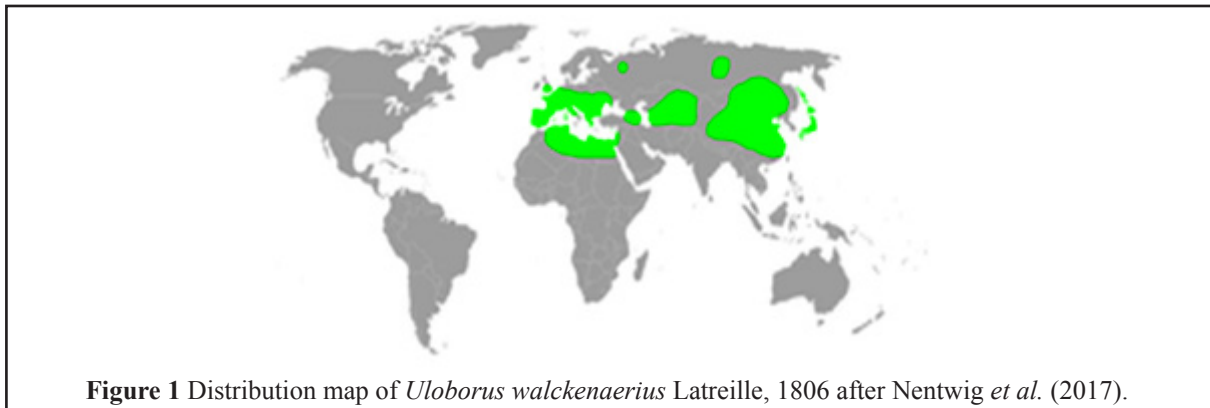
There are currently over 46909 described species placed in 4071 genera and 112 families of spiders until now (World Spider Catalog, 2017). Family Uloboridae has a moderate number among the families all over the world, from this family, 283 species of 19 genera are distributed all over the world while in Egypt, this family has one genus and two species (El-Hennawy, 2006).

Uloboridae is a family of non-venomous spiders, known as cribellate orb weavers or hackled orb weavers. Their lack of venom glands is a secondarily evolved trait. Instead, they wrap their prey thoroughly in silk, cover it in regurgitated digestive enzymes and then ingest the liquefied body. All members of this family produce a feathery, fuzzy silk called cribellate (or hackled) silk. These spiders do not use an adhesive on their orb webs, but rather the very fine fibers on each strand of silk tend to ensnare prey. Uloboridae webs often have a stabilimentum or zig-zag pattern through the center (Nentwig *et al.*, 2017).

Genus *Uloborus* has 80 species described all over the world (World Spider Catalog, 2017) while in Egypt only 2 species till date (El-Hennawy, 2006).

Uloborus walckenaerius Latreille, 1806 is distributed in North Africa, south Europe, middle and east of Asia (Figure 1).

This species was reared only one time in Egypt by Mohafez (2010) on the larvae & adult of the white fly (*Bemisia tabaci*) and the jassid (*Empoasca* sp.); hence this work is to give some light on the other preys of this species and to study its biological aspects.



MATERIAL AND METHODS

Rearing of spiders

Pure cultures of adult males and females of *Uloborus walckenaerius* were collected from Mango, Menofia Governorate, transferred to the laboratory then identified up to the species level. They were separately reared inside plastic vials, fed for some time. Females laid egg sacs after mating and observed till eggs hatched. After hatching, the spiderlings were divided into two groups from 8 egg sacs. The first group (67 individuals of spiderlings) reared on hatching larvae of the *Spodoptera littoralis* (Boisduval, 1833) (Order: Lepidoptera) till adult, the other group (72 individuals of spiderlings) from first to third spiderlings fed on the first larval stage of *S. littoralis* then from fourth to adult, fed on the second larval stage of the *S. littoralis*. The hatched spiderlings were reared individually in translucent plastic vials (3 cm in diameter and 5 cm in length); the upper lids of the vials were perforated for ventilation. All obtained spiderlings were reared in an incubator conditions of 22-24°C and 60-70% R.H.. The two groups were fed twice every week; spiderlings were supplied with a known number of preys and observed until they reached maturity. The biological aspects and behaviour of different spiderlings of this species was conducted. The life cycle and food consumption were determined.

Rearing of the prey

Cotton leaf worm *Spodoptera littoralis* was reared in the laboratory using a method described by Mostafa (1988). Field-collected egg batches of *S. littoralis* were cultured on castor bean leaves *Ricinus communis* L., in glass jars, 20 cm diameter by 15 cm height. The leaves were washed and cleaned. The jars were covered with muslin cloth held in position by rubber bands and kept in an incubator at 25°C and 60-70%R.H. The jars were daily examined. Adult moths were confined in glass chimneys as oviposition cages and were provided with *Nerium* leaves (*Nerium oleander*) as oviposition sites. These oviposition cages were provided with pieces of cotton soaked in 10% sugar solution for adult nourishment. The obtained eggs were re-cultured as mentioned above. The batches were left until hatching and the different larval instars were taken as introduced prey to the spider.

RESULTS AND DISCUSSION

Egg sac and eggs incubation period

The laid egg sac was rectangle in shape, and beige at first then typically changed to gray later, before hatching (Figure 2). The eggs inside the egg sac were circular and yellow at the

beginning after laying, then became dark before hatching; number of eggs ranged from 20 to 35 egg per egg sac with an average of 24.8 ± 4.7 eggs. These results differed with Mohafez (2010) who reared the same species on the larvae & adult of the white fly *Bemisia tabaci* and the jassid (*Empoasca* sp.), the egg sac contained an average of 14.6 ± 0.7 eggs when reared on 26-28% R.H.

The incubation period of eggs of *Uloborus walckenaerius* lasted for 20-27, averaged for 24.4 ± 3.2 days (Table 1), when fed on the hatching larvae of the *Spodoptera littoralis*, while lasted 15-22, averaged 18.8 ± 3.4 days, when fed on the first and second larval stages of *S. littoralis* (Table 2). These results indicated that the kind of the prey which affected the duration of the incubation period being longer when females fed on the hatching larvae of *S. littoralis* than on the first and second larval stages of the same prey.

Table 1 Life Cycle of the spider *Uloborus walckenaerius* Latreille, 1806 (Araneae: Uloboridae) when fed on the hatching larvae of cotton leaf worm *S. littoralis* at 22-24°C and 60-70% R.H.

Developmental Stage	Male				Female			
	Min.	Max.	Mean	S.D.	Min.	Max.	Mean	S.D.
Incubation Period	20	27	24.4	3.2	20	27	24.4	3.2
1 st spiderling	9	15	10.5	1.9	9	19	14.3	2.9
2 nd spiderling	13	24	20.5	2.8	11	25	20.5	2.8
3 rd spiderling	29	40	31.6	3.4	21	27	25.8	0.8
4 th spiderling	20	37	23.7	4.9	35	41	40.5	1.1
5 th spiderling	-	-	-	-	29	45	33.5	3.7
Total Spiderlings	81	94	86.4	4.3	124	141	133.2	3.5
Life cycle	109	117	112.1	3.0	150	166	160.4	4.3
Longevity	76	94	77	4.0	122	130	127.8	3.1
Life span	185	203	189.1	4.4	279	294	288.3	4.8

Table 2 Life Cycle of the spider *Uloborus walckenaerius* Latreille, 1806 (Araneae: Uloboridae) when fed on the first and second larval stages of the cotton leaf worm *S. littoralis* at 22-24°C and 60-70% R.H.

Developmental Stage	Male				Female			
	Min	Max	Mean	S.D.	Min	Max	Mean	S.D.
Incubation Period	15	22	18.8	3.4	15	22	18.8	3.4
1 st spiderling	15	21	17.0	2.9	15	24	16.7	3.5
2 nd spiderling	16	23	20.0	2.6	38	44	39.7	2.5
3 rd spiderling	30	36	32.0	3.1	31	43	36.4	3.4
4 th spiderling	25	28	26.9	1.1	32	47	39.8	3.5
5 th spiderling	-	-	-	-	31	42	37.2	3.9
Total Spiderling	87	98	96.0	3.1	163	178	169.8	4.2
Life cycle	109	120	117.6	3.2	183	194	188.3	4.2
Longevity	29	40	33.1	5.1	80	90	80.8	2.9
Life span	146	153	150.7	4.5	263	276	269.2	4.6

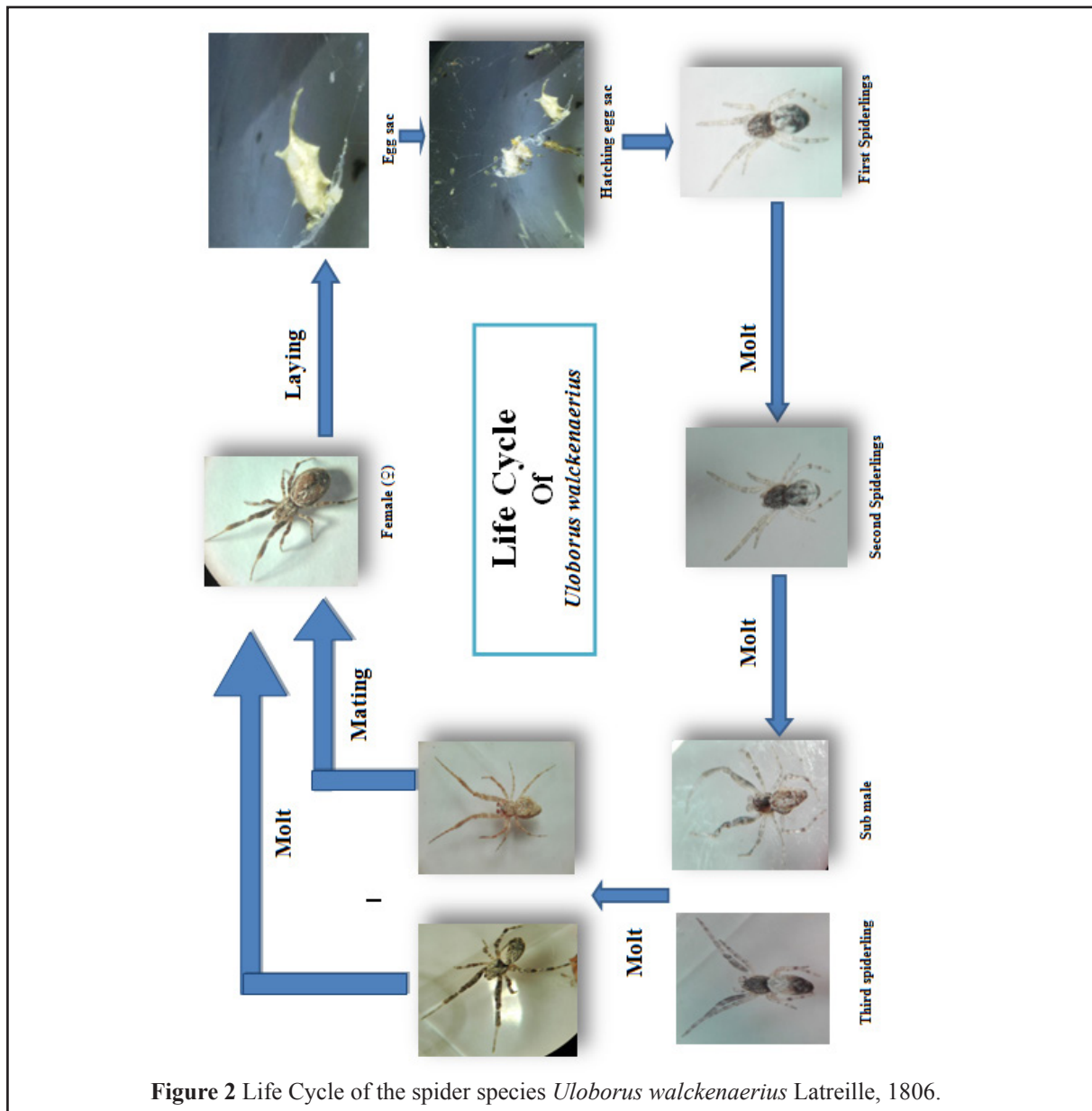


Figure 2 Life Cycle of the spider species *Uloborus walckenaerius* Latreille, 1806.

Spiderlings:

During rearing of the two groups of *U. walckenaerius*, females passed through 5 instars (spiderlings) while males passed through 4 instars (spiderlings) only when fed on the hatching larvae and (first & second) larval stages of the cotton leaf worm, *S. littoralis* (Figure 2, Tables 1 and 2), these results agree with Mohafez (2010) who reared the same species on the larvae & adults of the white fly *Bemisia tabaci* and the jassid (*Empoasca* sp.) but disagree with Peaslee and Peck (1983) who reared the uloborid spider *Octonoba octonarius* (Muma) and resulted that the spiders matured at fifth or sixth instars.

The life cycle:

Life cycle lasted 112.1 ± 3.0 and 160.4 ± 4.3 days for males and females respectively,

when fed on the hatching of the larval stage of the cotton leaf worm, *S. littoralis* (Table 1) while lasted 117.6 ± 3.2 and 188.3 ± 3.2 when fed on the first and second larval stages of the same prey (Table 2). These results differed and were longer than the results of Mohafez (2010) who reared on the larvae and adults of the white fly *Bemisia tabaci* and the jassid (*Empoasca* sp.); life cycle ranged from 81-85 days and 96-113 days for males and females, respectively.

Life cycle of the individuals of this species seemed to be shorter when fed on the hatching larval stage of the cotton leaf worm *S. littoralis*.

Sex ratio:

The sex ratio may be different according to the kind of food, even the instars of the same prey can change the sex ratio between the two groups of spiders. The sex ratio of adults was 1:1.88 (males: females) when the spider individuals fed on hatching of the larval stage of *S. Littoralis*, while it resulted different when fed on the first and second larval stages of the same prey, 1:1.62 (males: females) respectively.

Longevity:

Generally, males lived shorter period than the females, longevity average 77 ± 4.0 & 127.8 ± 3.1 and 33.1 ± 5.1 & 80.8 ± 2.9 days for males and females when fed on the hatching of the larval stage of the cotton leaf worm *S. littoralis* and (first and second) larval stages of the same prey respectively (Tables 1 and 2).

Oviposition:

Adult female required a pre-oviposition period of 9.0 ± 3.0 days, this result agrees with Mohafez (2010). The female usually stops feeding for 2-3 days before laying eggs and devoted her effort to web silky webbing by her spinnerets. The female was observed to embrace and guard her egg sac during the incubation period except during the feeding periods. Number of deposited egg sacs per mated female ranged from one to four during whole oviposition period, which averaged 69 ± 0.8 days. The female covered each egg sac with another layer of dense silky webbing and seemed to be semi-spherical. The post-oviposition period averaged 51.1 ± 3.0 days at 22-24°C & 60-70 % R.H. (Table 3).

The life span:

Average males life span was 189.1 ± 4.4 days and 288.3 ± 4.8 days for females when fed on the hatching of the larval stage of the cotton leaf worm *S. littoralis* while it averaged to 150.7 ± 4.5 and 269.2 ± 4.6 days for males and females respectively when fed on the first and second larval stages of the same prey. This clarifies that feeding on the hatching larval stage of *S. littoralis* elongates the life span for males and females respectively. Foelix (2011) reported that most spiders of temperate regions do live for only one year; but some may live for two. Generally, female spiders have longer life expectancy, while most males die shortly after mating.

Fecundity:

Table 3 shows the number of deposited eggs per egg sac averaged 19.2 ± 3.4 while the total average of eggs through the egg sacs was 96.7 ± 1.8 eggs. The average number of egg sacs per female was 4.1 ± 0.4 .

Feeding behaviour:

The spider attacks the larva of the *S. littoralis* by wrapping it with a lot of webs to paralyze it, then insert its chelicerae in the inter-sector membrane between head and thorax and turn the prey more than once before sucking its body fluids.

Food consumption:

During the study of food consumption of spider *U. walckenaerius*, different spiderlings (instars) and adults were fed on *S. littoralis* larvae. All the spiderlings were divided into two groups, first one fed on the hatching larval stage of the *S. littoralis* from first spiderlings to the adult (Table 4) while the second group (first and second spiderlings) were fed on the first instar of *S. littoralis*, then from third to adult fed on the second instar of the same prey (Table 5).

The mean total number of consumed individuals was 495.9 ± 5.6 and 646.2 ± 5.3 individuals for males and females respectively, when fed on the hatching larval stage of the cotton leaf worm *S. littoralis* while the mean total number of consumed individuals was 260.3 ± 4.4 and 446.6 ± 4.5 individuals for males and females, respectively, when fed on the first and second instars of the same prey, these results may be due to the size of the prey, the hatching larval stage of *S. littoralis* was very small compared with the rest of the instars so the spider individuals consumed a very large number of hatching larval stages.

Table 3 Fecundity of *Uloborus walckenaerius* Latreille, 1806 (Araneae: Uloboridae) at 22-24°C and 60-70% R.H.

Developmental period of female	Min.	Max.	Mean	S.D.
Pre-oviposition (days)	5	13	9.0	3.0
Oviposition (days)	68	70	69.0	0.8
Post-oviposition (days)	50	58	51.1	3.0
Total number of egg-sacs per female	4	5	4.1	0.4
Total number of eggs per egg-sac	18	27	19.2	3.4
Total number of deposited eggs per female	96	101	96.7	1.8

Table 4 Food consumption of *Uloborus walckenaerius* Latreille, 1806 (Araneae: Uloboridae) when fed on the hatching larvae of cotton leaf worm *S. littoralis* at 22-24°C and 60-70% R.H..

Developmental Stage	Male				Female			
	Min.	Max.	Mean	S.D.	Min.	Max.	Mean	S.D.
1 st spiderling	72	88	83.9	4.6	74	80	76.1	3.0
2 nd spiderling	98	107	103.9	2.7	94	100	99.4	1.5
3 rd spiderling	180	192	181.3	4.0	200	220	218.8	4.9
4 th spiderling	113	130	128.1	5.7	115	125	120.9	4.8
5 th spiderling	-	-	-	-	120	133	131.0	3.7
Total	487	500	495.9	5.6	638	658	646.2	5.3
Longevity	182	190	182.9	2.7	242	252	250.2	2.2
Life Span	669	685	677	4.9	880	896	886	4.1

Table 5 Food consumption of *Uloborus walckenaerius* Latreille, 1806 (Araneae: Uloboridae) when fed on the first and second larval stages of the cotton leaf worm *S. littoralis* at 22-24oC and 60-70% R.H..

Developmental Stage	Male				Female			
	Min.	Max.	Mean	S.D.	Min.	Max.	Mean	S.D.
1 st spiderling	22	31	25.3	3.6	30	44	35.3	5.4
2 nd spiderling	22	34	28.0	4.0	35	52	45.3	4.7
3 rd spiderling	85	90	87.5	2.6	80	95	82.5	5.8
4 th spiderling	111	130	119.5	4.1	120	140	138.3	5.8
5 th spiderling	-	-	-	-	135	150	148.8	4.3
Total	251	265	260.3	4.4	438	450	446.6	4.5
Longevity	75	90	79.0	6.6	160	185	182.9	7.2
Life span	326	354	338.3	6.4	623	635	629.5	7.5

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