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Effect of Food Type on Life Tables and Feeding Behavior of the Ascid Mite, *Lasioseius athiasae* (Acari: Ascidae)

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ABSTRACT

The ascid mite *Lasioseius athiasae* Nawar and Nasr considered an important predator related with herbaceous plants, fallen leaves and deciduous fruit tree debris *M. incognita*. When female predator provisioned *T. urticae* nymphs, the rm was 0.102 individual/ female per day. Thus, it could be concluded that the highest reproductive rate which observed from the mould mite and the bulb mite compared with feeding on other prey species.

INTRODUCTION

Mites of the family Ascidae (Acari: Mesostigmata) are distributed world wide and comprise 34 genera. This family encompasses the predatory mites in soil, on vegetation and on other animals. Most of these mites are predators but also found to feed on fungal mycelium while some are parasitic. Lasioseius species represents one of the most morphologically varied genus of this family with around 100 species (Halliday et al., 1998). Particular individuals were studied on different types of feeding as acarid mites, insects and fungi (HAINES, 1981; KHEIR, 1986; SMITH, 1983;). But on the other hand, Nematodes are specialized feeding predators (SHARMA, 1971; KARG, 1983). Species like *L. bispinosus* along with several other predatory mites were recorded as effective natural enemies against the bulb mite, *Rhizoglyphus robini* (Lesna et al., 1995). the known habitats of the members of this genus were rotting organic substances, forest litter, mosses, soil, nests of small mammals, birds, bee hives, decaying wood, old grass land, fields and herbaceous plants (Halliday, et al., 1998; Abou Awad, et al., 2001). The current study therefore aims to evaluate the performance of *L. athiasae* as a biocontrol agent for controlling the mites which associated with several fruit orchards and fallen leaves Accordingly, the biological aspectes and fertility life tables of L. athiasae were examined under varying types of prey provided.

MATERIALS AND METHODS

The ascid mite *L. athiasae* was collected from ploughman's spikenard grass and fallen leaves of fruit orchards at Dakahlia Governorate. The collected mites were used to initiate the stock colony of the predator under laboratory conditions. The experiment was done in two types of plastic cells provided with a mixture of floor of plaster of (9 Paris : 1 charcoal). The large cells of rearing were 2.5 cm in diameter and 2 cm in depth and used for mass rearing in the laboratory, whereas the small ones which used for biological experiments were 1.0 cm in diameter and 0.8 cm in depth. each cell were covered with A heavy glass to protect mites from escaping. The moderately moist plaster floor was achieved by providing little of moisture to the surface. The predatory mites, *L. athiasae*, were exposured to the mould mites *Tyrophagus putrescentiae* as a competent prey. Then each new larvae were put singly to the experimental cells (40 / larvae / each test) and each was provided with a suitable prey to determined the effecacy of different prey on all biological aspects . These contained nymphs of the mould mites *T. putrescentiae* , which were reared in laboratory maintained on a mixture of wheat germ, wheat bran and yeast powder (Jakobsen, 1989)., nymphs of the bulb mite, *R. robini* which were collected from heavily infested onion , the two-spotted spider mite *Tetranychus urticae* nymphs, which were achieved from highly infestation of castor leaves; and egg-masses of the root- knot nematode *Meloidoyne incognita* Chitwood collected from heavily infested tomato seedlings. The dipth of the experimental cells was spletted into two devisions. The first part was provided with a small piece of wet cotton to confine the egg-masses and the second one was left for the predator activity, Then each cell supplied with put five egg-masses and exchanged daily with fresh eggs. The average number of eggs / egg-mass was calculated by dissolving 10 egg-masses with 0.5% Chlorax (sodium hypochlorate) and the eggs were collected and counted (it was about 200 eggs). Becouse of practical difficulties , the consumption rate of *L. athiasae* immatures was not assessed. Predator larvae were provided with a determin known number of prey and observed until maturity. Exchange of prey was obtained daily and reports of prey utilization and development were recognized twice a daily. When individuals attained maturity, the males and females were kept togother for 24 h to relied on mating. Deposited eggs were removed daily after counted. Experiments were conducted at 27 + 2°C and 18 h dark : 6 h light periods. Data observeded from all biologacl parameters and feeding potential were presented to statistical analysis using ANOVA. The life table parameters were calculated according to the BASIC computer programme (Abou - setta et al., 1986).

RESULTS AND DISCUSSION

Data presented in Table (1) shows the average durations of the immature stages of the predator in relation to the four types of food. Developmental durations of predator fed on nymphs of the mould or the bulb mite were in an identical manner. The faster development of immature stages were obtained when fed on both of mould mites and bulb mite than that on other food. These durations of development of the predator are in conformity with periods recorded by Mowafi (1988) who found that the larval stage of female *L. athiasae* attained maturity after 8.3 and 9.1 days when provided with the two mites as preys, *R. robini* and *T. putrescentiae*, respectively. These results are also in consistent with Lesna et al., (1995) who mentioned that *L. bispinosus* along with several other predatory mites were recorded as effective natural enemies and a biocontrol agents against the bulb mite, *R. robini* . *T. putrescentiae* .

Table 1. Effect of prey type on certain biological parameters of the predator, *L. athiasae*

Developmental stages	Sex	Prey (mean ±. SD) *T.putrescentiae* (nymphs)	*R. robini* (nymphs)	*T. urticae* (nymphs)	*M. incognita* (eggs)
Egg (d)	Female	2.55 ± 0.23	2.43 ± 0.36	2.75 ± 0.27	2.87 ± 0.16
	Male	2.16 ± 0.18	2.37 ± 0.24	2.52 ± 0.19	2.35 ± 0.21
Larva (d)	Female	1.90 ± 0.30	1.70 ± 0.25	1.64 ± 0.27	1.63 ± 0.35
	Male	1.50 ± 0.20	1.45 ± 0.18	1.72 ± 0.31	1.68 ± 0.26
Protonymph (d)	Female	1.80 ± 0.27	1.63 ± 0.31	2.56 ± 0.17	3.40 ± 0.28
	Male	1.65 ± 0.17	1.94 ± 0.27	2.21 ± 0.24	4.20 ± 0.18
Deutonymph (d)	Female	1.93 ± 0.16	2.41 ± 0.26	2.90 ± 0.16	4.23 ± 0.35
	Male	1.70 ± 0.21	1.96 ± 0.32	3.21 ± 0.27	4.50 ± 0.28
Total immatures(d)	Female	8.18 ± 0.25 c	8.17 ± 0.15 c	9.85 ± 0.26 b	12.13 ±0.21 a
	Male	7.01 ± 0.31	7.72 ± 0.17	9.66 ± 0.18	12.73 ± 0.34
Oviposition (d)	Female	18.56 ± 0.17c	22.39 ± 0.28b	30.25 ± 0.14a	33.18 ±0.29a
Longevity (d)	Female	33. 25 ± 0.31c	35.24 ± 0.27c	40.29 ± 0.36b	45.04 ±0.21a
	Male	30.21 ± 0.24c	31.38 ± 0.21c	37.01 ± 0.32b	42.18 ±0.32a
Life span (d)	Female	41.43 ± 0.15 c	43.41 ±0.17 c	50.14 ± 0.28 b	57.17 ±o.16 a
	Male	37.22 ± 0.26 c	39.10 ±0.27 c	46.67 ± 0.18 b	54.91 ±0.25 a
% surviving	Female	100	100	100	70
	Male	100	100	100	65
No. observation	Female	28	3	27	14
	Male	12	16	13	12

The same letters in a raw are not-significantly different (ANOVA, P < 0.01).

The current observations proved that parasitic nematode eggs was unfortunate prey for the the predatory mite, *L. athiasae*, as its development was underdeveloped (12.13 days). (MOWAFI, 1988) attained a shorter period (9.5 days) free-living nematodes And Abou-Awad et al., (2001) recorded (12.9 days) in males develop faster to adults than females. Such is a benefit for mating. Mating is pivotal for oviposition. The adult longevity and life span affected significantly with the types of prey, which was significantly shorter on both *T.putrescentiae* and *R. robini*. Both adult males and females have the similar convention. During the larval stage, the female consumed 58.0 *T.putrescentiae* nymphs, 91 of *R. robini* nymphs and 46 of *T. urticae* nymphs (Table 2). The highest rate of consumption for predator female was observed during its oviposition period, as it consumed a daily average of 90 of *T.putrescentiae* nymphs, 102 of *R. robini* nymphs and 18 of *T. urticae* nymphs. The female feeding capacity was constantly more than that of male, regardless of the type of food involved.

The food affected oviposition and fecundity. In relation to the type of food supplied, the number of eggs laid per female and day is presented in (Table 2). The mould mites *T.putrescentiae* and the bulb mite *R. robini* consumed more egg production than the others (2.98 and 2.78 eggs/female per day). Spider mite nymphs induced egg production to a major expansion in female predator. It laid an average of 1.08 eggs/day when fed on mite nymphs, whereas it laid the lowest number of eggs (0.57 eggs/female per day) when provided the eggs of *M. incognita* . These are in agreement with Abou-Awad etal.,(2001) who obtained that during the oviposition period, the female *L. athiasae* consumed a daily number of 97 *A. dioscoridis* eggs, four *M. domestica* eggs, and ten of *T. urticae* nymphs. The average number of eggs per female and day was 3.21, 1.63 and 1.26, respectively. *M. incognita* eggs recorded the lowest rate of egg (0.35 eggs per female and day. Nasr et al. (1990) reported that the average number of eggs per female *L. athiasae* and day when offered the two acaridids *R. robini* and *T. putrescentiae* was equal to or higher than that observed for the same predator on eggs of free-living nematodes. The influence of prey type on the life table variables of *L. athiasae* is presented in Table (3). The intrinsic rate of increase (r_m) of the predator female was maximized when provisioned *T.putrescentiae* and R. robini nymphs (0.164 ,0.137 individual/ female per day) respectively , but there were a highly decline (0.036) when provisioned eggs of *M. incognita*. Using *T. urticae* nymphs as food, the r_m of the female predator was 0.102 femalel/ female/ day. In addition, both of the mould and bulb mites attained similar r_m. The net reproductive rate (R_0) was 40.21, 46.73, 25.84 and 8.92 eggs in a generation time (T) of 17.92, 23.44, 22.26 and 27.00 days, when female *L. athiasae* provided *T.putrescentiae*, *R. robini*, *T. urticae*, and *M. incognita*, respectively. As the same trend, The generation doubling times (DT) was 8.62 , 10.32 , 13.86 and 39.28 days, respectively, when *L. athiasae* fed on the same different prey , respectively. Thus, it could be concluded that the mould and bulb mites may improve the reproductive performance of predator compared to other prey species. Data agrees with Abou-Awad etal.,(2001) who reported that there was an increase limit in the r_m of the female predator when consumed A. dioscoridis, but a decrease limit when consumed other prey species. The net reproductive rate (R_0) was 44.73 eggs within a generation time (T) of 17.92 days when consumed the eriophyid mites. The eriophyid grass mite demonstrated to be the most acceptable prey improving reproduction.

Table 2. The daily consumption and oviposition rates of *L. athiasae* fed on *T.putrescentiae, R. robini*, *T. urticae*, and *M. incognita* under laboratory conditions.

Stage of *L. athiasae*	Sex	*T.putrescentiae* (nymphs) Mean±SD	Daily rate	T.F.	*R. robini* (nymphs) Mean±SD	Daily rate	T.F.	*T. urticae* (nymphs) Mean ±SD	Daily rate	T.F.	*M. incognita* (eggs) Mean± SD	Daily rate	T.F.
Larva	Female	7.13± 1.60	3.75		7.94±1.53	4.67		4.15±1.83	2.53		--	--	
	Male	4.22± 2.03	2.81		4.73±5.82	3.26		3.37±2.01	1.96		--	--	
Protonymph	Female	20.41±1.84	11.34		29.76±2.24	18.26		17.72±1.64	6.92		--	--	
	Male	16.25±3.52	9.85		30.71±3.74	15.83		11.32±3.16	5.12		--	--	
Deutonymph	Female	31.40±4.82	16.27		53.48± 2,84	22.19		25.00±2.53	8.62		--	--	
	Male	25.21±1.25	14.83		37,85±6,73	19.31		20.90±1.63	6.51		--	--	
Total immatures	Female	58.94±4.72	10.47		91.18±2.84	15.89		46.87±3.84	6.60		--	--	
	Male	45.68±4.82	9.42		73.29±4.63	13.70		35.59±4.82	4.98		--	--	
Oviposition	Female	1678.20 ± 142.73 b	90.42	55.26 ±2.85 a	2291.39 ± 121.74 a	102.34	62.18± 3.27 a	557.50 ± 23.85 c	18.43	32.70± 4.75 b	612.84± 36.24 c	18..47	18.79 ± 5.28 c
Longevity	Female	2344.79 ± 138.75 b	70.52		2996.46 ± 173.64 a	85.03		516.92 ± 26.92 c	12.83		538.22± 25.94 c	11.95	
	Male	1765.17 ± 193.65 b	58.43		2163.02 ± 152.65 a	68.93		315.70 ± 20.26 c	8.53		296.53± 54.92 c	7.03	
Life span	Female	2403.73 ± 173.73 b	61.82		3087.64 ± 151.65 a	75.35		563.79 ± 22.47 c	11.90		--	--	
	Male	1810.85 ± 184.72 b	51.65		2236.31 ± 127.64 a	60.89		351.29 ± 20.64 c	7.96		--	--	
No.observation	Female	28			3			27			14		
	Male	12			16			13			12		

***T.F.= total fecundity. The different letters in a raw are significantly different (ANOVA, P < 0.01).**

Table 3. Effect of different prey type on life table parameters of the predatory mite *L. athiasae*

Parameters	*T.putrescentiae* (nymphs)	*R. robini* (nymphs)	*T. urticae* (nymphs)	*M. incognita* (eggs)
Net reproduction rate (R_0)	40.21	46.73	25.84	8.92
Mean generation time (T)	15.73	17.94	25.04	29.74
Intrinsic rate of increase (r_m)	0.164	0.137	0.102	0.036
Finite rate of increase (e^{rm})	1.32	1.93	1.16	1.05
Generation doubling time (DT= In 2 /r_m)	8.62	10.32	13.86	39.28
No. observation (female)	28	3	27	14
Sex ratio (female/total)	45 : 55	42:55	38:55	30:55
(female : male)	4.50 : 1	3.23 : 1	2.24 : 1	1.36 : 1

*** In 2/r_m**

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خصائص جداول الحياة و سلوك المفترس الاكاروسى *Lasioseius athiasae* المتواجد باللأراضى المعشبة عند تغذيته علي انواع مختلفة من الغذاء.

علياء عبد القادر توفيق, أميرة الدسوقى مصباح , دعاء عبد المقصود أبو العطا و ولاء رشدى ابو زيد
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يتواجد المفترس الاكاروسي *Lasioseius athiasae* Nawar and Nasr مرتبط بالنباتات العشبية و الاوراق النباتية المتساقطه و حطام اشجار الفاكهة المتساقطة . ووجد ان يرقة المفترس تتغذي و تتطور بتغذيتها علي العديد من الفرائس ومنها حوريات اكاروس الاعفان *Tyrophagus putrescentiae* Schrank التابع لعائلة اكاريدي ، حوريات اكاروس الابصال *Rhizoglyphus robini* Claparede , و حوريات العنكبوت الاحمر ذو البقعتين *Tetranychus urticae* Koch و اخير بيض نيماتودا تعقد الجذور *Meloidogyne incognita* Chitwood . وقد اوضحت النتائج انه بالتغذية علي كلا من اكاروس الاعفان و اكاروس الابصال تستطيع الاطوار الغير كاملة للمفترس الاكاروسى المستخدم في الدراسة التطور بسرعه عند مقارنتها بانواع الفرائس الاخري. وكذلك اتضح من خلال تغذية انثى المفترس الاكاروسى اثناء فترة وضع البيض انها تستهلك حوالى 90 حوريه من اكاروس الاعفان و حوالى 102 حورية من اكاروس الابصال و حوالى 18 حورة من العنكبوت الاحمر ذو البقعتين وتعتبر القدره الغذائيه لذكور المفترس الاكاروسى منخفضه عند مقارنتها بقدرة اناث المفترس الاكاروسى علي التغذية خلال كل الاطوار وكان متوسط عدد البيض الذى تضعه انثى المفترس الاكاروسى هى 3.21 و 1.63 و 1.26 بيضة بالتغذية علي الثلاث فرائس الاكاروسية السالفة الذكر ، كما سجل اقل متوسط لوضع البيض لانثى المفترس الاكاروسى بالتغذيه على بيض نيماتودا تعقد الجذور حيث كان 0.35 بيضة. كما اوضحت الدراسة ان معدل الزياده الطبيعى لاناث المفترس الاكاروسى تتزايد بالتغذية علي كلا من حوريات اكاروس الاعفان و اكاروس الابصال حيث كان معدل الزياده الطبيعى 0.164 و 0.137 فرد/ انثى / يوم لكلا من الفريستين علي التوالي بالرغم من ان هذا المعدل قل بالتغذية علي بيض نيماتودا تعقد الجذور حيث سجل 0.36 بيضة/ انثى / يوم اما بالنسبة للتغذية على حوريات العنكبوت الاحمر ذو البقعتين فكان معدل الزيادة الطبيعى 0.102 بيضة / انثى / يوم. و من هنا نستنتج انه بتغذية المفترس الاكاروسى على كلا من اكاروس الاعفان و اكاروس الابصال ينتج اعلى معدل لتكاثر المفترس الاكاروسى مقارنة بباقى انواع الفرائس الاخرى .