SINAI Journal of Applied Sciences 12 (2) 2023 197-204

Available online at www.sinjas.journals.ekb.eg

SCREENED BY SINAI Journal of Applied Sciences

Print ISSN 2314-6079
Online ISSN 2682-3527

EFFECT OF DIFFERENT FOOD TYPES ON DEVELOPMENT AND LIFE TABLE PARAMETERS OF *Tyrophagus tropicus* ROBERTSON

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ARTICLE INFO

Article history:
Received: 19/03/2023
Revised: 30/03/2023
Accepted: 12/04/2023

Keywords:
Tyrophagus tropics,
Acari,
Biology.

ABSTRACT

The developmental stages of the acarid mite, *Tyrophagus tropics* Robertson (family Acaridae) included egg, larvae, protonymph, tritonymph and adult stage. Mites reared at different food types under 26±2°C., and 75±5% RH. The growth and development from egg to adult involved incubation, larval, protonymphal, deutonymphal and tritonymphal stages were 7.28 ± 0.24, 7.39 ± 0.31, 8.92±0.21 and 8.83 ± 0.27 days for female while it was 6.86 ± 0.18, 6.81± 0.18, 8.57 ± 0.25 and 8.29 ± 0.13 days for male when fed on yeast, luncheon, Hard cheese and peanuts, respectively. The preoviposition period was 2.06±0.13, 3.78 ± 0.26, 3.22 ± 0.59 and 3.06 ± 0.13 days, respectively. Generation time was averaged 9.33 ± 0.20, 11.17 ± 0.39, 12.14 ± 0.58 and 11.89 ±0.26 days respectively, at the previous pattern. Oviposition period averaged 7.00 ± 266, 9.83 ± 2.41, 7.25±1.82 and 7.33 ±1.78 days respectively. The post-oviposition period averaged 2.00±1.13, 2.42±1.51, 2.17±1.34 and 2.25 ± 1.66 days, when all the individual reread on yeast, luncheon, hard cheese and peanuts, respectively.

INTRODUCTION

Mites infest many types of stored items, including grain and grain-based commodities, in any respect levels of processing.Some mites produce direct damage through attacking grain, while other screate indirect damage by contaminating food and extracting it. Contaminated food can render livestock unappealing and even unfit for human consumption. Occupational illnesses such as dermatitis and allergic symptoms can be caused by stored product mites in workers who operate in the grain or food processing sectors **(Webester *et al*., 2004).**

Mites inflict direct damage to produce by devouring it; they rarely penetrate bulk flour deeper than 5–10 cm. Only the broken grain is targeted, but once outside the seed coat, the embryo is devoured, preventing germination and reducing nutritional value. The foggy aromas of heavily infested produce contaminate it, and food contamination is often the main impact. Interaction with micro organisms that results in the transfer of mycotoxins produced by fungi or harmful bacteria **(Hubert *et al*., 2013).**

In many preserved items, mites are a major source of qualitative and quantitative losses. The damages of the mite pests infesting stored products were summarized indirect consumption on human food, animal feed, or other changing that appear on the quality of infested products. Mites can reach and feed on the grain kernels throw the hard grains and destroy their germination power, changing medium

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https://doi.org/10.21608/SINJAS.2023.199897.1196

moisture contents, initiating growth, and spreading mould **(Taha, 1985; Luczynska, *et al*., 1990; Musken *et al*., 2003)**.

The astigmatic mites are considered to be economically important pests, decreasing the quality of stored grain when present in large numbers **(Hage-Hamsten and Johansson, 1992; Tee, 1994; Miller, 1995).**

In this work, the authors studied the effects of various food the types duration and development of *Tyrophagus tropics* Robertson (Astigmatind: Tyroglyphidae).

MATERIALS AND METHODS

Mite species were collected from rice grains, wheat grains and animal feed. For obtaining pure culture female and male adults were placed in the rearing plastic cups (3× 3 ×0.5 cm) filled with a mixture of (Cement: Charcoal in a ratio of 9: 1) as a substrate. A few grams of different tested food types *i.e.*, yeast, luncheon, hard cheese and peanuts were added to the rearing cups with a drop of water as a source of humidity. The adult male and female were left for mating, and after that the female allowed for egg laying then the deposited eggs were removed singly to an empty rearing plastic cup using a camel hair brush (No.00). Thirty rearing cups were used as replicates for each type of tested food, using a steromicroscope, the replicates were noticed twice a day buy adding the tested food, drop of water and recording the duration of developmental stages, longevity and fecundity. To stabilize the temperature and the relative humidity at 26±2˚c and 75% ± 5 RH., the replicat were kept in an incubator.

Statistical Analysis

Statistical analysis of results in all experiments was conducted using Proc ANOVA and GLM in SAS **(SAS Institute, 1998)**. Mean separation was conducted using Duncan Multiple Range Test in the same program.

All results were subject analysis using Proc ANOVA and GLM in SAS **(SAS Institute, 1988)**.

RESULTS AND DISCUSSION

Data Recording

The development of the mites was observed and monitored three times a day in 8-hour intervals using a standard binocular microscope. Once the mites reached adulthood, daily records were kept of their pre-oviposition, oviposition and post-oviposition periods, as well as their fecundity. This allowed for a detailed understanding of the mites' reproduction process and their reproductive potential.

Data Analysis

One-way analysis of variance (ANOVA) and mean comparison using Fisher's least significant difference (LSD) were conducted for development time, the number of eggs deposited and number of preys consumed, using the Super ANOVA program (**Gagnon *et al.,* 1989**). Significance level was $P \leq 0.05$.

The life table parameters of *Tyrophagus tropics* Robertson was calculated with Two-sex software, developed by Chi 1997. The program calculates the intrinsic rate of increase (r_m), the finite rate of increase (λ), the net reproductive rate (R_o) and the mean generation time (T). The life table was constructed according to **Birch (1948)**.

Developmental Time of Different Stages of *Tyrophagus tropics* Robertson Fed on Four Type of Food at 26 ± 2°C and 75±5 % RH.

Results revealed that there were significant differences from male to female duration periods for all the food types, when the individual reared on yeast, luncheon, hard cheese and peanuts at 26 ± 2°C and 75±5 % RH.

Incubation period

The eggs of *Tyrophagus tropics* Robertson were hatched after 1.33± 0.00, 1.33± 0.00, 1.36± 0.10 and 1.33 ± 0.00 days at 26 ± 2°C with 75±5% RH., respectively for female, while they were 1.33± 0.00, 1.33± 0.00, 1.33± 0.00 and 1.33 ± 0.00 days at 26 ± 2°C with 75±5% RH., respectively for male on yeast, luncheon, hard cheese and peanuts. There were insignificant differences among the tested food types as shown in Table 1.

Larval stage

The total larval periods were 1.44± 0.16, 1.78± 0.26, 2.11± 0.16 and 3.00 ± 0.00 days for female, while it was 1.33± 0.00, 1.52± 0.18, 2.19± 0.18 and 2.67 ± 0.00 days for male when feed on yeast, luncheon, hard cheese and peanuts, respectively. When the larval stage feed on four different foods (yeast, luncheon, Hard cheese and peanuts) the results showed significant differences, the Hard cheese had the longest period and yeast had the shortest one.

Protonymphal stage

The female protonymph (Table 1) lasted for 2.89± 0.26, 2.72± 0.13, 3.11± 0.26 and 2.61±0.13 days when fed on the same tested food types at 26 ± 2°C with 75 ± 5% RH.

The male protonymph lasted 2.62± 0.23, 2.48± 0.18, 2.52± 0.18 and 2.29 ± 0.13 days at the same trend. The previous results showed that there were significant differences between the different tested diets at the protonymphal periods.

Tritonymphal stage

The female tritonymph (Table1) lasted for 1.61± 0.13, 1.56± 0.16, 2.33± 0.00 and 1.89 ± 0.33 days when feed on yeast, luncheon, hard cheese and peanuts, respectively at 26 ± 2°C with 75 ± 5 % RH.

The male tritonymph lasted 1.57± 0.16, 1.48± 0.18, 2.52± 0.18 and 2.00 ± 0.19 days at the same trend. The previous results showed that there were significant differences between the different tested diets at the tritonymphal periods.

Duration of total immatures

Female immature stages lasted for 5.94± 0.24, 6.06 ± 0.31, 7.56± 0.26 and 7.50 ± 0.27 days, while those of male lasted 5.52± 0.18, 5.48± 0.18, 7.24± 0.25 and 6.95 ± 0.13 days at 26 ± 2°C with 75±5 % RH. on yeast, luncheon, hard cheese and peanuts, respectively.

In general, the time required for the female immature stage was longer than that of male stage at different tested diet and the differences were significant as shown in Table 2.

Life cycle

Female life cycle (which included incubation, larval, protonymphal and Tritonymphal stages) was completed in 7.28± 0.24, 7.39± 0.31, 8.92± 0.21 and 8.83 ± 0.27 days, while male life cycle was completed in 6.86± 0.18, 6.81± 0.18, 8.57± 0.25 and 8.29 ± 0.13 days at 26 ± 2°C with 75±5% RH. on yeast, luncheon, Hard cheese and peanuts, respectively (Table 2).

In general, it can be deduced that peanuts provide the longest life cycle, and the differences between the tested diets were significant.

Longevity

The longevity period (Table 2) averaged 11.06± 3.69, 16.03± 3.80, 12.64± 2.57 and 12.64 ± 3.14 days for female while it was 5.14± 1.35, 5.14± 0.69, 4.00± 0.00 and 7.29 ± 1.70 day for male at 26±2°C. and 75±5% RH., on yeast, luncheon, Hard cheese and peanuts, respectively.

In general, it can be concluded that the diet luncheon, and for females, and the diet hard cheese for males giving the longest longevity and the differences between the rest tested diets were significant.

Table 1. Developmental time of different stages of *Tyrophagus tropicus* Robertson fed on four Type of food at 26 ±2°C, and 75 ± 5 % RH.

Food type	Developmental time of *Tyrophagus tropics* Robertson stages (day)			
	Female		Male	
	No.	Mean ± SD	No.	Mean ± SD
		Egg		
Yeast	(12)	$1.33 \pm 0.00_{a}$	(7)	$1.33 \pm 0.00_{a}$
Luncheon	(12)	$1.33 \pm 0.00_{a}$	(7)	$1.33 \pm 0.00_{a}$
Peanuts	(12)	$1.36 \pm 0.10_{a}$	(7)	$1.33 \pm 0.00_{a}$
Hard cheese	(12)	$1.33 \pm 0.00_{a}$	(7)	$1.33 \pm 0.00_{a}$
		Larvae		
Yeast	(12)	$1.44 \pm 0.16_{d}$	(7)	$1.33 \pm 0.00_{d}$
Luncheon	(12)	$1.78 \pm 0.26_{c}$	(7)	$1.52 \pm 0.18_{c}$
Peanuts	(12)	$2.11 \pm 0.16_{b}$	(7)	$2.19 \pm 0.18_{b}$
Hard cheese	(12)	$3.00 \pm 0.00_{a}$	(7)	$2.67 \pm 0.00_{a}$
		Protonymph		
Yeast	(12)	$2.89 \pm 0.26_{b}$	(7)	$2.62 \pm 0.23_{a}$
Luncheon	(12)	$2.72 \pm 0.13_{bc}$	(7)	$2.48 \pm 0.18_{ab}$
Peanuts	(12)	$3.11 \pm 0.26_{a}$	(7)	$2.52 \pm 0.18_{a}$
Hard cheese	(12)	$2.61 \pm 0.13_{c}$	(7)	$2.29 \pm 0.13_{b}$
		Tritonymph		
Yeast	(12)	$1.61 \pm 0.13_{c}$	(7)	$1.57 \pm 0.16_{c}$
Luncheon	(12)	$1.56 \pm 0.16_{c}$	(7)	$1.48 \pm 0.18_{c}$
Peanuts	(12)	$2.33 \pm 0.00_{a}$	(7)	$2.52 \pm 0.18_{a}$
Hard cheese	(12)	$1.89 \pm 0.33_{b}$	(7)	$2.00 \pm 0.19_{b}$

- The numbers of individuals in each treatment are shown in brackets
- Means followed by a different subscript letter in columns only within each life stage are significantly different ($P \leq 0.05$).
- Means in column # followed by different subscript capital letters within a row are significantly different from each sex in each food type, compared using Student's t-test.

Table 2. Developmental time of different stages of *Tyrophagus tropics* Robertson fed on four Type of food at 26 ±2°C, and 75 ± 5 % RH

Food type	Developmental time of *Tyrophagus tropics* Robertson stages (day)			
	Female		Male	
	No.	Mean ± SD	No.	Mean ± SD
		Immature stage		
Yeast	(12)	5.94 ± 0.24 $_b$	(7)	5.52 ± 0.18 $_c$
Luncheon	(12)	6.06 ± 0.31 $_b$	(7)	5.48 ± 0.18 $_c$
Peanuts	(12)	7.56 ± 0.26 $_a$	(7)	7.24 ±0.25 $_a$
Hard cheese	(12)	7.50 ± 0.27 $_a$	(7)	6.95 ± 0.13 $_b$
		Life cycle		
Yeast	(12)	7.28 ± 0.24 $_b$	(7)	6.86 ± 0.18 $_c$
Luncheon	(12)	7.39 ± 0.31 $_b$	(7)	6.81 ± 0.18 $_c$
Peanuts	(12)	8.92 ± 0.21 $_a$	(7)	8.57 ± 0.25 $_a$
Hard cheese	(12)	8.83 ± 0.27 $_a$	(7)	8.29 ± 0.13 $_b$
		Longevity		
Yeast	(12)	11.06 ± 3.69 $_b$	(7)	5.14 ± 1.35 $_b$
Luncheon	(12)	16.03 ± 3.80 $_a$	(7)	5.14 ± 0.69 $_b$
Peanuts	(12)	12.64 ± 2.57 $_b$	(7)	4.00 ± 0.00 $_b$
Hard cheese	(12)	12.64 ± 3.14 $_b$	(7)	7.29 ± 1.70 $_a$
		Life span		
Yeast	(12)	18.33 ± 3.67 $_b$	(7)	12.00 ± 1.29 $_b$
Luncheon	(12)	23.42 ± 3.70 $_a$	(7)	11.95 ± 0.59 $_b$
Peanuts	(12)	21.56 ± 2.56 $_a$	(7)	12.57 ± 0.25 $_b$
Hard cheese	(12)	21.47 ± 3.11 $_a$	(7)	15.57 ± 1.75 $_a$

- The numbers of individuals in each treatment are shown in brackets
- Means followed by a different subscript letter in columns only within each life stage are significantly different ($P \leq 0.05$).
- Means in column # followed by different subscript capital letters within a row are significantly different from each sex in each food type, compared using Student's t-test

Life span

The life span (Table 2) averaged (including the period of life cycle and longevity) 18.33± 3.67, 23.42± 3.70, 21.56± 2.56 and 21.47 ± 3.11 days for female while it was 12.00± 1.29, 11.95± 0.59, 12.57± 0.25 and 15.57 ± 1.75 days for male at 26±2°C., and 75±5% RH., when all the individuals reread on yeast, luncheon, Hard cheese and peanuts, respectively.

In general, the time required for female life cycle, longevity and life span was longer than the male at different tested diets and the differences were significant as shown in Table 2.

Life table parameters

At 26 ± 2°C and 75 ± 5% RH. The preoviposition period (Table 3). Averaged 2.06±0.13, 3.78±0.26, 3.22±0.59 and 3.06 ± 0.13 days.

Average of generation time was 9.33± 0.20, 11.17±0.39, 12.14±0.58 and 11.89 ± 0.26 day. Average of oviposition period was 7.00±2.66, 9.83±2.41, 7.25±1.82 and 7.33±1.78 days. Average of post-oviposition period was 2.00±1.13, 2.42±1.51, 2.17± 1.34 and 2.25 ±1.66 days.

When all the individuals reread yeast, luncheon, hard cheese and peanuts, respectively.

The previous results showed that there were significant differences between the effects of different tested temperature degrees as shown in Table 3.

Table 3. Life table parameters of *Tyrophagus tropics* Robertson feeding on yeast, luncheon, hard cheese and peanuts

Food type	Duration time of adult female *Tyrophagus tropics* Robertson (day)			
	No.	Mean ± SD	Max.	Min.
		Pre oviposition period		
Yeast	(12)	2.06 ±0.13 $_{c}$	2.33	2.00
Luncheon	(12)	3.78 ±0.26 $_{a}$	4.33	3.67
Peanuts	(12)	3.22 ±0.59 $_{b}$	3.67	2.00
Hard cheese	(12)	3.06 ±0.13 $_{b}$	3.33	3.00
		Generation time		
Yeast	(12)	9.33 ±0.20 c	9.67	9.00
Luncheon	(12)	11.17 ±0.39 b	11.67	10.67
Peanuts	(12)	12.14 ±0.58 a	12.67	11.00
Hard cheese	(12)	11.89 ±0.26 a	12.00	11.33
		Oviposition period		
Yeast	(12)	7.00 ±2.66 $_{b}$	10.00	1.00
Luncheon	(12)	9.83 ±2.41 $_{a}$	12.00	5.00
Peanuts	(12)	7.25 ±1.82 $_{b}$	9.00	3.00
Hard cheese	(12)	7.33 ±1.78 $_{b}$	9.00	3.00
		Post-oviposition period		
Yeast	(12)	2.00 ±1.13 $_{a}$	3.00	0.00
Luncheon	(12)	2.42 ±1.51 $_{a}$	4.00	0.00
Peanuts	(12)	2.17 ±1.34 $_{a}$	3.00	0.00
Hard cheese	(12)	2.25 ±1.66 $_{a}$	4.00	0.00

Means followed by a different subscript letter only within each period are significantly different ($P \leq 0.05$).

SUMMARY

In this investigation, biological studies focused on the astigmatic mite *Tyrophagus tropics* Robertson a laboratory setting feeding on four different types of food: yeast, luncheon meat, Hard cheese, and peanuts.

The results obtained indicated that the life cycle of *Tyrophagus tropics* Robertson consists of egg, larvae, protonymph, tritonymph, and adult stages, all of which are impacted by the type of food consumed. Additionally, fecundity, life span, and longevity were found to be affected by the food types.

Life cycle

The life cycle duration was 7.28± 0.24, 7.39± 0.31, 8.92± 0.21 and 8.83 ± 0.27 days while it was 6.86± 0.18, 6.81±0.18, 8.57± 0.25 and 8.29 ± 0.13 days for female and males, respectively at 26 ± 2°C with 75 ± 5% RH.

Longevity

The longevity period average where 11.06± 3.69, 16.03± 3.80, 12.64± 2.57 and 12.64 ± 3.14 days for female while it was 5.14± 1.35, 5.14± 0.69, 4.00± 0.00 and 7.29 ± 1.70 days for male at 26±2°C. and 75±5% RH., on yeast, luncheon, hard cheese and peanuts, respectively.

Life span

The life span averaged (which included the period of life cycle and longevity) was 18.33± 3.67, 23.42± 3.70, 21.56± 2.56 and 21.47 ± 3.11 days for female while it was 12.00± 1.29, 11.95± 0.59, 12.57± 0.25 and 15.57 ± 1.75 days for male at 26±2°C., and 75± 5% RH., when all the individual reread on yeast, luncheon, Hard cheese and peanuts, respectively.

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الملخص العربي

تأثير أنواع الغذاء المختلفة على التنمية ومعايير جدول الحياة لـ *Tyrophagus tropicus* Robertson

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تم تربية الحلم الأكاريدى *Tyrophagus tropics* Robertsonالتابع لفصيلة Acaridaeعلى أربع أنواع مختلفة من المواد الغذائية تحت ظروف المعمل على درجة حرارة 26±2°C ورطوبة نسبية 5% RH ±75. وتتلخص النتائج في الاتي: هذا الأكاروس يمر في حياته بأربع اطوار مختلفة هي البيضة، اليرقة، الحورية الأولى، الحورية الثالثة ثم الطور البالغ. دورة الحياة من البيضة حتى الوصول الى الطور البالغ استغرقت حوالي 7.28، 7.39، 8.92 و8.85 يوم بالتوالي للأنثى، اما بالنسبة للذكر فقد كانت 6.86، 6.81، 8.57 واخيرا 8.29 يوم للذكر عند التغذية على الخميرة، اللانشون، الجبن الرومي والفول السوداني على الترتيب. أما فترة ما قبل وضع البيض فقد كان المتوسط 2.06، 3.78، 3.22 ثم 3.06 يوم على التوالي. أما فترة وضع البيض فقد كان المتوسط 7.00، 9.83، 7.25 ثم 7.33 يوما على الترتيب السابق. أما فترة ما بعد وضع البيض فقد كان المتوسط 2.00، 2.42، 2.17 ثم 2.20 يوما على الترتيب السابق.

الكلمات الاسترشادية: الحلم الأكاريدى ، بيولوجي *Tyrophagus tropics*.

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