

INFLUENCE OF PREY TYPES AND TEMPERATURES ON THE BIOLOGICAL ASPECTS OF THE PREDATORY MITES *Cheyletus malaccensis* OUDEMANS AND *Neoseiulus Bakeri* (HUGHES) .

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ABSTRACTS

The effect of temperatures and food types were investigated on biological aspects of *Cheyletus malaccensis* and *Neoseiulus barkeri* when fed on eggs and immature stages of the grain mite *Tyrophagus putrescentiae* at 25 & 30°C and 65±5% RH.

Data showed that the predator mite *Ch. malaccensis* passed through one larval and two nymphal stages before being adult female, while the male had one larval and one nymphal stage before being adult.

Female total immature stages lasted 10.9 days at 25°C, while at 30°C this period lasted 9.72 days when predator mite fed on immature stages of *T. putrescentiae*, while when it fed on eggs these periods lasted 10.37 and 9.55 days respectively.

The obtained data cleared that female longevity lasted 52.8 & 47.76 days at 25 and 30°C, when mite fed on immature stages of *T. putrescentiae*, while when it fed on eggs this period lasted 49.11 and 38.43 days at the same pattern.

The effect of temperature and prey types were investigated on biological aspects of the phytoseiid mite *N. barkeri* when fed on eggs and immature stages of the grain mite *T. putrescentiae* at 25 and 30°C and 65±5% RH, whereas, female and male life cycle of *N. barkeri* were (7.4 & 6.7) and (8.1 & 7.5) days when they fed on eggs and immatures at 25°C, while at 30°C, these periods lasted (6.8 & 6.3) and (7.5 & 7.0) days for both sexes female and male respectively.

INTRODUCTION

Mites associated with stored products are great economic importance which cause serious various degrees of damage, not only due to their consumption products, but also contaminate food with their bodies and extractions. During favorable conditions, the mite-population in stored food products may markedly increase, making it unsuitable for human and domestic animal consumption. Moreover, mites of stored food products are known to cause various diseases to persons, handling these products if infested with mites.

Mites of sub-order Astigmata (Acaridida) include more than 40 families has a high intrinsic rate of increase in number and diverse feeding habits and environmental requirements. Some species of astigmatid mites feeding directly on grain kernels and cause great reduction in their weight and germination, El-Sanady (2000).

Oudemans (1906) recorded *Cheyletus malaaccensis* Oud. associated with acarid mites infesting different kinds of dried food stuffs. Also, Rack

(1970) found large number of *Neoseiulus bakeri* (Hughes) associated with six species of acarid mites infesting stored grains.

The present work aimed to study the effect of temperature and two types of food on the biological aspects of the two predator mites *Cheyletus malaccensis* and *Neoseiulus bakeri*.

MATERIALS AND METHODS

1-Isolation of mites:-

For isolating mites, samples of about 250g were taken from each material of stored products and spread (over muslin) in modified berlese funnel, which kept for about 24 hours below 60 watt electric lamp. Then mites received in petri-dishes (10 cm diameter) and smearing its side by ring of vasline mixed with cironella oil to prevent mite escaping.

A piece of moistened cotton was placed in each petri-dish to provide the mites with sufficient moisture. Active adult of mites were transferred by 0.1 mm camel hair brush and examined using steno-microscope.

2-Mounting, preservation and identification:-

Isolated specimens were placed in Nesbitt solution, for 24 hrs. then mounted by placing a drop of Hoyers medium, in the Center of a clean 7x3 microscope glass slide mite individual was pressed carefully to the bottom of the droplet and arranged using a clean pair of foreceps.

The specimens were identified and validated according to general morphology and terminology followed Griffith (1960), Hughes (1976) and Attiah (1969).

3-Biological studies:

Biological studies were carried out on two predator mite species:

1-*Cheyletus malaccensis* Sub-order Actinedida (Prostigmata) belong to family cheyletidae.

2-*Neoseiulus bakeri* sub-order Camasida (mesostigmata) belong to family phytoseiidae.

Cheyletus malaccensis and *Neoseiulus bakeri* were fed on eggs and immature stages of the grain mite *T. putrescentiae* at 25 & 30°C and 65±5% RH. Mites were reared singly using small units of hemisphaerical plastic chambers (1.3 cm diameter x0.4 cm depth). Previously used by Kandil, 1974, were adopted. The scratched bottom of each chamber covered with small slide glass. The plastic chamber was covered with glass slide and fitted with rubber bands. Thirty five replicates were used for each biological experiment of both predatory mites, *Cheyletus malaccensis* and *Neoseiulus bakeri*.

The plastic units were investigated twice daily for supplying preys and recorded the biological aspects of the predatory mites.

4-Statistical analysis:

All presented data were subjected to one-way analysis of variance (ANOVA) and means were separated by Duncan's multiple range test Duncan, (1955) and Anon (1985).

RESULTS AND DISCUSSION

1- Effect of prey types and temperature on biological developmental stages of the predator mite *Cheyletus malaccensis*:-

Cheyletus malaccensis reared on eggs and immature stages, of the grain mite *Tyrophagus putrescentiae* (Shrank) at 25°C and 30°C and 65±5% RH.

Incubation period:

The obtained data are arranged according to the more favourable diet, and suitable degree of temperature. The incubation period at 25°C was (3.21 & 3.21) and (3.71 & 3.65) days when mites fed on eggs and immature stages of the grain mite *T. putrescentiae*, respectively, whereas at 30°C, it durated (3.31 & 3.10) and (3.35 & 2.88) days when reared on eggs and immature stages of the previous prey ,respectively..

Larval stage:

The duration of larval female stage at 25°C was 4.49 & 5.24 days when fed on eggs and immature stages, but at 30°C this period lasted 4.2 and 4.475 days when mite fed on the above mentioned diets respectively.

Protonymphal stage:

The protonymphal is more larger in size than larva and has four paired of legs. The duration of active protonymph stage lasted 3.41 & 3.52 days at 25°C when mite fed on eggs, while when it fed on immatures it durated (3.58 & 3.70) days for both sexes female and male respectively, Tables (1 & 2), it was obviously that significant effects on the duration of the protonymphal stage were recorded for temperature than applied foods.

Table (1): Duration of different stages of the predatory mite *C. malaccensis* when fed on eggs of *T.putrescentia* at 25 and 30°C and 65+5% RH.

Stage	25°C		30°C		
	Female	Male	Female	Male	
Incubation period	3.21+0.031	3.21+0.021	3.31+0.36	3.10+0.03	
Larva	A	3.19+0.026	3.01+0.141	3.10+0.09	
	Q	1.3+0.012	1.14+0.213	1.10+0.03	1.21+0.331
Protonymph	A	3.41+0.036	3.52+0.045	3.81+0.091	3.21+0.0701
	Q	1.18+0.066	1.03+0.036	1.22+0.043	1.06+0.039
Deutonymph	A	3.77+0.23		3.24+0.092	
	Q	1.221+0.053		1.20+0.31	
Total immature stages	A	10.37+0.292	6.53+0.459	9.55+0.273	5.83+0.74
	Q	3.701+0.131	2.17+0.267	3.52+0.104	2.27+0.37
Life cycle		17.281+0.46	11.91+0.783	16.38+0.467	11.2+1.14
Generation P.		21.481+0.68		19.68+0.647	
Longevity		49.11+4.705	15.32+0.36	38.43+0.501	11.93+0.36
Life span		66.391+5.16	27.23+1.143	54.81+0.968	23.13+15

Table (2): Duration of different stages of the predatory mite *C. malaccensis* when fed on immature stages of *T. putrescentiae* at 25 and 30°C and 65±5% RH.

Stage	25°C		30°C	
	Female	Male	Female	Male
Incubation period	3.71±0.099	3.65±0.0839	3.35±0.10	2.87±0.08
Larva	A	3.65±0.0839	3.12±0.086	3.28±0.075
	Q	1.59±0.0064	1.31±0.067	1.195±0.05
Protonymph	A	3.58±0.010	3.705±0.064	3.175±0.049
	Q	1.275±0.064	1.19±0.0658	1.03±0.056
Deutonymph	A	3.70±0.118		3.34±0.094
	Q	1.215±0.054		1.01±0.062
Total immature stages	A	10.90±0.40	6.82±0.36	9.72±0.41
	Q	4.07±0.02	2.96±0.03	3.14±0.069
Life cycle		18.73±0.21	12.80±0.107	16.34±0.182
Generation P.		23.38±0.26		20.28±0.179
Longevity		52.805±1.26	17.95±0.88	47.76±0.94
Life span		72.99±1.38	30.55±0.786	64.10±1.85

Table (3): Duration of life span and number of deposited eggs of *C. malaccensis* when fed on eggs and immature stages of *Tyrophayus putrescentiae* at 25 and 30°C and 65±5% RH.

Predator stages	Sex	Average period/days			
		Eggs of <i>T. putrescentiae</i>		Immature stages of <i>T. putrescentiae</i>	
		25°C	30°C	25°C	30°C
Preoviposition	Female	4.2±0.223	3.30±0.18	5.1±0.103	4.012±0.08
Oviposition	Female	39±4.352	31.11±0.19	42.3±2.301	37.211±0.45
Postoviposition	Female	5.01±0.13	4.02±0.13	5.43±0.09	5.01±0.109
Longevity	Female	49.11±4.705	38.4±0.501	52.805±1.21	47.76±0.94
	Male	15.32±0.36	11.93±0.36	17.95±0.88	13.86±0.54
Life span	Female	66.391±5.16	54.81±0.968	72.99±1.38	64.10±1.85
	Male	27.23±1.143	23.13±15	30.55±0.786	25.35±0.552
No. Of eggs/ female	Female	174.4±7.44	201±16.302	161.5±5.43	183.4±12.40
Daily rate	Female	4.34	6.46	3.81	4.92

Deutonymphal stage:

It was concluded that the increase of temperature from 25°C to 30°C showed a significant effect on the duration of deutonymphal stage and also for the applied diets, whereas, female deutonymphal stage lasted 4.99 and 4.44 days at 25°C and 30°C when mite fed on eggs and immature stage of *T. putrescentiae*.

The total period of immature stages, female ranged from 14.07 to 13.07 and from 14.97 to 12.86 days when mite fed on eggs and immature at 25°C and 30°C, Table (1 & 2), while those of the male from 8.7 to 9.78 days and from 9.1 to 8.46 days when mite was reared on the previous preys and temperatures respectively.

Life cycle:

At 25°C, the duration of life cycle of *Ch. malaccensis* were 17.28 & 11.91 days for female and male when they fed on eggs while, dурated 18.73 and 12.8 days when they fed on immatures. The duration of the life cycle is greatly affected by type of food when mite fed on eggs and immatures as food types.

Longevity:

The longevity of the predator mite *Ch. malaccensis* at 25°C when fed on eggs and immature stages were 49.11 & 15.32 days and 52.8 & 17.95 days for female and male respectively. While, at 30°C it dурated 38.43 & 11.93 days on eggs and 47.76 & 13.86 days on immatures for both female and male respectively, Tables (3).

Life span:

Individual of *Ch. malaccensis* reared at 25°C on eggs and immature stages of *T. putrescential* showed that life span dурated 66.39 & 27.23 days and 72.99 & 30.35 days for female and male, respectively but at 30°C it being 54.81 & 23.13 and 64.1 & 25.35 days on the above mentioned preys, respectively. These results agree with Yousef *et al* (1982) and Soliman (1987).

Fecundity:

Female laid 174.4 & 161.5 eggs when fed on eggs and immatures at 25°C while at 30°C female deposited an average of 201 & 183.4 eggs when she fed on eggs and immatures at 30°C.

Food consumption of *Chetyletus malaccensis*:

To determine the number of prey individuals consumed by *Chetyletus malaccensis* during its duration, an experiment was conducted in the laboratory at 25 and 30°C and 65±5% RH, using two kinds of preys, eggs and immature stages of the grain mite *Tyrophagus putrescentiae*, as indicated in table (4). Data cleared that predators are very useful in mass-rearing in laboratory and using as biological control agents.

Female immature stages of mite consumed a total average number 47.5 and 40.7 eggs at 25 and 30°C while they consumed 12.2 and 13.7 of immature stages of *T. putrescentiae* at the same pattern.

Table (4): Number of preys consumed per female and male of *C. malaccensis* when fed on immature stages of *T. putrescentiae* during life span at 25°C and 65±5RH

Stage	25°C		30°C	
	Female	Male	Female	Male
Larva	3.2	2.6	3.8	2.9
Protonymph	3.8	3.4	4.1	3.9
Deutonymph	5.2	-	5.8	-
Total immature stages	12.2	6.0	13.7	6.8
Pre-oviposition	30.5	-	42.8	-
Oviposition	206.2	-	297.3	-
Post-oviposition	29.3	-	21.7	-
Longevity	266	52.4	361.8	48.02
Total	278.2	58.4	375.5	54.82

Male of *Cheyletus malaccensis* followed the similar trend, but it relatively consumed lower numbers of prey when compared with those consumed by female, whereas, it consumed 26.7 and 29 eggs at 25 and 30°C, but it destructive 6.0 and 6.8 immature stages of the previous prey.

Data in table (4) showed that temperature affected on the feeding capacity of adult female which devoured 30.5, 206.2 and 29.3 eggs during its preoviposition, oviposition and postoviposition, when reared at 25°C while at 30°C, she consumed 42.8, 297.3 and 21.7 eggs of the previous prey.

**2- Biological studies on the predator mite *Neoselulus bakeri* (Hughes):
(Family phytoseiidae: Mesostigmata).**

These studies were carried out on the predatory mite *N.bakeri* where it fed on eggs and immature stages of the grain mite *Tyrophagus putrescentiae* at 25°C and 30°C and 65±5% RH.

Biological aspects:

Incubation period:

Obtained data in Tables (5 & 6) showed that eggs and immature stages of the grain mite *T.putrescentiae* had no effect on incubation period, whereas the incubation period of *N. bakeri* was recorded 1.9 and 2.0 days when mite fed on eggs and immature stages. It is clear that the incubation period was affected by temperature had 1.8 days when mite fed on eggs and 1.9 days when it fed on immature stages at 25 and 30°C respectively.

Larval stage:

During this stage which lasted (1.2 & 1.1) and (1.3 & 1.2) days for both female and male when they fed on eggs and immature stages of *T. putrescentiae* at 25°C. It was noticed that as the increase of temperature from 25°C to 30°C enhanced the development of this stage 1.2, 1.1 and 1.2 days at 25°C compared with (1.1 & 1.0) and (1.2 & 1.1) days for both female and male when they fed on the above mentioned diets, Tables (6 & 7).

Protonymphal stage:

The duration of female protonymphal stage averaged 1.8 & 2.1 days at 25°C but it being 1.6 and 1.9 days at 30°C (Tables 5 & 6), in case of male protonymphal period averaged 1.5 & 1.8 days at 25°C and it averaged 1.4 and 1.6 day at 30°C when fed on eggs and immature stages of *T. putrescentiae*, respectively, respectively.

It was noted that the duration of protonymphal stage was affected by temperature, it was longest at 25°C than that at 30°C, also noted that, this period was affected by the type of food.

Deutonymphal stage:

The deutonymphal stage differ from the protonymphal in being larger in size. Obtained results proved that, the period was affected by both temperature and types of food. Deutonymphal stage averaged (2.5 & 2.2) and (2.7 & 2.5) days for female and male, when they fed on eggs and immature stages at 25°C and (2.3 & 2.1) and (2.5 & 2.4) days at 30°C, when female and male fed on the abovementioned diets respectively.

Table (5): Duration of life span and number of deposited eggs of *N. barkeri* (Hughes) when fed on eggs and immature stages of *Tyrophayus putrescentiae* at 25 and 30°C and 65±5% RH.

Predator stages	Sex	Average period/days			
		Eggs of <i>T. putrescentiae</i>		Immature stages of <i>T. putrescentiae</i>	
		25°C	30°C	25°C	30°C
Preoviposition	Female	3.7±0.56	3.5±0.45	3.9±0.55	3.8±0.03
Oviposition	Female	16.8±1.72	17.6±0.36	18.5±0.80	19.4±0.96
Postoviposition	Female	5.1±0.87	4.8±0.36	5.6±0.56	5.2±0.83
Longevity	Female	25.6±0.56	25.9±2.36	28.0±0.55	28.4±1.36
	Male	13.2±1.62	12.5±0.69	15.1±0.56	13.8±0.66
Life span	Female	33.0±3.69	38.7±2.97	36.1±2.50	35.9±3.54
	Male	20.4±2.30	18.8±1.00	22.6±0.51	21.3±0.54
No. of eggs/ female	Female	48.6±3.70	55.4±6.32	39.8±1.23	58.2±4.37
Daily rate	Female	2.9±0.54	3.1±0.012	2.2±0.63	3.0±0.59

Table (6): Duration of life cycle and generation period of *N. barkeri* (Hughes) fed on eggs and immature stages of *Tyrophayus putrescentiae* at 25 and 30°C and 65±5% RH.

Predator stages	Sex	Average period/days			
		Eggs of <i>T. putrescentiae</i>		Immature stages of <i>T. putrescentiae</i>	
		25°C	30°C	25°C	30°C
Incubation period		1.9±0.49	1.8±0.40	2.0±0.44	1.9±0.50
Larva	Female	1.2±0.56	1.1±0.55	1.3±0.45	1.2±0.54
	Male	1.1±0.50	1.0±0.47	1.2±0.54	1.1±0.51
Protonymph	Female	1.8±0.63	1.6±0.63	2.1±0.81	1.9±0.52
	Male	1.5±0.50	1.4±0.66	1.8±0.80	1.6±0.54
Deutonymph	Female	2.5±0.56	2.3±0.62	2.7±0.45	2.5±0.25
	Male	2.2±0.72	2.1±0.59	2.5±0.44	2.4±0.12
Total immature	Female	5.5±0.79	5.0±0.73	6.1±0.65	5.6±0.03
	Male	4.8±0.45	4.5±0.54	5.5±0.56	5.1±0.25
Life cycle	Female	7.4±0.54	6.8±0.90	8.1±0.86	7.5±0.82
	Male	6.7±0.66	6.3±0.51	7.5±0.56	7.0±1.00
Generation period	Female	11.1±0.73	10.3±0.78	12.0±0.73	11.3±0.96

Total immature stages:

The duration of total immature stages lasted 5.5 and 6.1 days for female, when it fed on eggs and immature stages at 25°C, while at 30°C. This period lasted 5.0 and 5.6 days when it fed on the abovementioned diets. It clear that the duration of immature stages was markedly affected by temperature and type of food.

Life cycle:

Obtained data in Tables (5 & 6) clear that female and male life cycle of *N. barkeri* when reared at 25°C and fed on eggs and immature stages of *T.*

putrescentiae duraated (7.4 & 6.7) and (8.1 & 7.5) days. At 30°C this period decreased to (6.8 & 6.3) and (7.5 & 7.0) days for both sexes female and male respectively.

Life span:

Females life span reared at 25°C and fed on eggs of *T. putrescentiae* durated 33.0 days, but when fed on the same diet at 30°C female life span lasted 38.7 days, whereas female life span lasted 36.1 to 35.9 days when fed on immature stages at 25 & 30°C respectively Table (5 & 6).

These results confirmed by Abd-Allah (2004) who studied the biology of phytoseiid mite *N. communsis* reared on immature stages of *T. putrescentiae* at five constant temperature (18, 22.28 and 32°C), while Azouz (2005) studied the effect of five constant temperature on developmental stages and fecundity of phytoseiid mite *N. neorticulatus* (Y & E).

Fecundity:

Female of the predatory mite *N. Bakeri* deposited an average of eggs 48.6, 55.4 when she fed on eggs at 25 & 30°C, while, when she fed on immatures, female deposited 39.8 & 58.2 eggs at the same trend.

Food consumption of *Neoseiulus bakeri* :

As shown in table (7) *Neoseiulus bakeri* was successfully reared and reproduced on eggs and immatures of *Tyrophagus putrescentiae*. Results showed that at 25°C, the female (proto and deutonymph consumed an average of (8.1 & 15.5) eggs and (5.9 & 8.64) immatures of *T. putrescentiae* respectively, at 25°C. Whereas at 30°C, female (proto & deutonymph) consumed (9.28 & 17.5) eggs and (5.89 & 9.75) immatures respectively.

During adult female longevity it consumed an average of 309.8 eggs, 95.13 immatures at 25°C while at 30°C, it consumed 398.86 eggs and 213.0 immatures. Male adulthood devoured 124.1 eggs and 77.01 immatures at 25°C, while at 30°C, it consumed 145.0 eggs and 93.89 immatures of *T. putrescentiae*, respectively.

Table (7): Number of preys consumed per female and male of *N.bakeri* when fed on egg and immature stages of *T.putrescentiae* during life span at 25 and 30°C and 65±5RH

Stage	25°C		30°C	
	Female	Male	Female	Male
Eggs				
Protonymph	8.1	6.3	9.23	7.4
Deutonymph	15.5	12.8	17.5	15.12
Immature stages	23.6	19.1	26.78	22.52
Longevity	309.8	124.1	398.86	145.0
Life span	333.4	143.2	425.64	167.52
Immature stages				
Protonymph	5.9	3.19	5.89	4.32
Deutonymph	8.64	7.0	9.75	8.18
Immature stages	14.54	12.5	15.64	12.50
Longevity	95.13	77.01	213.0	93.84
Life span	209.67	89.51	228.64	106.34

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تأثير نوع الفريسة ودرجة الحرارة على الخصائص البيولوجية للحلم المفترس
كيليتس ملاكنسس وكذلك الحلم المفترس نيوسيلولس بكراي .
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لقد تم إجراء بعض الدراسات البيولوجية لمعرفة تأثير كل من الحرارة والغذاء على
تطور وخصوبة للمفترس كيليتس ملاكنسس *Cheyletus malaccensis* و المفترس
نيوسيلولس بكراي *Neoseiulus barkeri* عند تربيتهم على البيض والأطوار الغير كاملة لحلم
الحبوب *T.putrescentiae* عند درجة حرارة ٢٥م ، ٣٠م ورطوبة نسبية ٦٥±٥%.

لقد اوضحت الدراسة أن المفترس *Ch. malaccensis* يمر بيرقة واحدة وحوريتين
قبل أن يصل إلى طور المرحلة الأخيرة وهي الطور الكامل وذلك في حالة الأنثى، أما في حالة
الذكر فيمر بطور اليرقة و طور واحد للحورية فقط.

وكذلك اوضحت الدراسة أن الأطوار الغير كاملة استغرقت ١٠,٩ يوم على درجة
حرارة ٢٥م أما على درجة الحرارة ٣٠م فقد استغرقت فترة منتهى ٩,٧٢ يوم عندما غذى المفترس
على اطوار الغير كاملة للحلم الحبوب *T.putrescentiae* ، بينما استغرقت هذه الفترة
١٠,٣٧ ، ٩,٥٥ يوم عندما غذى المفترس على البيض.

وكذلك أيضا اوضحت الدراسة المتحصل عليها ان طول فترة وضع البيض للأنثى كانت
٥٢,٨ ، ٤٧,٧٦ يوم على درجة الحرارة ٢٥ ، ٣٠م عند التغذية او التربية على الأطوار الغير
كاملة للحلم الحبوب، بينما كانت هذه الفترة ٤,١١ ، ٣٨,٤٣ يوم عند تغذية المفترس على بيض
الحلم.

وأيضا تم إجراء الدراسات البيولوجية للحلم المفترس *Neoseiulus baker* حيث تم
تربيته على البيض والأطوار الغير كاملة لحلم الحبوب *putrescentiae.T* عند درجة حرارة
٢٥ ، ٣٠م ورطوبة نسبية ٦٥±٥%.

ومن الدراسة و النتائج المتحصل عليها أن دورة حياة هذا الحلم المفترس كانت (٧,٤ ،
٦,٧ يوم)، (٨,١ ، ٧,٥ يوم) عند تربيته على البيض والأطوار الغير كاملة على التوالي على
درجة حرارة ٢٥م بينما (٦,٨ ، ٦,٣ يوم)، (٧,٥ ، ٧,٠ يوم) عند درجة حرارة ٣٠ م الأنثى
والذكور على الترتيب. في كلا النوعين استهلكت الإناث في مرحلة وضع البيض أكبر عدد من
الأطوار الغير كاملة وكذا البيض عنها في حالة مراحل الأطوار الغير كاملة ومرحلتى ما قبل وبعد
وضع البيض .