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EFFECT OF DIFFERENT TYPES OF FOOD AND TEMPERATURES ON DEVELOPMENTAL STAGES, FECUNDITY AND LIFE TABLE PARAMETERS OF THE ACARID MITE, *Caloglyphus berlesei* (MICHAEL) (ACARI: ACARIDIDA: ACARIDAE)

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ABSTRACT

Biological studies were carried out on the acarid mite, *Caloglyphus berlesei* (Michael) when it fed on three different types of food (dry yeast, crushed wheat and crushed maize) under laboratory conditions of 25 & 30 ºC and 70% R.H. Developmental stages and female fecundity of mites were affected by different food types and temperature where as female total immature stages lasted (10.7 &10.45), (14.12 &11.43) and (16.44 & 12.13) days at 25 & 30 ºC respectively when mites fed on dry yeast, crushed wheat and crushed maize respectively. Female and male were life cycle ,(14.3 &13.0), (17.8 &15.65) and (20.95 &17.04) days at 25 ºC when mites fed on the above mentioned diets at the some trend. Female fecundity also was affected by both food and temperature where the average number of deposited eggs and the daily rate were (297.5 &27.5), (232.1 &20.4) and (185.7 &12.3) eggs at 25 ºC, while the average number of eggs and daily rate at 30 ºC were (208.4 &21.1), (184.1 &14.4) and (162.9 &9.7)eggs when female fed on dry yeast, crushed wheat and crushed maize, respectively.

INTRODUCTION

Mites of sub-order Acaridida (Astigmata) are known to infest a variety of stored grains throughout the world. They are common pests in grain storages. They aren't readily seen because they are very small in size. Mites are of the major cause of qualitative and quantative losses to stored products. Acaridid mites have great economic importance which cause variable degree of damage not only they can consume a large amount of stored products but also contaminate food with their bodies and extractions. As well as they can attack and feed on the germ of stored grains and seeds, they can penetrate into the hard grains and feed directly on the germ kernels, therefore they destroy their germination power, change the moisture content of medius, initiating growth and spread mold Sinha, (1963 &1964), Sinha and Wallace, (1973 & 1977) and Taha, (1985). The present work aims to study the effect of different food types; dry yeast granules, crushed wheat and crushed maize and different temperatures (25 ºC & 30 ºC) at 70% R.H. on the biological aspects, fecundity, sex ratio and life table parameters of acarid mite, *Caloglyphus berlesei* (Michael).

MATERIALS AND METHODS

Caloglyphus berlesei was reared in plastic chamber (6 cm in diameter × 1.5 cm thick) filled partially with a mixture (cement: clay: charcoal on ratio of 7: 2: 1). These plastic chambers contain dry yeast granules and few drops of water as sources of food and humidity, covered with soft plastic cover after adding two females and a male from the laboratory culture of *Caloglyphus berlesei*. These cultures were observed daily and kept in an incubator at 25 ºC and 70% R.H. For rearing experiment, newly deposited eggs of the mite were transferred singly to plastic cells filled partially with a mixture of plaster of Paris and charcoal (1.3 cm diameter × 0.4 cm high). Newly hatched larvae were fed during their life span on one of the tested diets; dry yeast granules, crushed wheat and crushed maize under laboratory conditions 25 ºC and 30 ºC at 70% R.H. Thirty replicates were used for each source of diets and temperature which investigated twice daily with adding few amounts of different food types as required. Biological studies, fecundity and sex ratio were studied. Life table parameters were calculated according to Birch (1984) using the BASIC computer program of Abou Setta *et al.*, (1986).

RESULTS AND DISCUSSION

In this study, the experiments were carried out under laboratory conditions of 25 & 30 ºC and 70% R.H., when mite fed on three different food sources; dry yeast granules, crushed wheat and crushed maize. All the selected diets have already been found suitable to some extent for mite survival and development. The acarid mite, *Caloglyphus berlesei* was isolated from samples of wheat grain and wheat-flour and wheat-bran collected from Beni-Suef Governorate. The acarid mite, *Caloglyphus berlesei* passes through egg, larva, protonymph and tritonymph before reaching maturity. Between protonymph and tritonymph, a non-feeding hypopus stage may occur under unfavorable conditions. There is a quiescent stage before molting for each moving immature stage; larva, protonymph and tritonymph. Mating is necessary for *Caloglyphus berlesei* so as to deposit eggs. The eggs of *Caloglyphus berlesei* are deposited randomly in clarks of rearing cells singly under some substrate particles and food, these eggs are witish and slightly longitudinal. As shown in (Tables 1 & 2) under laboratory experimental conditions of 25 ±1 ºC and 70% R.H., there were significant differences for the influence of different food types on egg incubation period of *Caloglyphus berlesei* of both female and male, this period ranged from 3.60 to 4.51 days for female and 2.69 to 3.47 days for male. It's short on yeast, prolonged on crushed maize. Dry yeast granules was the most attractive to *Caloglyphus berlesei* followed by crushed wheat and the least diet was crushed maize, whereas, this reaction was reinforced as the duration of the test was increased for crushed maize. Generally, there were significant differences occurred between the total immature stages duration of both sexes when mite individuals fed on the above mentioned types of food. Female and male total immature stages lasted (10.7 &10.26), (14.12 &12.5) and (16.44 &13.6) days at 25 ºC. While female and male were total immature

stages lasted (10.45 &9.76), (11.43 &10.5) and (12.13 &11.14) days at 30 ºC. The total immature stages were completed in the shortest duration when mite fed on dry yeast granules. It's interest to note that male last shorter time than female. Also it's noticed that the total immature stages were completed in the shorter duration at 30 ºC than at 25 ºC.These results agree with Woodring (1969 b), Hughes (1976) and Eraky & Osama (2008). Life cycle duration for both female and male has significant results due to type of food and temperature. *Caloglyphus berlesei* female life cycle averaged (14.3 &13.1), (17.8 &14.34) and (20.95 &14.73) days at 25 ºC and 30 ºC when they fed on dry yeast, crushed wheat and crushed maize, respectively (Tables 1, 2, 3 &4). Female longevity decreased when temperature increased, (16.1 &12.74), (17.5 &14.0) and (22.1 &16.91) at 25 ºC and 30 ºC when they fed on the aforementioned diets. The oviposition period also followed similar trend. The oviposition period was completed in the shortest duration with the maximum number of eggs were laid when mite fed on dry yeast granules. Female oviposition period lasted (10.81 &9.9), (11.39 &10.3) and (14.99 &12.41) days when it fed on aforementioned diets at 25 ºC and 30 ºC, respectively. The female fecundity averaged (297.5 &208.4), (232.2 &184.1) and (185.7 &162.9) eggs at 25 ºC and 30 ºC respectively when it fed on aforementioned diets (tables 5 &6). Similar results were obtained by Hughes (1976), Eraky & Osama (2008) and Taha *et al.*, (2010). Life table parameters which have been into considerations were affected by diets and temperatures (Tables 7 &8). It could be generally concluded that dry yeast granules are the most suitable food for developing and reproduction of this mite species. These results agree with that obtained by Taha *et al.*, (2002) and Eraky & Osama (2008).

Table (1): Duration of different stages of *Caloglyphus berlesei* female when fed on different food sources at 25 ºC and 70 % R.H.

Stages		Food sources		
		Dry yeast granules	Crushed wheat	Crushed maize
Incubation period		3.60 ±0.29 ^{c}	3.97± 0.39 ^{c}	4.51±0.21 ^{b}
Larva	A	2.30±0.23 ^{c}	3.32±0.39 ^{b}	4.1±0.26 ^{a}
	Q	1.2±0.13 ^{c}	1.34±0.19 ^{c}	1.45±0.17 ^{b}
Protonymph	A	2.4±0.32 ^{c}	2.99±0.54 ^{b}	3.4±0.42 ^{a}
	Q	1.20±0.15 ^{c}	1.61±0.24 ^{c}	1.84±0.24 ^{b}
tritonymph	A	2.30±0.21 ^{c}	3.15±0.39 ^{b}	3.84±0.29 ^{a}
	Q	1.30±0.19 ^{b}	1.71±0.24 ^{a}	1.91±0.26 ^{a}
Total immature		10.7±0.64 ^{c}	14.12±1.27 ^{b}	16.44±0.82 ^{a}
Life cycle		14.3±0.84 ^{c}	17.8±1.86 ^{b}	20.95±0.68 ^{a}
Generation period		15.5±0.74 ^{c}	20.8±1.88 ^{b}	24.2±0.59 ^{a}
Longevity		16.1±1.69 ^{c}	17.5±1.64 ^{b}	22.1±2.3 ^{a}
Life span		30.4+1.3 ^{c}	35.3±2.11 ^{b}	43.0+2.78 ^{a}

A = active stage Q= quiescent stage

- L.S.D. = Least significant difference at 0.05

- The difference between data of similar letter is non-significant.

- The difference between data of different letters (a, b & c) are significant.

Table (2): Duration of different stages of *Caloglyphus berlesei* male when fed on different food sources at 25 ºC and 70 % R.H.

Stages		Food sources		
		Dry yeast granules	Crushed wheat	Crushed maize
Incubation period		2.69±0.28 [b]	3.35±0.31 [a]	3.47+0.25 [a]
Larva	A	2.19±0.14 [c]	3.01±0.28 [b]	3.41±0.53 [b]
	Q	1.26±0.19 [c]	1.15±0.14 [b]	1.38±0.27 [a]
Protonymph	A	2.41±0.26 [c]	2.82±0.36 [b]	2.84±0.21 [b]
	Q	1.15±0.14 [b]	1.44±0.22 [a]	1.52±0.19 [a]
Tritonymph	A	2.2±0.16 [c]	2.63±0.21 [b]	2.85±0.33 [a]
	Q	0.94±0.13 [c]	1.45±0.28 [b]	1.6±0.17 [b]
Total immature		10.26±0.56 [c]	12.5±0.64 [b]	13.6±0.74 [a]
Life cycle		13.0±0.49 [c]	15.65±1.03 [b]	17.04±0.86 [a]
Longevity		10.79±1.22 [c]	15.22±1.84 [b]	18.93±2.91 [a]
Life span		23.74+1.26 [c]	31.04+1.96 [b]	35.93+2.71 [a]

A = active stage Q= quiescent stage
- L.S.D. = Least significant difference at 0.05
The difference between data of similar letter are non-significant. -
- The difference between data of different letters (a, b & c) are significant.

Table (3): Duration of different stages of *Caloglyphus berlesei* female when fed on different food sources at 30 ºC and 70 % R.H.

Stages		Food sources		
		Dry yeast granules	Crushed wheat	Crushed maize
Incubation period		2.63±0.21[c]	2.91±0.33 [b]	3.36±0.47 [a]
Larva	A	2.28±0.22 [c]	2.5±0.21 [b]	2.83±0.44 [a]
	Q	1.17±0.17 [c]	1.24±0.17 [b]	1.25+0.18 [b]
Protonymph	A	2.32+0.25 [b]	2.55+0.34 [a]	2.5+0.26 [a]
	Q	1.14±0.13 [c]	1.2±0.16 [b]	1.31±0.19 [a]
tritonymph	A	2.25±0.16 [c]	2.71±0.26 [a]	2.66±0.30 [a]
	Q	1.28±0.19 [c]	1.53±0.23 [b]	1.58±0.21 [b]
Total immature		10.45±0.57 [c]	11.43±0.75 [b]	12.13±0.47 [a]
Life cycle		13.1+0.64 [c]	14.34±0.81 [a]	14.73±0.67 [a]
Generation period		14.61±0.69 [b]	16.22±0.93 [a]	16.25±0.93 [a]
Longevity		12.74+1.37 [c]	14.0+1.31 [b]	16.91+1.68 [a]
Life span		25.93±1.89 [c]	31.36±2.1 [b]	35.26±2.61 [a]

A = active stage Q= quiescent stage
- L.S.D. = Least significant difference at 0.05
The difference between data of similar letter are non-significant. -
The difference between data of different letters (a, b & c) are significant.

Table (4): Duration of different stages of *Caloglyphus berlesei* male when fed on different food sources at 30 ºC and 70 % R.H.

Stage		Food sources		
		Dry yeast granules	Crushed wheat	Crushed maize
Incubation period		2.59±0.16 [b]	2.82±0.14 [c]	3.41±0.35 [a]
Larva	A	2.17±0.16 [b]	2.39±0.15 [c]	2.61±0.43 [a]
	Q	1.11±0.1 [c]	1.15±0.08 [b]	1.2±0.13 [a]
Protonymph	A	2.16±0.11 [b]	2.35±0.23 [a]	2.28±0.23 [b]
	Q	1.17±0.13 [b]	1.13±0.04 [b]	1.24±0.18 [a]
Tritonymph	A	2.15±0.08 [a]	2.38±0.14 [b]	2.41±0.24 [c]
	Q	1.22+0.17 [c]	1.36±0.15 [c]	1.4±0.09 [a]
Total immature		9.76±0.98 [c]	10.5±0.92 [b]	11.14±0.36 [a]
Life cycle		12.1±1.09 [c]	13.37±0.9 [b]	14.6±1.65 [a]
Longevity		9.78±0.94 [c]	11.14±1.21 [b]	14.8±1.34 [a]
Life span		21.97±1.83 [c]	24.52±1.4 [b]	29.4±1.28 [a]

A = active stage Q= quiescent stage
The difference betwee
n data of similar letter are non-significant. -
The difference between data of different letters (a, b & c) are significant.-
-L.S.D. at 0.05 level of incubation period for -
Sex = 0.103 Diet = 0.1315

Table (5): Adult female longevity and fecundity of the acarid mite, *Caloglyphus berlesei*, when fed on different food sources at 25 ºC and 70 % R.H.

Diets	Average duration (days)			Fecundity		Sex ratio % (female/total)
	Pre-oviposion period	Oviposition period	Post-oviposition	Eggs/ female	Daily rate	
Dry yeast granules	2.19+0.36 [c]	10.81+1.72 [a]	3.07+0.47 [c]	297.5+19.14 [c]	27.5	68.5 %
Crushed wheat	2.6+0.37 [b]	11.39+1.31 [a]	3.5+0.52 [c]	232.1+13.980 [b]	20.4	60.2 %
Crushed maize	3.2+0.38 [a]	14.99+2.1 [a]	4.45+0.56 [b]	185.7+19.247 [a]	12.3	54.4%
L.S.D. at 0.05	0.116	1.903	1.125	3.651	2.39	-

- L.S.D. = Least significant different at 0.05
The difference between data of similar letter are non-significant.-
- The difference between data of different letters (a, b & c) are significant.

Table (6): Adult female longevity and fecundity of the acarid mite, *Caloglyphus berlesei*, when fed on different food sources at 30 ºC and 70 % R.H.

Diets	Average duration (days)			Fecundity		Sex ratio % (female/total)
	Pre-oviposition period	Oviposition period	Post-oviposition	Eggs/ female	Daily rate	
Dry yeast granules	1.37±0.16 [c]	9.9±1.31 [c]	2.07±0.17 [b]	208.4±17.43 [a]	21.1±2.4	62.5 %
Crushed wheat	1.87±0.27 [c]	10.3±1.16 [b]	2.1±0.26 [a]	184.1±16.40 [a]	14.4±1,98	54.4 %
Crushed maize	2.0±0.19 [b]	12.41±1.72 [a]	2.5+0.30 [a]	162.9±15.94 [b]	9.7±0.94	51.5 %
L.S.D. at 0.05	0.131	2.632	1.153	5.764	2.33	-

-L.S.D. = Least significant different at 0.05
- The difference between data of similar letter are non-significant.
- The difference between data of different letters (a, b & c) are significant.

Table (7):Effect of different food sources on life table parameters of the acarid mite, *Calogylphus berlesei* at 25 ºC and 70 % R.H.

Parameters	Dry yeast	Crushed wheat	Crushed maize
Net reproduction rate (Ro)	68.5	57.2	38.8
Mean generation (T)	33.4	35.2	46.1
Intrinsic rate of increase (rm)	0.18	0.14	0.04
Finite rate of increase (exp rm)	1.15	1.13	1.8
Sex ratio (% female per total)	0.68	0.60	0.54
Fraction of eggs reaching maturity	0.79	0.72	0.65

Table (8):Effect of different food sources on life table parameters of the acarid mite, *Calogylphus berlesei* at 30 ºC and 70% R.H.

Parameters	Dry yeast	Crushed wheat	Crushed maize
Net reproduction rate (Ro)	59.2	46.4	32.5
Mean generation (T)	28.5	31.4	35.1
Intrinsic rate of increase (rm)	0.15	0.13	0.09
Finite rate of increase (exp rm)	1.12	1.12	1.08
Sex ratio (% female per total)	0.62	0.54	0.51
Fraction of eggs reaching maturity	0.72	0.68	0.62

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تـأثير أنـواع مختلفـة مـن الغذاء ودرجـة الحـرارة علـى مراحـل التطـور والخصـوبة وجداول الحياة للحلم الأكاريدي*Caloglyphus berlesei*

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أوضـحت الدراسـات البيولوجيـة أن التطـور والخصـوبة للحلـم الأكاريـدي *Caloglyphus berlesei* تـأثرت بـالأنواع المختلفـة من الغذاء ودرجات الحـرارة حيث استغرقت الأطـوار غير الكاملـة (١٠.٧ &١٠.٢٦) و (١٤.١٢ &١٢.٥) و (١٦.٤٤ &١٣.٦) يومـاً لكل من الأنثـى والـذكر عنـد ٢٥ °م ولكـن اسـتغرقت الأطـوار غيـر الكاملـة (١٠.٤٥ &٩.٧٠) و (١١.٤٣ &١٠.٥) و (١٢.١٣ &١١.١٤) يوماً لكل من الأنثى والذكر على الترتيب عند ٣٠ °م عند التغذيـة على الخميرة الجافـة والقمـح المجـروش والـذرة المجروشـة علـى الترتيـب. كمـا أن فتـرة وضـع البـيض اسـتغرقت (١٠.٨١ &٩.٩) و (١١.٣٩ &١٠.٣) و (١٤.٩٩ &١٢.٤١) يومـاً عنـد ٢٥ °م و ٣٠ °م علـى الترتيب عند التغذية على الغذاء السابق الذكر وكان متوسط عدد البيض للأنثى الواحدة عند ٢٥ °م و ٣٠ °م على الترتيب (٢٩٧.٥ &٢٠٨.٤) و (٢٣٢.١ & ١٨٤.١) و (١٨٥.٧ &١٦٢.٩) على نفس النمط ، حيث أوضـحت النتـائج أن الخميـرة الجافـة هـي أفضـل غـذاء للحلـم لقصـر مراحـل التطـور وارتفاع معدل الخصوبة، كمـا أنـه عند ارتفـاع درجـات الحـرارة تقصـر مراحـل التطـور ويقل معدل وضع البيض للإنـاث. وأوضـحت الدراسـة أن أفضـل أنـواع الغذاء لتطـور الحلـم هـي الخميـرة الجافـة بالمقارنـة عند التغذيـة علـى القمـح المجـروش والـذرة المجروشـة. كمـا أن معدل وضـع البيض للإنـاث كان مرتفعاً عند درجة حرارة ٢٥ °م عنها عند ٣٠ °م ممـا يوضـح أن هذا المعدل من الحـرارة أدى إلى زيادة الخصـوبة للإناث.

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