ACARINES: Journal of the Egyptian Society of Acarology 2:45-48, 2008

Some Biological Aspects and Life Table Parameters of *Caloglyphus manuri* Eraky & Osman (Acaridida: Acaridae) Fed on Different Kinds of Food

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ABSTRACT

Some biological aspects of the Acaridae mite, *Caloglyphus manuri* Eraky & Osman fed on baker's yeast, dry cheese and egg masses of the root knot nematode, *Meloidogyne sp.* were studied under laboratory conditions at 25±1 °C. Mean life cycle durated 5.90, 7.80 and 10.40 days for *C. manuri* female and 4.50, 6.40 and 8.10 for male when fed on baker's yeast, dry cheese and *Meloidogyne sp.* egg masses, respectively. Female life span averaged 21.60, 19.40 and 28.20 days, while it averaged 17.30, 15.80 and 35.8 days for male when fed on the previously mentioned food, respectively. Mean generation time (T) averaged 9.32, 11.82 and 15.85 days, net reproductive rate (R_o) values were 346.40, 298.53 and 83.05 times, net rate of natural increase (r_m) was 0.627, 0.482 and 0.278 individual/♀/day and the finite rate of increase (e^{rm}) was 1.87, 1.61 and 1.32 time/♀/day on the same foods, respectively. Doubling time (DT) and gross reproductive rate (GRR) were 1.10, 1.43 & 2.49 ; and 447.28, 368.17 & 127.45 when fed on baker's yeast, dry cheese and egg mass of the root knot nematode (*Meloidogyne* sp.). Baker's yeast was the most suitable food for rearing *C. manuri*.

Key Words: Biology, Life table parameters, Acaridae, *Caloglyphus manure*.

INTRODUCTION

Acaridae is a large family of world wide distribution. About 400 species of acaridid mites belonging to nearly 90 genera are known in the world and many others are yet to be identified, especially in the tropical area (Zhang, 2003). Acaridides abound in leaf litter and in the upper strata of soils rich in organic matter, as well as in decomposing animal droppings. Many species are associated with nests or bodies of invertebrates and vertebrates (Gerson *et al.* 2003). On the other hand, an accumulated knowledge concerning the Acaridides fauna in Egypt is extremely scarce compared with the other groups of mites (Eraky, 2000). Therefore the present work aims to study some biological aspects of *Caloglyphus manuri* Eraky & Osman fed on baker's yeast, dry cheese and egg masses of the root knot nematode, *Meloidogyne* sp. under laboratory conditions of 25±1 °C. The effect of different foods on *C. manuri* life table parameters was also studied.

MATERIALS AND METHODS

Individuals of the mite *C. manuri* were extracted from chicken manure in a poultry farm of the Faculty of Agriculture, Mansoura University, using Tullgren funnels, and then cultured in the laboratory. Two types of plastic cells containing a floor plaster of paris and charcoal (mixed in a 9: 1 ratio) were used. The big rearing cells (2.5 cm diameter and 2 cm deep) were used for laboratory culture. The small ones (1 cm in diameter and 0.8 cm deep) were used in the biological experiments. A heavy glass cover was used for each cell to prevent mites escape. The plaster of Paris floor was kept moderately moist by adding droplets of water when needed.

Acaridid cultures were kept in big rearing cells representing three major groups according to the kind of food. The first group was provided with dry cheese, the second with baker's yeast and the third with egg masses of the root knot nematode, *Meloidogyne* sp. All groups were incubated at 25±1 °C and observed daily for egg deposition.

Newly deposited eggs were singly transferred from the cultures to the small cells. The incubation period was recorded and the newly hatched larvae were fed on dry cheese, baker's yeast, and root knot nematode, egg masses. Newly emerged females were exposed to young males of the same food. Observations were noted twice daily and developmental durations of the mite different stages were recorded. Each rearing experiment was started with not less than 20 newly hatched larvae and life table parameters were calculated according to Birch (1948), and using the Basic Computer Program of Abou–Setta and Childers (1986).

RESULTS AND DISCUSSION

I. Immature stages:

As in other Acaridae, both sexes of *C. manuri* pass through egg, larva, protonymph, deutonymph and tritonymph before reaching adult. Under experimental conditions of 25±1 °C, there were

Table (1): Duration in days of the immature stages of *Caloglyphus manuri* fed on different kindes of food at 25±1°C.

Food	Sex	Egg	Larva	Protonymph	Deutonymph	Tritonymph	Life cycle
Yeast	♀	1.00±0.00[c]	1.60±0.22[c]	1.40±0.16[a]	1.10±0.10[b]	0.80±0.13[b]	5.90±0.23[c]
	♂	1.00±0.00[c]	1.10±0.10[b]	1.00±0.00[a]	1.00±0.00[a]	0.50±0.16[b]	4.50±0.16[c]
Cheese	♀	2.00±0.00[b]	2.10±0.10[b]	0.90±0.10[b]	1.70±0.15[a]	1.00±0.00[ab]	7.80±0.20[b]
	♂	2.00±0.00[b]	1.40±0.16[b]	1.00±0.00[a]	1.00±0.00[a]	1.00±0.00[a]	6.40±0.16[b]
Meloidogyne sp.	♀	3.30±0.15[a]	3.00±0.00[a]	1.50±0.16[a]	1.50±0.16[ab]	1.10±0.10[a]	10.40±0.40[a]
	♂	3.40±0.16[a]	2.40±0.16[a]	1.00±0.00[a]	1.00±0.00[a]	0.30±0.15[b]	8.10±0.27[a]
L.S.D	♀	0.2559	0.1629	0.4252	0.4141	0.2792	0.8450
	♂	0.2735	0.42161	0.0001	0.0001	0.3787	0.6066

Means in columns by different letters are significantly different, $P < 0.05$ by SAS, L.S.D test.

Table (2): Adult longevity in days and female fecundity of *Caloglyphus manuri* fed on different kinds of food at 25±1 °C.

Food	Sex	Preovi.	Ovip.	Postovi.	Longevity	Fecundity	Daily rate
Yeast	♀	1.30±0.15[a]	12.30±1.11[a]	2.10±0.71[ab]	15.70±1.52[ab]	601.40±7.61[a]	48.89
	♂	-------------	-------------	----------	12.80±2.56[b]	----------	----------
Cheese	♀	1.200±0.13[a]	9.50±0.83[a]	0.90±0.17[b]	11.60±0.87[b]	535.00±1.89 [a]	56.31
	♂	-------------	-------------	----------	9.400±0.54[b]	----------	----------
Meloidogyne sp.	♀	1.10±0.10[a]	14.00±1.75[a]	2.70±0.39[a]	17.80±1.78[a]	159.10±2.72[b]	11.36
	♂	-------------	-------------	----------	27.70±4.57[a]	----------	----------
L.S.D	♀	0.3787	17.1128	1.5384	4.1867	111.4414	----------
	♂	-------------	-------------	-------------	8.8298	----------	----------

Means in columns by different letters are significantly different, $P < 0.05$ by SAS, L.S.D test.

significant differences for the influence of different food kinds on egg incubation period of *C. manuri* of both female and male. This period ranged from 1.00 to 3.00 days being short on yeast (one day) prolonged to two days on dry cheese and three days on the root knot nematode *Meloidogyne sp.* egg masses (Table 1).

Concerning life cycle duration (egg, larva, and proto, deuto & tritonymphal stages), significant results due to type of food occurred. *C. manuri* female life cycle averaged 5.9, 7.8 and 10.4 days when fed on yeast, dry cheese and the root knot nematod respectively (Table 1). Similar results were generally obtained with male and different immature stages. It is of interest to note that male emerged earlier than female.

However, no significant differences occurred between the total life cycle duration of both sexes when mite individuals fed on the same kind of food (Table 1). Therefore, it is clear that the egg masses of nematode gave the longest life cycle followed by dry cheese, while yeast gave the shortest developmental time. Similar results were obtained by Eraky (1987) when reared *Caloglyphus berlesei* (Mich.) on Drosophila, as the life cycle durated 7.5 day at 26 °C. Woodring (1969) stated that life cycle of *Caloglyphus anomalus* averaged 6.5 days at 23 °C whereas, Walia and Mathur (1998) indicated that *Tyrophagous putrescentiae* (Schrank) female life cycle durated 13.12 days when reared on juveniles of root knot nematode (*Meloidogyne javanica*). Chmielewski (2000) reported that female *C. berlesei* life cycle was 19.90 days when fed on bee-bread, while in 2003, he found that its life cycle decreased to 17.7 days when reared on buckwheat sprouts at 20°C, and 95-100% RH.

II. Adult stage:

C. manuri female deposited an average 601.40, 535.00 and 159.10 eggs with a daily rate 48.89, 56.31 and 11.36 eggs when fed on yeast, dry cheese and nematode egg masses, respectively. The oviposition period averaged 12.30, 9.50, and 14.00 days, when female fed on the afore mentioned diets, respectively. In general, it is clear that kind of food significantly affected the oviposition period, adult female longevity and fecundity of *C. manuri*. Female lived for 15.70, 11.60 and 17.80 days and male for 12.80, 9.40 and 27.70 days on the previously mentioned diets, respectively. Adult male longevity followed similar trend but being shorter than that of female except in the case of feeding on nematode egg masses (Table, 2).

Szlendak and Boczek (1992) showed that males of *Acarus siro* L. lived longer than females, since

Table (3): Effect of different foods on the life table parameters of *Caloglyphus manuri* at 25±1 °C.

Type of food	Mean Total Fecundity	T	DT	R_0	r_m	e^{rm}	GRR
Yeast	601.40 ± 7.61 [a]	9.32	1.10	346.40	0.627	1.87	447.28
Cheese	535.00 ± 1.89 [a]	11.82	1.43	298.53	0.482	1.61	368.17
Meloidogyne sp.	159.10 ± 2.72 [b]	15.85	2.49	83.05	0.278	1.32	127.45

DT: doubling time GRR: Gross reproductive rate R_O: the net reproductive rate
r_m: interinsic rate of natural increase e^{rm}: finite rate of increase T: The mean generation tim

female lived about 15 days and males about 20 days at 25 °C and 85% RH. On the other hand, Woodring (1969) found that *C. anomalus* female laid 930 and 545 eggs and lived for 23.4 and 18.5 days when fed on mealworms and yeast, respectively. In 1987, Eraky reported that *C. berlesei* deposited an average of 755.7 eggs in 15.9 days. Walia and Mathur (1998) reported that *T. putrescentiae* female laid an average of 171.40 eggs when reared on juveniles of the root knot nematode, *M. javanica*.. Chmielewski (2000) recorded that mean total deposited eggs per female of *C. berlesei* was 221.70 when reared on bee-bread whereas in 2003, he found that its fecundity averaged 237.4 eggs when reared on buckwheat sprouts.

III. Life table parameters

The calculated life table parameters which have been taken into consideration were: mean generation time (T), net reproductive rate (R_0), doubling time (DT), intrinsic rate of natural increase (r_m), finite rate of increase (e^{rm}) and gross reproductive rate (GRR) (Table, 3).

The mean generation time (T) of *C. manuri* was significantly affected by the type of food. The longest time needed for one generation (15.85 days) was recorded when the mite fed on the nematode egg masses, whereas the shortest was 9.32 days on yeast. The population of *C. manuri* had the capacity to double every 1.10, 1.43 and 2.49 days when fed on yeast, dry cheese and nematode egg masses, respectively.

Net reproductive rate (R_0) of variance kind of food indicated that the mite increase about 346.4, 289.53 and 83.05 times within a single generation when fed on yeast, dry cheese and nematode egg masses, respectively. It is clear that the population of the *C. manuri* reared on yeast could increase four times in the course of one generation as compared with feeding on egg masses of nematode. The values of r_m on yeast was about two times higher than that on nematode egg masses. Thus, yeast proved to be the optimum diet compared with those tested as it had the highest value of r_m (0.627). On the other hand, when the values of (r_m) was converted to the finite rate of increase (e^{rm}), it is clear that population of *C. manuri* had a capacity to multiply about 1.87, 1.61 and 1.32 times per ♀/day when fed on yeast, dry cheese and nematode egg masses, respectively. Consequently, a population of individuals of *C. manuri* could increase in a period of one week to become 805.34, 291.94 and 69.97 individuals when fed on the aforementioned foods, respectively. Gross reproductive rate (GRR) was 447.28, 368.17 and 127.45 when reared on the same diets. It could be generally concluded, that yeast is the most suitable food for the development and reproduction of this mite species. This result agrees with those obtained by Eraky (1995) who found that net reproductive rate (R_o) and intrinsic rate of increase (r_m) were 80.24 and 0.09 whereas, the mean generation time (T) and doubling time (DT) were 49.29 and 7.70 when *T. putrescentiae* reared on the bird–cherry aphid *Rhopalosiphum padi* L . at 18 °C.

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