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EFFECT OF DIFFERENT PREY ON THE REPRODUCTION AND FECUNDITY OF GAMASID MITE, AMBLYSEIUS HUTU (MESOSTIGMATA: PHYTOSIIDAE)

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ABSTRACT

The gamasid mite Amblyseius hutu (Prichard & Baker) was reared on five different types of food; first nymph and egg of Parlatoria blanchardii (Targ.) (date scale insect), fungus Fusarium oxysporum, immatures and eggs of Oligonychus afrasiaticus (McGregor) (old world date mite), At laboratory conditions (30°c and 75% R.H). This study showed that the lowest incubation period noticed for resulted males in case of feeding on 1st nymph of scale date insect was (1.3 days) but the longest recorded when the female individuals of predatory mite fed on the eggs of Oligonychus afrasiaticus was (2.9 days). The duration of life cycle for both sexes male and female was highly affected by the type of food employed. The lowest total period averaged (5.84, 10.85, 9.25, 6.74 and 13.67 days) for males and (6.93, 11.95, 10.35, 7.7 and 15.85 days) for female individuals when the predatory mite, Amblyseius hutu reared on the aforementioned food, respectively. It may clarify its potential as a biological control agent for Parlatoria blanchardii and as a biocontrol agent to Oligonychus afrasiaticus, which attack storage date and date palm trees.

Key words: *Date palm trees, Amblyseius hutu, biology, biocontrol, prey (date scale insect, old world date mite, fungi).*

INTRODUCTION

Date Palm is considered the most cash crops in many countries of the world; Pests attacking date palm trees are key factors which are affecting -to great extent- the degradation of both quality and quantity of date yield as well as longevity and survivor of these permanent trees.

Phytophagous mites are serious pests on field crops, vegetables and fruits and frequently cause a considerable loss in crop yields. *Oligonychus afrasiaticus* considered the most abounded of Tetranychid mites inhibiting leaves, buds, stems, shoots and fruits of different plant species (Al-Shammery, 2010).

Also, great damage can be done by the scale insects *Parlatoria blanchardii* not only by sucking the plant sap that gives low photosynthesis and respiration which leads to curling, yellowing and dropping of leaves, but also malformations, dwarfing, decreasing or

destroying chlorophyll, impairing photosynthesis and productivity and subsequently, causing considerable quality and quantity yield losses and also low marketing value of fruits. A characteristic symptom of infestation with *Parlatoria blanchardii* is the appearance and accumulation of its scales on attached palm parts (El-Said, 2000; El-Sherif *et al.,* 2001 and Blumberg, 2008).

Therefore the scope of this work was to study the effect of different prey; date scale insect, *Parlatoria blanchardii*, immature stages and eggs of mite, *Oligonychus afrasiaticus* and fungus, *Fusarium oxysporum* on biological aspects, reproduction and fecundity of the predatory mite, *Amblyseius hutu* under laboratory conditions.

MATERIALS AND METHODS

Samples of date palm trees were collected from different areas at Dakahlia governorate, and then examined by using Stereo microscope at the laboratory.

Gamasid mite *Amblyseius hutu*, Family: Phytosiidae was cultured, only adult female mites were used and no attempt was made to determine their age.

Culture of gamasid mite *A. hutu* was reared on five different prey (egg and first nymph of *Parlatoria blanchardii*, fungus, *Fusarium oxysporum,* eggs and immatures of *Oligonychus afrasiaticus*).

In order to examine, the prey consumption rate per day in relation to prey abundance, each adult female mite was given. either 3, 5, 10 or 15 fresh Egg of *Parlatoria blanchardii* for 24 hours at 30°c, the age of the eggs was (0-24) hours temperature and the First nymph of *Parlatoria blanchardii*. Eggs and immatures of Oligonychus afrasiaticus and fungus, *Fusarium oxysporum*.

Cultures of fungi, *Fusarium oxysporium* obtained from Plant-Pathology-Research-Inistitute, A.R.C., Ministry of agriculture.

Experiments were carried out in an incubator at a temperature 30°c and 75% R.H. and were inspected twice daily.

Culture:

Large Petri dishes filled with wetted cotton and Mulbeberry leaves and putted into it as a substrate for predator mite and then putted the suitable different foods.

Life-table-parameters were calculated according to (Birch, 1948) using the GW-Basic computer program of (Abou-Setta *et al.,* 1986).

RESULTS AND DISCUSSION

These trials were conducted to study the effect of different prey on biological aspects of the predatory mite, *Amblyseius hutu* under laboratory conditions of 30±2°c and 75±5% R.H.

The following is an account of the results obtained on this biology as affected by food variation. Both females and males of the predatory mite were found to be passing through one larval and two nymphal stages (protonymph and deutonymph) before reaching adult stage.

Egg deposition:

Mating is essential for egg production. Females deposited their eggs singly or scattered on the substratum and sometimes on the hyphae of fungus, *Fusarium oxysporum* present.

Egg hatching:

The female deposited their white eggs which become orangey before hatching. The embryo moved to one side which appeared dark in color. Hatching occur through a longitudinal median split, hatched larvae crawls searching for food.

Unmated females could oviposited but their eggs failed for hatched.

Incubation period:

As shown in Table (1), the incubation period of gamasid mite *Amblyseius hutu* was greatly affected by different prey. The male incubation period was short when it fed on the first nymph of scale date insect (1.3 days) while the longest incubation period was recorded when the female individuals of predator mite fed on the eggs of *Oligonychus afrasiaticus* (2.9 days).

The statistical analysis of the obtained data showed that L.S.D at 0.05 level was (0.367) and (0.395) for effect of sex (males and females), respectively.

Life cycle:

From the tabulated data in Table (1), it could be observed that the duration of life cycle for both sexes was highly affected by the type of food employed. This total period averaged (5.84, 10.85, 9.25, 6.74 and 13.67 days) for male and (6.93, 11.95, 10.35, 7.7 and 15.85 days) for female when *Amblyseius hutu* reared on first nymph and egg of *Parlatoria blanchardii* (date scale insect), fungus, *Fusarium oxysporium*, immatures and egg of *Oligonychus afrasiaticus*, Family: Tetranychidae, respectively.

L.S.D at 0.05 level is (0.936) and (0.600) for effect of sex (male and female), respectively.

Table (1): Mean developmental times in days of gamasid predator mite, Amblyseius hutu females and males when reared on five different foods at 25±2?C and 75±5 R.H.

Developmental stages		Egg		Larva		Protonymph		Deutonymph		Total immature		Life cycle		Longevity		Fecun-dity	Life span	
		♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♀	♂	
Food type	1st nymph of date scale insect	1.3 ± 0.16	1.65 ± 0.12	0.9 ± 0.10	0.88± 0.11	1.59± 0.12	1.9 ± 0.12	2.05± 0.14	2.5 ± 0.13	4.54 ± 0.17	5.28 ± 0.10	5.84 ± 0.33	6.93 ± 0.19	32.2 ± 0.37	37.69± 1.01	95 ± 1.43	38.04± 0.40	44.62± 0.95
	Eggs of date scale insect	2.15± 0.12	2.85 ± 0.12	1.9 ± 0.12	2.05± 0.14	2.85± 0.12	3.0 ± 0.17	3.95± 0.13	4.05± 0.14	8.7 ± 0.31	9.1 ± 0.15	10.85± 0.35	11.95± 0.05	30.95± 0.71	34.85± 0.69	59 ± 1.04	41.8 ± 0.74	46.8 ± 0.68
	Fusarium oxysporum	1.9 ± 0.12	2 ± 0.0	1.3 ± 0.09	1.7 ± 0.09	2.5 ± 0.15	2.75± 0.11	3.55± 0.09	3.9 ± 0.10	7.35 ± 0.23	8.35 ± 0.18	9.25 ± 0.34	10.35± 0.18	23.6 ± 0.40	25.39± 0.59	74 ± 0.50	32.85± 0.52	35.74± 0.52
	Immatures of *Oligonychus afrasiticus.*	1.45± 0.09	1.85 ± 0.12	1.1 ± 0.12	1.2 ± 0.05	1.94± 0.19	2.15± 0.12	2.25± 0.17	2.5 ± 0.22	5. 29 ± 0.24	5. 85 ± 0.20	6.74 ±0.27	7.7 ± 0.21	16.65± 0.29	21.5 ± 0.80	85 ± 1.14	23.39± 0.46	29.2 ± 0.87
	Eggs of *Oligonychus afrasiaticus*	2.55± 0.09	2.9 ± 0.20	2.63± 0.07	2.85± 0.16	3.54± 0.14	4.8 ± 0.09	4.95± 0.14	5.3 ± 0.21	11.12± 0.27	12.95± 0.38	13.67± 0.27	15.85± 0.29	39.27± 0.27	42.73± 0.65	64 ± 1.02	52.94± 0.50	58.58± 0.72
	LSD 0.05%	0.367	0.395	0.314	0.359	0.445	0.384	0.424	0.504	0.742	0.667	0.936	0.6	1.3	2.266	3.171	1.599	2.364
	F. test	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***

Adult longevity:

Adult longevity of gamasid mite *Amblyseius hutu* was highly influenced by different prey.

As shown in Table (1) female longevity exceeds the male longevity in the all tested prey. That female longevity lasted (37.69, 34.85, 25.39, 21.5 and 42.73 days) when the individuals fed on aforementioned prey, but these periods changed to (32.2, 30.95, 23.6, 16.65 and 39.27 days) for male when it fed on tested prey, respectively.

L.S.D at 0.05 level is (1.300) and (2.266) for effect sex (male and female), respectively.

Therefore, Table (2) showed that the pre-oviposition, oviposition and post-oviposition periods were obviously affected by prey types, where as the First nymphs of *Parlatoria blanchardii* was the most favorable prey for female oviposition period of the predatory mite, *A. hutu.*

Fecundity:

Obtained results cleared that the first nymphs of *Parlatoria blanchardii* proved to be the most favorable prey as it gives the highest reproduction rate (95.0 eggs). On the contrary, the eggs of *Parlatoria blanchardii* (59.0 eggs) resulted in the least number of deposited eggs by female Table (3).

L.S.D is (3.171) for effect of different prey on female fecundity.

Food consumption:

To investigate the suitability of various diets for predatory mite, *Amblyseius hutu* of the previously mentioned prey were used.

Table (2) : Prey consumption of the predator Gamasid mite *Amblyseius hutu* when fed on different prey. (30±2°c & 75±5% R.H.).

Predator stage		No. of –devoured-prey-individuals	
		First nymph of *Parlatoria* date scale insect.	Immature of *Oligonychas afrasiaticus.*
Larvae	♂	4.4± 0.51	2.8± 0.37
	♀	5.2± 0.58	3.2± 0.2
Protonymph	♂	5.8±0.37	3.6± 0.24
	♀	6.6± 0.4	4.4± 0.24
Deutonymph	♂	7.6± 0.4	5.2± 0.58
	♀	8.8± 0.58	6.4± 0.24
Immatures	♂	17.8± 0.37	11.6± 0.50
	♀	20.6± 0.4	14± 0.31
Longevity	♂	35± 0.71	25± 0.70
	♀	68.4± 0.92	46.2± 0.86
Life span	♂	52.8± 0.58	36.6± 0.81
	♀	89± 0.63	60.2± 0.86
Pre-oviposition		15.2± 0.37	10.4± 0.51
Oviposition		48.2± 0.8	33.2± 0.58
Post-oviposition		5± 0.31	2.6± 0.24

As shown in table (2), the predatory mite *Amblyseius hutu* fed successfully on the tested prey. And the number of devoured prey of immature individuals of first nymph of *Parlatoria blanchardii* was significantly higher than immature stages of *Oligonychus afrasiaticus*, the consumed numbers were (20.6 and 14.0) for female and (17.8 and 11.6) for male.

However, during the life span of the predatory mite *Amblyseius hutu*, the total numbers of tested consumed prey were significantly differed.

L.S.D at 0.05 level is (1.58) and (1.52) for effect of the first nymph of *Parlatoria blanchardii* and immature stages of *Oligonychas afrasiaticus*), respectively.

The numbers were (52.8) and (89.0) prey when the predator mites male and female fed on the first nymphs of *Parlatoria blanchardii* at the tested conditions.

During life span male and female destroyed an average number of immature stages of *Oligonychus afrasiaticus* (36.6) and (60.2) individuals under laboratory conditions for males and females, respectively.

During the oviposition period of predator female was the highest effeciency of devoured prey, (48.2) and (33.2) prey when fed on the first nymphs of *Parlatoria blanchardii* and immatures of *Oligonychus afrasiaticus*, respectively.

The predator mite *Amblyseius hutu* when fed on the eggs of *Oligonychus afrasiaticus* gave the most increasing rate of mite population development while immature gave the lowest mite population.

Also, the former first nymph of *Parlatoria blanchardii* food accelerate mite development and resulted into the greatest egg production as it gave (95.0) eggs.

The first nymph of *Parlatoria blanchardii* proved to be the most favorable prey for Gamasid mite species as it induced the reproductive potential resulting in the greatest population development.

However, the first nymph of *Parlatoria blanchardii* increased the female fertility of gamasid mite as it gave the highest average of deposited eggs (95.0, 59.0, 74.0, 85.0 and 64.0 eggs), when fed on the above mentioned prey, respectively.

Similar results were obtained by [Rasmy, *et al.,* (2003); Ali and Zaher, (2007)] which investigated the effects of food such as phytophagous mites, insects, fungus and pollen on the biology and predation capacity of phytoseiid mites. Also, many studied the effectiveness of the phytoseiid mites in controlling population growth of the spider mite, *Oligonychus* sp. [John and Fred, 1983; Mark, *et al.,* 2000; Mark, *et al.,* 2009, Pickett and Gilstrap, 1986].

Life table parameters

The calculated life table parameters were constructed using the survival data of a specific age class and (LX) and the female offspring produced per female in each age class (mx).The net reproductive rate (Ro),the mean generation time (T), the intrinsic rate of in-

crease (rm),and the finite rate of increase (λ) and Gross reproduction rate (GRR), Table(3).

Table (3) :): Effect of different foods on the life table parameters of predator gamasid phytoseiid mite, *Amblysieus hutu* at 30+2 °C and 75+5% R.H

Parameters:-	prey1	prey2	prey3	prey4	prey5
Life cycle	7.13	12	10.35	7.7	15.85
Oviposition period [a]	25	20	16	15	35
Mean total fecundity(egg/♀)	95	59	74	85	64
Daily rate (egg/♀/day)	3.8	2.95	4.63	5.7	1.83
Mean generation time (T_c) [a]	15.42	19.966	16.61	13.524	27.548
Doubling time (DT) [a]	2.85	4.22	3.28	2.572	5.654
Net reproductive rate (R_o) [b]	42.57	26.55	33.48	38.25	28.98
Intrinsic rate of increase (r_m) [c]	0.2433	0.16423	0.21137	0.26945	0.12221
Finite rate of increase (λ)	1.27545	1.1784	1.2354	1.3092	1.129
Gross reproduction rate (GRR)	52.27	34.53	38.26	46.43	37.59

[a]Days, [b]per generation, [c]Individuals/female/ day, prey1: 1st nymph of date scale insect, prey 2: Eggs of date scale insect, prey 3: *Fusarium oxysporum*, prey 4: Immatures of *Oligonychus afrasiaticus*, prey 5: Eggs of *Oligonychus afrasiaticus*.

The mean generation time (T) of predator mite, *Amblyseius hutu* was significantly affected by the type of food. The longest time needed for one generation (27.548 days) was recorded when the mite fed on prey5, whereas, the shorter period was (13.524 days) on prey4. The population of *Amblyseius hutu* had the capacity to double (DT) every (2.85, 4.22, 3.28, 2.572 and 5.654 times) within a single generation when fed on five mentioned prey, respectively.Net reproductive rate (R_o) was (42.57, 26.55, 33.48, 38.25 and 28.98) per generation. On the other hand, when the values of (r_m) was converted to the finite rate of increase (e^{rm}) or (λ), it was clear that population of predator had capacity to multiply about (1.275, 1.178, 1.2354, 1.3092 and 1.129) times/female/day when it fed on 5 mentioned prey, respectively. Gross reproductive rate (GRR) was (52.27, 34.53, 38.26, 46.43 and 37.59) times/female/day when reared on the same five mentioned prey, respectively. It could be generally concluded that prey1 was the most suitable prey for the development and reproduction of predatory mite, *Amblyseius hutu* as it gave high Gross Reproductive rate (52.27 times/ female/day).

These results are similar with those obtained by [Gotoh, *et al.,* 2006; Abou-Awad, *et al.,* 2010; Osman, *et al.,* 2010; Momen, 2001; Rahman, *et al.,* 2013; Collier, *et al.,* 2007; Osman, *et al.,* 2010].

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الملخص العربى

تأثير بعض انواع الفرائس على التكاثر والخصوبه للحلم الاكاروسى (*Amblyseius hutu*, Mesostigmata: Phytosiidae)

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تم تربيه المفترس الأكاروسى *Amblyseius hutu* (phytoseidae) على ٥ أنواع مختلفه من الفرائس وهى:(الحورية الأولى و بيض حشرة النخيل القشرية برلاتوريا ,الفطر الفيوسيريم أوكسى سبورم ,الأطوار الغير كاملة و بيض حلم الغبار) وذلك تحت الظروف المعملية (٣٠°م - ٧٥٪ رطوبة نسبية). وقد لوحظ ان أقل فترة حضانه للبيض لهذا المفترس كانت عند تغذيتة على الحورية الأولى لحشرة النخيل القشرية برلاتوريا (١,٦٥يوم) أطولها كانت عند التغذية على بيض حلم الغبار (٢,٩ يوم). ولقد تأثرت فترة حياة كل من الإناث والذكور تأثيراً معنوياً بتغير نوع الفريسة المستخدمة. من ناحية اخرى كانت أطول فترات حياة الأفراد البالغة هى (٤٢,٧٣ يوماً) للإناث عند التغذية على بيض حلم الغبار وأقلها عند التغذية على الأطوار الغير كاملة لحلم الغبار (٢١,٥ يوماً). و قد اثبتت هذه التجربه كفاءه هذا المفترس الاكاروسى فى مكافحه حشرة النخيل القشرية برلاتوريا و حلم الغبار كمكافح حيوي قوى بديل للمبيدات واضرارها المتعدده.

JOESE 5

EFFECT OF DIFFERENT PREY ON THE REPRODUCTION AND FECUNDITY OF GAMASID MITE, AMBLYSEIUS HUTU (MESOSTIGMATA: PHYTOSIIDAE).

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