

BIOLOGICAL STUDIES ON THE PREDATORY MITE, *SANIOSULUS NUDUS* FED WHEN FEEDING ON EGGS OF PURPLE SCALE, *LEPIDOSAPHES BECKII* AND DATE PALM POLLEN

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Abstract

The biological aspects of the predatory mite, *Saniosulus nudus* Summer were studied at two types of food (the purple scale, *Lepidosaphes beckii* (Newm.) eggs and pollen grains of the date palm). Generally, the biological aspects of the predatory mite were affected by temperature and food types. The incubation period of *S. nudus* was (7.57 & 6.85) and (6.0 & 5.32) days; when mite fed on eggs and pollens at 16 & 24 °C, respectively. Similar results obtained for larval, protonymphal and deutonymphal stages. Female and male longevities were long with feeding on eggs. While, its short with feeding on pollens at 16°C. It could be concluded that data palm pollens was more favourable diets for female and male under two constant temperatures. Female and male life span of *S. nudus* affected by temperature, the longest period was recorded at 16°C when fed on date palm pollens. The pre-oviposition, oviposition and post- oviposition periods for female were affected by temperature and types of food. The total number of deposited eggs/female were (129.97 & 129.1), (135.1 & 132.6) eggs with a daily rate (2.15 & 2.12) and (2.42 & 2.3) eggs at 16 & 24°C, respectively. The sex ratio also changing as temperature change. Female's percentages as (females/total) of *S. nudus* increased as temperature increase. The feeding capacity of *S. nudus* was affected by predator stage and sex. The average number and daily rate of consumed prey increase with the successive predator developmental stages. Also, the immature of female fed on greater number of prey than those of male.

INTRODUCTION

The purple scale, *Lepidosaphes beckii* (Newman) (Homoptera : Diaspididae) is among the principal armoured scale insect pests of the world (Beardsley and Gonzales, 1975). Also, it is a dominant pest on citrus trees in Egypt (Hafez *et al.*, 1987).

The predatory mite, *Saniosulus nudus* Summers (Acarina : Stigmaeidae; Eupalopsellidae).

The present work is an attempt to study the biological aspects of the predatory mite, *Saniosulus nudus* feeding on the purple scale, *Lepidosaphes beckii* (Newman) and date palm pollen at two constant temperatures (16 and 24±1°C).

MATERIALS AND METHODS

1. Source of the predatory mite, *Saniosulus nudus*

The predatory mite, *S. nudus* individuals were collected from the Navel orange trees (*Citrus sinensis* var. *washing*) at Qalubiya Governorate and were identified by mounted on glass slides after clearing in Nesbitt's solution by using Hoyer's medium, then microscopically examined for identification by members of taxonomy, Acarology Dept., Plant Protection Research Institute.

2. Mass rearing of the predatory mite, *S. nudus*

Citrus leaves were used and hatching larvae were fed on *L. beckii* eggs. Newly deposited predator eggs were transferred singly each to a mulberry or citrus disc. Each hatched larvae were used in biological experiments.

3. Biological studies of the predatory mite, *S. nudus*

Laboratory experiments were carried out to study the biological aspects of *S. nudus* attacking scale insects on Navel orange trees.

3.1. Effect of two types of food on the predatory mite, *S. nudus*

For studying the attraction of *S. nudus* to *L. beckii* eggs and pollen grains of the date palm. Petri dish of 9 cm in diameter was filled with a wet cotton wool pad upon, which a leaf of citrus was situated upside down. A group of prey eggs and pollens was stuck on a small piece of double scotch tape placed at equal distances of 1 cm. on the circumference of a circle, 4 cm diameter, on the plant leaf. Twenty eggs of *L. beckii* (prey) or a group of pollen were used. Twenty of predator females, fed and starved for 24 hrs, were tested by introduced singly in a successive order to the center of the leaf and kept under observation till reaching its preferable food (Abd Allah, 1996).

The number of consumed prey individuals were estimated daily and replaced with fresh ones till reaching maturity. Emerged females were copulated and kept for

oviposition. Observations concerning the biological aspects were recorded during the predator life span.

3.2. Effect of two constant temperatures on incubation, oviposition periods, adult longevity, fecundity and feeding capacity of the predatory mite, *S. nudus*

Effect of two diets (*L. beckii* eggs and date palm pollen grains) on some biological aspects of *S. nudus* at 16 and 24 ±1°C and 70±5R.H.

Twenty newly deposited eggs of *S. nudus* predator were collected from a laboratory culture and placed on citrus leaf discs for the latter in Petri dishes of 5 cm in diameter with wet cotton wool pad. Relative humidity was maintained by adding few water drops when needed. Eight Petri dishes were kept in the incubator (16 and 24±1°C) fecundity of these females were examined and feeding capacity of both females and males were also estimated. The obtained data were statistically analyzed at 5%

RESULTS AND DISCUSSION

1. Durations of immature stages

The durations of immature stages of *S. nudus* were studied under two kinds of diet (*L. beckii* eggs and pollens of the date palm).

1.1. Egg stage (incubation period)

Results in Tables (1&2) indicate that the incubation period of the predator, *S. nudus* was affected by temperature and food types decreased by temperature increase. The longest incubation period lasted (7.57± 6.85) and (6.08 & 5.32) days recorded at 16 and 24°C, when fed on eggs and pollen grains.

1.2. Larval and nymphal periods

As shown in Tables (1&2) the immature stages periods of the predator, *S. nudus* was decreased when temperature increased. The longest durations of female and male (26.67±0.21 & 25.98±0.24 days) were estimated at 16°C when fed on *L. beckii* eggs. While, these periods lasted (25.61±0.50 & 24.27±0.50 days) at 16°C when mites fed on pollens of the date palm. On the other hand, female and male immature stages reached (20.10±0.26 & 19.37±0.23 days) when predator fed on *L. beckii* eggs and (20.47±0.61 & 20.70±0.10 days) when fed on pollens of the date palm at 24°C, respectively.

Statically analysis showed that no significant differences in immature stages between the two kinds of diets at 16 and 24°C for female and male.

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Table 1. Durations of the developmental stages of the predator, *Saniosulus nudus*
 Summer fed on two diets at 16±1°C and 70±5R.H.:

Duration		sex	Eggs of <i>L. beckii</i>	Pollens of date palm
Egg (incubation period)			7.57±0.05	6.85±0.11
Larval period		♀	6.73±0.25	6.90±0.24
		♂	6.55±0.28	6.70±0.26
Nymphal period	Protonymph	♀	8.83±0.15	8.40±0.56
		♂	8.60±0.10	8.17±0.48
	Deutonymph	♀	11.10±0.20	11.53±0.21
		♂	10.83±0.15	11.28±0.28
Total immature period		♀	26.67±0.21	25.61±0.50
		♂	25.98±0.24	24.27±0.50
Total developmental period		♀	34.27±0.16	33.76±0.60
		♂	33.52±0.13	33.11±0.25
Longevity		♀	117.05±4.90	122.32±0.35
		♂	115.20±4.95	120.13±0.32
Adult's life span		♀	151.32±4.96	156.08±0.42
		♂	148.72±4.84	153.05±0.40

Table 2. Durations of the developmental stages of the predator, *Saniosulus nudus*
 Summer fed on two diets at 24±1°C and 70±5R.H.

Duration		sex	Eggs of <i>L. beckii</i>	Pollens of date palm
Egg (incubation period)			6.00±0.18	5.32±0.16
Larval period		♀	5.27±0.31	5.47±0.21
		♂	4.93±0.32	5.23±0.25
Nymphal period	Protonymph	♀	6.83±0.15	6.57±0.59
		♂	7.20±0.20	7.67±0.15
	Deutonymph	♀	8.00±0.20	8.43±0.21
		♂	7.23±0.15	7.80±0.20
Total immature period		♀	20.10±0.26	20.47±0.61
		♂	19.37±0.23	20.70±0.10
Total developmental period		♀	26.23±0.21	25.90±0.52
		♂	25.23±0.15	29.90±0.12
Longevity		♀	84.13±2.02	25.90±0.12
		♂	80.47±2.14	88.33±1.48
Adult's life span		♀	110.37±2.02	84.73±1.92
		♂	105.70±2.07	110.63±1.25

1.3. Total developmental periods

According to the aforementioned results of larval and nymphal stages, the total developmental period of immature stages were affected by temperature. It could be concluded that date palm pollens was more favourable diet for female and male it was (25.90 ± 0.52 and 29.90 ± 0.12 days) at 24°C , while reached to (26.23 ± 0.21 and 25.23 ± 0.15 days) when fed on *L. beckii* eggs. On the other hand, this period reached to (33.76 ± 0.60 and 33.11 ± 0.25 days) when fed on pollens at 16°C , (34.27 ± 0.16 and 33.52 ± 0.13 days) when fed on *L. beckii* eggs at the same degrees of temperature.

Statically analysis revealed that life cycle of female and male was affected by food types and temperature.

1.5. Adult's longevity

Under two constant temperatures and feeding the predacious mite, *S. nudus* adults on pollens of date palms, the adult female and male lived for the longest times 122.32 ± 0.35 and 120.13 ± 0.32 at 16°C , respectively, while in case of, mites fed on eggs of *L. beckii* the adult female and male lived shortest time (84.13 ± 2.02 and 80.47 ± 2.14 days) at 24°C , respectively.

Statically analysis revealed that, there are significantly effects on the adult longevity of female and male, when they fed on *L. beckii* eggs and date palm pollens. In other words, the adult's longevity was negatively affected by temperature, i.e. longevity decrease by increasing temperature.

In this respect, Ibrahim (1971) found that the incubation period, immature stages and longevity of the predacious mite, *S. nudus* fed on eggs of *L. beckii* were affected by temperature.

1.6. Adult's life span

From the mentioned data, longevity and life span of *S. nudus* female affected by temperature, the longest period (156.08 ± 0.42 days) was recorded at 16°C when fed on date palm pollens, while it was (151.32 ± 4.96 days) when fed on *L. beckii* eggs. Also, male life span take the same trend of female, but the male life span was shorter than female, at two diets (153.05 ± 0.40 days) when fed on date palm pollens and (148.72 ± 4.84 days) when fed on *L. beckii* eggs. On the other hand, the life span of *S. nudus* was shorter at 24°C in the two diets.

1.7. Oviposition periods

1.7.1. Pre-oviposition period

Table (3) shows the pre-oviposition period for *S. nudus* was affected by temperature, it was decreased with temperature increasing. The pre-oviposition period was 8.65 ± 0.25 and 4.57 ± 0.20 days at 16 and 24°C when mites fed on *L. beckii* eggs, while it was 9.10 ± 0.22 and 5.08 ± 0.28 days at the same temperatures when female fed on date palm pollens, respectively.

1.7.2. Oviposition period

Also, the oviposition period of *S. nudus* was affected by temperature, it being the shortest period at 24°C and longest at 16°C. This period affected also by type of food, it being longest with pollens (61.07 ± 0.33 and 57.78 ± 1.37 days at 16 and 24°C), respectively, while when female fed on *L. beckii* eggs oviposition period lasted 60.50 ± 0.50 and 55.62 ± 1.23 days at 16 and 24°C). Hassan (1976) examined the biological response of *S. nudus* to crawlers of *Chrysomphalus ficus* (L.) and *Lepidosaphes tableyi*. He mentioned that the total period of immature averaged 13.6 and 14.8 days when fed on crawlers of *C. ficus* and 10.5 days on *L. tableyi* but female longevity was shorter on the former (30 days) and longer on the latter (33.4 days) during the life span.

Table 3. Effect of various diets on oviposition periods and fecundity of *Saniosulus nudus* Summer female at two constant temperatures (16 & 24±1°C) and 70±5R.H.

Duration		Eggs of <i>L. beckii</i>		Pollens of date palm	
		16°C	24°C	16°C	24°C
Pre-oviposition		8.65±0.25	4.57±0.20	9.10±0.22	5.08±0.28
Oviposition		60.50±0.50	55.62±1.23	61.07±0.33	57.78±1.37
Post-oviposition		50.78±0.46	24.25±0.44	52.15±0.38	25.47±0.55
Longevity		117.05±4.90	84.13±2.02	122.32±0.35	88.33±1.48
No. of eggs /female	Daily rate	2.15±0.02	2.42±0.10	2.12±0.00	2.30±0.07
	Total average	129.97±0.35	135.10±1.40	129.10±0.36	132.63±0.91
Sex ratio females/total (%)		49.17	50.00	48.33	51.00

1.7.3. Post-oviposition period

The post-oviposition period was affected by temperature and type of food and took the same trend of oviposition period, whereas the longest period when female fed on pollens date palm (52.15 ± 0.38 and 25.47 ± 0.55 days) while when fed on *L. beckii* eggs (50.78 ± 0.46 and 24.25 ± 0.44 days at 16 and 24°C), respectively.

1.8. Fecundity

Data in Table (3) shows that the daily and total number of deposited eggs/female of *S. nudus* are affected by both temperature and two types of food offered to adult female. The number of deposited eggs increased gradually by increasing temperature that 24°C was suitable temperature and the lowest number of deposited eggs/female was recorded at 16°C.

1.9. Sex ratio

Data in Table (3) show that sex ratio was affected by temperature. Female's percentages as (females/total) of *S. nudus* increased as temperature increase till 24°C. The highest percentage (51.00%) was recorded at 24°C when fed on pollens, while the lowest one (48.33%) was obtained at 16°C when fed on pollens

1.10. Feeding capacity of *S. nudus* on *L. beckii* prey

Data in Tables (4&5) revealed that, feeding capacity of *S. nudus* was affected by predator stage and sex. The average number and daily rate of consumed prey increase with the successive predator developmental stages. Also, the immature of female fed on greater number of prey than of those of male. Throughout the whole period of the immature stages, female consumed an average of 40.90 ± 0.36 and 43.12 ± 0.55 eggs at 16 and 24°C, respectively. Male followed similar trend as that of female, but in smaller numbers. Concerning the feeding capacity of adult's it is clear that the female consumed higher numbers of prey than male. These due to those females eggs production. Hassan (1976) reported that the adult female of the predator consumed an average of 180.8 and 158.3 crawlers of *C. ficus* and *L. tableyi*, respectively.

Table 4. Rate of consumed pry/female of *Saniosulus nudus* Summer fed on *LEPIDOSAPHES beckii* at two constant temperatures (16 and 24 \pm 1°C) and 70 \pm 5R.H.

Duration		Eggs of <i>L. beckii</i>			
		16°C		24°C	
		Total consumption	Daily consumption	Total consumption	Daily consumption
Larvae		9.50 \pm 0.50	2.00 \pm 0.00	11.21 \pm 0.75	3.00 \pm 0.50
Protonymph		11.23 \pm 0.75	1.98 \pm 0.06	13.52 \pm 0.55	2.18 \pm 0.12
Deutonymph		20.17 \pm 1.53	2.90 \pm 0.14	23.24 \pm 1.61	3.84 \pm 0.51
Total consumption of immatures		40.90 \pm 0.36	-	43.12 \pm 0.55	-
Adult's female	Pre-oviposition	16.17 \pm 1.26	16.17 \pm 1.26	15.24 \pm 0.25	17.15 \pm 0.14
	Oviposition	285.17 \pm 8.04	285.17 \pm 8.04	288.14 \pm 6.25	287.24 \pm 6.12
	Post-oviposition	53.83 \pm 6.77	53.83 \pm 6.77	56.47 \pm 0.48	55.17 \pm 0.81
Total consumption/female		355.17 \pm 8.38	-	347.15 \pm 6.14	-

Table 5. Rate of consumed pry/male of *Saniosulus nudus* Summer fed on *LEPIDOSAPHES beckii* at two constant temperatures (16 and 24 \pm 1°C) and 70 \pm 5R.H.

Duration		Eggs of <i>L. beckii</i>			
		16°C		24°C	
		Total consumption	Daily consumption	Total consumption	Daily consumption
Larvae		9.50 \pm 0.50	1.98 \pm 0.11	10.21 \pm 0.56	1.75 \pm 0.21
Protonymph		11.00 \pm 0.50	1.99 \pm 0.10	12.15 \pm 0.41	1.87 \pm 0.87
Deutonymph		20.33 \pm 0.76	3.01 \pm 0.02	21.21 \pm 0.55	2.47 \pm 0.14
Total consumption of immatures		40.83 \pm 0.58	-	41.45 \pm 0.65	-
Total consumption/female		215.33 \pm 5.03	-	222.15 \pm 6.01	-

REFERENCES

1. Abd Allah, Amira, M. S. 1996. Biological and ecological studies on some predacious mites. Ph. D. Thesis, Fac. of Agric. Cairo, Univ., 151 pp.
2. Abd El-Rahman, S. I. 1996. Studies on some tetranychid mites. Ph. D. Thesis Fac. Agric., Cairo Univ., 296 pp.
3. Beardsley, J. M. and R. H. Gonzales 1975. The biology and ecology of armoured scale. *Ann. Rev. Entomol.*, 20: 47-73.
4. Hassan, M. F. 1976. Studies on prostigmatid mites. M.Sc. Thesis, Fac. of Agric. Cairo, Univ., 70 pp.
5. Ibrahim, M. A. 1971. Studies on predacious mites associated with scale insects in Egypt. M.Sc. Thesis, Fac. of Agric. Cairo, Univ., 71 pp.

دراسات بيولوجية للمفترس *Saniosulus nudus* عند تغذيته علي بيض الحشرة
القشرية الأرجوانية وحبوب لقاح نخيل البلح

علاء حلاوة ، عزيزة فؤاد عجمي

معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - جيزة

السمات البيولوجية لمفترس *Saniosulus nudus* تم دراستها علي نوعين من الفرائس وهما بيض الحشرة القشرية الأرجوانية وحبوب لقاح نخيل البلح. بصفة عامة السمات البيولوجية لهذا المفترس تتأثر بارتفاع درجة الحرارة ونوع الغذاء. ففترة الحضانة نقل بارتفاع درجة الحرارة. حيث سجلت أطول فترة للحضانة عند درجة حرارة ١٦م، عند التغذية علي بيض الحشرة القشرية الأرجوانية. وفترة العمر غير الكاملة لهذا المفترس نقل أيضا بارتفاع درجة الحرارة فقد سجلت أطول فترة عند درجة حرارة ١٦م عند التغذية علي بيض الحشرة القشرية الأرجوانية. أطول فترة عمر لهذا المفترس عند التغذية علي بيض الحشرة القشرية الأرجوانية. وفترة حياة المفترس تتأثر بارتفاع درجة الحرارة فقد سجلت أطول فترة عند درجة حرارة ١٦م عند التغذية علي حبوب اللقاح. كما وجد أن فترة ما قبل وضع البيض وفترة وضع البيض وفترة ما بعد وضع البيض تتأثر جميعها بتغير درجة الحرارة فنقل بارتفاع درجة الحرارة. كما وجد أن كمية البيض الموضوعة يوميا تتأثر بتغير درجة الحرارة ونوع الغذاء. في حين تتأثر النسبة الجنسية بتغير درجة الحرارة حيث تزيد بزيادة درجة الحرارة. علي الجانب الآخر تتأثر القدرة علي التغذية تبعاً لطور المفترس وجنسه.