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Effect of different prey types and temperature on biological aspects of predatory mite *Protogamasellus discorus* (Acari: Gamasida: Ascidae) with special references of chemical analysis of prey

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Abstract:

The predatory mite *Protogamasellus discorus* Manson (Acari: Gamasida: Ascidae) was isolated from soil under debris of palm trees at Giza Governorate and reared under laboratory conditions of (25 and 30 ºC) on bulb mite *Rhizoglyphus robini* Claparède (Acari: Astigmata: Acaridae), larvae of *Musca domestica* L. (Diptera: Muscidae) , free living nematode *Rhabditella masculata* and three species of fungi *Fusarium oxysporium*, *Asperagillus niger* and *Pencilium notatum*. Obtained results showed that significant effects of different prey and temperature on biological aspects, fecundity and reproduction, whereas, life cycle duration lasted (9.9 and 9.4), (12.5 and 10), (10.7 and 9.4), (15.6 and 13.1), (10.9 and 9.6) and (9.2 and 8.8) days, when the predatory mite *P. discorus* fed on the above mentioned diets at 25 and 30 ºC, respectively. Female fecundity affected by temperatures and food types, where it is generally increased as temperature increased, also it being higher with free living nematodes (61.4 and 64.5) followed by *R. robini* (59.6 and 62.0) and larvae of *M. domestica* (32.3 and 36.5) eggs at 25 and 30 ºC, respectively, while, deposited eggs are very low with fungi, the rate of reproduction was greater at 25 ℃ when mite fed on fungi and at 30 ℃ on other prey where, the highest rate obtained with nematodes while the lowest with *P. notatum*. Chemical analysis of some prey showed that free living nematodes contain the highest percent of phosphorus (2.9%), so females deposited the highest number of eggs when it fed on nematodes than others.

Introduction

Predacous mites play an important role in biological control of associated pests in different habitats, i.e. aerial and soil organisms. Mesostigmatic mites consider one of the most important groups, they are numerous and differ in their feeding habits, some are predators of aerial pests infesting different crops, while other species live in soil and organic manure feeding on soil pests, mites, immatures, while some of them are fungivorous. Researches by several authors were mainly concerned with survey, morphology and taxonomy of vast number of species in different countries of the world. The biology of some predacous and parasitic mites attracted many investigators e.g. Hoda *et al*., 1986; Nawar and Nasr, 1988; Ibrahim *et al*., 1989; Ali, 1994; Taha, 1991 and Taha *et al.,* 2006.

The present work aims to study: 1. The effects of different prey and fungi on biological developmental stages and fecundity of the predatory mite *Protogamasellus discorus* Manson (Acari: Gamasida: Ascidae) under laboratory conditions. 2. Estimation of the rate reproduction as affected by prey types and rearing temperature. 3. Analysis of phosphorus contents in the prey. 4. Chemical analysis of dry matter, crude protein, ether extracts, nitrogen and ash, of different prey.

Materials and methods

1.Collection:

The predatory mite *P. discorus* was extracted from soil under palm trees associated with acarid mites, free living nematodes and other organisms at Giza Governorate. Samples were freshly transferred to laboratory for extraction using modified Tullgren funnels for 24 h. Mites received in petri dishes filled with water. Living specimens were examined using stereomicroscope and collected by camel hair brush for biological experiments.

2. Specimens identification:

Adult individuals were firstly cleared in Nesbitt's solution, then mounted in Hoyer's medium on glass slides and examined microscopically for identification; slides were labeled with locality, stage, sex and date of mounting.

3. Rearing procedures:

The predatory mite *P. discorus* was reared in plastic rings 2.8 cm. in diameter and 2.0 cm. in depth, they were filled up to 0.5 cm. with plaster of Paris and charcoal, drops of water were added daily to maintain suitable relative humidity. For culturing mites, several adult females were placed in plastic rings supplied with food and kept in an incubator at 25 and 30 ºC. For individual rearing, newly deposited eggs were transferred singly to prepare ring. Each newly hatched larva was supplied with a known number of prey and developed individuals replaced daily by fresh ones till reaching maturity. Mites were examined twice daily with the aid of stereomicroscope. Emerging females were copulated and kept for oviposition. Observations concerning all biological aspects were recorded during the predator life span. Each rearing experiment was started with 25 newly hatched larvae, immature stages of bulb mite *Rhizoglyphus robini* Claparède (Acari: Astigmata: Acaridae), larvae of *Musca domestica* L. (Diptera:Muscidae), free living nematode *Rhabditella masculata* and three species of fungi *Fusarium oxysporum*, *Aspergillus niger* and *Penicilium notatum* were used as different types of food at 25 and 30 ºC.

4. Sources of food:

4.1. Immature stages of the bulb mite *R. robini* were obtained from rot infested onion and rearing at laboratory on dry yeast granules.

4.2. *M. domestica*, the same technique of rearing house fly in laboratory described by Mohamed (1976) was used to obtain daily fresh larvae as a main source of food.

4.3. Free living nematodes *R. musculata* as extracted from humified materials which put in Baerman's funnel for 24 hour. The extraction was added to petri dishes contain slides of ornamental bulb on potatoes as a mixture food source for rearing nematodes, petri dishes left for one week in natural condition by using a camel brush, drops of this feeding were put in each rearing cell of mites as the main source of food.

4.4. Fungal culture:

The fungal cultural of *F.oxysporum*, *A. niger* and *P. notatum* were obtained from Plant Pathology Dept., Fac. of Agric., Cairo Univ. These fungi were cultured on agar medium and species from culture.

4.5.Mixture (*)

R. robini, larvae of *M. domestica* and *R. masculata*.

4.6. Mixture (**) *F. oxysporium, A. niger and P. notatum*.

4**.7.** Mixture (***)

R. robini, larvae of *M. domestica*, *R. masculata*, *F. oxysporium, A. niger and P. notatum*.

4.8. Chemical analysis of prey:

Experiments were carried out to shed light on the effect of chemical constituents of different prey types on the whole activity of the predatory mite, *P. discorus*. The prey contents of protein, phosphorus, ether extracts, and nitrogen free extract with amino acids were analyzed in the Central Lab. for Food and Feed, Agric. Res. Center. These contents were estimated using the method of Bhargava and O'Neil (1975).

Results and discussion

1. Biological studies:

1.1. Habitat and behaviour:

The predatory mite *P. discorus* was isolated from soil under debris of palm trees at Giza Governorate. This mite species was reared in laboratory on the bulb mite *R. robini*, larvae of *M. domestica*, free living nematode *R. musculala* and three species of fungi, *F. oxysporum*, *S. niger* and *P. notatum*. Thelytoky in *P. discorus* was observed as unmated females deposited unfertilized eggs which gave rise to only females. It was observed that females deposited their eggs in the substratum. Also, cannibalism was observed for this mite species.

1.2. Hatching:

Eggs are oval white and hatching occur through a medial longitudinal slit surrounding the eggs and dividing the shell into two parts except one slide. Hatching larvae then crawls outside leaving the egg shell.

1.3. Moulting:

Any immature stage when full grown enters a semi quiescent phase. This period lasted for about one hour at a laboratory temperature, after that, the individual bend it's for legs, then stretches its forward without leaving its place and shakes its body laterally then stops. This process is repeated several times and then the mite gets ride of the skin through a ventral longitudinal slit. Moulting process lasted an hour.

1.4. Biological developmental stages:

The incubation period lasted (1.5 and 1.4), (1.7 and 1.5), (1.8 and 1.5), (2.3 and 1.8), (1.5 and 1.6) and (1.5 and 1.4) days at 25 and 30 ºC when adult females were fed on the previous diets , respectively, as shown in Table (1). It is clear that the incubation period was shorter at 30 ºC than that at 25 ºC.

1.5. Total immature stages:

The total immature stages stayed (8.0 and 8.5), (8.5 and 10.5), (7.9 and 8.9), (11.3 and 13.3), (8.1 and 9.3) and (7.8 and 7.7) days at 30 and 25 ºC, when the predatory mite *P. discorus* fed on the above mentioned diets, respectively. Obtained data cleared that food types and temperature affected on immature stages (Table, 1). These results coincided with that obtained by Taha *et al*., (1988) and 2006.

1.6. Life cycle:

Life cycle period was greatly affected by temperature. It was short at high than low temperature; also, this period was differed according to the types applied food. The duration of life cycle was (9.2 and 9.9) and (8.8 and 9.4) days on *P. notatum* and *R. robini* at 25 and 30 ºC, resepectively, which consider were more favourable than other diets for the predatory mite *P. discorus.*

1.7. Longevity and life span:

The obtained data as shown in Table (1) cleared that female longevity was shorter (25.8 and 17.4) days when it fed on *P. notatum* and prolonged with free living nematodes (28.5 and 22.1) days at 25 and 30 ºC, respectively, while life span was short (30.0) days on *P. notatum* and prolonged to 40.0 and 39.2 days on larvae of *M. domestica* and free living nematodes.

1.7. Female oviposition:

The period of female oviposition found to be affected by different diets and temperature, it is greatly shorter (8.5 and 8.2 days) on *A.niger* and *F. oxysporum* at 30 ºC, while, on the bulb mite *R. robini* (21.1 and 16.9) days at 25 and 30 ºC, respectively (Table, 2). These results agree with those obtained by Nawar and Nasr, 1988 and Ibrahim *et al*., 1989. They found that female of *P. primitis* oviposition period affected by different types of food.

1.8. Female fecundity:

The female fecundity of the predatory mite *P. discorus* was affected by different types of food and temperature, where it is generally increased as temperature increased, also, it is being higher with free living nematodes (61.4 and 64.5) eggs followed by *R. robini* (59.6 and 62.0) and larvae of *M. domestica* (32.3 and 36.5) eggs at 25 and 30 ºC, respectively. Obtained results showed that female fecundity was very low when fed on fungi, whereas, female deposited a total average of 5.0, 4.7 and 2.3 eggs with a daily rate of 0.55, 0.53 and 0.17 eggs when it fed on *F. oxysporum*, *A.niger* and *P. notatum* at 25ºC, respectively. From the above mentioned data, it could be concluded that the free living nematodes is the most suitable diets for mass production of the predatory mite, *P. discorus.* These results are agreed with that obtained by Abou-El-Naga *et al.,* 1987 and Taha *et al*., 1988.

1.9. Feeding capacity as influenced by prey types:

As shown in Table (3) female immature (proto and deutonymph) of *P. discorus* consumed (23.8 and 33.7) and (15.5 and 21.5) individuals of *R. robini* and larvae of *M. domestica* at 25 and 30 ºC., respectively. During the oviposition period, female was at the highest efficiency, it consumed (65.1 and 81.0) and (38.3 and 49.8) individuals of *R. robini* and larvae of *M. domestica* at 25 and 30 ºC, respectively (Table, 3).

1.10. Reproduction and feeding:

This experiment was carried out by keeping virgin females of *P. discorus* in screw cupped glass container (5 cm in diameter) supplied with diet and incubated at 25 and 30 ºC. This species reproduced parthenogntically, after one month, individuals were counted, whereas, experiments was replicated five times. The obtained results in Table (4) showed that level of reproduction was greater at 30 ºC compared to its level at 25 ºC for free living nematodes *R. robini* and *M. domestica*. On the other hand, level of reproduction was greater at 25 ºC than that obtained at 30 ºC for fungi. Reproduction was affected by types of palpitated food. Free living nematodes recorded highest rate, while, fungi recorded lower reproduction. Mixture (***) recorded the highest number (330.4 and 350.4) individuals at 25 and 30 ºC, respectively, but mixture (*) recorded (310.6 and 346.8) individuals, while mixture (**) contained all fungi under investigation recorded the lowest number of individuals (Table, 4).

2. Chemical analysis:

Chemical analysis of prey *R. robini***,** larvae of *M. domesticae* and free living nematodes were conducted for some knowledge about (1)Phosphorus, (2) Moisture and dry matters, (3) Dry matter, (4) Crude proteins, (5) Ether extracts, (6) Nitrogen free extracts, (7) Amino acids and ash. Chemical analysis of prey was carried out to shed light on its effect on the predatory mite *P. discorus* activity.

2.1. Phosphorus contents (%) of the prey:

By using the methods of Bhargava and O'Neil (1975), phosphorus contents was estimated in dry matter samples. Results, showed that free living nematodes contained the highest percentage of phosphorus (2.9 % /g. dry matter) followed by both larvae of *M. domestica* and *R. robini* (2 %) (Table, 5).

2.2. Moisture and dry matter:

Estimation of the percentage of moisture and dry matter in different preys is very important because if the percent of moisture was relatively high in the prey, the predacous mite was very active and its feeding capacity increased. Data showed that, free living nematodes contain the highest percentages of moisture reached to 95.1 %. On the other hand, organic manure recorded low percentage of moisture (13.7 %) and high percentage of dry matter reached to 86.3 % (Table, 6).

2.3. Dry matter:

The bulb mite *R. robini* contain the highest percentages of dry matter 14.7% followed by *M. domestica* 14.0% and free living nematodes 4.8% (Table, 5).

2.4. Crude proteins: Larvae of *M. domestica* contain the highest amount of crude proteins (51.5 % / g. dry matter) followed discendingly by free nematodes 40.7 % and *R. robini* 31.8 %.

2.5. Ether extracts:

Ether extracts is necessary for predacous mite to provide it with energy which is needed for its movements and reproduction. Ether extracts are recorded in all preys, but in different percentages, free living nematodes contain the highest percent of ether extract (26.6 %) followed by R. robini (24.64 %) and larvae of *M. domestica* (12.22 %), therefore, the predacous mite *P. discorus* feeding on prey containing the highest percent of ether extracts was more active than other (Table, 6).

2.6. Ash:

The bulb mite *R.robini* contains the highest percent of ash (15.0 %), followed by free living nematode (6.7 %) and larvae of *M. domestica* (5.28 %). Statistically highly significant deviations existed between the ash in different tested preys (Table, 6).

2.7. Amino acids: As shown in Table (7) by using instrume: High performance, Amino acids analyzer, Model: Beckman, system 7300 and Data system 7000.Column: Na- A/B/D 25-Cm Column. Sample Vol: 50 Ul. From Table (7), it was shown that free living nematodes contained 15 amino acids, while larvae of *M. domestica* and immature stages of *R. robini* are contained 14 amino acids. Data cleared that larvae of *M. domestica* contained the highest percentage of amino acids, while *R. robini* contained the highest percentage of two amino acids; serine (1.38 %) and Alanine (2.52 %). Free nematodes contained the lowest percentage of 13 amino acids except Aspartic acid (1.12 %) and Glutamic acid (1.33 %) (Table, 7).

Table (1): Duration of developmental stages of the predatory mite *Protogamasellus discorus* reared on different diets at 25 and 30 ºC.

Predatory stage	Temp.	Average periods in days					
		Rhizoglyphus robini	Larva of *Musca domestica*	*Rhabditella masculata*	*Fusarium oxysporium*	*Asperagillus niger*	*Pencilium notatum*
Egg	25 ºC	1.5 + 0.5	1.7+0.5	1.8+0.7	2.3+0.7	1.5+0.5	1.5+0.5
Larva		2.3+0.5	2.1+0.6	2.3+0.4	2.0+0.5	2.7+0.5	2.3+0.5
Protonymph		3.1+0.6	3.7+0.9	3.0+0.5	5.6+0.4	3.1+0.7	22.3+0.4
Deutonymph		3.1+0.5	4.7+1.3	3.0+0.7	5.7+1.1	3.5+0.6	3.1+0.8
Total immature		8.5+1.1	10.5+1.4	8.9+1.1	13.3+1.4	9.3+1.0	7.7+1.1
Life cycle		9.9+1.2	12.5+1.5	1.7+1.5	15.0+1.6	10.3+1.3	9.2+1.3
Longevity		28.5+2.4	27.5+4.6	28.5+3.8	22.8+3.7	24.1+2.4	25.8+2.1
Life span		38.4+2.1	40.0+5.1	39.2+3.8	38.4+3.3	35.0+2.8	30.0+2.9
Egg	30 ºC	1.4+0.5	1.5+0.5	1.5+0.5	1.8+0.6	1.6+0.5	1.4+0.5
Larva		2.2+0.6	2.1+0.7	2.0+0.7	2.2+ 0.7	2.2+ 0.4	2.3+0.8
Protonymph		3.5+0.5	3.1+0.7	2.3+0.4	3.8+0.8	2.9+ 0.7	2.2+0.6
Deutonymph		2.4+0.7	3.3+0.7	3.6+0.5	5.3+0.8	3.1+ 0.6	3.0+ 0.6
Total immature		8.0+1.2	8.5+0.9	7.9+1.1	11.3+1.6	8.1+ 1.0	7.8+0.7
Life cycle		9.4+1.1	10.0+1.1	9.4+1.0	13.1+1.7	9.6+1.3	8.8+ 1.1
Longevity		21.6+1.3	21.4+1.8	22.1+2.8	19.2+ 1.3	16.6+ 1.6	17.4+2.3
Life span		31.0+1.1	31.4+2.3	31.5+3.6	32.3+ 1.5	29.4+ 2.9	25.2+ 2.1

Table (2): Effect of different types of food on longevity and fecundity of the predatory mite *Protogamasellus discorus* at 25 and 30 ºC.

Type of food	Average duration in days						Number of eggs / female			
	Pre-oviposition		Oviposition		Post-oviposition		Total average		Daily rate	
	25 ºC	30 ºC	25 ºC	30 ºC	25 ºC	30 ºC	25 ºC	30 ºC	25 ºC	30 ºC
Rhizoglyphus robini	3.6+0.8	4.9+0.5	21.1+2.3	16.9+1.8	3.8+0.8	2.8+0.4	59.6 +7.5	62.0+6.9	2.8+0.6	3.7+0.6
Rhabditella masculata	6.8+0.4	4.4+0.5	14.7+4.3	12.2+ 1.9	6.9+0.9	4.5+0.7	61.4+5.0	64.5+3.2	4.2+0.4	5.3+0.2
Larvae of *Musca domestica*	3.8+1.2	2.6+0.5	20.1+4.0	16.1+ 1.2	3.6+0.8	2.7+0.8	32.3+5.5	36.5+4.8	1.7+0.5	2.1+0.4
Fusarium oxysporium	5.4+0.9	4.6+0.5	9.0+2.1	8.2+1.1	8.4+ 1.1	6.4+0.5	5.0+3.7	10.0+1.6	1.2+0.6	1.1+0.3
Asperagillus niger	6.8+1.3	5.0+0.7	8.8+2.0	8.5+0.8	8.5+ 1.4	6.0+1.9	4.7+1.7	5.0+1.0	0.5+0.3	0.5+0.3
Pencilium notatum	4.4+1.4	4.4+0.5	12.9+1.4	5.2+1.1	13.5+2.0	7.8+0.8	2.3+0.8	2.8+0.8	0.2+0.1	0.5+0.04

Table (3): Food consumption of the predatory mite *Protogamasellus discorus* during life span at 25 and 30 ºC.

Predatory stage	*Rhizoglyphus robini*		Daily rate		Larvae of *Musca domestica*		Daily rate	
	25 ºC	30 ºC	25 ºC	30 ºC	25 ºC	30 ºC	25 ºC	30 ºC
Protonymph	10.5 + 2.3	15.2 +3.4	3.4 + 4.5	4.3 + 1.5	6.7 +2.0	10.2 +4.1	1.8+0.5	3.3+0.7
Deutonymph	13.5 + 2.3	18.5 + 2.9	4.2 + 0.7	7.7 + 1.3	8.8+2.9	11.3+3.3	1.8+0.6	4.3+1.1
Total immature	23.8 + 1.9	33.7 + 7.5	3.9 + 0.7	4.2 + 1.3	15.5+3.8	21.5+7.9	1.0+0.5	3.6+1.0
Oviposition	65.1 + 13.7	81.0 +13.7	3.1 + 0.7	4.1 + 0.7	38.3+9.2	49.8+10.5	1.9+0.4	3.6+0.7
Longevity	104.0+23.7	126.7+25.1	3.6 + 0.8	4.8 + 1.5	7552+12.1	75.0+28.2	1.8+0.7	3.5+0.5
Life span	138.8 + 9.5	170.4+18.3	3.6 + 0.8	5.0 + 1.3	77.8+10.2	106+17.3	2.0+0.5	3.4+0.8

Table (4): Reproduction and feeding of *Protogamasellus discorus* at different temperature and types of food

Type of diets	No. of individuals after one month			
	25ºC		30 ºC	
	Average	Range	Average	Range
***Rhabditella masculata* (1)**	274.4	250-301	304.8	283-321
***Rhizoglyphus robini* (2)**	156.4	144-173	167.6	154-177
Larvae of *Musca domestica* (3)	147.2	125-201	153.4	133-190
***Fusarium oxysporium* (4)**	94.2	76-114	89.8	82-99
***Asperagillus niger* (5)**	18.2	0-31	17.8	0-28
***Pencilium notatum* (6)**	7.8	0-16	7.8	0-13
***mixture (1+2+3)**	310.6	280-335	346.8	290-375
**** mixture (4+5+6)**	121.0	111-140	136.4	110-155
***** mixture (1-6)**	330.4	290-360	350.4	312-384

Table (5); Percentage of moisture, dry matter and phosphorus in different preys

Content prey	Moisture	Dry matter %	Phosphorus %
Rhabditella masculata	95.18	4.82	2.9
Rhizoglyphus robini	85.30	14.70	2.0
Larvae of *Musca domestica*	86.0	14.0	2.0

Table (6): Chemical analysis of dry matter contents of tested preys

Prey	D.M. %	C. P. %	E. E. %	H. F. E. %	Ash
Larvae of *Musca domestica*	14 (100)	57.5	12.22	31.0	5.28
Rhizoglyphus robini	14.7 (100)	31.80	24.64	28.56	15.0
Rhabditella masculata	4.82 (100)	40.7	26.6	26.0	6.700

O.M.: Dry Matter, C.P.: Crude Protein, E.E.: Ether Extract, N.F.E.: Nitrogen Free Extract

Table (7) : Amino acids (%) in test preys

Amino acids	Larvae of *Musca domestica*	*Rhizoglyphus robini*	*Rhabditella masculata*
Aspartic acid	4.15	2.26	1.12
Therionine	1.82	1.09	0.40
Serine	1.18	1.38	0.37
Glutamic acid	3.41	2.19	1.33
Glycine	3.05	1.64	0.17
Alanine	2.30	2.52	0.63
Valine	2.02	1.43	0.51
Methionin	-	-	0.23
Isoleucine	1.58	1.02	0.40
Leucine	2.90	1.89	0.72
Tyrosine	0.98	0.76	0.15
Phenylalanin	2.99	1.53	0.52
Histidine	1.28	0.62	0.36
Lysine	2.83	1.66	0.45
Prginine	1.74	1.53	0.39

References

Abou-El-Naga, M. M.; Ibrahim, G. A.; Taha, H. A. and Abou El-Soud, A. B. (1987): Nematodes as a natural food for *Chiropturopoda* *bakeri* Zaher & Afifi (Acarina: Uropodidae). Zagazig J. Agric. Res., 14 (2): 665-672.

Ali, F.S. (1994): Biological and ecological studies on some predacous mesostigmatic mites with special reference to family Phytoseiidae. Ph. D. Thesis, Fac. Agric. Cairo University

Bharagava, K. K. and O 'Neil (1975): Evaluation of dehydrated poultry waste from Cago reared Broilersas as a food ingredient for Broilers. Poultry Science, 54: 1506 – 1511.

Hoda, F. M.; Taha, H.A.; Ibrahim, G. A. and El-Beheri, M.M. (1986): Biological observation on the predatory mite, *Hypoaspis miles* Berlese (Acarina: Laelapidae). Bull. Soc. Ent. Egypt, 66: 103- 106.

Ibrahim, G. A.; Afifi, A. M. and Abdel Halim, S. M. (1989): Laboratory observation on the biology of *Proctolaelaps pygmaeus* (Muller) and *Protogamasellus pygmaeus* (Athias-Henriot) (Acari: Gamasida: Ascidae). Bull. Soc. Ent. Egypt, 86: 43-47.

Mohamed, H. M. (1976): Mites associated with citrus in Florida. Bull. Univ. Fla. Agric. Exp. St.: 640-679.

Nawar, M. S. and Nasr, A. K. (1988): Biology of the ascid mite *Protogamasellus perimitis* Genis, Loots and Ryke with description of immature stages (Acari: Mesostigmata: Ascidae). Bull. Soc. Ent. Egypt, 68: 85-94.

Taha, H. A. (1991): Effect of temperature on duration, efficiency and fecundity of the predatory mite, *Androlaelaps zaheri* Hafez, El-Badry and Nasr (Acarina: Laelapidae). Proc. 4th Arab Congress, Plant Protection, Cairo: 527- 532.

Taha, H. A.; El-Naggar, M. E. ; Abou El-Naga, M. M. and Soliman, S. M. (1988): Effect of different prey species on development and fecundity of the predacous mite, *Neocunaxoides anderei* (Baker and Hoff.) (Acari: Cunaxidae). Agric. Res. Rev., 66 (1): 129-135.