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Physiological effects of *Amblyseius swirskii* during feeding on some natural Dites

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Abstract
Background: Predatory mites *Amblyseius swirskii* (Phytoseiidae) was reared on different natural diets to evaluate their value as alternative food source for rearing of this species. *Tetranychus urticae* kotch (Acari: Tetranchidae) is the mite pests attacking over 1, 100 species of plants in 140 families with economic value.
The aim of this study: was evaluated the Physiological effect of feeding on *A. swirskii* rearing. Using of some artificial diets as an alternative food source for rearing of *A. swirskii.*
Methods: the experiments were carried out under laboratory conditions, at 25 ± 5 ° C and 70% R.H. Most diets reduced the total developmental time of the predator. *A. swirskii* was feeding on Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains and Bean powder.
Results: *A. swirskii* when fed on Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains and Bean powder the life cycle of *A. swirskii* were 7.2, 8.2, 7.5and 8.9 days per females but were 6.3, 6.8, 6.9 and 6.9 per males respectively. The life span were 24.4, 20.1, 27.6 and 29.7 in females but were in males 15.5, 16.2, 15.1 and 15.7 respectively. The Chemical analysis of the different foods was 889.6, 826.6, 5.37 and 2.133 total amino acid and was 27.7, 25.6, 698.3 and 2.47 total Proteins.

Keywords: physiological, effect, feeding, *Amblyseius swirskii*, rearing

Introduction

The main of the present study was evaluate biochemical and biological effect of different natural diets as an alternative food source for *Amblyseius swirskii* rearing. Family Phytoseiidae is important family of acarine predators of plant pest mites [1, 2]. *Amblyseius swirskii* passes during 4 immature stages before reaching the adult stage. The development of *A. swirskii* influenced by the type of food and environmental conditions. The immature developmental times for this species are quite variable, ranging from 4.8 days when the predator is fed on *Bemisia tabaci* larvae (Gennadius) at 26 ºC [3] to 24.1 days on pollen of *Zea mays* L. at 15 ºC [4]. When *A. swirskii* is fed on live prey it generally develops faster than when fed on pollen. For example, the immature developmental time of the mite reared on *Aculops lycopersici* (Massee) (Acari: Eriophyidae) or *Tetranychus urticae* Koch (Acarina: Tetranychidae) was shorter than that on pollen of *Typha latifolia* L. or *Ricinus communis* (L.) [5, 6]. The reproduction of *A. swirskii* is affected when it fed on (prey species or plant material), food quantity and environmental conditions. The reproduction of *A. swirskii* was higher on the natural prey *A. lycopersici* or *T. urticae* than on pollen of *T. latifolia* or *R. communis*, respectively [5, 6]. Fouly et al. [3] proved food quantity highly affected on fecundity and life table parameters of *A. swirskii*. Also, different temperatures affected on egg production of the predator [7, 8, 10]. When the temperature increased from 15 to 35ºC daily oviposition of *A. swirskii* increased from 0.49 to 2.4 eggs/female/day [8]. Zaher et al., [9] mentioned that the relative humidity influenced the fecundity of the predator, with females laying a lot of eggs at 70% & 80% R.H. (13 and 12 eggs/female/10 days, respectively) than at 55% and 95% R.H. (10 and 9 eggs/female/10 days, respectively). Zaher et al., [9] also, mentioned the effect of host plant leaf surface on *A. swirskii* ovipositi the females fed on *Eutetranychus orientalis* (Klein) (Acari: Tetranychidae) deposited a lot of eggs on the smooth leathery leaves of grapefruit (15.8 eggs/10 days) than on the coarse reticulated leaves of guava (10.8 eggs/10 days). Yousef et al., [11] mentioned that the effect of photoperiod on the reproduction of *A. swirskii*, with increasing photoperiods resulting in lower prey consumption and an associated drop in fecundity.
The aim of this study was evaluated the Physiological effect of feeding on *Amblyseius swirskii* rearing. Using of different artificial diets as an alternative food source for rearing of *Amblyseius swirskii.*

Materials and Methods

Rearing technique

Spodoptera littoralis

Spodoptera littoralis Strains used in the present studies were taken from laboratory pests & plant protection Department at the National Research Centre, Giza, Egypt.

Amblyseius swirskii

Predator was mass rearing on freshly leaves of ficus, *ficus discora* L. arising on moisten cotton in aluminum trays (30x20x7 cm) provided with water. Tangle –foot (a mixture of Canada balsam and both castor and citronella oils) surrounding the edges of the tray was applied to prevent the mite from escaping. The trays were supplied with enough individuals of *Tetranychus urticae* Koch different stages under room condition. Water was added when needed maintaining suitable moisture.

The predacious mite *Amblyseius swirskii* were carried out in the incubator at constant temperature of 25± 2°C and 60± 5%. Apure culture of predator was maintained on moving stages of the phytophagous mites *T. urticae* Koch on leaf discs of Castor oil plant of about 2.5 cm. diameter, on cotton wool in petri- dishes. Water was daily added to maintain suitable moisture.

Newly egg laying females of *A. swirskii* were divided into five groups of ten individuals each. These groups were fed for ten days on any of the preys. The preys were nymphs of *Trips tabaci* Lind., *Aphis gossypii* Glover and adult females of the mite *Eutertranychus orientalis* (Klein).

Trials were also conducted to study the suitability of non- prey food substances. These substances were Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains and Bean powder, which were sterilized by a piece of cotton soaked in alcohol before use.

Apparatus

Mites were homogenized for biochemical analysis in a chilled glass Teflon tissue homogenizer (ST – 2 Mechanic-Preczyina, Poland). After homogenation , supernatants were kept in a deep freezer at -20ºc till use for biochemical assays . Double beam ultraviolet / visible spectrophotometer (spectronic 1201, Milton Roy Co., USA) was used to measure absorbance of colored substances or metabolic compounds.

Preparation of mites for analysis

The insects were prepared as described [12]. They were homogenized in distilled water (50 mg /1 ml). Homogenates were centrifuged at 8000 r.p.m. for 15 min at 2 ºC in a refrigerated centrifuge. The deposits were discarded and the supernatants, which is referred as enzyme extract, can be stored at least one week without appreciable loss of activity when stored at 5^0C.

Biochemical analysis

Total amino acids were colorimetrically assyed by ninhydrin reagent according to the method described [13]. The reaction mixture consists of 1 ml sample and 1.9 ml ninhydrin-citrate buffer-glycerol mixture that consists of 0.5 ml of 1% ninhydrin solution in 0.5 M citrate buffer (PH 5.5); 0.2 ml of 0.5 M citrate buffer (PH 5.5) and 1.2 ml glycerol. The mixture was heated in aboiling water bath 10 min and cooled in a tap water bath.The developed color was read at 570 nm. The amino acids were expressed as ug alanine per gm body weight.

Statistics

All experiments contained 3-4 replicates (insects homogenates), and the results of biochemical determinations were pooled from triplicate determinations. The results were analyzed by one – way analysis of variance (ANOVA) using costat statistical software (cohort software, Berkeley). When the ANOVA statistics were significant ($P < 0.01$), means were compared by the Duncan's multiple range test.

Results

Data in Table (1) showed that, the egg, Larva stages, Proto nymph, Deuto nymph, Adult and the total life cycle of *A. swirskii*. The egg period was 1.2 days when *A. swirskii* fed on all types of food (Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains and Bean powder), Larva stages was 1.2 days when *A. swirskii* fed on all types of food (Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains and Bean powder), Proto nymph was 1.5, 2.4, 1.8, and 2.8 days when *A. swirskii* fed on Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains and Bean powder, respectively. Deuto nymph was 1.9, 1.6, 1.7, and 1.8 days when *A. swirskii* fed on Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains and Bean powder, respectively. Adult was 1.4, 1.9, 1.6, and 1.9 days when *A. swirskii* fed on Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains and Bean powder, respectively and the total life cycle was 7.2, 8.2, 7.5, and 8.9 days when *A. swirskii* fed on Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains and Bean powder, respectively.

Table 1: The Predator *A. swirskii* life cycle on different foods, powder at 25 ° C ±5, 70% R.H.

Developmental Stages	Types of food							
	Spider various stages of powder		Cotton Worm Egg Powder		Pollen grains		Bean powder	
	F	M	F	M	F	M	F	M
Egg	1.2 ± 0.0	1.2 ± 0.0	1.2 ± 0.0	1.2 ± 0.0	1.2 ± 0.0	1.2 ± 0.0	1.2 ± 0.0	1.2 ± 0.0
Larva	1.2 ± 0.01	1.1 ± 0.00	1.2 ± 0.02	1.1 ± 0.00	1.2 ± 0.0	1.2 ± 0.0	1.2 ± 0.1	1.1 ± 0.0
Proto nymph	1.5 ± 0.02	1.2 ± 0.01	2.4 ± 0.03	1.2 ± 0.03	1.8 ± 0.01	1.4 ± 0.00	2.8 ± 0.03	1.3 ± 0.01

Deuto nymph	1.9 ± 0.01	1.7 ± 0.05	1.6 ± 0.18	1.5 ± 0.04	1.7 ± 0.00	1.6 ± 0.02	1.8 ± 0.16	1.7 ± 0.11
Adult	1.4 ± 0.00	1.1 ± 0.10	1.9 ± 0.23	1.8 ± 0.01	1.6 ± 0.02	1.5 ± 0.07	1.9 ± 0.01	1.6 ±0.5
Life cycle	7.2 ± 0.07	6.3 ± 0.04	8.2 ± 0.05	6.8 ± 0.07	7.5 ± 0.03	6.9 ± 0.06	8.9 ± 0.15	6.9 ± 0.09

Data in Table (2) showed that, the preoviposition, Oviposition, Post ovipostion, Longavity, Life span and Number of egg of *A. swirskii*. The preoviposition period was 1.5, 1.6, 1.4 and 1.8 days when *A. swirskii* fed on Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains and Bean powder, respectively. Oviposition was 12.4, 11.3, 12.8 and 11.5 days when *A. swirskii* fed on Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains and Bean powder, respectively. Post ovipostion was 3.3, 4.9, 5.9, and 7.5 days when *A. swirskii* fed on Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains and Bean powder, respectively. Longavity was 17.2, 17.8, 20.1, and 20.8 days when *A. swirskii* fed on Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains and Bean powder, respectively. Life span was 24.4, 20.1, 27.6, and 29.7 days when *A. swirskii* fed on Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains and Bean powder, respectively and Number of egg Number of egg was 17.2, 16.9, 17.0, and 15.5 days when *A. swirskii* fed on Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains and Bean powder, respectively.

Table 2: The Predator *A. swirskii* longevity, life span, number of egg and daily rate on different foods, powder at 25 ° C± 5, 70% R.H.

Developmental Stage	Types of food							
	Spider various stages of powder		Cotton Worm Egg Powder		Pollen grains Powder		Bean powder	
	F	M	F	M	F	M	F	M
P preoviposition	1.5 ± 0.07	-	1.6 ± 0.36	-	1.4 ± 0.41	-	1.8 ± 1.10	-
Oviposition	12.4 ± 1.20	-	11.3 ± 0.03	-	12.8 ± 0.60	-	11.5 ± 0.07	-
Post ovipostion	3.3 ± 1.13	-	4.9 ± 1.10	-	5.9 ± 1.08	-	7.5 ± 0.17	-
Longavity	17.2 ± 0.17	8.7 ± 0.53	17.8 ± 0.02	9.4 ± 0.12	20.1 ± 1.11	8.2 ± 0.12	20.8 ± 0.20	8.8 ± 0.11
Life span	24.4 ± 0.03	15.5 ± 0.19	20.1 ± 0.51	16.2 ± 0.20	27.6 ± 0.12	15.1 ± 0.03	29.7 ± 0.01	15.7 ± 0.12
N. of egg	17.2 ± 0.2	-	16.9 ± 0.2	-	17.0 ± 0.05	-	15.5 ± 0.09	-
Daily rate	1.0 ± 0.00	-	0.95 ± 0.16	-	0.85 ± 0.09	-	0.7 ± 0.81	-

Data in Table (3) showed that, Total amino acid was 889.666, 826.666, 5.369and 2.133 Ugalamnime in Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains Powder diets, respectively. Total Proteins was 47.536, 40.366, 39.966 and 53.866 Mg/gm in Spider various stages of powder, Cotton Worm Egg Powder, Pollen grains Powder diets, respectively.

Table 3: The Chemical analysis of the different foods fed by the predator *A. swirskii.*

Foods / Analysis	Spider various stages of powder	Cotton Worm Egg Powder	Pollen grains Powder	Bean powder
Total amino acid	**889.666 Ugalamnime**	**826.666 Ugalamnime**	**5.369 Ugalamnime**	**2.133 Ugalamnime**
Total Proteins	47.536 Mg/gm	40.366 Mg/gm	39.966 Mg/gm	53.866 Mg/gm
G. O. T	45.333 UX^{10}/GM	46 UX^{10}/GM	963 UX^{10}/GM	2.031 UX^{10}/GM
G.P.T	27.777 UX^{10}/GM	25.666 UX^{10}/GM	698.333 UX^{10}/GM	2.471 UX^{10}/GM

Glutamic pyruvic transaminase (GPT) and glutamic oxaloacetic transaminase

Discussion

The use of an artificial diet may represent more cost-effective rearing of generalist phytoseiid mites and other biocontrol agents [5]. Artificial diets can be an alternative to natural and factitious prey for the mass production of biocontrol agents, reducing costs and facilitating automation of the production [14].

The development rate, survival rate, reproduction rate and rate of population increase of an arthropod population [15, 16].

Our study proved distinct effects of some artificial diets on bioecological parameters of the predatory mite *A. swirskii*. Our results sproved that *A. swirskii.* can feed and develop to the adult stage on all tested diets. However, pre adult duration was different among tested diets. The suitability of pollen grains has also been proved for other phytoseiid species [17].

Conclusion

The diets supplemented with arthropod components, as well as with bull sperm or maize pollen all enhanced survival, development and reproduction of *A. swirskii*, and consequently its population growth parameters. However, further experiments are needed to develop a suitable artificial diet for providing higher reproductive performance for phytoseiid mites. In addition, further work will be needed to develop a diet in a practical form for mass production and/or as a supplementary diet in the crop.

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