Abating of Bemisia tabaci (Gennadies) using *Amblyseius cydnodactylon (Shehta &Zoher)* in the same ecological niche (Inseta, Aleyrodidae & Acari, phytoseiide)

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Abstract: The phytoseiide mite *Amblyseius cydnodactylon (Shehta and Zoher)* as predator on *Bemisia tabaci* (Gennadies) was studied at laboratory conditions, 25±2ºC and 70±5% R.H. The predator was able to feed and complete its development on the tested prey. The larval stage developed to the protonymphal stage without feeding. On the other hand, the consumption rate increased through the developmental stages, respectively. Maximum mean for the total food consumption of the female predator was recorded during the oviposition period, it consumed an average of (242.61) preys, while the average number of *B. tabaci* devoured during life span were (303. 8 and 212.65) preys for female and male, respectively. This study declared that *A. cydnodactylon* may be considered of great value for controlling *B. tabaci* under greenhouses and field crops in Egypt.

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1. Introduction

Hemipteran pests can seriously damage crops by feeding directly on plant sap, excreting honeydew, and transmitting more than 110 plant viruses **Jones, 2003**,**Mughra, *et al.*,2008 and El-Sharkawy2013**. The whitefly, *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae), is a complex species, it firstly described in Greece by **(Gennadius, 1889)**, it has become one of the most serious agricultural and ornamental plant pests in many areas of the world in recent decades (**DeBarro, 1995; Tanigoshi, *et al.* 2001; Hodges and Evans 2005; Qiu, *et al.* 2007 and Qiu, *et al.*, 2009).** This pest completed its development on 118 species of plants in 79 genera belonging to 28 families and caused damage through feeding, causing sooty mold by its honey dew, transmitting more than 111species of plant pathogenic viruses, and inducing plant physiological discords (**Gerling, 1990, Heinz 1996; Brown, 2001 and Abd-Rabou & Simmons 2010).** Historically, *B. tabaci* has been difficult to control with conventional insecticides in agronomic and horticultural production systems (**Palumbo *et al.*, 2001).**

The diet of phytoseiid mites may include several whitefly and mite species as well as pollen in several agro ecosystems. The whitefly, *B. tabaci*is a pest with high resistance to chemical insecticides that occur in greenhouses in temperate regions (**El-Banhawy, *et al.*, 2000 and Nomikou**, ***et al.*, 2001).**

The predacious mite, *Amblyseius cydnodactylon* Shehata and Zaher (Acari, Phytoseiidae) is a common natural enemy inhabiting low growing plants like cucumber in Egypt. It has been recorded associated with infestations of the two-spotted spider mite, *Tetranychus urticae* Koch (Acari, Tetranychidae) and the whitefly, *Bemesia tabaci* (Genn.). The mite *A. cydnodactylon*is considered a generalist predator and it was recorded preying on several pests including tetranychid and eriophyid mites in addition to nymphs of whiteflies and thrips (**El-Banhawy *et al.*, 2001)**.

However, the present study was conducted to evaluate the effect of laboratory conditions on the developmental life stages, life cycle, longevity, fecundity, lifespan and prey consumption of *A. cydnodactylon* as a biocontrol agent controlling the insect pest, *B. tabaci.*

2. Material and Methods

Prey culture:

The whitefly, *Bemisia tabaci* (Gennadius) was found and daily obtained from leaves of castor oil plants, *Ricinus communisi* L. (Euphorbiaceae) at Hehia district, El-Sharkia Governorate, Egypt .during 2014/2015 season.

Predator culture:

A laboratory colony of *Amblyseius cydnodactylon* Shehata and Zaher occurring with mulberry plant leaves, *Morus alba* L. (Moraceae) at the same area. Mass culture was maintained in the laboratory on castor leaves infested with *Tetranychus urticae Koch (*Acari, Tetranychidae) as prey.

Experimental procedure:

The experiment was conducted under the laboratory conditions, 25 ±2 ° C and 70±5% R. H. Thirty gravid females of *A. cydnodactylon* were taken randomly and transferred to rearing substrates. The rearing substrates were disks of castor oil plants leaves (one inch in diameter), placed on cotton moistened with water in Petri-dishes (6 cm in diameter). Females were left 24 hours and their oviposited eggs are considered the first step of biological aspects. Thereafter, when a sufficient number of eggs were laid, the adult females were removed and thus eggs from the same age were obtained to start the investigation. Observations were made every 6 hours intervals to observe the eggs hatching. As the eggs hatched into larvae, individuals were transferred very carefully onto fresh leaf disks of castor leaves (one inch in diameter). Leaf discs were placed with the upper surface facing down on cotton layer, moistened with water in a Petri-dishes (6 cm in diameter). Water was added when needed to maintain the suitable moisture. The leaf margin was surrounded by tangle foot (candabalsm, castor beans & eitronella oils) to prevent the escaping of mites. Twenty replicates were maintained for the experiment. All Petri dishes were kept under laboratory conditions. Crawlers of *B. tabaci* were given as food for the predatory mite, *A. cydnodactylon*. The biological aspects for female and male predator were recorded by a stereomicroscope binocular.

Statistical analysis:

Data were statistically analyzed using the analysis of variance according to **Sendecor and Cochran (1982)** using the computer program **SPSS (2006).**

3. Results

Developmental stages of *Amblyseius cydnodactylon* Shehata and Zaher fed on crawlers of *B. tabaci* (Genn.) at laboratory conditions are presented in (Tables 1 & 2).

The incubation period for the eggs of *A. cydnodactylon* averaged 1.8 and 1.71 days for female and male, respectively. After hatching, the larval stage developed to the protonymphal stage without feeding, remained active for a short period of 1.41and 1.26 days for female and male, respectively. The duration period of the female and male protonymphs recorded 2.45 and 2.11 days after molting to give the deutonymphs. Generally, the immature stages and life cycle required average periods of (7.45 & 6.38) and (9.25 & 8.19) days for female and male, respectively (Table 1).

Table (1): Developmental stages of *A. cydnodactylon*, fed on crawlers of *B. tabaci* at 25±2 °C and 70±5% R.H..

Stages	**Mean ± SE. days**	
	Female	**Male**
Incubation period	1.8±0.258	1.71±0.441
Active larva	1.41±0.137	1.26±0.473
Protochrysalis	0.75±0.375	0.6±0.029
Larval stage	2.1±0.394	1.91±0.013
Active protonymph	1.68±0.544	1.31±0.118
Deutochrysalis	0.81±0.044	0.77±0.353
Protonymphal stage	2.45±0.438	2.11±011
Active deutonymph	2.11±0.353	1.71±0.071
Tritochrysalis	0.83±0.125	0.65±0.016
Deutonymphal stage	2.9±0.350	2.36±0.21
Total immature	7.45±0.669	6.38±1.23
Life cycle	9.25±0.669	8.19±1.59

During adulthood, longevity of *A. Cydnodactylon* female and male took an average of 21.45 and 18.15 days, respectively. The life span was 30.7 and 26.34 days, for female and male, respectively.

Regarding to the fecundity, the number of deposited eggs per female was 31.2 eggs, with a daily rate of 1.79 eggs (Table 2).

Table (2): Duration of longevity, life span and fecundity of *A. cydnodactylon*, fed on crawlers of *B. tabaci* at 25±2◦C and 70±5% R.H.

Periods and Fecundity	Mean±SE. days	
	Female	**Male**
Pre-oviposition	1.35±0.242	-
Oviposition	17.35±1.06	-
Post- oviposition	2.75±0.540	-
Longevity	21.45±1.04	18.15±0.629
Life span	30.7±1.31	26.34±1.28
Fecundity		
*** No. of eggs/ female**	31.2±2.098	-
*** No. of eggs/ female/day**	1.79±0.603	-

Food consumption of *A. cydnodactylon:*

The consumption rate increased through the developmental stages, respectively (Table 3). The larval stage developed to the protonymphal stage without feeding. The female longevity of *A. cydnodactylon* was 21.45 days while that of male was 18.15 days. The consumption of *B. tabaci* nymphs was more by female predator (274.1 nymphs) than male (205.34 nymphs). The maximum means for total food consumption of the female predator was recorded during the oviposition period, it consumes an average of (242.61 prey). Finally, the average number of devoured victim during life span were 303.8 and 212.65 preys for female and male, respectively.

Table (3): Total prey consumption of different life stages of *A. cydnodactylon* fed on crawlers of *B. tabaci* at 25±2◦C and 70±5% R.H.

Consumption rate	+Mean ± SE. days	
	Female	**Male**
Larva	0.0±0.0	0.0±0.0
Protonymph	11.6±1.174	8.3±0951
Deutonymph	18.1±1.197	9.1±1.246
Life cycle	29.7±1.197	17.3±1.629
Longevity	274.1±13.739	205.34±11.28
Life span	303.8±14.32	212.65±13.74

4. Discussion

Little previous study has been made concerning the predation of this species; therefore I could not compare the results with previous published studies. However, there are numerous investigations on other phytoseiid species, revealing the effect *B. tabaci* on the biological aspects of *A. cydnodactylon*.

Results demonstrate that local population of *A. cydnodactylon* is able to feed and complete developmental stages when fed on the crawlers of *B. tabaci*.

The present results agree with**, El Banhawy, *et al.* (2001).** They reported that, *A. cydnodactylon* able to develop and reproduce when fed on other different prey species such as, nymphal stages of *Bemisiatabaci*, *Thripstabaci* (Lindeman) and *Tetranychus urticae*. They added, consumption rate of *A. cydnodactylon* increased as the development progressed. Also **Nomikou *et al.* (2001)** mentioned that the phytoseiid mite, *Amblyseius swirskii* (Athias-Henriot), feed on eggs and crawlers of *B. tabaci* and develops well on this prey.

The present study showed that temperature affects the feeding capacity of all life stages of *A. cydnodactylon* except the larval stage, where it developed to the protonymphal stage without feeding. Non feeding larval behavior may be a mechanism to avoid sibling cannibalism. Similar findings have been reported for other phytoseiid species by **Zhang *et al.* 1998; El-Banhawy *et al.* 2000; Chittenden & Saito, 2001; Kouhjani *et al.*, 2009 and Fatemeh *et al.* 2011**.

During immature stages of *A. cydnodactylon*, food consumption rate increased at the experimental temperature (25ºC). **Metwally *et al.*, 2005** and **Fatemeh *et al.*, 2011** showed that the food consumption increased from 20 to 25◦C. They added, it could be concluded that the optimal temperature for predation of this predator was about 25◦C.

The present data showed that the predator females during oviposition consumed a significantly higher number of prey, suggesting that females need extra food for egg production during this period. This information is in agreement with other findings of **Tanigoshi, *et al.*, 2001; Saha, *et al*., 2001; Kouhjani *et al*., 2009 and Omar and Mesbah 2013.**

Although, I observed the same trend in all experiments, the obtained values were different because of different prey and predator species were used in the experiments. Furthermore, several other factors, such as relative humidity, photoperiod, presence of pollen, and the type of experimental arena may also affect a predator's feeding **(Fernando and Hassell, 1980).**

The results from the current study would help us to gain a better insight into the efficiency and practical application techniques of a predator in biological control programs of spider mites. According to the findings, *A. cydnodactylon* could be a beneficial biocontrol agent for *B. tabaci* in both greenhouses and field when temperature is 25◦C; however, to optimize results, additional experiments should be performed. **Gerling, *et al.* (2001)** reported that reviews current efforts in biological control of *B. tabaci* in greenhouse and field crops, and highlights research gaps and directions deserving further development.

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