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A study on the Biology of Predatory Mite, *Euseius scutalis* (Athias-Henriot) (Acari: Phytoseiidae) Feeding on Black Scale Insect, *Parlatoria ziziphi* (Lucas) (Homoptera: Diaspididae)

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ABSTRACT

Euseius scutalis developed and oviposited when provided with egg stage of *Parlatoria ziziphi* as prey under laboratory conditions of $28 \pm 2^{\circ}\text{C}$ and $70 \pm 5\%$ relative humidity (RH). *Euseius scutalis* was significantly affected by food source but a slight difference was noticed between females and males. The efficiency of the predator increased as it advanced in its development. Egg incubation period of female and male lasted 2.11 days. The life cycle lasted 8.04 and 7.32 days for female and male, respectively. The female lived for a longer period than that of the male, where longevity was 23.3 and 17.11 days for female and male, respectively. The number of prey eggs consumed per individuals was 16.11 and 10.30 eggs for total immature stages. The female predator devoured 43.81 prey eggs during the oviposition period (11.46 days) and deposited 0.91 eggs per day.

INTRODUCTION

Scale insects found in different parts of the world fall within 23 families while only 12 out of that number are found in Egypt, and one of the most important of these insects are armored scale insects (Diaspididae) (Hassan *et al.*, 2012). These insects attack different important economic crops in Egypt. Most species that belong to this family attack various parts of the host plant, leaves, stem, bark, crown and fruits. The main injury is caused due to their ingestion of plant sap, reduction of plant vigor, drop of leaves or spottily yellowing, deformation of shoot and twig, blister like galls, fruit drops and effects on the normal physiological activities of the trees (Capinera, 2008). The black parlatoria scale insect (Nabk scale insect) *Parlatoria ziziphi* (Lucas) (Homoptera: Coccoidea: Diaspididae) was originally recorded from Europe and later from particularly every tropical and subtropical part of the world and is present throughout the Mediterranean basin. Thirty four plant species belonging to 11 families have been recorded as hosts of this pest, most of them on citrus (Katsoyannos, 1996). This insect pest did not attract attention and it was not a key insect pest of citrus in Egypt until the seventies of the last century. *P. ziziphi* is considered an important pest on citrus and it attacks leaves, branches and fruits (Abdel Fattah *et al.* 1978).

Many predaceous Phytoseiid mites are now used as biological control agents in various agricultural ecosystems, and are important predators of mite and insect

populations in IPM programs on outdoor and greenhouse crops. *Euseius scutalis* (Athias-Henriot) is one of the most important generalist predators of mites and insects and is widely found on various crops (McMurtry and Croft, 1997). *E. scutalis* feeds on mites, eggs and pre-adult stages of some insects and different plant pollens. Many authors studied the biology of this predator on various kinds of diets, e.g. tetranychid mites, insects and pollens (Meyerdirk and Coudriet, 1986; Bounfour and McMurtry, 1987; Kasap and Sekeroglu, 2004; Osman *et al.*, 2010; Al-Shammery, 2010; Fouly *et al.*, 2013).

In Egypt, *E. scutalis* is considered the most abundant and widely distributed and it was noticed feeding on mites and insects inhabiting the same habitat (Zaher, 1986). There are some previous studies about rearing different predaceous mites on the black scale insect, *P. ziziphi*, e.g. El-Sherif (1989) and Shoeb (1996). But, unfortunately there are no studies on the biological aspects of this predator when fed on this pest. So, the present study was performed to investigate the ability of *E. scutalis* to feed and develop on eggs of *P. ziziphi*.

MATERIALS AND METHODS

Black parlatoria scale insect:

The crawlers of black parlatoria scale insect, *P. ziziphi* were found and collected from leaves of citrus trees, *Citrus* spp. (Family: Aurantioideae) where the predator is associated with it. Eggs were collected and transferred (on small pieces of the host leaf) to the rearing arenas for the feeding experiments. The leaf pieces with eggs were replaced daily with fresh ones.

Maintenance of the mite stock culture:

The predator mite, *E. scutalis* was collected from heavily infested citrus leaves at Giza Province, Egypt, and reared on all stages of the two spotted spider mite *T. urticae* in the laboratory at $28 \pm 2^\circ\text{C}$ and $70 \pm 5\%$ relative humidity (RH) with 16:8 L:D hr photoperiodic regime.

Effect of preys on development:

The rearing arena (3 cm diameter) of excised castor bean leaves, placed on saturated cotton in plastic Petri dishes (9 cm diam.), was used to confine the predator. Water saturated, absorbent cotton strip, 1-cm wide, was placed around the edge of the leaf to prevent mites from escaping and to hold the leaf flat. Thirty *E. scutalis* eggs for each test were transferred individually with a fine sable brush to each arena, and the newly hatched larvae were supplied with the food resource to be evaluated. Developmental stages were recorded twice daily. Prey eggs consumed were replaced daily by fresh ones.

Effect of preys on longevity and fecundity:

Newly emerged females, after mating, were confined individually on test arenas, along with the food to be tested. A few strands of cotton wool were provided as an ovipositor site on each arena. Oviposition and survival were recorded. Thirty females of *E. scutalis* in each experiment were observed daily and each experiment was repeated three times.

The data about duration of different stages, fecundity and longevity were analyzed by one way ANOVA followed by Duncan's Multiple Range test.

RESULTS AND DISCUSSION

Both sexes of *E. scutalis* passed through an egg, larvae, protonymph and

deutonymph stages before reaching the adulthood as in other phytoseiid species. As shown in Table (1), egg incubation period of female and male lasted 2.11 days. The duration of larval stage remained 1.11 and 1.01 days, the protonymph was 2.07 and 1.89, the deutonymph was 2.86 and 2.43 days. The life cycle lasted 8.04 and 7.32 days for female and male, respectively. The results indicated that survival percent of female and male predator was 100%. A longer developmental time was reported of the predatory mite, *Agistemus longisetus* Gonzalez when it was fed on eggs of scale insect, *P. zizyphi* (15. days) (Momen, 2001).

Table 1: Average duration (in days) of *E. scutalis* fed on egg stage of *P. zizyphi* (No. of replicates 15) at $28 \pm 2^\circ\text{C}$ and $70 \pm 5\%$ R.H.

| Developmental stage | Duration in days (Mean \pm SD) | |
|----------------------------|-----------------------------------|-------------------------------|
| | Female | Male |
| Egg | 2.11 ^a \pm 0.73 | 2.11 ^a \pm 0.73 |
| Larva | 1.11 ^a \pm 0.44 | 1.01 ^a \pm 0.36 |
| Protonymph | 2.07 ^a \pm 0.56 | 1.89 ^a \pm 0.11 |
| Deutonymph | 2.86 ^a \pm 0.22 | 2.43 ^a \pm 0.28 |
| Total immature | 5.94 ^a \pm 0.33 | 5.42 ^a \pm 0.36 |
| Life cycle | 8.04 ^a \pm 0.28 | 7.32 ^a \pm 0.11 |
| Preoviposition | 3.07 \pm 0.22 | - |
| Oviposition | 11.46 \pm 0.45 | - |
| Postoviposition | 8.77 \pm 0.31 | - |
| Longevity | 23.3 ^a \pm 0.36 | 17.11 ^b \pm 0.41 |
| Life span | 31.34 ^a \pm 0.48 | 24.43 ^b \pm 0.11 |
| % surviving | 100 | 100 |
| Sex ratio % (female/total) | 60 % | |
| Total number of eggs | 10.42 \pm 0.44 | - |
| Daily number of eggs | 0.91 \pm 0.06 | - |

(Means in row followed by the same letter are not statistically different, $p > 0.05$ Duncan's Multiple Range test).

Fouly *et al.* (2013) found that life cycle duration of *E. scutalis* was averaged 5.20 and 6.19 days, 6.40 and 7.23 days, 7.30 and 7.85 days for male and female when fed on palm pollen, immature stages of *T. urticae* and *B. tabaci*, respectively. The female lived for a longer period than that of male, where longevity was 23.3 and 17.11 days for female and male, respectively. The predator life span lasted 31.34 and 24.43 days for female and male, respectively. Kasap and Sekeroglu (2004) reported that developmental times of *E. scutalis* were 6.7, 4.9 and 4.2 days at 20, 25 and 30C, respectively, using stages of *Panonychus citri* (McGregor) as diet.

Table (2) demonstrated that, with the advance of the developmental stages the average number of consumed prey eggs increased. The average number of eggs was consumed by *E. scutalis* female and male larva, protonymph and deutonymphal stages were 3.01, 5.20 and 7.90, 1.80, 3.60 and 4.90, respectively. During the preoviposition, oviposition and postoviposition periods, the predator consumed 15.36, 17.21 and 11.24 prey eggs respectively. The average number of consumed eggs by adult females and males during longevity period were 43.81 and 36.12, respectively. On the other hand, the average number of consumed eggs by adult females and males during life span period were 59.92 and 43.22 for female and male, respectively. Results obtained by Badii *et al.* (2004) indicated that *Euseius hibisci* (Chant) consumed significantly more *T. urticae* eggs than other prey stages. Generally, the present results may help in planning a successful IPM program to Black parlatoria scale insect, *P. zizyphi* in Egypt.

Table 2: Food consumption of the predatory mite, *E. scutalis* fed on of eggs of *P. ziziphi* (n=20) at 28 ± 2°C and 70 ± 5% R.H.

| Predator stage | Average No. consumed (Mean ±SD) | |
|-----------------|---------------------------------|---------------------------|
| | Female | Male |
| Larva | 3.01 ^a ± 2.11 | 1.80 ^b ± 2.23 |
| Protonymph | 5.20 ^a ± 3.82 | 3.60 ^a ± 1.89 |
| Deutonymph | 7.90 ^a ± 2.77 | 4.90 ^b ± 0.93 |
| Total immature | 16.11 ^a ± 2.56 | 10.30 ^b ± 0.89 |
| Preoviposition | 15.36 ± 2.55 | - |
| Oviposition | 17.21 ± 3.21 | - |
| Postoviposition | 11.24 ± 2.45 | - |
| Longevity | 43.81 ^a ± 1.89 | 36.12 ^b ± 0.11 |
| Life span | 59.92 ^a ± 1.48 | 43.22 ^b ± 1.25 |

(Means in row followed by the same letter are not statistically different, $p > 0.05$ Duncan's Multiple Range test).

REFERENCES

- Abdel Fattah, M.I., El-Minshawy, A.M. and Darwish, E.T. (1978). Biology of the zizyphus scale, *Parlatoria ziziphi* (Lucas) in Egypt (Homoptera: Diaspididae). *Proceeding of the fourth conference of pest control, September, 30-October 3, Cairo, Egypt*. Part 1 pp. 9-56.
- Al-Shammery, K.A. (2010). Different biological aspects of the predaceous mite *Euseius scutalis* (Acari: Gamasida: Phytoseiidae) and the effects due to feeding on three tetranychid mite species in Hail, Saudi Arabia. *Asian J. Biol. Sci.*, 3(2): 77-84.
- Badii M.H., Hernandez-Ortiz E, Flores, A. E. and Landeros, J. N. (2004). prey stage preference and functional response of *Euseius hibici* to *Tetranychus urticae* (Acari: Phytoseiidae). *Exp. Appl. Acaol.*, 34: 263-273.
- Bounfour, M. and McMurtry, J.A. (1987). Biology and ecology of *Euseius scutalis* (Athias-Henriot) (Acarina: Phytoseiidae). *Hilgardia*, 55(5):1-23.
- Capinera, J.L. (2008). Encyclopedia of Entomology "Citrus pests and their Management". 2nd Edition, Springer Science, Business Media B.V., Dept. of Entomology and Nematology, Univ. of Florida, USA, pp. 896.
- El-Sherif, A.S. (1989). Studies on Egyptian Actinedida. *Ph.D. Thesis, Fac. of Agric., Cairo Univ.*, 217 pp.
- Fouly, A.H., Nassar, O.A. and Osman, M.A. (2013). Biology and life table of *Euseius scutalis* (A.-H.) reared on different kinds of food. *Journal of Entomology*. 1-8.
- Hassan, N.A., Radwan, S.G. and El-Sahn, O.M.N. (2012). Common scale insects (Hemiptera: Coccoidea) in Egypt. *Egypt. Acad. J. Biology. Sci.*, (A-Entomology) 5(3): 153 -160.
- Kasap, I. and Sekeroglu, E. (2004). Life history of *Euseius scutalis* feeding on citrus red mite *Panonychus citri* at various temperatures. *Biocontrol*, 49: 645-654.
- Katsoyannos, P. (1996). Integrated Insect Pest Management for Citrus in Northern Mediterranean Countries. *Benak Phytopathological Institute*, 110 pp.
- McMurtry, J.A. and Croft, B.A. (1997). Life-styles of phytoseiid mites and their roles in biological control. *Annu. Rev. Entomol.*, 42: 291-321.
- Meyerdirk, D.E. and Coudriet, D.L. (1986). Evaluation of two biotypes of *Euseius scutalis* (Acarina: Phytoseiidae) as predators of *Bemisia tabaci* (Homoptera: Aleyrodidae). *J. Econ. Entomol.*, 79(3): 659-663.

- Momen, F.M., (2001). Effects of diet on the biology and life tables of the predacious mite *Agistemus exsertus* (Acari: Stigmaeidae). *Acta Phyto. et Entomo. Hungarica*, 36: 173-178.
- Osman, M.A., Abou-Ellella, G.M. and Tawfic, A.A. (2010). Role of four phytoseiid mite species and acarophagous ladybirds, *Stethorus gilvifrons* (Mulsant) as bioagents of the two spotted spider mite, *Tetranychus urticae* Koch. *Acarines*, 4: 47-55.
- Shoeib, A.M. (1996). Biological and Ecological studies on some predaceous mites. *Ph.D. Thesis, Fac. of Agric., Cairo Univ., 156 pp.*
- Zaher, M.A. (1986). Survey and ecological studies of phytophagous, predaceous and soil mites in Egypt. Final report PL 480, Programme USA Project No. EG. ARS-30, grant No.FG-139. *Faculty of Agriculture, Cairo University.*

ARABIC SUMMERY

دراسة علي حيوية المفترس الأكاروسي *Euseius scutalis* (أكاري: فيتوسيدي) عند تغذيته علي الحشرة القشرية السوداء *Parlatoria ziziphi* (متجانسة الأجنحة: الحشرات القشرية المسلحة)

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أجريت هذه الدراسة بغرض دراسة المظاهر البيولوجية للنوع الأكاروسي المفترس *Euseius scutalis* عند تغذيته علي بيض الحشرة القشرية السوداء *Parlatoria ziziphi* التي تصيب الموالح وذلك علي درجة حرارة 28 ± 2 °م ورطوبة نسبية 70 ± 5 %. نجح المفترس في النمو والتشكل من طور اليرقة إلي الطور الكامل عند تغذيته علي بيض هذه الآفة، وكانت فترة حضانة البيض ٢,١١ يوماً للإناث والذكور. بينما استغرقت دورة الحياة $8,04$ و $7,32$ للأنثى والذكر علي التوالي. كما سجلت النتائج أن الاناث تعيش فترة أطول من الذكور. وكانت فترة الخصوبة للإناث والذكور $23,3$ و $17,11$ يوماً علي التوالي. كما أشارت الدراسة إلي أن متوسط ما تستهلكه الأطوار الكاملة للمفترس $16,1$ و $10,30$ بيضة من الفريسة للإناث والذكور علي التوالي. و سجلت النتائج أن الأنثى تستهلك $43,81$ بيضة للفريسة خلال فترة وضع البيض ($11,46$ يوماً). ووضعت $0,91$ بيضة/يوم. من نتائج هذه الدراسة يمكن أن يلعب هذا المفترس الأكاروسي دوراً كبيراً وهاماً في مجال مكافحة البيولوجية لهذه الآفة.