Study of the occurrence of predatory actinedid mites with biological aspects of *Agistemus exsertus* Gonzalez (Acari: Stigmaeidae)

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Abstract: To study the important role of actinedid predatory mites in biological control of some pests, forty five samples of various materials i.e. plants, soil debris and organic manure, were collected from different localities at Ismailia governorate, Egypt. A total of 238 of actinedid mites were collected. Mites belonging to seven families, fifteen genera and fifteen species were recorded. These families are; Cheyletidae, Stigmaeidae, Cunaxidae, Bdellidae, Eupallopselidae, Neophyllobiidae and Eupodidae. On the other hand, results revealed that *Agistemus exsertus* Gonzalez was noted as the most common predacious mite in the investigated areas. *A. exsertus* feeding on eggs of the scale insects *Pulvinaria psidii* Maskell under two different temperatures degrees and relative humidity.

Keywords: Predaceous mites- Actinedida - *Agistemus exsertus*.

INTRODUCTION

The Actinedida is a large and complex of aerial, terrestrial, storage and aquatic inhabitants. Most of them are known as important free livings, while others are predacious, fungivorus or feeding on debris or organic matter. The most important predatory species belonging to suborder Actinedida are Cheyletidae, Stigmaeidae, Cunaxidae and Bdellidae (Gerson *et al.*, 2003). This group of mites plays a considerable role in reducing population of many species of agricultural pests such as phytophagous mites, scale insects, aphids and white flies (Kandeel 1993). In Egypt, many species of actinedids have been recorded (Zaher *et al.*, 1973, Hassan 1979, Hassan *et al.*, 1986, Hoda *et al.*, 1986, Kandeel and Nassar 1986, Shoukry *et al.*, 1999, El-Kady *et al.*, 2006 and El-Sharabasy *et al.*, 2008.

Mites of the family Stigmaeidae are predominantly predator of different plant feeding mites (tetranychids, tenuipalpids and eriophyids) and small insect pests like aphids and scales. (Rasmy 1975; Krantz 1978 and Childers *et al.*, 2001). These are increasingly being used as bio-control agents of phytophagous mites in crops, fruit trees, vegetables and ornamentals.

The predatory mite, *Agistemus exsertus* is an important natural enemy of acarine pests in Egypt, Feeding range, as an essential factor for evaluating; its role in reducing the populations of plant pests, has been studied by many authors, e. g. Zaher *et al.*, 1971, Soliman *et al.*, 1976, Hanna *et al.*, 1980, Yousef *et al.*, 1982, EL-Bagoury and Reda 1985, and Abou-Awad and El-Sawi 1993. The stigmaeid mites of genus *Agistemus* has gained a great economic importance as bio-control agent and can successfully be used in IPM. Biological control is becoming inevitable for the control of insect and mite pests due their increased resistance to chemicals.

Therefore, the aim of these studies was to survey actinedid predacious mites at Ismailia Governorate. Biological aspects of the most common species of family Stigmaeidae, *A. exsertus* feed on eggs of the scale insects *Pulvinaria psidii* Maskell (Hemiptera : Coccidae), were conducted as a method of biological control.

MATERIAL AND METHODS

Survey of predaceous actinedid mites:

Forty five samples were collected from leaves of some plants, soil, debris and organic manure from different localities at Ismailia Governorate. Collected samples were directly examined using a steromicroscope or extracted by using Tullgren Funnels. Specimens were mounted in Hoyer's medium and identified according to Krantez, 1978 and Zaher, 1986. Field observation, occurrence and richness were recorded.

Rearing of *A. exsertus* Gonz.

This predator was reared on eggs of scale insects *P. psidii* at two different degrees of temperature; 26 ± 1◦C and 30 ± 1◦C and also at two different relative humidity; 70% and 75% ± 5 R.H. The mite culture was established by placing a copulated female on the underside of guava leaf discs (2.5 cm in diameter). Discs were put on cotton wool soaked in water in Petri dishes (9 cm diam.). For solitary rearing, newly deposited predator eggs were transferred singly to guava leaf discs. Hatched larvae was supplied with a known number of prey eggs. The number of consumed prey eggs were counted daily and replaced with fresh ones till reaching maturity. Emerged females were copulated and kept for oviposition. Observations concerning all biological aspects were recorded during the predatory life span.

RESULTS AND DISCUSSION

Survey of predaceous actinedid mites:

A total of 238 mite specimens were found including the following families: Eupodidae 2.94 %, Bdellidae 5.9%, Cunaxidae 18.9%, Cheyletidae 27.31%, Stigmaieda 34.03%, Eupalopsellidae 6.3% and Eupalopsellidae 4.62% of the total number of collected mites. The mite composition and abundance of the total mites found in samples are shown in table 1 and revealed that twelve mite species were found in debris, whereas six and five species were found in soil and organic manure respectively. Only four mite species were found inhabiting leaves of guava, olive and citrus.

The total composition of the mites of the examined samples were characterized by the dominance of family Stigmaiedae which formed 34.03% of total number. This family was represented by three species: *Stigmaeus zaheri* Gomaa & Hassan, *Apostigmaus aegyptiacus* Soliman & Gomaa and *A. exsertus*. Numerous the most recorded stigmaied species, was *A. exsertus* which was found on leaves of citrus trees. This species is widely distributed allover Egypt on citrus trees (Kandeel and Nassar 1986). While Kandeel (1993) found *A. exsertus* in moderate numbers inhabiting olive buds in North Sinai. Family Cheyletidae was the second abundant and represented by four species. This family was the most abundance in debris and *Hemicheyletia bakeri* (Ehara) was noted in moderate numbers. Kandeel (1993) found few numbers of *H. bakeir* on leaves of date palme, citrus eggplant and organic manure.

Mites of family Cunaxidae was found numerically dominant in organic manure, whereas those of Families Eupodidae and Eupalopsellidae were the lowest in number.

Duration of developmental stages of *A. exsertus*:

Life cycle, longevity and fecundity of the predaceous mite, *A. exsertus Gonz.* are summarize in tables 2 and 3. Results of duration of *A. exsertus* fed on eggs of *P.psidii* showed that duration of total immature stages were 13.8±0.51 days for females and 11.3± 0.42 days for males when reared at 26±1°C and 70 %±5 RH. Life cycle, longevity and life span were 18.1±0.82, 21.1±1.54 and 39.2 ±1.67 for females and 15.2±0.89, 12.1±2.1 and 27.3±2.29 for males.

On the other hand, feeding *A. exsertus* on eggs of *P. psidii* at 30±1°C and 75%±5 RH. reduced duration of immature stages (8.27 ±0.61 and 6.27 ±0.45 for females and males, respectively). Also, results showed that each of Life cycle, longevity and life span were reduced (11.37±1.24, 10.03±1.11 and 21.41±1.86 for females and 6.5±2.52, 5.6±1.22 and 12.83±1.76 for males, respectively). Fecundity at 30±1°C and 75%±5R.H. was short when compared by fecundity at 26±1°C and 70 %±5 R.H. Soilman *et al.* (1976) indicated that the predatory mite, *A. exsertus* was faster development, longest life span and highest reproductive rate when fed on eggs of *Lepidosaphes beckii* (Newman) and crawlers of *Chysomphalus ficus* Riley. Yousef (1990) found that duration of immature stages was shorter when *A. exsertus* fed on *Tetranychus urticae* Koch (6.8 days) than on eggs of *Lepidosaphes beckii* (Newm) (10.8 days) at 28 °C.

Table (1): List of mite species found in different habitats at Ismailia Governorate.

Mite species	Number of specimens					
	Plant	Soil	Debris	Organic manure	Total	%
Eupodidae Koch (Total)	-	4(2.5)	3(3.8)	-	7	2.94
Eupodes momeni AbouAwad	-	4	3	-	7	2.94
Bdellidae Duges (Total)	-	3(5.6)	4(5.1)	7(12.3)	14	5.9
Cyta laterostris (Hermann)	-	3	4	7	14	5.9
Cunaxidae (Total)	-	3(5.6)	17(21.5)	25(43.6)	45	18.9
Cunaxa setirostris (Hermann)	-	3	5	12	20	8.4
Neocunaxoides andrei (B.andH.)	-	-	2	13	15	6.3
Pseudocunaxa simplix(Ewing)	-	-	10	-	10	4.2
Cheyletidae Leach (Total)	15(30.6)	-	36(45.6)	14(24.6)	65	27.31
Cheyletus malaccensus Oudemans	-	-	4	14	18	7.6
Hemicheyletia bakeri (Ehara)	-	-	20	-	20	8.4
*Acaropsella sp.*Volgin	-	-	12	-	12	5.01
Cheletogenes ornatus C. and F.o	15	-	-	-	15	6.3
Stigmaeidae Oudemans (Total)	22(44.9)	32(60.4)	16(20.3)	11(19.3)	81	34.03
Stigmaeus zaheri Gomaa and Hassan	-	13	8	-	21	8.8
Apostigmaus aegyptiacus Soliman & Gomaa	-	9	5	11	25	10.5
Agistemus exsertus Gonzalez	22	10	3	-	35	14.7
Eupalopsellidae Willmann (Total)	12(24.5)	-	3(3.8)	-	15	6.3
Eupalopsella sp. Sellnick	7	-	-	-	7	2.9
Saniosulus nudus Summers	5	-	3	-	8	3.4
Neophyllobiidae Southcoth (Total)	-	11(20.6)	-	-	11	4.62
Neophyllobius mangiferus Zaher and Gomaa	-	11	-	-	11	4.62
Total individuals	49	53	79	57	238	100

Efficiency of different stages of A. exsertus:

Food consumption *A. exsertus* on eggs of *P. psidii* at 30±1°C and 75%±5RH. and 26±1°C and 70 %±5 RH. are summarized in tables 4 and 5. With the advance of the developmental stages of the predator mite, the average number consumed eggs of *P. psidii* was increased. The average number of consumed prey by *A. exsertus* female and male larva, protonymph and deutonymph were 5.9 ±0.99, 5.5 ±0.85 and 6.2± 0.78 and 5.6± 0.97, 6.0± 0.57 and 5.4± 0.51, respectively at 26±1°C and 70 %±5 RH. (Table 4).

During the pre-oviposition, oviposition and pos-oviposition the predator devoured 4.8 ±1.6, 27.2± 3.7 and 12.1 ±3.7 eggs, respectively. The average number

consumed of prey by adult females and males were 42.9 ±4 and 25.4± 0.16 eggs, respectively. Similar results were obtained by El-Halawany and El-Naggar (1984). From Table 5, the average number of consumed prey by *A. exsertus* female and male larva, protonymph and deutonymph at 30±1°C and 75%±5R.H. were 5.5 ±1.5, 4.3 ±1.03 and 6.3 ±1.5 and 9.4± 0.83, 3.4 ±1.1 and 5.5± 9.3, respectively. The average number consumed of prey by adult females and males were 18.2 ±1.7 and 10.1± 0.57 eggs, respectively. Results of food consumption (Table 4 and 5) indicated that the temperature degree 26 ± 1°C and 70% ± 5 R.H. was more suitable for the predatore to fed on the eggs of the prey.

Table (2): Duration of *A. exsertus* different stages when fed on *P. psidii* at 26 ± 1°C and 70% ± 5 R.H.

Predator stage	Duration in days	
	Females	Males
Incubatuion period	5.3± 0.67	4 ±0.85
Larval stage	5.4 ± 0.52	4.5± 0.055
Prtonymphal stage	4.8 ± 0.54	3.3 ± 0.6 2
Deutonymphal stage	4.5 ± 1.55	3.5 ± 0.43
Life cycle	18.1± 0.82	15.2± 0.089
Longevity	23.4 ±1.54	12 ±2.10
Life span	39.2 ±1.67	27.3± 2.29
Fecundity	1.4±2.2 egg/day	-

Table (3): Duration of *A exsertus* different stages when fed on P. *psidii* at 30 ± 1°C and 75% ± 5 R.H.

Predator stage	Duration in days	
	Females	Males
Incubatuion period	3.03±.063	1.31±0.37
Larval stage	3.12±.075	1.94±0.33
Prtonymphal stage	2.85±.059	1.70±0.38
Deutonymphal stage	2.30±.062	2.63±0.26
Life cycle	11.37±1.24	6.50±2.52
Longevity	10.03±1.11	5.60±1.22
Life span	21.41±1.86	12.83±1.67
Fecundity	.095±1.54 eggs/day	-

Table (4): Food consumption of *A exsertus* when fed on P. *psidii* at 26 ± 1°C and 70% ± 5 R.H.

Predator stage	No. of devoured preys			
	Females		Males	
	Total average	Daily rate	Total average	Daily rate
Larval stage	5.9±0.99	1.90	5.6±0.97	1.92
Prtonymphal stage	5.5±0.85	1.93	6.0±0.57	1.81
Deutonymphal stage	6.2±0.78	2.15	5.4±1.51	2.46
Total immature	17.6±1.35	1.99	17.1±2.40	1.52
Pri-oviposition period	4.8±1.60	2.18	-	-
Oviposition period	27.2±3.70	2.24	-	-
Post-oviposition	12.1±3.70	2.24	-	-
Longevity	42.9±4.00	2.03	25.4±0.16	2.12

Table (5): Food consumption of *A exsertus* when fed on *P. psidii* at 30 ± 1°C and 75% ± 5 R.H.

Predator stage	No. of devoured preys			
	Females		Males	
	Total average	Daily rate	Total average	Daily rate
Larval stage	5.5±1.50	1.74	4.9±0.83	2.51
Prtonymphal stage	4.3±1.03	1.51	3.4±1.06	1.98
Deutonymphal stage	6.3±1.5	2.74	5.5±0.93	2.33
Total immature	16.1±2.4	1.92	13.8±1.28	2.33
Pri-oviposition period	3.7±0.93	2.95	-	-
Oviposition period	13.2±1.82	1.87	-	-
Post-oviposition	1.4±0.65	0.87	-	-
Longevity	18.2±1.69	1.81	10.1±2.53	1.80

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