Studies on some parasitic and predaceous mites associated with the red palm weevil, *Rhynochophorus Ferrugineus* olivier (coleoptera: curculionidae)

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ABSTRACT

The predaceous and parasitic mites play an important role as biological agents of different pests infesting economic crops. Thirteen predaceous and parasitic mites belong to sub-order Gamasida were recorded associated with the red palm weevil, (RPW), Rhynochophus ferrugineus Olivier (Coleoptera: Curculiodae) in Ismailia Governorate. These mite species; Fascuoropod marginata, Leiodinychus armeri (Uropodidae), Aegyptus rhynchophorus, A. zaheri (Trachyuropodidae), Oodinychus sp. (Trimaturidae), Machrocheles merdarius, Macrocheles sp., (Macrochelidae), Protogamasellus denticus, Proctolaelaps striatus (Ascidae), Sejius paloghi (Sejidae), Cosmolaelaps feeni (Laelapidae), Dendrolaelaps sp., Digamasellus sp. (Digamasellidae) were isolated from adults, pupae (cocoons) and cores around tunnel borded and larvae inside the palm trees. The uropodid and trachyuropodid mites are parasitic on adults and pupae of (RPW), while the other mite species are predators. Biological studies were carried out on the parasitic mite, Aegyptus rhynchophorus when it reared on pupae of RPW and diet of sugarcane under laboratory conditions. Obtained data revealed that both sexes female and male passed through; egg, larva and two nymphal stages before reaching adult stages. Female oviposition period lasted (8.5 & 9.4) days and deposited an average of (37.2 &23.0) eggs with a daily rate of (4.3 & 2.4) eggs when reared on the above mentioned sources, respectively. Female longevity lasted (16.3 & 18.7) days, while male adulthood lasted (13.2 &14.4) days when they fed on (RPW) pupae and diet of sugarcane, respectively.

Key words: Acari; Mites, Red Palm Weevil, *R. ferrugineus*.

INTRODUCTION

The red palm weevil (RPW), *Rhynchophorus ferrugineus* Olivier (Coleoptera : Curculionidae) is an economically importance invasive tissue borer that has been broad host range restricted to palm trees, mostly young trees less than 20 years old, where the stem of the young palm is soft, juicy and easily penetrated (Eppo, 2008), (Salama *et al.,* 2009) and (El-Mergawy and Al-Ajlan, 2011). Biodiversity of mites associated with the red palm weevil *R. ferrugineus* is varying degrees of bio-relationship between each of the associated, ecto, endoparasitic, predaceous, phoretic and fungivorus mites. The parasitic and biocontrol agents of different pests infesting different economic crops. Studies on some mites associated with the red palm weevil have been reported by Gomaa, 2006 who isolated three mite species associated with (RPW). El-Bishlawy and Allam

(2007) recorded new genus and new species, *Aegyptus rhynchophorus* (Trachyuropodidae) associated with pupae and adults of (RPW). Abde-El-Hamed (2009) recorded 14 mite species, associated with differ stages of (RPW) in Egypt. Hassan *et al.,* (2011) studied the biodiversity and seasonal fluctuation of mite families associated with the red palm weevil in Egypt and Al-Dhafar and Al-Qahtani (2012) recorded three mite species associated with (RPW) one of which *Aegyptus alhessa* n. sp. (Gamasida, Trachyuropodidae) as a parasite on eggs, pupae, cocoons and adults of (RPW). Wisniewski *et al.,* (1992) recorded four mite species isolated from *R. ferrugineus* and described. The present study aims to throw lights on some gamasid mites associated with different red palm weevil stages and study the biological developmental stages, fecundity of the parasitic mite, *Aegyptus rhynchophorus* when fed on pupae of (RPW) and diet of sugarcane under laboratory conditions.

MATERIALS AND METHODS

Different stages, larval instars, pupae and adults of RPW were collected from infested palm tree at Ismailia Governortae, Egypt during spring, summer and fall seasons throughout 2009/2010 years. Collected samples of immature stages and adults in addition to materials from their habitats were transferred in plastic boxes (20 x 10 x 10 cm) containing shredded sugarcane stems to the laboratory foe investigation.

Extraction of Mites:

Different stages of RPW were examined individually using dissecting microscope, whereas, detecting mites were removed gently with fine brush or needle from pupae (cocoons), then collected mites were cleared in Nesbitt's solution and mounted in Hoyer's medium for identification.

Identification of mites:

Identification different mite species for their categories, families, genera and species depend mainly on those given by Baker and Wharton (1952), Evans *et al.,* (1961), Lindiquist and Evans (1965), Baker (1968), Hughes (1976), El-Bishlawy and Allam (2007), Eppo (2008) and Abde-El-Hamed (2009).

Source of mite culture:

To obtained the pure culture of parasitic mite, *A. rhynchophorus*, single adult female and male were collected from pupae, then placed in rearing cells and supplied with favorable food and left to lay eggs, which formed the nucleus of its pure culture.

Biological studies:

Eggs of mite, *A. rhynchophorus* were transferred individually to rearing cells (one egg / cell) after hatching to larvae, mites were investigated twice daily and adding suitable of food each of pupae of RPW and pieces of diet sugarcane during developmental stages. Ten replicates were used for each type of food during the biological developmental stages under laboratory conditions of 25+1 ºC and 70 % R.H.

RESULTS AND DISCUSSION

Date palm (*Phoenix dactylifera* L.) is an economically crop, widely cultivated in Egypt and many Arabian countries for its quality of fruit production in addition to numerous known important materials such as fibres, fuel and furniture (FAO, 1984). The red palm weevil (RPW) is considered one of the most economically important tissue boring pest of date palm of the world and it become the major pest of palm in the Mediterranean (Eppo, 2008). The larvae are responsible for damaging the palm and once they have gained access, the death of the palm generally issues. The larva normally never comes to the surface, since; it begins its life inside the palm. The relationship between both predaceous and parasitic mites and different stages of red palm weevil as biocontrol agents are well known to be capable of suppressing its population.

Biodiversity of different mite species associated with the red palm weevil.

Thirteen parasitic and predaceous mites belong to 11 genera; eight families under sub-order Gamasida were isolated from adults and pupae of (RPW) and the cores of around the tunnel borded by larvae inside the palm trees, Table (1).

1- Family : Trachyuropodidae Berlese

The Trachyuropodid mites were the highest number throughout the course of study. This family represented by two parasitic mite species, *Aegyptus rhynchophorus* (El-Bishlawy and Allam) and *A. zaheri*… …. were found associated with pupae and adults of (RPW) inside the palm trees. Al-Dhafar and Al-Qahtani (2012) recorded and described *Aegyptus alhessa* as a new species and parasitic on eggs, larvae, pupae (cocoon) under elytron of adults.

2- Family: Uropodidae.

The uropodid mites represented by the two parasitic mites: *Fascuropod marginata* and *Leiodinychus karmeri* (G. & R., Canestrini) were found associated with larvae, pupae and adults in high numbers. The parasitoids of both trachyuropodid and uropodid successfully suppressed population density of RPW stages within few days when its found in high numbers, whereas, they killing the different immature stages by sucking their body fluid as well as the larval and pupal weight significantly decrease by increasing numbers of parasitoid mites.

3- Family: Ascidae Voigts and Oudemans.

Ascid mites are known as predaceous mites inhabiting different localities. Two ascid mites; *Prtogamasellus*

denticus and *Proctolaelaps striatus* were recorded associated with larvae and pupae of RPW in moderate numbers

4- Family Macrochelidae Vitzthum.

The two macrochelid mites *Macrocheles maridarus* and *Macrocheles* sp. were found in high numbers during the course of study associated with larvae and pupae, whereas macrochelid mites isolated from core and pupae cocoons. Macrochelids are a wide distribution in different localities and play an important role as biological agents of different pests such as nematodes, housefly (eggs and larvae) and acarid mites.

5- Family : Digmasellidae Evans

This family was represented by two predatory mite species were found associated with different stages of the red palm weevil in rarely numbers.

6- Family: Trematuridae

Oodinychus sp., the only predatory mite species isolated in rarely numbers associated with pupae.

7- Family: Laelapidae Berlese

Laelapid mites represented by only *Cosmolaelaps keni* was found predation on larvae and pupae of RPW I high numbers.

8- Family: Sejidae

This family represented by the predatory mite, *Sejius paloghi* where, it collected from core of palm, pupae and adults in moderate numbers

Biological aspects of the parasitic mite, A. rhynchophorus

The present study was conducted to determine the developmental stages and duration of various life stages, adult longevity and fecundity as well as the effect of food type on biological aspects of the parasitic mite, *A. rhynophorus* fed on pupae of RPW and pieces of sugarcane.

Developmental stages:

Both sexes female and male passed through developmental stages; egg, larva and two nymphal stages before reaching adult stages.

Incubation period

The incubation period of *A. rhynchophorus* lasted (4.1 &5.1) days for female and (4.0 &4.2) days for male when reared on pupae and pieces of sugarcane, respectively.

Larval stage:

Female and male larval stages durated 4.0 days for both when fed on pupae, while when fed on pieces of sugarcane, the period recorded (4.8 and 4.4) days for female and male at the same trend.

Protonymphal stages:

The mean protonymphal period of the parasitic mite female was (4.0 & 4.5) days when fed on the above mentioned types of food, respectively.

Deutonymphal stages:

Female Deutonymphal stage of *A. rhynchophorus* averaged (9.4& 9.8) days when it fed on pupae and sugarcane, while male individuals, the average Deutonymphal stage lasted (7.2 &7.3) days at the same pattern.

Life cycle

The mean duration of life cycle for individuals was (21.4&24.2) and (19.1&19.8) days when the parasitic mite, *A. rhynchophorus* female and male fed on pupae of RPW and pieces of sugarcane at 25+1ºC, respectively.

Adult longevity:

Mean female longevity was (16.3 &18.7) days, when it fed on pupae and sugarcane, respectively. On the other hand, male adulthood lasted (13.2 & 14.4) days at the same trend. The general trend was that obtained durations were significantly longer on pieces of sugarcane than pupae. This applied to both females and males. These results indicated that pupae of (RPW) is the preferred prey. Obtained relative values for males were generally less than females, Table (2).

Female oviposition and fecundity:

As shown in Table (3), female oviposition period and fecundity were significantly affected by different types of food under laboratory conditions of constant temperature and relative humidity. Female oviposition period lasted (8.5 &9.4) days and deposited an average of (37.2 &23.0) eggs with a daily rate of (4.5 &2.4) eggs when reared on pupae and sugarcane, therefore, the pupae as a host of the parasitic mite, *A. rhynchophorus* was attractive for mite survival and development. These results agree with the finding of Sobhi (2006), Abde-El-Hamed (2009), El-Beshlawi and Allam (2007) and El-Dhafar & Al-Qahtani (2012) and Allam *et al.,* (2013).

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Tables

Table (1): The parasitic and predaceous mites associated with different stages of the red palm weevil *Rhynchophorus ferrugineus* on date palm cultivars at Ismailia Governorate.

Families	Species	Remarks
1- Trachyuropodidae	*Aegyptus rhynchophorus*	+++
	A. zaheri	+++
2- Uropodidae	*Fuscuropod marginata*	+++
	Leiodinychus karmeri	+++
3- Ascidae	*Protogamasellus denticus*	++
	Proctolaelaps steriatus	++
4- Macrochelidae	*Macrocheles maridaryus*	+++
	Macrocheles sp.	+++
5- Digmasellidae	*Dendrolaelaps* sp.	+
	Digmamasellus sp.	+
6- Trematuridae	*Oodinychus* sp.	+
7- Laelapidae	*Cosmolaelaps* sp.	+++
8- Sejidae	*Sejius paloghi*	++

High numbers = +++, Moderate numbers = ++, Rarely numbers = +

Table (2): Duration of developmental stages of the parasitic mite, *A. rhynchophorus* when fed on pupae of RPW and pieces of sugarcane at 25+1 ºC.

Parasitic stage	Female			Male		
	Pupae	Sugarcane	L.S.D. at 0.05	Pupae	Sugarcane	L.S.D. at 0.05
Incubation period	4.0+0.2	5.1+0.3	0.796	4.0+0.3	4.2+0.3	0.12
Larva	4.0+0.3	4.8+0.3	0.17	4.0+0.0	4.4+0.2	0.09
Protonymph	4.0+0.2	4.5+0.2	0.16	3.9+0.3	3.9+0.3	0.00
Deutonymph	9.4+1.7	9.8+0.8	0.02	7.2+0.5	7.3+0.8	0.09
Total immatures	17.4+1.8	19.1+1.9	0.33	15.1+0.8	15.6+1.0	0.42
Life cycle	21.4+1.9	24.2+0.8	0.19	19.1+0.8	19.8+1.1	0.41
Longevity	16.3+0.6	18.7+0.5	0.91	13.2+0.6	14.4+0.8	0.94
Life span	37.3+1.5	42.9+1.4	0.97	32.3+1.6	34.2+1.5	0.93

Table (3): Female longevity and fecundity when the parasitic mite, *A. rhynchophorus* fed on pupae of RPW and sugarcane pieces at 25+1 ºC.and 70 % R.H.

Food types	Duration in days			Longevity (days)	Fecundity	
	Pre-oviposition	Oviposition	Post-oviposition		Egg/female	Daily rate
Pupae of RPW	4.1+0.2	8.5+0.4	3.7+0.3	16.3+0.6	37.2+1.5	4.3+0.1
Pieces of sugarcane	4.0+0.3	9.4+0.6	5.3+0.4	18.7+0.5	23.0+1.2	2.4+0.03