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BIOLOGICAL ASPECTS OF PEAR BUD MITE *Eriophyes pyri* (PAGENSTECHER) (ACARI : ERIOPHIDAE) UNDER DIFFERENT TEMPERATURES IN EGYPT

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ABSTRACT

The pear bud mite or pear leaf – gall mite *Eriophyes pyri* (Pagenstecher) successfully developed from egg to adult stage when reared on terminal buds of soft apple divided branches dipped in test tubes at different temperatures and 65% R.H., for the first time. The effect of temperature on the development, reproduction and population growth was investigated. At 14 and 34 °C the adults began to slow down and ceased all activity and died. It was able to develop at temperatures between 17 and 29°C with 65 % R.H. inside apple buds. At least of 34 % of the generation time was spent in the egg stage at 29°C. Adult life cycle and longevity decreased with increasing temperature. Fecundity was highest at 29°C with 20.66 eggs per female. Life table parameters showed that the intrinsic rate of natural increase (rm) increased with temperature to a maximum of 0.153 at 29°C. The population of *E pyri* inside buds multiplied 14.31 times in a generation time of 17.29 days at 29°C and lowered to 4.06 times in a generation time of 23.40 days at 17 °C under the same laboratory conditions.

Keywords: Pear, Apple, Biological aspects, Eriophyidae, Blisters, Buds

INTRODUCTION

The eriophyid mite *Eriophyes pyri* (Pagenstecher) [= *Phytoptus pyri* Pgst.] has a world-wide distribution and restricted on a number of host plants which is one exception are within the Rosaceae (Stubbings, 1950). It is of economic importance in the cultivation of apples and pears. In Egypt, it is found mainly on apples, but rarely on pear trees (Abo-Awad, 1976). There are two races of this mite species one that attacks the buds and one that produces galls or blisters on the leaves. Damage may cause a 25- percent loss of crop production (Morgan *et al.* 1962). The sever damage that is done by the pear bud mite occurs in winter, when the fruit buds may be attacked and completely damaged. This may result in a total crop loss. A further consequence of the injury caused by this race is the distorted and scabby appearance of the fruits that develop from infested flowers; the entire tree may be weakened, and the foliage of such a tree is spare and consists of stunted, misshapen leaves (Meyer, 1981). The most familiar symptom caused by the leaf – gall or blister race is the knops that are produced on the apple and pear leaves. The upper surface of leaves show reddish – yellow blisters corresponding to a slight erineum on the lower surface. Trees have been observed with from 30 to 70 % of the leaves affected (Ronald *et al.* 1994). Despite the wide spread distribution of the mite and its increasing importance as a component of integrated pest management programmers, its life- history has not been studied in details, thus this study aims to provide information on the life- history of the pear bud mite race *E. pyri* at different temperatures under laboratory conditions.

MATERIALS AND METHODS

The method described by Abou-Awad *et al.* (2005) for rearing the eriophyid mites was followed. A medium consisted of agar 8.0 grams, murashige and skoag 1.1 grams, rose bengal 1.0 gram and indol acetic acid 1.0 cc solved in distilled water 1000 cc. Agar was transferred to a vial and was melted using a boiling water-bath, then a vial was removed. Murashige and skoag was agitated in the melted agar till dissolved. The obtained mixture was then sterilized by adding rose bengal which was dissolved by agitation Indol acetic acid was added to the dissolved mixture. Soft terminal apple branches with terminal buds of 15-20 cm were washed and all attached leaves were removed for each branch to rear the pear bud mite *E. pyri* between outer of first and second bracts of the buds. Cuttings were dipped, for tow seconds, into indol acetic acid to encourage developing roots, before the inserting into tubes contained the above-cited prepared medium. Thirty individuals of the adult mite stage placed singly between out bracts of the buds. Each female was allowed to deposit 1-2eggs, then removed.
Table was placed in the incubator and the development of mite was observed twice daily.

Insemination took place soon after male and female emergence, each newly virgin female was transferred for 24 h, to outer bracts of bud previously inhabited by an adult emerged male, to allow insemination by spermatophores , then females and males were transferred back to their previous substrates.

Experiments were conducted under laboratory conditions of 14±1, 17± 1, 23± 1, 29±1 and 34±1 °C and 65 % R.H. and a photoperiod 12/12 h light/dark. Life table parameters were calculated according to a Basic computer program (Hulting *et al.* 1999).

RESULTS AND DISCUSSION

E.pyri was able to develop successfully from egg to adult through the entire life history at temperatures between 17 and 29 °C and 65 % R.H. At 14 and 34°C the adult began to slow down and ceased all activity, then died. Up till now, little is known about the biology of eriophyoid mites, especially inside buds, due to that the study of these mites is very difficult both from the zoology and the botanical paint of view. Thomsen (1976) studied the life cycle of *Phytoptus tiliae* in Denmark; she observed that the new adult female into leaf buds reproduced as long as the temperature conditions permitted the reproduction which was above 11°C. Abou-Awad *et al.* (2010) mentioned that below 20°C all activity of the peach silver mite *Aculus fockeui* ceased and by36°C new virgin adults died. However, eriophyoid mites are unique phytophagous mites, because they have many simplification in external and internal structures and with the absence of several organs, are the result of process of adaptation of a high degree in connection with the parasitic mode of life inside the plant tissue.

The egg of *E. pyri* are elongated, oval in shape, with blunt rounded ends, averaging 43µ long by 31µ wide and pearly white when first lade, later becoming opaque as a result of development of the embryo. An embryo develops within the egg which then hatches into a first instar nymph. First nymph passes fewer abdominal rings and the prosoma is longer in relation to the rest of the body, and passes through a nymphocrysalis before molting into the second instar nymphs which possess more striations than do those of the first nymphs but fewer than adults. The second nymph passes through an imagochrysalis before molting, giving rise to the adult. During the quiescent stage the nymphs take on a pearly luster. Just prior to the molting the new integument can be seen under the old one. Unfertilized females, fertilized females and the moulting behavior of *E.pyri* were similar to the olive bud mite *Aceria oleae* (Abou-Awad *et al.* 2005) and the peach silver mite *Aculus fokeui* (Abou-Awad *et al.* 2010).

The mean development times of *E. pyri* females at each of three temperatures are shown in Table (1). Egg duration decreased with an increase in the temperature up to 29°C. Egg duration at 17°C was about 1.7 times as long as that at 29°C.The total life cycle was completed in 11.39 and 10.96, 8.94 and 8.58 and 7.05 and 6.68 for females and males at 17, 23 and 29°C, respectively. Males developed faster. The life cycle results of Barké *et al.* (1972) on the peach silver mite *Aculus cornutus* (Banks) and Easterbook (1979) on the apple rust mite *Aculus schlechtendali* (Nalepa) are nearly in agreement at the aforementioned temperatures. A generation took 8.71 days at 29°C; a decrease of 6°C and 12°C increased it by 2.80 and 8.01 days, respectively; at least 34% of the generation time was spent in the egg stage. Mites appeared to show normal behavior at 29°C and the difference between 23 and 29°C of the generation time was insignificant.

The longevity of ovipositing females decreased with increasing temperature. Longevity at 17°C was 27.86 days, about 1.41 times as long as at 29°C .Total fecundity gradually increased with an increase in temperature. Females deposited an average of 5.93, 12.57 and 20.66 eggs, during an oviposition period that averaged 15.93, 16.21 and 15.77 days, and then survived for 6.60, 4.14 and 2.33 days at 17, 23 and 29°C, respectively (Table 1). The highest number of eggs per female was observed to be 20.66 at 29°C and decreased with a decrease in temperature. It could be concluded that 29°C as on optimum temperature accelerated the rate of development and induced greater reproduction of *E. pyri*. The data obtained are in agreement with those reported by Al-Azzazy (2005), who found nearly the same effect of temperature degrees on the mango bud mite *Aceria mangiferae* Syed. The life history took 39.25 and 37.03, 31.86 and 30.96 and 26.81 and 25.84 days for females and males at the same previous temperatures, respectively. In general, life histories studied by Abou-Awad *et al.* (2000) and Haque and Kawai (2003) are in agreement.

It is of interest to note that the mating process in eriophyoid mites had been described by Oldfield *et al.* (1970). Males produce packets of the sperm cells that are known as spermatophores which they are attractive to non-inseminated protogynes. Insemination occurs when a female comes into contact with a spermatophore. Occasionally, the spermatophore is pulled free from the plant and the base and stalk protrude from the females genitalia. Oldfield and Newell (1973) demonstrated that a few days after fertilization, the progeny was predominantly female, with a sex ratio of 2:1, while unfertilized females produced only males. This is an agreement with the results reported for this work (Table 2). Similar findings were also reported on the mango bud *A. mangifera* (Al-Azzazy 2005) and the olive bud mite *Aceria oleae* Nalepa (Abou-Awad *et al.* 2005).

Table 1: Developmental stages (in days) and fecunditiy rate of *Eriophyes pyri* reared on apple buds at different temperatures and 65% R.H.

Mite stage	sex	*E. pyri* Mean ± SD Temperatures(°C)		
		17±1	**23±1**	**29±1**
Egg	Female	5.20±0.11	4.21±0.19	3.00±0.12
	Male	5.07±0.16	4.07±0.14	2.83±0.17
First stage nymph	Female	3.06±0.09	2.14±0.16	1.94±0.16
	Male	2.92±0.14	2.07±0.21	1.91±0.16
Nymphochrysalis	Female	0.36±0.11	0.26±0.09	0.21±0.08
	Male	0.36±0.14	0.26±0.11	0.18±0.08
Second stage nymph	Female	2.46±0.24	2.07±0.18	1.72±0.22
	Male	2.30±0.16	1.92±0.14	1.58±0.21
Imagochrysalis	Female	0.31±0.16	0.26±0.16	0.18±0.11
	Male	0.31±0.11	0.26±0.09	0.18±0.09
Total	Female	11.39±0.34a	8.94±0.22b	7.05±0.21b
	Male	10.96±0.24a	8.58±0.14b	6.68±0.22b
Pre-oviposition	Female	5.33±0.34	2.57±0.26	1.66±0.18
Generation	Female	16.72±0.54a	11.51±0.34b	8.71±0.22b
Oviposition	Female	15.93±0.57	16.21±0.77	15.77±0.96
Total fecundity	Female	5.93±0.44	12.57±0.67	20.66±1.07
Post-oviposition	Female	6.60±0.54	4.14±0.33	2.33±0.24
Longevity	Female	27.86±0.88a	22.92±1.11b	19.76±1.23b
	Male	26.07±1.12a	22.38±0.78b	19.16±0.96b
Life span	Female	39.25±0.96a	31.86±1.20b	26.81±1.34c
	Male	37.03±1.06a	30.96±1.15b	25.84±1.14c
% Surviving	Female	100	100	100
	Male	100	100	100
Number of observations	Female	20	21	20
	Male	10	9	10

Means marked with the same litters in a horizontal column are not significantly different (F- test . $P < 0.05$, $P < 0.01$).

A life table parameter at three different temperatures and 65% R.H. were constructed from the life history data (Table2). It showed that the intrinsic rate of natural increase (rm) increased with temperature to a maximum of 0.153. at 29°C and decreased to 0.059 at 17°C . The maximum rate is nearly equal to that of the mango bud mite *A. mangiferae* (rm=0.146, Al-Azzazy 2005) which is the most serious eriophyid mite pests in mango orchards. The population of *E. pyri* also multiplied 14.31 times in a generation time of 17.29 days at 29 °C, while its population only increased 4.06 times in a generation time of 23.40 days at 17°C. Based on the above results, *E.pyri* is considered to be disastrous mite on apple and pear orchards, particularly in spring months.

Table 2: Life table parameters of the pear bud mite *Eriophyes pyri* reared on apple buds at different temperatures and 65% R.H.

Parameters	*E. pyri*		
	Temperatures (°C)		
	17±1	23±1	29±1
Net reproduction rate (R_o)	4.06	8.53	14.31
Mean generation time (T)	23.40	19.63	17.29
Intrinsic rate of increase(r_m)	0.059	0.109	0.153
Finite rate of increase ($e.^{rm}$)	1.060	1.115	1.165
50%mortality (in days)	37	30	26
sex ratio (female/total)	20/30	21/30	20/30
sex ratio (female/male)	2.00:1	2.00:1	2.00:1

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بيولوجيا أكاروس براعم الكمثري الدودي الاريوفيس بيراي في مصر

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أكاروس براعم الكمثري أو التفاح الدودي الذي ينتمي إلي فصيلة الأكاروسات الاريوفية أو الدودية المتخصصة والمدمرة لعوائلها، له سلالتان منتشرتان علي المستوي العالمي، الأولي وهي متخصصة في إصابتها للبراعم، والاخري متخصصة في إصابتها للمجموع ألورقي، محدثة أوراما أو بثرات علي أسطح الأوراق العلوية وفي مصر تكون تلك الآفة أكثر انتشارا علي معظم بساتين التفاح، وأقلها علي الكمثري، ولها أضرار اقتصادية جسيمة لكل من البراعم الخضرية والثمرية طوال العام.

هذا وقد نجحت دراسة وتربية تلك الآفة الاكاروسية معمليا ولأول مره علي الحراشف الخارجية للبراعم الطرفية المتواجدة علي الأفرع الغضة وعلي درجات حرارة متباينة، ورطوبة نسبية بلغت 65 %، و أسفرت نتائج تلك الدراسة عن أنة عند درجتي حرارة دنيا 14°م وقصوى 34°م تتوقف فتره نشاطها تماما، ويحدث تدهور سريع وموت لجميع الأطوار وبنسبة 100%، وأن ألمدي الحراري ما بين 17°م إلي 29°م هو ألمدي الأفضل لتربية وتكاثر هذا النوع دون ادني مشاكل أو عثرات معملية، وأتضح تماما أن دورة حياة الكائن تتناقص فترات التطور بها بازدياد درجات الحرارة، وأن 34% علي الأقل من فترة الجيل تشملها فترة حضانة البيض، كما أن خصوبة الإناث تبلغ أقصاها بمتوسط 20.66 بيضه للأنثى الواحدة عند الدرجة القصوي البالغة 29°م. وعند دراسة معايير كفاءة الآفة وقدرتها علي إحداث الضرر لعوائلها النباتية، فقد أتضح أن معدل التكاثر الذاتي للأنثى الواحدة يوميا يزداد زيادة مطردة مع زيادة درجات الحرارة، حتى بلغ أقصاها (0.153) عند 29°م ، كما أن تعداد تلك الآفة الاكاروسية قد تضاعف بداخل البراعم حتي بلغ 14.31 مرة في فترة جيل بلغت 17.29 يوما عند الدرجة القصوي 29°م، كما انخفض هذا التضاعف إلي 4.06 مره فقط في فترة الجيل التي طالت وبلغت 27.4 يوما عند درجة الحرارة الصغرى 17 °م، تحت نفس الظروف المعملية، مما يوضح شراسة تلك الآفة داخل البراعم وتدميرها للأجنة وعدم بزوغ براعمها الخضرية و الثمرية في فترتي الإزهار والعقد، ومن هنا يتضح جسامة الخطر لمثل هذه الأكاروسات المتخصصة داخل البراعم لبساتين الفاكهة التي تنتمي عوائلها إلى العائلة الوردية مثل التفاح و الكمثري وما شابة.

قام بتحكيم البحث

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