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Biological studies on only one mite species *lardoglyphus* sp. belong to astigmited mites under the laboratory conditions

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ABSTRACT

This work was conducted to study the effect of four types of food (peanuts, yeast ,cheese, luncheon) on biological aspects , fecundity, longevity, life cycle and life span of only one species which was collected during the period of the work were done ,belong to astigmited mites namely, *lardoglyphus* sp. under laboratory conditions (26 ± 2°C and 70 % RH).

The results showed that *lardoglyphus* sp. pass through its life by egg, larvae ,protonymph, hypopus ,tritonymph and adult stage, all of these were affected by food types .Also ,fecundity , life span and longevity were affected by different food types. As well as, the feeding on yeast was very dangerous among four types food because its generation time was the shortest while its daily rate was the highest when *lardoglyphus* sp. feed on it , so its rate give very large amount of population in stored products, but peanuts was less effective as it deposit less population as its generation and daily rate was very long when fed on peanuts .

***Keywords*:** *lardoglyphus* sp., Biology , Generation time, Daily rate, Food type .

Introduction

Mites of sub- order Acaridida are common pests in grain storage and mostly attack either stored unprocessed products (grains, vegetables, fruits, meat, bulbs, hay etc.) or prepared products (flour or flour products, cheese, dried fruits, cured-fish etc). They are a major cause of qualitative and quantitative losses to several stored products (Hubert, 2011). Firstly, storage mites directly endanger human health due to allergenic contamination of food (Olsson and Hage-Hamsten, 2000; Arlian, 2002;Spiegel *et al*., 1995; Castillo *et al*., 1995; Matsumoto *et al*., 1996). Secondly, mites are vectors of toxicogenic fungi (Hubert *et al*., 2003) and thus indirectly contribute to contamination of food and feed with mycotoxins (Hubert *et al*.,2004). Thirdly, mites cause significant grain weight losses and decrease of germ inability (Solomon,1946).

The objective of this study was to determine the effect of four types of food on the biology of only one species, belong to astigmited mite namely, *lardoglyphus* sp. under the laboratory conditions .

Materials and methods:

In the present study, one astigmated mites *lardoglyphus* sp. of family Acaridae were reared under controlled laboratory condition of temperature and R.H.%, feed on four different type of food at the same degree of temperature. To make pure culture female and male adults were reared according to the method by using plastic blocks (3× 3 ×0.5 cm) each block contained a small rearing circular chamber(1.2 ×.4cm). with a bottom covered with a substrate for .5cm filled with a mixture of (Cement: Charcoal in ratio of 9: 1). two adult (male and female)from the identified species are sufficient to make pure culture and were placed in the rearing chamber and provided with food (peanuts, yeast ,cheese, luncheon) and a drop of water as a source of humidity, then each cell was covered with plastic cover to prevent mites from escaping for obtaining pure culture. The culture was examined twice a daily and kept under laboratory condition at 26 ± 2°C and 70±5 % R.H.

The effect of different food (peanuts, yeast , luncheon , cheese) on biological aspects, fecundity of acarid mite, *lardoglyphus* sp. will investigate. For rearing of *lardoglyphus* sp. by using circular plastic blocks (5.5cm diameterx 1.5cm thick) twenty replicates were used for each sexes of

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the mite (female and male). Each replicate contained a singly newly deposited egg and covered with small glass cover to prevent mite escaping, the egg is transferred by using of a fine camel brush (,3mm). Twenty replicates were investigated twice daily under a steromicroscope.

During each investigation add few piece of different food aspects separately (peanuts, yeast, luncheon, cheese) to 20 replicates each replicate have single egg also add drop of water in each block of biology and then noted.

The different biological aspects (incubation period, hatching, moulting, mating, (active and quiescent) larvae, protonymph, hypopus , tritonymph, adult female and male), were determined, and recorded emergence males and females were sexed and then separated for note the longevity of females and males respectively. A single female and male were placed together, to notice the mating behavior and calculated the life cycle, generation period, fecundity and life span, by counting the number of eggs laid every day.

Results and Discussion:

Developmental duration:

Incubation period:

As shown in Table (1 & 2) Incubation period of *lardoglyphus* sp. lasted 4.03, 3.85, 3.66 and 3.42 days for female, while it was 3.08, 2.75, 2.71 and 3.12 days for male under laboratory condition (26 ± 2°C and 70 ± 5% R.H) when it fed on peanuts ,yeast, luncheon and cheese, respectively. the previous data showed that there were significant differences occurred between the four different food on egg incubation period for female as it is being short on cheese , prolonged on peanuts, but there was no different significant between the different food types for male .

Larval stage:

The duration of active larval stage Table (1 & 2) lasted for 1.93, 0.85 , 2.38 and 2.00 days for female, while it was 0.83 , 0. 58, 1.29 and 2.00 days for male at (26±2°C and 70±5% R.H) when they feed on peanuts ,yeast, luncheon and cheese, respectively.

The average period of quiescent stage lasted 0.46 , 0.56 , 0.48 and 0.50 days for female and 0.37 , 0.33 , 0.37and 0.37 days for male at (26±2°C and 70±5% R.H)when the individual feed on peanuts ,yeast, luncheon and cheese, respectively. Statistical analysis revealed that the active period for both female and male significantly affected by food ,while the quiescent period no significant differences when female and male fed on the aforementioned diets.

The total larval periods were 2.39, 1.41, 2.86 and 2.49 days for female, while it were 1.20, 0.91, 1.66 and 2.37days for male when it feed on the previous diet, respectively. The differences between the periods of larval stages were significant for both female and male; the highest period was when the mite feed on luncheon, cheese then peanuts, while the less period was when the mite feed on yeast.

Protonymphal stage:

obtained data in Table (1 & 2) showed that the duration of active female protonymph lasted for 2.63, 0.87, 2.40 and 1.36 days, while the quiescent stage lasted for 0.56, 0.48, 0.51 and 0.51 days at (26±2°C and 70±5% R.H) when the individual feed on peanuts ,yeast, luncheon and cheese, respectively.

The active male protonymph lasted 1.66, 0.58, 1.37 and 1.37 days while the quiescent stage lasted 0.41, 0.33, 0.45 and 0.41 days at the same trend, statistical analysis revealed that the quiescent period for both female and male no significant. The total protonymphal period was 3.19, 1.34, 2.91 and 1.87 days for female, while it was 2.07, 0.91, 1.83 and 1.78 days for male at the same trend.

The previous data showed that there were significant differences between the effects of the food types on the protonymphal periods for both male and female, *lardoglyphus* sp. exhibited the

Table 1: Duration of different stages of *lardoglyphus* sp. male when fed on different food types (26±2ºC and70±5% R.H).

		Lardoglyphus sp.													
Sex	Food types	Incubation Period	larva		Total	Protonymph		Total	Hypopus	Tritonymph		Total	Immature stage	Life cycle	Longevity	Life span
			A	Q		A	Q			A	Q					
Male	Peanut	3.08± 0.35 a	0.83± 0.76 c	0.37± 0.12 a	1.20± 0.80 c	1.66± 0.31 a	0.41± 0.15 a	2.07± 0.30 a	-----	0.91± 0.46 c	0.33± 0.00 b	1.24 ± 0.46 c	4.52± 0.87 b	7.60± 0.70 b	13.88± 3.72 ab	21.47± 3.99 b
	Yeast	2.75± 0.16 a	0.58± 0.15 c	0.33± 0.00 a	0.91± 0.15 c	0.58± 0.15 c	0.33± 0.00 a	0.91± 0.15 c	0.45± 0.17	0.58± 0.15 c	0.33± 0.00 b	0.91± 0.15 c	2.72± 0.29 c	5.47± 0.17 c	11.00± 3.96 b	16.47± 3.98 c
	Luncheon	2.71± 0.58 a	1.29± 0.12 b	0.37± 0.12 a	1.66± 0.00 b	1.37± 0.12 b	0.45± 0.17 a	1.83± 0.18 b	------	2.24± 0.58 a	0.45± 0.17 a	2.70± 0.63 a	6.18± 0.66 a	8.89± 0.79 a	14.38± 2.62 ab	23.26± 2.49 ab
	Cheese	3.12± 0.53 a	2.00± 0.31 a	0.37± 0.12 a	2.37± 0.28 a	1.37± 0.12 b	0.41± 0.15 a	1.78± 0.17 b	--------	1.33± 0.00 b	0.33± 0.00 b	1.66± 0.00 b	5.81± 0.36 a	8.93± 0.65 a	17.38± 4.41 a	26.31± 4.66 a

Means in the same coulomb not followed by the same letter are significantly different ($P < 0.05$)
A= Active stage
Q= Quiescent stage

Table 2: Duration of different stages of *lardoglyphus* sp. female when fed on different food types (26±2ºC and70±5% R.H).

Lardoglyphus sp.															
Sex	Food types	Incubation Period	larva		Total	Protonymph		Total	Hypopus	Tritonymph		Total	Immature stage	Life cycle	Longevity	Life span
			A	Q		A	Q			A	Q					
Female	Peanut	4.03± 0.31 a	1.93± 0.50 b	0.46± 0.17 a	2.39± 0.49 b	2.63± 0.34 a	0.56± 0.16 a	3.19± 0.38 a	------	2.05± 0.41 b	0.59± 0.14 a	2.64± 0.45 b	8.22± 0.85 b	12.25± 0.68 b	15.90± 5.52 b	28.15± 5.48 a
	Yeast	3.85± 0.17ab	0.85± 0.23 c	0.56± 0.16 a	1.41± 0.24 c	0.87± 0.23 d	0.48± 0.17 a	1.34± 0.28 d	0.50± 0.17	0.71± 0.14 d	0.49± 0.27 ab	1.11± 0.29 d	4.36± 0.55 d	8.20± 0.47 d	14.45± 2.87 b	22.65± 3.03 b
	Luncheon	3.66± 0.34 b	2.38± 0.45 a	0.48± 0.17 a	2.86± 0.50 a	2.40± 0.35 b	0.51± 0.17 a	2.91± 0.40 b	------	2.89± 0.59 a	0.48± 0.17 ab	3.37± 0.59 a	9.14± 0.86 a	12.80± 1.04 a	15.75± 2.90 b	28.55± 3.23 a
	Cheese	3.42± 0.46 c	2.00± 0.59 b	0.50± 0.17 a	2.49± 0.55 b	1.36± 0.10 c	0.51± 0.17 a	1.87± 0.22 c	----	1.33± 0.00 c	0.43± 0.16 b	1.76± 0.16 c	6.13± 0.62 c	9.54± 0.64 c	19.85± 2.94 a	29.39± 2.99 a

Means in the same coulomb not followed by the same letter are significantly different ($P < 0.05$)
A= Active stage
Q= Quiescent stage

longest period when fed on the peanuts, followed by luncheon, then cheese ,which was the shortest period when fed on yeast.

Tritonymphal stage:

The active female tritonymphal occupied 2.05, 0.71, 2.89 and 1.33 days, while the quiescent stage occupied 0.59, 0.49, 0.48 and 0.43 days at (26±2°C and 70±5% R.H) but active male Tritonymphal occupied 0.91, 0.58, 2.24 and 1.33 days; the quiescent stage lasted 0.33, 0.33, 0.45 and 0.33 days when the individual feed on peanuts ,yeast, luncheon and cheese, respectively Table (1&2).

The total Tritonymphal periods were 2.64, 1.11, 3.37 and 1.76days for female, while it were 1.24, 0.91, 2.70 and 1.66 days for male at the same trend from the obvious data, there was significant difference between the food types, it is being short on yeast, prolonged on luncheon.

Finally result indicated that, all the selected stored food products have already been found suitable to some extent for mite survival and development ,yeast was the most attractive to the acarid mite *lardoglyphus* sp. and sometimes intermediate type between protonymph and tritonymph occur additional (facultative) stage so called hypopus under experimental condition, as in the case of feeding on yeast lasted for 0.45 days for male while it was 0.50 days for female.

Total immature stages:

The female total immature which included larval, protonymphal and tritonymphal stages lasted for 8.22, 4.36, 9.14 and 6.13 days Table (1&2) while those of male lasted 4.52, 2.72, 6.18 and 5.81 days at (26±2°C and 70±5% R.H) when the individual feed on peanuts ,yeast, luncheon and cheese, respectively.

Generally, in each mite species the time required for female immature stage was longer than the male immature stage at different tested food types and the differences was significant as shown in

These results clearly indicated that yeast are the most suitable diet for immature stages to reach maturity prolonged on luncheon.

Life cycle:

Female life cycle of the acarid mite, *lardoglyphus* sp. lived longer than male under tested conditions of different kinds of food, whereas, obtained data in Table (1&2) revealed that highly significant differences in life cycle of female completed in 12.25, 8.20, 12.80 and 9.54 days when fed on peanuts ,yeast, luncheon and cheese, respectively.

on the other hand, in case of male individuals, life cycle lasted 7.60, 5.47, 8.89 and 8.93 days when fed on aforementioned diets at the same trend. It is interest to note that male emerged ealier than female.

Longevity period:

As shown in Table (1&2) which is illustrated graphically showed that the type of food affected longevity. The female longevity period was 15.90, 14.45, 15.75and 19.85 days, while it was 13.88, 11.00, 14.38 and 17.38 days for male when fed on peanuts ,yeast, luncheon and cheese, respectively. Statistical analysis showed highly significant differences between female and male longivety when they fed on aforementioned diets under laboratory conditions; the highest period was when the mite fed on cheese, while the less period was when the mite fed on yeast.

In general, it can be concluded that the female giving the longest longevity and the differences among them were significant.

Life span:

As shown in Table (1&2) the life span (which included the period of life cycle and longevity) averaged 28.15, 22.65, 28.55 and 29.39 days for female while it was 21.47, 16.47, 23.26 and 26.31 days for male when fed on peanuts ,yeast, luncheon and cheese, respectively. In general,

the time required for female life span was longer than the male and the differences were significant between the four types of food as female and male life span prolonged on cheese, as it is being short on yeast.

2. Specific female stages:

Generation time:

Female generation period Table (3) and Figure (1) required 14.15, 9.25, 13.90, 11.79 days when it fed on peanuts, yeast, luncheon and cheese, respectively. There were significant differences among different food, which was the shortest generation time with average 9.25 days when fed on yeast ,but prolonged when fed on peanuts.

Pre-oviposition period:

The obtained data tabulated in Table (3) proved that this period was affected by different types of food , whereas , female pre-oviposition period lasted 1.90, 1.05, 1.10 and 2.25 days when female fed on the above mentioned diets , respect *lardoglyphus* sp. was significantly longest pre-oviposition with average of 2.25 days when fed on cheese and was the shortest period with average of 1.05 days when fed on yeast.

Ovi-position period:

The present data in Table (3) cleared that there were significant differences among different food. as *lardoglyphus* sp. was significantly longest oviposition period with average of 11.75 days when fed on luncheon ,followed by cheese with average 11.70 days and peanuts with average 10.80 days ,then when fed on yeast which was the shortest period with average of 9.55 days .

Table 3: Duration time of the four feed types on *lardoglyphus* sp. female during generation time, oviposition periods and the fecundity **.**

Feed type	Generation time (days)	Oviposition period (days)			fecundity	
		Pre- ovi	Oviposition	Post- ovi	Total average of egg	Daily rate
Peanuts	14.15±0.80 [a]	1.90± 0.31 [b]	10.80±4.87 [ab]	3.20±1.79 [b]	104±85.36 [b]	8.37±3.68 [c]
Yeast	9.25± 0.56 [c]	1.05± 0.22 [c]	9.55± 2.39 [b]	3.85±1.23 [b]	162.50±49.15 [a]	16.93± 2.17 [a]
Luncheon	13.90±1.07 [a]	1.10±0.31 [c]	11.75± 2.59 [a]	2.90±1.52 [b]	143.35±66.37 [ab]	11.64± 4.51 [b]
Cheese	11.79±1.09 [b]	2.25±0.85 [a]	11.70± 2.11 [a]	5.90±1.48 [a]	127.20±47.67 [ab]	10.65±2.56 [b]

Post-oviposition period:

There were significant differences among different food, as female of *lardoglyphus* sp. was the longest post-oviposition period with average of 5.90 days when fed on cheese, followed by yeast with average 3.85 days , peanuts with avearge 3.20 days , then luncheon was the shortest period with average 2.90 days as shown in Table (3).

Fecundity :

Obtained data in Table (3) and figure (1) of female *lardoglyphus* sp. showed that food type affected the number of deposited eggs therefore ,feed on yeast increased the number of deposited eggs with an average of 162.50 eggs with daily rate 16.93 eggs/day recorded the highest average fecundity value followed by the females fed on luncheon which gave totally 143.35 eggs with daily rate 11.64 eggs/day then when fed on cheese which gave totally 127.20 eggs with daily rate 10.65 and finally , the peanuts which gave the minimal total of 104.85 eggs and daily rate 8.37 eggs/day .

These resultes agree with that obtained by Matsumoto (1966, 1968, and 1973) (Matsumoto *et al* ., 1992and1993) and Philips and Norton (1979).

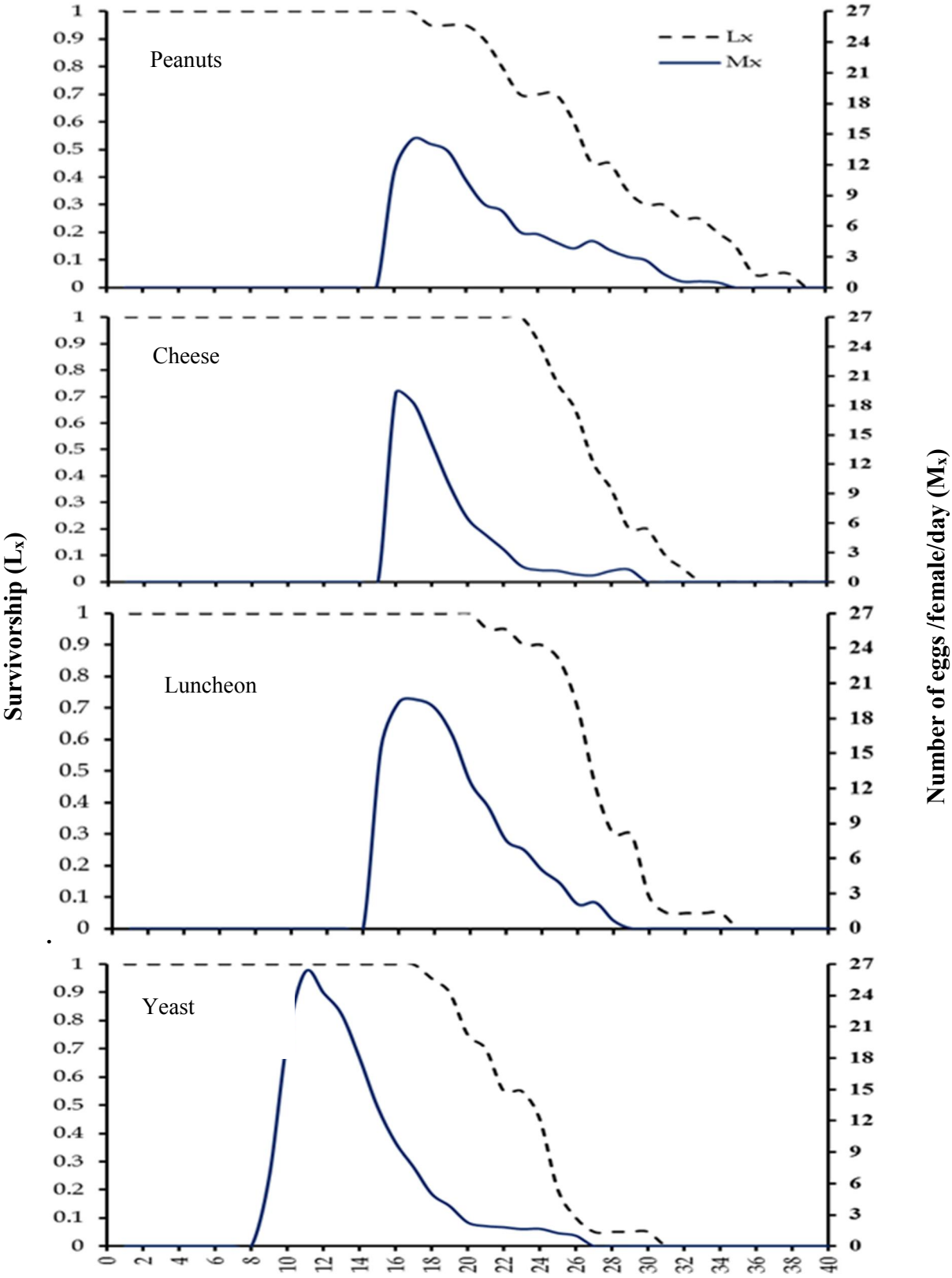

Fig. 1: Effect of Food type on Survivorship (Lx) and age - specific fecundity (Mx) of lardoglyphus sp. Female at (26±2°C and 70±5% R.H).

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