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EVALUATION OF STUDIES ON BIOLOGY, FECUNDITY AND LIFE TABLE PARAMETERS OF STORED GRAIN MITE *Gohieria fusca* (OUD.) FED ON CRUSHED MAIZE

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Abstract

Under laboratory conditions of 25 ±2 ˚C and 65% relative humidity (R. H.), biological studies were carried out on stored grain mite *Gohieria fusca* (Odum.) fed on crushed maize food, to determine development, fecundity, reproduction and life table parameters. Results showed that the duration of immature stages lasted 31.81 for females and 29.78 days for males. Female oviposition duration lasted 29.1 days and deposited an average number of eggs with a daily rate of 91.3 and 3.14 eggs.

INTRODUCTION

Several species of mites infest stored foods and other organic debris such as grain, flour, cereals, pet foods and mold (Rodriguez and Rodriguez, 1987; Chambers, 2002). Mites infesting stored grains and other products are responsible for causing both qualitative and quantitative losses especially when stored in moist and unhygienic conditions (Sinha *et al*., 1962). Both biotic and abiotic factors influence the quality of stored grains. Storage grains are considered one of the most important sources of human food, therefore, it is important to study the pests which attack them and causing much harm which leads to decrease in the amount of storage grains. Astigmatid mites form an important group among biotic factors although they are very small in size but cause considerable damage in stored grains when contains high moisture content. The amount of damage caused by stored product mites has been studied by Cunnington (1972) to be roughly proportional to the size of their population. The growth of mite population is directly related with the biological as well as physical factors operating the ecosystem. Most of mite species belonging to sub-order Astigmata attack different stored food products such as wheat-grain, wheat-flour, maize, rice, dry dates, barley, pepper and others. The infestation of stored products by mites and other arthropods is usually associated with three types of damage (Stejskal, 2001). Firstly, storage mites directly endanger human health due to allergenic contaimination of food (Olsson and Hage-Hamsten, 2000; Arlian, 2002; Spiegel *et al*., 1996; Castillo *et al*., 1995; Scala, 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 (Griffiths *et al*., 1959; Aucamp, 1969; Armitage and George, 1986; Franzolin *et al*., 1999; Hubert

et al., 2004). Thirdly, mites cause significant grain weight losses and decrease of germinability (Rodionov, 1940; Solomon, 1946; Zdarkova and Reska, 1976). The present work aims to study the biology, fecundity and life table parameters of *Gohieria fusca* when fed on crushed maize under laboratory conditions at temperature of 25 ±2 ˚C and 65% relative humidity (R. H.).

MATERIALS AND METHODS

Gohieria fusca (Oud.) was reared under controlled laboratory condition of temperature (25 ±2 ˚C) and relative humidity (65%), where mites were fed on crushed maize. Pure culture of *G. fusca* was reared by using plastic block (5 x 5 x 1.5 cm), each one contained a small rearing circular chamber (1.5 x 0.5 cm), the bottom of each chamber was covered with mixture of plaster paris charcoal and the top covered with small slide glass. Two adults, one female and one male, sufficient to make pure culture were placed in rearing chamber and provided with food. Food was added with few drops of water as a source of humidity and then placed on an incubator at temperature of 25˚C and relative humidity of 65%. Five replicates were used; each one has a single egg and then investigated twice daily, with adding a few pieces of crushed maize as a food type. Then biological aspects, like, fecundity was recorded.

RESULTS AND DISCUSSION

The experimental study was carried out under laboratory conditions of 25 ˚C temperature and 66% relative humidity. The aim was to evaluate the different biological developmental stages, reproduction and life table parameters of mite, *Gohieria fusca*, when fed on crushed maize.

HABITAT AND BEHAVIOR:

Gohieria fusca found infesting a number of different grains and its products, such as maize, wheat-grain, flour, etc. in different locations of south Kashmir. Immature stages are white in color, while adult male and female are brown. The unmated female kept under observation until death did not oviposite any eggs but only copulated female laid eggs.

HATCHING:

The deposited eggs were usually spherical and translucent and then changed to white color. During hatching the egg shell ruptured through a longitudinal slit from which larva crawled outside with its legs leaving the shell. This process lasted about 2 minutes. The hatched larva stayed inactive for a short period of about 5 minutes and then began its activity.

MOULTING:

Full grown immature stages entered in quiescent period in which it seeks a dry hole cracks in the substrate of rearing cell. The body color becomes pale brown, legs become shrinkled and contracted under body surface. The anterior part of body become translucent and the old skin ruptured along transversal line behind the hysterosomal region. The hind legs appear from the old skin at first and then the new stage crawls backward to get rid of the old exuvia. Newly emerged individuals kept quite beside its old skin for a short time, then started active searching for food. Molting lasted about 45 minutes.

BIOLOGICAL ASPECTS

INCUBATION PERIOD: The incubation period of astigmatide mite *Gohieria fusca* (for female and male) fed on crushed maize at temperature of 25˚C and 65% relative humidity, varies from 5.48 ±0.9 in females to 4.78±0.49 in males.

TOTAL IMMATURE STAGES:

Duration of total immature stages for females was 20.8 days, while for male this period lasted 18.57 days. Thus, total immature stages in male being shorter than females. Therefore, male becoming adult earlier than female.

GENERATION PERIOD:

On feeding crushed maize, female generation period required 42.19 days

LONGEVITY:

Fed on crushed maize, longevity period of female was 42.3 days while that of male was 40.19 days.

OVIPOSITION PERIOD:

As the table 3 shows, the oviposition period of *G. fusca* mite when fed on crushed maize was about 29.10 days.

FECUNDITY:

The female fecundity, fed on crushed maize, was 91.30 ± 8.33 eggs with a daily rate of 3.14 eggs.

REPRODUCTION:

A virgin female of *G. fusca* with one adult male were kept in glass container (5cm diameter) provided with crushed maize under the laboratory conditions of 25 ˚C temperature and 65% relative humidity. After 4 weeks, immature and adults were counted. Three replication experiments were done. Female reproduction was 242 individuals (220-294).

LIFE TABLE PARAMETERS:

The effect of crushed maize food on the life table parameters of astigmatid mite *G. fusca* when reared under laboratory conditions of 25 ˚C temperature and 65% relative humidity is shown in table 4. The obtained data revealed that net reproduction rate ($R_{\circ}$) is a product of mean total fecundity. The net reproductive rate ($R_{\circ}$) which is a survival rate showed 58.8. The mean generation time (T) was 44.89, while the intrinsic rate of increase (rm) was 0.24. The finite rate of increase (exprm) was 1.28. Obtained data revealed that survival rate of sex ratio of progeny (females/total) was 0.62.

Table 1. Duration (in days) of different stages of *Gohieria fusca* female when fed on crushed maize at 25 ˚C and 65% R. H.

Stage		Duration in days
Larva	A	7.43 ± 0.58
	Q	2.29 ± 0.45
Protonymph	A	8.38 ± 0.49
	Q	2.33 ± 0.47
Tritonymph	A	8.52 ± 0.49
	Q	2.86 ± 0.35

Total immature	31.81 ± 1.26
Life cycle	37.29 ± 1.45
Generation period	42.19 ± 1.32
Longevity	42.30 ±1.25
Life span	79.20±1.93

A= Active stage, Q= Quiescent stage

Table 2. Duration in days of different stages of *Gohieria fusca* male when fed on crushed maize at 25˚C and 65% R.H.

Stage		Duration in days
Incubation period		4.78±0.49
Larva	A	7.11±0.51
	Q	2.00±0.00
Protonymph	A	7.89±0.51
	Q	2.00±0.00
Tritonymph	A	8.33±0.43
	Q	2.44±0.45
Total immature		29.78±1.11
Life cycle		34.56±1.14
Longevity		40.20±2.15
Life cycle		75.17±2.86

A=Active stage, Q= Quiescent stage

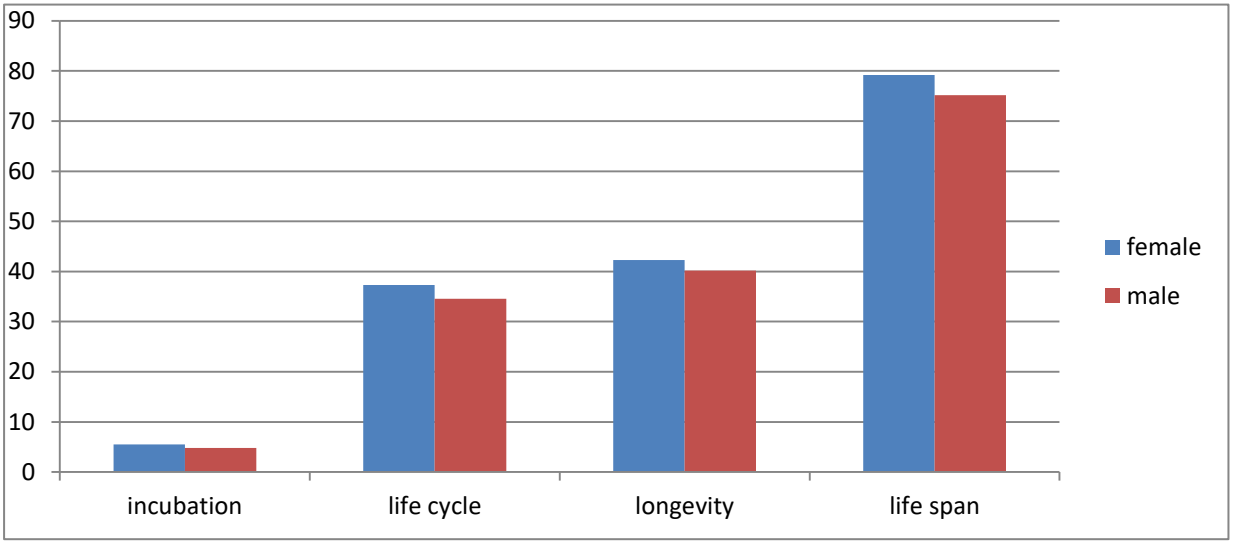
Table 3. Adult female longevity and fecundity of *Gohieria fusca* fed on crushed maize food at 25±2 ˚C and 65±5% R.H.

Diet	Average duration (days)			Longevity (days)	Fecundity		Sex ratio (% females/ total)
Crushed maize	Pre-oviposition	oviposition	Post-oviopositon		Eggs/female	Daily rate	
	4.90±0.74	29.10±1.37	8.30±0.67	42.30±1.25	91.30±8.33	3.14	62%

Table4. Life table parameters of *Gohieria fusca* fed on crushed maize at 25±2 ˚C and 65±5 R.H.

Food	Net reproductive rate	Mean generation time	Intrinsic rate of increase	Sex ratio (% females/total)
Crushed maize	58.86	44.89	0.24	0.62

Fig. 1: Duration (in days) of different stages of Gohieria fusca females and males when fed on crushed maize food at 25±2 ˚C and 65±5 % R.H.



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