LIFE-CYCLE, LONGEVITY AND FECUNDITY OF *BLOMIA TROPICALIS* (ACARI: GLYCYPHAGIDAE) IN A TROPICAL LABORATORY

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Abstract. In the present study on the life-cycle of *Blomia tropicalis*, freshly laid eggs were observed until they developed into adults; the development periods between stages were recorded. The eggs took an average of 22.9 ± 6.4 days to develop to adults. For longevity experiments, newly emerged adults were kept at 25°C and observed until they died. There was no significant difference in longevities of the different sexes ($p = 0.053$). Production of eggs by mated females were monitored until egg production stopped and the female died. Mated females and males survived an average of 32.2 ± 15.4 and 30.9 ± 17.7 days respectively. The difference in longevity of the mated females, and males was not significant ($p = 0.747$). Longevity of the mated females was found to be significantly ($p < 0.05$) shorter than unmated females.

INTRODUCTION

Certain pyroglyphid mites are important producers of allergens affecting man and numerous biological studies of these mites have been reported. There are non-pyroglyphid mites which produce allergens too. Very little is known about the biology of these non-pyroglyphid species. One such mite is a glycyphagid species, *Blomia tropicalis*, which had been described as the most numerous non-pyroglyphid mite in house dust (Gabriel *et al*, 1982; Hurtado and Parini, 1987).

B. tropicalis is very abundant in tropical and subtropical regions (Hurtado and Parini, 1987; Garcia-Ibanez *et al*, 1991). The climatic conditions in these regions, with a mean annual temperature of 28°C and a mean relative humidity of 82%, offer a good environment for the growth of this species (Puerta *et al*, 1991). The existence of a great abundance of *B. tropicalis* had been observed in homes of mite allergic individuals (Caraballo *et al*, 1990). Diagnostic test results showed that sensitization to *B. tropicalis* is common in subjects with asthma and/or allergic rhinitis (Puerta *et al*, 1991).

Biological studies with respect to pre-reproductive period, reproductive period, fecundity, development time and longevity are important for determination of reproductive potential in any species. Longer pre-reproductive period may limit reproduction and population development in laboratory cultures (Hart and Fain, 1988). Features such as mortality of eggs and longevity may also influence population dynamics in laboratory cultures.

The following studies were conducted to improve understanding of the reproduction biology of *B. tropicalis* and thus enhance the culture of laboratory colonies in order to supply allergens for diagnostic purposes or for commercialization in the future. Such information is also useful for the control of the mite.

MATERIALS AND METHODS

B. tropicalis colonies kept in the Division of Acarology, Institute for Medical Research, Malaysia, were used. These colonies contained mixed generations and were maintained in an air-conditioned room with an average temperature of 25°C ± 2°C.

The containers used for the study were clear plastic vials of height 3.7 cm and diameter 2.0 cm. A sheet of cigarette paper was placed over the mouth of each vial. The paper was secured in place with a plastic snap cap which had a 1 cm diameter hole in the center. Held in such a manner, the paper allowed ventilation of the vials and prevented the escape of the mites. Approximately 2 mg of food were introduced and evenly spread over the floor of the vial. All the vials were kept in a dessicator containing a saturated sodium chloride solution which maintained the relative humidity inside the dessicator at 75%. These culture conditions are as reported by Brownswijk *et al* (1973).

Life cycle duration

Forty-three freshly oviposited eggs were placed individually in separate vials. The contents of the vials were observed once daily and the duration of development of various stages from egg to adult was recorded.

Longevity of adults

Fifty adults (25 females and 25 males) which had newly emerged from isolated pharate adults were kept individually in separate vials. The mites were observed once daily until they died. The number of days they lived was recorded.

Fecundity and longevity of reproductive females

Thirty-five pairs of freshly emerged adult males and females were used for the study. Each pair was placed in a separate vial. Approximately 2 mg of food ground (rat chow) were introduced and evenly spread over the floor of the vial. Counts of eggs laid were made once daily. The eggs deposited each day were then removed from the vial. Each female was monitored until it died. The longevity of males was also monitored. Observation on fecundity of the females was continued even if the males died before the females; however the dead males were not replaced.

The period between the deposition of the first and last eggs was defined as the reproductive period. Fecundity was the total number of eggs laid per female and rate of reproduction was calculated as the number of eggs laid per day of a female's reproductive period. Pre-reproductive period is the time beginning from the newly emerged females been introduced to the males, to deposition of the first egg.

Statistical analysis

Student's *t* test with a 95% confidence level was used for the comparison of longevities.

RESULTS

Life cycle duration

The duration of development of each stage from egg to adult is shown in Table 1. Eggs took an average of 22.9± 6.4 days to develop to adults. Of the 43 eggs prepared, only 26 (60%) successfully became adults. Eight (19%) eggs did not hatch. The percentage mortality observed in the larval and protonymph stage was 16% and 9% respectively. Mortality was also observed in the pharate stages. Twenty-one percent was observed in pharate protonymph and 12% in pharate tritonymph. No mortality was observed in the tritonymph stage.

Table 1

Development period of life-cycle stages of *Blomia tropicalis* at 25°C and 75% RH.

Stage	Duration (days)	Mean ± SD (days)
Egg	5 - 8	5.7 ± 0.8
Larva	2 - 13	4.2 ± 3.0
Pharate protonymph	1 - 5	1.7 ± 0.8
Protonymph	1 - 7	3.1 ± 1.9
Pharate tritonymph	1 - 2	1.2 ± 0.4
Tritonymph	1 - 9	3.8 ± 2.1
Pharate adult	1 - 3	1.8 ± 0.5
Total	17 - 38	22.9 ± 6.4

Table 2

Student's *t*-test analysis of the longevity of sexes at 95% confidence interval.

Comparing groups	Probability, P	Significance
Females and males	0.053	Not significant
Females and mated females	0.000	Significant
Males and mated males	0.000	Significant
Mated females and males	0.747	Not significant

Egg development time was longer than the other stages. Duration of the egg stage was approximately 25% of the total development time. This is followed by the larval stage (18%), protonymphal stage (14%) and tritonymphal stage (17%).

Longevity

The mean longevities of individual females and males were 57.5 ± 33.2 and 81.9 ± 7.5 days respectively. There was no significant difference between the sexes where longevity was concerned ($p = 0.053$) (Table 2).

Fecundity

Reproductive data for *B. tropicalis* are shown in Table 3. The pre-reproductive period had a mean of 2.8 ± 1.4 days, and the average reproductive period was 16.5 ± 7.0 days. The average fecundity was 28.2 ± 17.0. The number of egg-laying days ranged from 4-27 days with a mean of 12.3 ± 5.4 days. The mean number of eggs deposited per day was 2.3 ± 1.0. Two of the mated females (5.7%) did not lay any eggs.

Mated females and males survived an average of 32.2 ± 15.4 and 30.9 ± 17.7 days respectively. The difference in longevity of the mated females and males was not significant ($p = 0.747$). Longevity of the mated females was found to be significantly shorter than unmated females ($p < 0.05$). Five (14.3%) of the mated females died on the same day as the males. It was observed that 17 of the mated females (48.6%) died before the males and 13 females (37.1%) died after the males.

Table 3

Reproductive statistics for *Blomia tropicalis*.

	Duration (days)	Mean ± SD (days)
Mated female longevity	11 - 62	32.2 ± 15.4
Mated male longevity	7 - 69	30.9 ± 17.7
Pre-reproductive period	1 - 7	2.8 ± 1.4
Reproductive period	7 - 33	16.5 ± 7.0
Fecundity	6 - 74	28.2 ± 17.0
Rate of reproduction	0.7 - 3.9	1.7 ± 0.8
# egg-laying days	4 - 27	12.3 ± 5.4
# egg/egg laying day	1.0 - 5.4	2.3 ± 1.0

35 pairs of males and females examined.

DISCUSSION

The development period of *B. tropicalis* from egg to adult in this study falls in the range reported by Arlian *et al* (1990). They reported that *B. tropicalis* requires 34.0 ± 5.9 days and 19.3 ± 2.5 to complete one life-cycle from egg to adult at 23°C and 30°C, respectively.

The capacity of a population to increase in numbers is affected by the ability of the individuals in the population to survive to adulthood and to reproduce. In this study, the mortality rates decreased as development progressed. Mortality was present in all stage except the tritonymph stage. High mortalities in the egg and larval stages have also been reported for other house dust mites (Ho and Nadchatram, 1984; Saha and Modak, 1992). The high mortality in the egg and the larval stage might be due to the longer development times involved when compared to the other stages. Minor fluctuations in temperature and humidity to the house dust mite populations in the tropics during development time may affect their survival (Colloff, 1991).

Under the same laboratory conditions, development period of all the stages in the life-cycle of *B. tropicalis* was found to be much shorter than another house dust mite, *Dermatophagoides pteronyssinus* (Ho and Nadchatram, 1984). Only the development period of the egg stage was similar (5-7 days). The shorter life-cycle may be the reason why *B. tropicalis* had been described as the most numerous mite in house dust.

The longevity of the unmated adult mites was 58 to 82 days and the mated ones 62 to 69 days. These observations agree with that reported by Bronswijk *et al* (1973). They observed *B. tropicalis* mites were dead after 67 days.

The reproductive period, fecundity and rate of reproduction for *B. tropicalis* was much shorter when compared to those reported by Arlian *et al* (1990) for *D. pteronyssinus*. Differences in the type of food and temperature used are possible contributory factors. Animal protein and yeast were used at 23°C by Arlian *et al* (1990) to culture the mites.

The data obtained in this study should be considered as baseline data under the specified laboratory conditions. The effect of change in temperature, relative humidity and food type on population dynamics of *B. tropicalis* should be investigated further for optimizing culture conditions.

ACKNOWLEDGEMENTS

The authors wish to thank the Director, Institute for Medical Research, Kuala Lumpur, Malaysia, for permission to publish this paper.

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