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LIFE-CYCLE OF HOUSE DUST MITE *DERMATOPHAGOIDES PTERONYSSINUS* (ACARI: PYROGYLPHIDAE) UNDER LABORATORY CONDITIONS IN KOLKATA METROPOLIS

S. Podder [1,2], H. Biswas [1], S.K. Gupta[1] and G.K. Saha[1]*

[1] Department of Zoology, University of Calcutta, 35, Ballygunge Circular Road, Kolkata 700019, India; e-mail: gkszoo@rediffmail.com
[2] Department of Zoology, Darjeeling Govt. College, Darjeeling – 734101, West Bengal, India

ABSTRACT: The life cycle of *Dermatophagoides pteronyssinus* was studied at 25 °C and 80% relative humidity. Observation was made on freshly laid eggs until they develop into adults and periods between different stages were recorded. The eggs required an average 11.26 days to develop into adults. The ranges of life longevity of mated males and females were 18–64 days and 20–54 days, respectively. The conditions used in the rearing experiments may be considered optimal for maintaining culture of *D. pteronyssinus*.

KEY WORDS: *Dermatophagoides pteronysinus*, house dust, mite culture, allergy, Kolkata

INTRODUCTION

It is now well documented that the mite allergen is one of the common sources of respiratory allergy. Studies on mite fauna suggest that *Dermatophagoides pteronyssinus* is the most common domestic mite species in Kolkata, India. The clinical relevance of *D. pteronyssinus* was already investigated amongst an asthmatic population from Kolkata. It was found to be a source of sensitizing allergens in house dust (Podder et al. 2006). Naturally, the information regarding the biology of this mite is important for understanding the population dynamic of laboratory cultures and in mite control. As regards other works in this field from it can be mentioned that there are a number of references available regarding previous research of this mite, and some recent ones are as follows: Arlian et al. (1990) on development of *D. pteronyssinus*; Colloff (1991) on ecology of the house dust mite; Cunningham (1998) on effect of temperature and humidity on the dust mite in general; Arlian and Dippold (1996) on development of fecundity of *D. farinae*; Alexander et al. (2002) on mating behavior and fecundity of *D. farinae*; and Pike et al. (2005) on development of *D. pteronyssinus* at different temperature and humidity. However, the majority of those studies pertained to the temperate climate and practically no study or very little work has been done from the tropical world in general and from the Indian subcontinent in particular. Since, it is one of the most dominating allergy-causing mites, it was thought necessary to investigate the life cycle of this mite with a special reference to the duration of different developmental stages, so this was studied and the results are presented here.

MATERIALS AND METHODS

Adult mites were isolated from a house occupied by asthmatic patients in and around Kolkata. Fifty milligram of dust from each sample was suspended in 50% lactic acid. All mites present in each sample were collected with a fine needle, placed in two drops of Heinze's medium on a microslide and identified. Mass culture of *D. pteronyssinus* was set up at 25°C and 80% RH in Petri dishes (3.5 cm in diameter) and approximately 2 mg of food (wheat flour) was placed in each dish. All the dishes were kept in BOD incubator at the constant temperature and humidity.

To determine the duration of life stages, 30 freshly laid eggs were considered for the present experiment. Each one was placed in a separate Petri dish and observations were recorded at 24 hour intervals under a stereomicroscope. The time of development of different stages from egg to adult was recorded. A total of 15 eggs (50%) reached the stage of adult mites. The data pertaining to different life stages were taken from these 15 cases where the complete life cycle was reached, and this also gave the percentage of mortality at different stages. Similarly, for computation and statistical analysis of the data, only those cases where the life cycle was completed were used. In order to determine the pre-oviposition, oviposition and post-oviposition periods, a separate experiment was designed. For this, 25 Petri dishes (5 cm diameter) were taken and each pair of newly emerged virgin adult male and female were released; observations were recorded every 24 hours under a stereomicroscope. Each dish was covered with a fine muslin cloth and it was tied up with a rubber band to prevent the escape of mites. While taking obser-

vations, the number of newly laid eggs was counted in each Petri dish and thereafter the eggs were destroyed by pricking them with a needle. This was continued until the cessation of egg laying. The time between the deposition of the first and last egg was defined as the oviposition period. A paired t-test with unequal variances was done to observe the differences between the longevity of males and females. The statistical analysis was done by using SPSS 10.0 for Windows.

RESULT

The average time from the egg to the adult period was 11.26 days. Fifteen of the 30 eggs observed (50%) became adult. The sex ratio of male and to female was 1: 2.75. Mortality at the larval and protonymph stages was 23% and 12% respectively. There was no mortality at the tritonymph stage. Duration of the egg stage was approximately 2.45 days, followed by the larval 1.57, protonymphal and tritonymphal stages each accounting for 2.64 and 2.6 days respectively (Table). The quiescent protonymphal and resting tritonymphal stages were also observed, each one with duration of approximately 1 day.

The pre-oviposition period was found to be 2.57 days, oviposition period 23.78 days and post oviposition period 25.73 days. The fecundity ranged from 51–122 eggs. The total oviposition period ranged from 8–22 days and 1.3 to 6.4 eggs / day/ female.

Mated males and females lived 18–64 days and 20–54 days, respectively, although the difference of longevity between males and females is not statistically significant ($t_{0.05}$ =2.13)

DISCUSSION

In the present study, the development of *D. pteronyssinus* from the egg to adult was faster (9–14 days) than other reports like Mulvey (1972), Ho and Nadchatram (1984), Mariana et al. (1996), who stated that the life cycle of *D. pteronyssinus* was completed within 16–24 days. Our results are in conformity with those of Ho and Nadchatram (1984) and Matsumoto et al. (1986). Our findings revealed that the span of the life-cycle of adult males is about 6–7 weeks. Female mites were, however, observed to live shorter than their male counterparts, but the difference is statistically insignificant. In the opinion of Spieksma (1967), Spieksma-Boezeman (1967) and Mulvey (1972), the adult male and female of *D. pteronyssinus* lived for 60–80 days and 100–150 days, respectively, at 25ºC and 80% RH.

Studies on the fecundity of *D. pteronyssinus* revealed that the number of eggs laid/female/day ranged between 1.3 to 6.4 under laboratory conditions (25ºC and 80% RH). The present findings disagree with the data of Spieksma (1967), who observed a low fecundity rate for *D. pteronyssinus* i.e. 1.2–2.5 / day at 25 ºC and also with Matsumoto et al. (1986), who also observed that the fecundity of *D. pteronyssinus* was 1–2 eggs/ day and at 86% RH.

The observation on the life-cycle of *D. pteronyssinus* further pointed out that the rate of mor-

Table

The duration of different developmental stages (in days) and reproductive statistics for females of *Dermatophagoides pteronyssinus* at 25ºC and 80% RH

Stage	Duration (days)	
	Mean ± S.E	Range
Egg	2.45 ± 0.1	2–3
Larva	1.57 ± 0.11	1–2
Protonymph	2.64 ± 0.19	2–4
Tritonymph	2.46 ± 0.13	2–3
Egg — adult	11.26 ± 0.47	9–14
Pre-oviposition period	2.57 ± 0.19	1–4
Oviposition period	23.78 ± 1.51	10–34
Post-oviposition period	25.73 ± 2.75	5–42
Fecundity	85.06 ± 6.94	51–122
Rate of oviposition	4.2 ± 0.41	1.3–6.4
Longevity of males	46.46 ± 3.25	18–64
Longevity of females	38.2 ± 3.45	20–54

tality was highest during the larval stage (23%), but as the development progressed a gradual decrease in the mortality rate was noticed. These findings agree with the observation made by Ho and Nadchatram (1984). Colloff (1987) reported marked differences in the development and mortality of eggs between the laboratory and wild populations of *D. pteronyssinus* reared under fluctuating conditions of temperature and humidity.

The results obtained from the present study did not tally with those of earlier works. One of the reasons of difference may be the difference in temperature and RH under which the different studies were conducted. In the present case the temperature and RH were 25^{o}C and 80%, respectively, while the earlier studies performed the experiment at varying temperature and RH. The most striking difference was in respect of longevity of females which was 38.2 days in the present study, where as it was almost three times higher in the studies by Pike et al. (2005) and Arlian et al. (1990). According to Arlian et al. (1990) the egg to adult period also was much longer (122.8 days), compared to 11.26 days in the present study. As regards the duration of egg and larval periods, the data were also markedly different in the present study it was 2.45 and 1.57 days, while it was 9.3 and 3.4 as indicated by Pike et al. (2005). Regarding the rate of oviposition, the present findings more or less come closer to those of Pike et al. (2005) and Arlian et al. (1990). So, it can be inferred that the present findings by and large are quite different from those obtained earlier. The environmental conditions under which the referred studies were conducted are different, and that may be the reason for differences in the result. Due to lack of studies from tropical areas, the present findings could not be compared with those results.

Temperature, RH and food availability are the most important environmental factors that influence the biology and growth of dust mites, and these factors determine where they live, how large the populations become and how they fluctuate seasonally (Mercado et al. 2001). These authors also pointed out that the *D. pteronyssinus* mites has a broad distribution range that appears to be less constrained by microclimates. This can be explained by the better maintenance of the body water balance within the Pyroglyphidae, which helps pyroglyphid mites to adapt to the periodic microclimatic fluctuations in homes.

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