

A study of a population of house dust mite in its natural environment

A. MARGARET HUGHES and KATE MAUNSELL

Biology Department, Royal Free Hospital Medical School, London, and
Department of Medical Microbiology, King's College Hospital Medical School, London

Summary

A study was made of the house dust mite, *Dermatophagoides pteronyssinus*, in its natural surroundings for a year. Records of the relative humidity inside and outside the bed and of the temperature outside the bed were kept. An estimate of the number of mites on the surface of the mattress was made by brushing the mattress dust into a container at monthly intervals and then counting the mites. Suction cleaning of the mattress was also carried out to ascertain whether it is possible to control the number of mites by such measures. It was found that suction cleaning and brushing of the mattress considerably reduced the numbers of live and dead mites. The number of live mites remained low during the winter, but increased during the late spring and summer when temperature and relative humidity became higher. It is suggested that, for effective control, cleaning of mattresses should be carried out more frequently in the spring and summer than in the winter.

Records of the relative humidity inside and outside the bed confirmed the fact that when a bed is occupied the relative humidity falls, but attains equilibrium with the surrounding air again soon after the occupant has left the bed.

Introduction

House-dust allergy is of widespread occurrence and many substances, moulds, vegetable and animal fibres, etc., have been suggested as the causal agents. It was not until 1964, however, that the work of Voorhorst, Spieksma-Boezeman & Spieksma provided evidence that one particular species of mite, *Dermatophagoides pteronyssinus* (Trouessart, 1897), is a producer of the most important allergen in house dust. Later, the fundamental research of Spieksma (1966, 1967) and Spieksma & Spieksma-Boezeman (1967) showed that this mite, and occasionally *D. farinae* Hughes, 1961 and *Euroglyphus maynei* (Cooreman, 1950), occur in the dust of most houses in Holland, and are particularly numerous in samples taken from damp and inadequately heated houses. Cunningham (1967) and Maunsell, Wraith & Cunningham (1968) confirmed the presence of *D. pteronyssinus* in house dust in England and also showed that the mites were particularly abundant in the surface dust of mattresses. Since

Correspondence: Dr A. M. Hughes, Cox Green Cottage, Rudgwick, Sussex.

desquamated skin scales form the main food of the mite, it is not surprising that its presence in house and mattress dust has been confirmed in many other parts of the world, but it appears that in Columbus, Ohio, *D. farinae* is more widespread than *D. pteronyssinus* (Larson, Mitchell & Wharton, 1969).

The object of this investigation was to ascertain the effects of naturally varying temperature and relative humidity on a population of *D. pteronyssinus* inside a particular bed over the period of one year, and to find out whether it is possible to control the number of mites by means available to most housewives and without the use of acaricides.

Materials and method

The bed chosen was in a north-west-facing bedroom which is continuously heated during the winter. The bed had a $3\frac{1}{2} \times 6$ ft Dunlopillo mattress, underblanket, sheets, two over-blankets, bedspread and eiderdown. Records were kept of the relative humidity outside and inside the bed by means of two hair hygrometers, the one inside the bed fitted with a probe. The hygrometers were calibrated together at the start of the experiment, and every 3 weeks while the experiment lasted. Two measurements were taken each day at about 12-hourly intervals, and a record of the temperature outside the bed was also kept.

An estimate of the number of mites on the mattress was obtained by brushing the surface of the mattress with a soft brush, collecting the dust in a Petri dish and then counting the mites under a low-power dissecting microscope. Care was taken to keep the sampling as uniform as possible. The mattress was then thoroughly cleaned with a vacuum cleaner and the bed remade with clean sheets and underblanket. The surrounding carpet was also suction cleaned. This procedure was followed every 4 weeks. For most of the year, the bed was only occupied on one night every week.

Results

The twice daily readings of relative humidity and temperature confirmed the well-known fact that, when a bed is occupied, the relative humidity of the air inside it falls (Fig. 1). When the occupant leaves the bed in the morning, the relative humidity soon rises to come into equilibrium with that of the air in the room. Readings of the relative humidity taken outside the bed also showed that, except for part of the month of January when the weather was exceptionally wet, the relative humidity of this particular room during 1970-71 fell during the winter months and rose, with the temperature, during spring and summer.

At the beginning of the experiment in November 1970, 221 live and dead mites were found in the mattress dust, and this number fell to fifty-one at the beginning of December. After this, the live and dead mites were counted separately. Apart from a slight rise in January, the number of live mites fell at the end of February and remained at zero or one during April and May. The dead mites decreased in number more slowly, possibly because they become entangled in the fibres of the blankets and are only gradually shaken into the mattress dust.

At the end of April 1971, the weather became warmer, the central heating was turned off and the relative humidity and temperature of the room rose and came into equilibrium with that of the air outside the house. When the mattress dust was examined in late May, it was found that, although the number of dead mites had

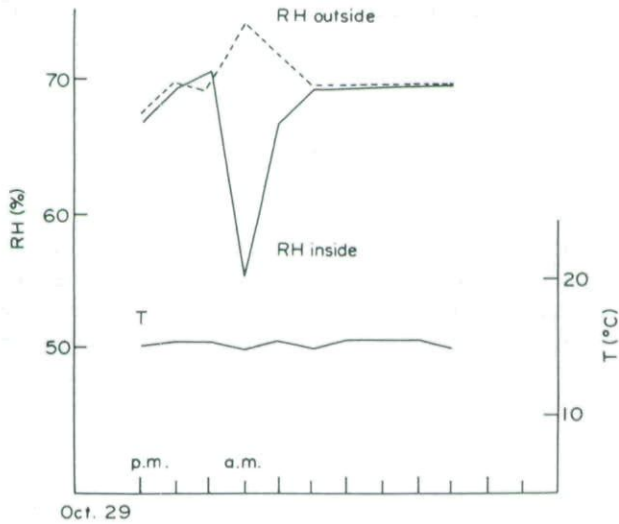


Fig. 1. Daily readings of temperature (T) and relative humidity (RH) inside and outside the bed between 29 October and 4 November. The bed was slept in on 30 October.

continued to fall, the number of live mites increased from one to sixty-one (Fig. 2). The majority of these mites were immature stages.

During the rest of the summer, conditions of temperature and relative humidity were particularly favourable for the mites, and a few live and dead ones were found

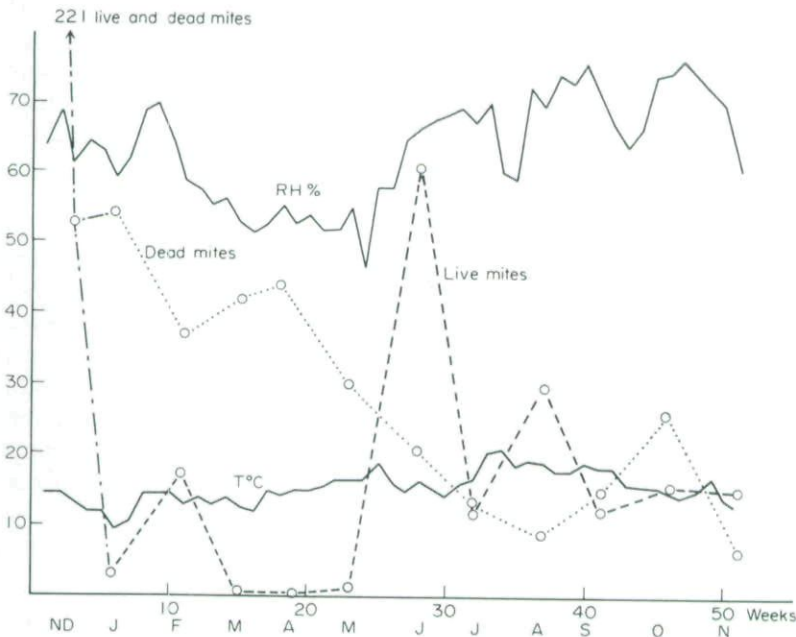


Fig. 2. Weekly averages of temperature (T) and relative humidity (RH) outside the bed between November 1970 and November 1971. The months of the year are indicated by their initials.

every month. In November 1971, the brushed sample yielded fifteen live mites and nine dead ones, a total of twenty-four; whereas in the previous year there were 221. Regular vacuum cleaning of the mattress was continued until May 1972, when a further sample was brushed off the mattress. In this were found two live mites, but no dead ones.

Discussion

The relative humidity of the air inside a bed falls when it is being slept in (Fig. 1), because the temperature inside the bed is raised by the heat given off by the human body, and warm air holds more water vapour than cool air. The majority of mites are particular susceptible to dry conditions, since they readily lose water through the cuticle and become dehydrated. The house dust mite obviously can withstand these periods of comparative drought, possibly because its wrinkled cuticle traps a layer of static air around the body which prevents evaporation. On the other hand, it breeds freely in continuously damp conditions where little disturbance occurs, and beds in holiday cottages or in the spare bedroom often harbour very large populations of mites. One of the few beds we have examined which was found to be free from mites, was occupied by two people: one using it at night, the other during the day; so maintaining a dry atmosphere in the bed all the time.

The results of sampling (by means of brushing the mattress) in November and December 1970 showed that brushing and suction cleaning considerably reduces the number of live and dead mites (Fig. 2). The sudden increase in number in late May 1971 may have been due to the fact that, whilst vacuuming and brushing removes a large number of the mites, the eggs are not affected. In fact, no eggs were found in any of the brushed samples. During the winter, owing to the heating of the room, the relative humidity is usually low and less favourable for the hatching of the eggs. In the late spring, however, temperature and relative humidity start to rise and the eggs then hatch. This is confirmed by the fact that most of the mites in the May sample were either larvae or nymphs. The eggs are spindle-shaped, and when disturbed they tend to lie in the grooves between the threads of the mattress cover and are difficult to dislodge. They are not stuck to the cover or fastened by silken threads.

If cleaning of the mattress had not been continued in the summer of 1971, the young mites would have become adult and started breeding, resulting in large populations in late summer and early autumn. This agrees with the results of Spieksma and his wife (1967) who found that the largest number of mites was found in house dust in September and October. The occurrence of small numbers of live mites in the mattress dust in June, July and August can be accounted for by the fact that cleaning of the mattress was carried out once a month and the life cycle of *D. pteronyssinus* takes from 19 to 27 days (Spieksma, 1967), so that eggs laid just before one cleaning would have given rise to adults which would start to reproduce before the next cleaning. This suggests that in late spring and summer months hygienic precautions should be carried out more frequently.

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