THERMAL DEATH POINT OF *DERMATOPHAGOIDES PTERONYSSINUS* (TROUESSART, 1897) (ASTIGMATA, PYROGLYPHIDAE), THE HOUSE DUST MITE

BY

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INTRODUCTION

House dust has long been known to cause allergic bronchial asthma in sensitive patients (COOKE, 1922) and recently it has been shown that a relatively unknown pyroglyphid mite, *Dermatophagoides pteronyssinus*, is abundant in most samples of house-dust and is the major source of the allergen (VOORHORST *et al.*, 1964, 1967). Since this discovery, interest has been centred on the biology and ecology of this mite and the means of controlling it.

The purpose of the present study was to investigate the thermal death point of *D. pteronyssinus*, thermal death-point being defined as the lowest temperature causing 100 % mortality after a specified period of exposure.

MATERIALS AND METHODS

The apparatus was broadly based on that of MELLANBY (1932). Exposure tubes, made from 4 cm lengths of 0.6 cm bore glass tubing covered at one end with fine nylon gauze and corked at the other, were suspended in a Woulff bottle (exposure bottle) 4 cm above a potassium hydroxide solution giving an atmospheric R. H. of 60 % (SOLOMON, 1951). Air at the required temperature and at 60 % R. H. was passed slowly through the exposure bottle from a similar bottle containing a thermometer and the whole apparatus was submerged in a thermostatic water bath.

The apparatus was kept at the required temperature for 15 mins before the start of each experiment and then the tubes containing about 20 mites were suspended in the exposure bottle. Previous to this the mites had been kept in culture at approximately 19°C and 80 % R.H.

At the end of the exposure period the mites were examined, still in the tubes, and the numbers dead and alive were counted. Where mortality was 100 % the mites appeared shrivelled, but at lower mortalities a death criterion was necessary. *D. pteronyssimus* normally moves rapidly from a bright light (von BRONSWIJK *et al.*, 1971) so immobile mites which failed to respond to brilliant illumination were classed as dead.

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Results and discussion

Table 1.

	6 hours exposure				24 hours exposure		
Temp. °C	Living	Dead	% Mortality	Temp. °C	Living	Dead	% Mortality
47	23	5	17.9	42.5	28	7	20
48	33	5	13.2	43	14	32	69.5
48.5	30	6	16.7	43.5	9	29	76.5
49	24	54	69.2*	44	5	35	87.5
49.5	3	77	96.2*	44.5	9	20	69
50	6	64	91.4*	45	1	18	94.5
51	0	27	100	45.5	0	21	100
51.5	0	38	100	46	0	35	100

* Results from exposure of four batches of mites instead of two as are the other results.

The results for exposure periods of 6 and 24 hours to various temperatures at 60 % R.H. are shown in Table 1. The thermal death points are considerably higher than those recorded for other species of mite.

Madge (1965) investigated 9 species of Oribatid mites and found that the thermal death points for exposures of one hour at 60 % R.H. varied from 44°C for *Humerobates rostrolamellatus* Grandjean, a species found on the bark of apple trees and classed as a xerophyll, to 29°C for *Hypochthonius rufulus* (Koch.) which occurs in sphagnum and is a hygrophyll. He suggested that an ill-defined relationship may exist between the thermal death point of the mites and their different habitats : the more moist the habitat, the lower the thermal death point.

The thermal death point of *Sarcoptes scabiei* (L.) the scabies mite, was investigated by Mellanby (1942) who found that a temperature of 49°C (120°F) was fatal in exposures of 10 minutes and 47.5°C (117.5°F) was fatal in 30 minutes. Atmospheric humidity had no effect on the thermal death point, and the mites were killed by heat before adverse effects from desiccation became important. *Sarcoptes* is adapted to living in the skin of man where it will normally experience only a very narrow range of temperatures. This might explain its susceptibility to abnormal exposures.

The optimum temperature for development and reproduction of *D. pteronyssinus* is 25°C. However, this species is cosmopolitan in distribution and populations occur in environments with a wide range in temperature. It is common in both human beds, where there is a regular diurnal fluctuation between ambient and 31°C (Sesay and Dobson, 1972), and in the nests of other animals (Fain, 1966) which must reach high temperatures where exposed to a hot sun. Thus the ability to survive large fluctuations in temperature will be an evolutionary advantage.

At present control measures are directed towards reduction of *D. pteronyssinus* populations in the beds of asthmatics by steam sterilisation. As well as killing the live mites, steam sterilisation also gives dilution of the allergen which they excrete/secrete onto the mattress but it also has many disadvantages. It cannot be used on foam mattresses due to the high temperatures involved and with interior sprung mattresses can cause rusting of the springs and soiling of the cover due to the movement of contaminants with the steam. If dry heat at a little over the thermal death point of the house dust mite could be applied this might be a more acceptable means of treating the mattresses of asthmatics.

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Summary

The thermal death point of *Dermatophagoides pteronyssinus*, the house dust mite, was investigated. At 60 % relative humidity all mites were killed by a six-hour exposure to 51°C (122°F) or a twenty-four hour exposure to 45.5°C (112°F).

Résumé

La température létale de l'acarien des poussières de maisons *Dermatophagoides pteronyssinus* est étudiée. A 60 % d'humidité relative tous les Acariens sont tués au bout de 6 heures à 51° (122°F) ou de 24 heures à 45.5° (112°F).

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