

Short Communication

Four-year stability of *Der p* I in house dust under simulated domestic conditions *in vitro*

Kort HSM, Kniest FM. Four-year stability of *Der p* I in house dust under simulated domestic conditions *in vitro*.

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For almost 4 years, the stability of *Der p* I was assessed by RAST inhibition in house-dust samples incubated under simulated domestic conditions (5 or 25°C and 75% relative humidity). *Der p* I concentrations were determined before heating dust samples at 60°C to kill the mites, and at 0, 6, 14, 21, and 47 months after heating. Heating at 60°C for 24 h caused no significant change in *Der p* I concentration. After a 47-month incubation under simulated domestic conditions, reduction of *Der p* I was still not obvious. It is concluded that even after extermination of mites, home textiles remain allergen reservoirs for an extended period of time.

Avoidance schemes should take this into account.

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The stability of mite allergens *in vivo* is important for avoidance procedures. Various avoidance schemes have been developed to reduce mite allergen exposure (2). Most avoidance measures are based on the extermination of mites and removal of their allergens by use of chemicals, or by dehydration of their niche by humidity management.

The success of the measures is assessed in air dust samples or in house-dust samples, vacuumed from the top of the dust reservoir. It was shown, however, that mites are present not only in the top layer of mattresses, but also in older dust deeper in the mattress (3).

The concentration of *Der p* I, a house-dust mite allergen, is one of the variables, in addition to mite counts and guanine content, used to measure the allergenicity of house dust in order to control mite allergens in homes of mite-allergic patients. This study was undertaken to assess the stability of *Der p* I in house dust, which remains behind in the mite niche after mite extermination measures have been taken.

Material and methods

Three dust samples were taken from two Dutch homes: 1) sample A from a carpet in the living room

(Utrecht), 2) sample B from a carpet in a bedroom, and 3) sample C from a mattress (last two in Valkenswaard). Dust was collected with a Hoover S 2222 vacuum cleaner (550 W, Hayesgate, UK), by vacuuming with an intensity of 1 min/m². The dust was analyzed for mites by a flotation method according to van Bronswijk (11). Subsequently, two aliquots of 5 g were weighed from each sample.

Mite extermination was done by dry-heating the 5-g subsamples at 60°C for 24 h in an open tube. After this treatment, the subsamples were incubated at 75% relative humidity (RH) and 5°C to simulate floor conditions, or at 75% RH and 25°C to simulate furniture and mattress conditions. Samples were stored in glass tubes of 2.5 × 5.5 cm, closed with a screw cap.

Der p I concentrations were determined in 100-mg aliquots taken 6 months before heating and after at 0, 6, 14, 21, and 47 months of incubation. The RAST inhibition test was used in duplicate (12) (Centraal Laboratorium voor de Bloedtransfusiedienst (CLB), Amsterdam, the Netherlands). Statistical analysis was performed with the arithmetic mean values. The Mann-Whitney U-test (10) was used, and the confidence limit was set at 5%.

Most avoidance procedures exterminate mites but leave most fungi viable (9). In this study, domestic

Table 1. Arthropods present in house-dust samples before heating, and given in numbers per gram dust

	Samples		
	A	B	C
Mites			
<i>Dermatophagoides farinae</i>	—	8	—
<i>D. pteronyssinus</i>	25	621	446
Storage mites	5	—	—
Gamasina	10	12.5	—
<i>Cheyletidae</i>	—	2.5	2.5
Other mites*	—	38	8.5
Total mites	40	682	457
Dust lice	5	10	—

* In sample B: Tarsonemini and Oribatei; in sample C: Tarsonemini, Oribatei, and *Chortoglyphus arcuatus*.

conditions during an avoidance situation are simulated. Heating to 60°C of house dust results in the extermination of mites (4), while still leaving some fungal activity (8) that may decompose proteins in the dust (11).

Results

D. pteronyssinus was present in all dust samples. *D. farinae* was present only in bedroom floor dust

(sample B). In addition to house-dust mites (90%), non-Pyroglyphid mites and dust lice were identified (Table 1).

The concentration of *Der p* I was not changed by heating at 60°C for 24 h. The increase of 33–43% of the *Der p* I concentration over preheating measurements was not statistically significant ($P < 0.35$). For over 1 year, *Der p* I remained constant; after 14 months, an increase was seen, except for sample A, which had a relatively low starting concentration. Again, changes were not statistically significant.

In dust samples incubated at 5°C for almost 4 years, 50% to 90% of the *Der p* I concentration found immediately after heating could be detected. In dust samples incubated at 25°C, 29% to 50% of the starting *Der p* I concentration after heating was found (Fig. 1). However, dust samples incubated at 5 or 25°C did not differ statistically in *Der p* I concentration. In fact, none of the changes in time were statistically significant.

Discussion

All changes found in *Der p* I concentrations can be explained by the natural heterogeneity of the domestic dust (11). Therefore, neither heating to 60°C nor storage for 4 years influenced the *Der p* I concen-

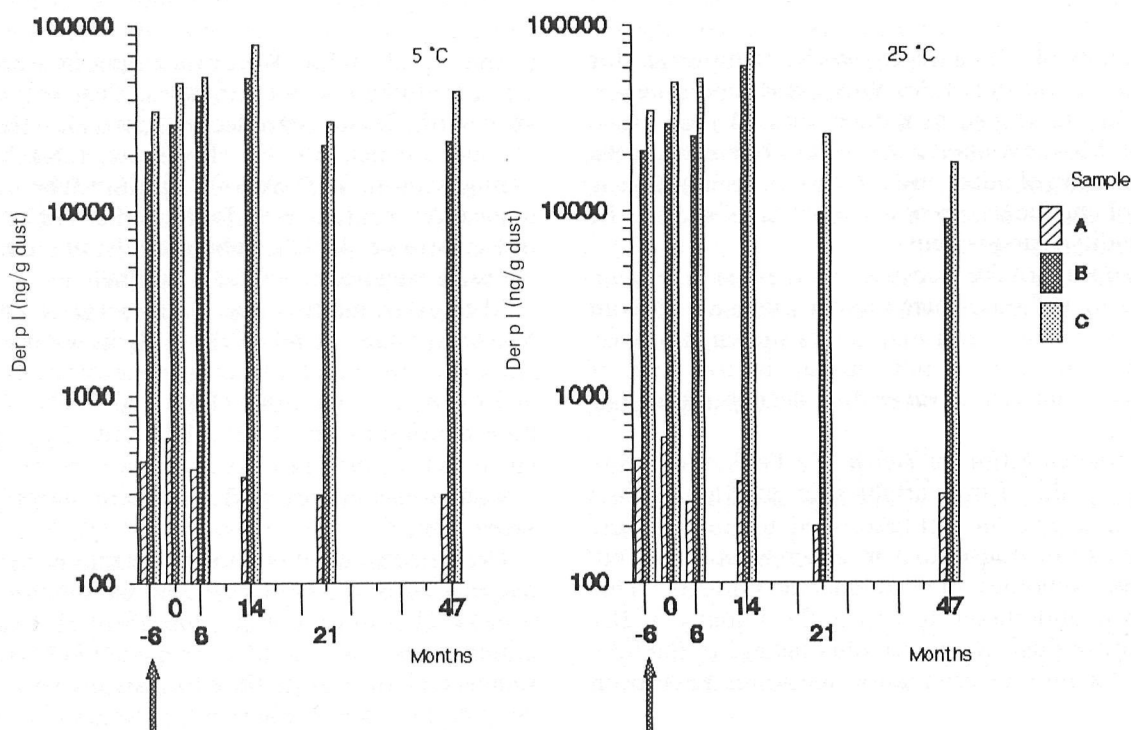


Fig. 1. Mean *Der p* I concentrations (RAST inhibition results) before heating (arrow) and over period of almost 4 years after heating of house-dust samples, incubated at 5°C and 75% RH to simulate floor conditions (left) or at 25°C and 75% RH to simulate furniture and mattress conditions (right). *Der p* I concentrations are expressed in ng/g dust and plotted on logarithmic scale. Sample A = carpet, home near Utrecht (Netherlands). Sample B = carpet, home in Valkenswaard (Netherlands). Sample C = mattress, home in Valkenswaard (Netherlands).

tration. In whole mite extracts, incubated at 23°C for 1 and 3 months, 75% of the starting *Der p I* content could still be detected (1).

It has been shown before that *Der p I*, in aqueous extract of *D. pteronyssinus*, may remain intact after heating at 56°C for 24 h, but after a 1-h heating, a five- to 10-fold reduction in IgE antibodies binding was seen, whereas heating for 1 h at 75°C reduced the binding 100-fold (6). In our study, heating of house dust at 60°C for 24 h did not denature *Der p I* either. Apparently, *Der p I* is more stable in native house dust than in solution.

At the start of this study, both bedroom dust samples (mattress and floor) had *Der p I* concentrations above the suggested allergologic risk level of 2000 ng of *Der p I* per gram dust (7). After almost 4 years' incubation, *Der p I* values were still higher than this risk level. This indicates that even after extermination of mites, home textiles remain allergen reservoirs for extended periods of time. Therefore, in mite allergen avoidance programs it is desirable to combine mite extermination with allergen removal.

In the near future, we will examine the stability of *Der p I* under better simulated home conditions such as those devised by Schober et al. (9) and extended by Koren (5).

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