

Environmental distribution of house dust mite allergen (Der p 5)

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The prevalence of asthma in schoolchildren in Taipei was observed to increase from 1.3% in 1974, to 5.1% in 1985, and to 10.8% in 1994 (unpublished data). Anti-mite IgE sera from patients allergic to mites in Taiwan reacted with a number of components as determined by Western blot analysis.¹ To date, at least seven groups of these allergens have been cloned and characterized.² Both in vitro IgE binding studies and skin tests revealed that more than 90% of the allergic children with asthma and mite allergy in Taiwan reacted to the two well characterized major allergens Der p 1 and Der p 2, and approximately 60% of these children reacted to a newly characterized low molecular weight allergen, Der p 5.³ Interestingly, although Der p 5 reacted with only 60% of sera from patients allergic to mites, the IgE reactivity appeared to be stronger than that of both Der p 1 and Der p 2. In addition, the group with asthma had significantly more reactivity to Der p 5 than the group with rhinitis alone. The seasonal variation of the major allergen Der p 1 concentrations in Taiwan has been previously evaluated.⁴ Similar environmental study on the concentrations and distributions of Der p 5 has not been reported before. In this investigation, Der p 5 concentrations in mattresses and the floors of bedrooms and living rooms were evaluated in the homes of 12 asthmatic children allergic to house dust mites in

the Taipei area every 2 months, from March 1994 to January 1995.

METHODS

Subjects and house visiting

Houses of 12 children allergic to house dust mites were visited every 2 months, from March 1994 to January 1995. Dust samples were collected from three major sites: the top surface of the child's mattress, the bedroom floor beside the mattress, and the living room floor in each residence. A portable vacuum cleaner (POWER-VAC VC 800; ANEX, Hong Kong) containing a fresh glass fiber filter, placed in front of a dust trap, was used to vacuum 1 m² of surface area of each sampling site for 2 to 4 minutes. None of the investigated homes had any carpeted floors.

Extraction and analysis of dust samples

Collected dust samples were sieved through a 0.3 mm mesh screen to obtain fine dust. Later, fine dust samples were extracted in a 1:20 wt/vol of 0.125 mol/L NH₄HCO₃ buffer (pH 7.4) for 6 hours with constant rotation at 4° C, then centrifuged for 10 minutes at 3000 rpm. Some of the dust samples collected in September, November, and January with less than 10 mg of fine dust were excluded from analysis. The supernatant was used as a dust extract and stored at -20° C for subsequent sandwich ELISA for antigen Der p 5 content.⁴ The Der p 5-specific monoclonal antibody (3E1) was prepared by immunizing mice with recombinant Der p 5 antigen (unpublished data), and rabbit polyclonal antibody against Der p 5 was prepared as previously described.⁴ The standard response curves were constructed from reference recombinant Der p 5 antigen solutions in the range of 1 ng/ml to 100 ng/ml with an intraassay variation of approximately 10%. The results are expressed as nanograms per gram of fine dust. A control curve with a standard preparation of antigen Der p 5 was performed in parallel with each assay. The Kruskal-Wallis test and Wilcoxon rank sum test were used to determine the level of significance between variables and any variation between sampling locations, respectively.

RESULTS

Dust samples collected from the homes of the 12 asthmatic children allergic to house dust mites

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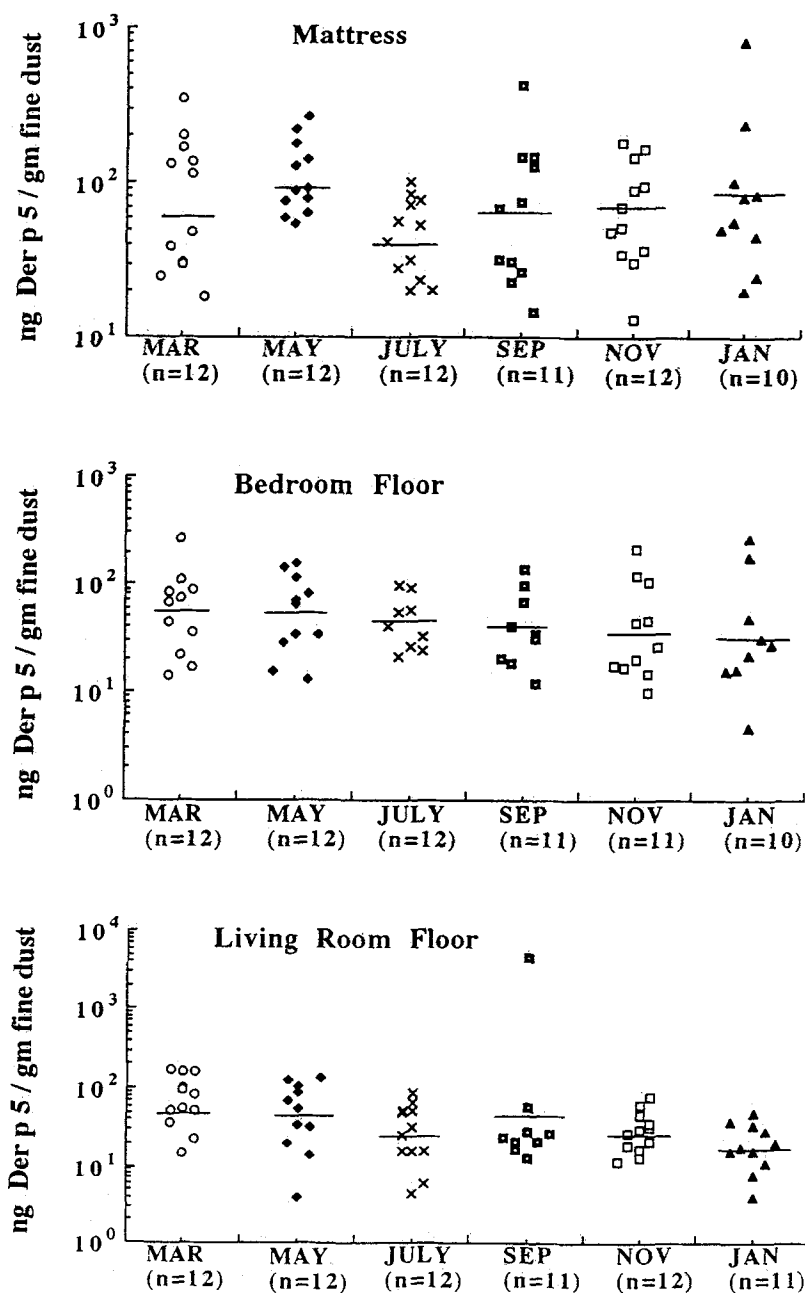


FIG. 1. Seasonal variation in distributions of Der p 5 concentrations from various parts of the investigated homes, including mattresses and floors of bedrooms and living rooms. The Der p 5 concentrations of mattress samples observed in May were statistically higher than those observed in July, and Der p 5 contents found in dust samples from living room floors in January were statistically lower than those observed in March and May. Sample numbers of bedroom floors with a Der p 5 concentration below the detection limit were 1, 1, 3, and 2 for March, May, July, and September, respectively. Sample numbers of living room floors with a Der p 5 concentration below the detection limit were 1 and 2 for May and September, respectively.

from March 1994 to January 1995 were found to contain Der p 5 concentrations ranging from 4 to 4630 ng/gm. The highest geometric mean Der p 5 concentration was observed in January, and the

lowest concentrations occurred in July and September. In addition, no statistically significant bi-monthly variations of Der p 5 concentrations were observed in the Taipei area. Regarding Der p 5

concentration distributions in the different sampling sites of the domestic environments (as shown in Fig. 1), no statistically significant bimonthly variations were found in these three collection sites, respectively. However, the Der p 5 concentrations of mattress samples in May were statistically higher than those observed in July, and Der p 5 concentrations found in dust samples from living room floors in January were statistically lower than those in March and May. Moreover, the dust samples from the mattresses contained statistically significantly higher Der p 5 antigen levels compared with those from the floors of living rooms in November and January.

DISCUSSION

Our field study of the Der p 5 allergen in house dust was the first report to demonstrate environmental distributions of Der p 5 allergen in the world. It was found that a lower amount of Der p 5 than Der p 1 is present in domestic residential environments in the Taipei area.⁴ In addition, the environmental distributions of Der p 5 did not show any significant seasonal variation. The precise reason for these differences is unknown. Der p 1 is a cysteine protease, which is probably associated with the digestive tract of the mite,⁵ and it is present in high concentrations in both mite feces and body extracts. In contrast, it has been demonstrated that unlike Der p 1, Der p 5 could not be detected in the fecal particles of mites, and only a small amount of the protein was detected in the whole mite body extract (Chua. Unpublished data). It therefore appears that Der p 5 is a relatively minor mite protein as compared with Der p 1. This may partly account for the environmental data obtained in this study.

Absolute humidity was shown to be the best

single guide for excess mite growth; however, no correlation was found between absolute humidity and Der p 5 mite allergen content in our current evaluation or between absolute humidity and Der p 1 mite allergen content.⁴ Because the indoor absolute humidity in Taipei is always higher than 9 gm/kg, which has been suggested to be critical for mite growth, humidity cannot be used as a determining factor for mite growth in subtropical climates.

In summary, this investigation is the first report to evaluate the mite allergen Der p 5 content in homes. The study indicated that Der p 5 content did not vary with seasons and was not influenced by the change in indoor absolute humidity in the Taipei area. Moreover, no seasonal variations in Der p 5 contents were found among mattresses, bedroom floors, and living room floors.

We thank the occupants of the 12 houses for their patience in allowing us to use their homes to conduct an extensive sampling throughout the year.

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