

Seasonal variation of house dust mite allergen (*Der p* I) in a subtropical climate

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- Taipei, Taiwan, Republic of China

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GM Geometric mean

HDM House dust mite

According to an epidemiologic study of asthma in schoolchildren in Taipei, the prevalence of asthma increased from 1.3% in 1974 to 5.8% in 1992 (unpublished data). More than 90% of children with asthma had positive skin test responses to house dust mite (HDM), and *Dermatophagoides pteronyssinus* (*Der p*) was found to be the dominant species.¹ Furthermore, more than 80% of the HDM-allergic children with asthma have positive skin test reactions to the *Der p* I antigen (*Der p* group I allergen) (manuscript submitted). Therefore *Der p* I is regarded as one of the major allergens in Taiwan. Taiwan is located in a subtropical area with high temperatures and relative humidity throughout the year. Therefore HDMs grow quickly and easily in Taiwan. In this report *Der p* I concentrations in mattresses and on the floors of bedrooms and living rooms were evaluated in the homes of six HDM-allergic children with asthma and six healthy persons in the Taipei area every 2 months, from June 1992 to April 1993.

Methods

Subjects and house visits

Houses of six HDM-allergic children and six normal persons were visited every 2 months, from June 1992 to April 1993. The 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 vacuum cleaner containing a fresh glass fiber filter was used to vacuum 1 m² of surface area of each sampling site for 2 to 4 minutes.

Extraction and analysis of dust samples

The collected dust samples were sieved through a 0.3 mm mesh screen to obtain the fine dust. Later, the 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 August and October with less than 10 mg fine dust were excluded from analysis. The supernatant was used as a dust extract and stored at -20° C for subsequent sandwich ELISA assays for antigen *Der p I* content.² The standard response curves were constructed from reference recombinant *Der p I* antigen solutions in the range of 0.3 ng/ml to 1000 ng/ml with an intraassay variation of approximately 16% ± 6%. The results are expressed as nanograms per gram of fine dust. A control curve with a standard preparation of antigen *Der p I* was performed in parallel with each assay.

Results

Dust samples collected from the homes of the six HDM-allergic children with asthma and six healthy persons from June 1992 to April 1993 were found to contain *Der p I* concentrations ranging from 10 ng/gm to 1,169,500 ng/gm (■Fig. 1). The highest concentrations were observed in November (range, 60 to 99,400 ng/gm) and December (range, 200 to 234,800 ng/gm), and the lowest concentrations occurred in February (range, 10 to 18,900 ng/gm). Between these two periods, a 100-fold difference in calendar geometric mean (GM) *Der p I* concentration was observed. Regarding *Der p I* concentration distributions in the different sampling sites of the domestic environments (■Fig. 2), the highest concentrations in the mattresses occurred in June, November, and December (GM, 77,000 ng/gm), and the lowest level was again found in February (GM, 630 ng/gm). For the floors of bedrooms and living rooms, the highest calendar GM concentrations, which also occurred in December, were found to be 9,400 ng/gm and 16,800 ng/gm, respectively. Moreover, the dust samples from the mattresses contained the highest *Der p I* antigen levels compared with the samples from the floors of bedrooms and living rooms.

FIG. 1. The seasonal variation of the distribution of *Der p I* concentrations. A wide range of *Der p I* concentrations was observed, and seasonal variation of *Der p I* concentrations was remarkable. GM values are presented for *Der p I*. The GM peaks are found in December, and the lowest levels are found in February.

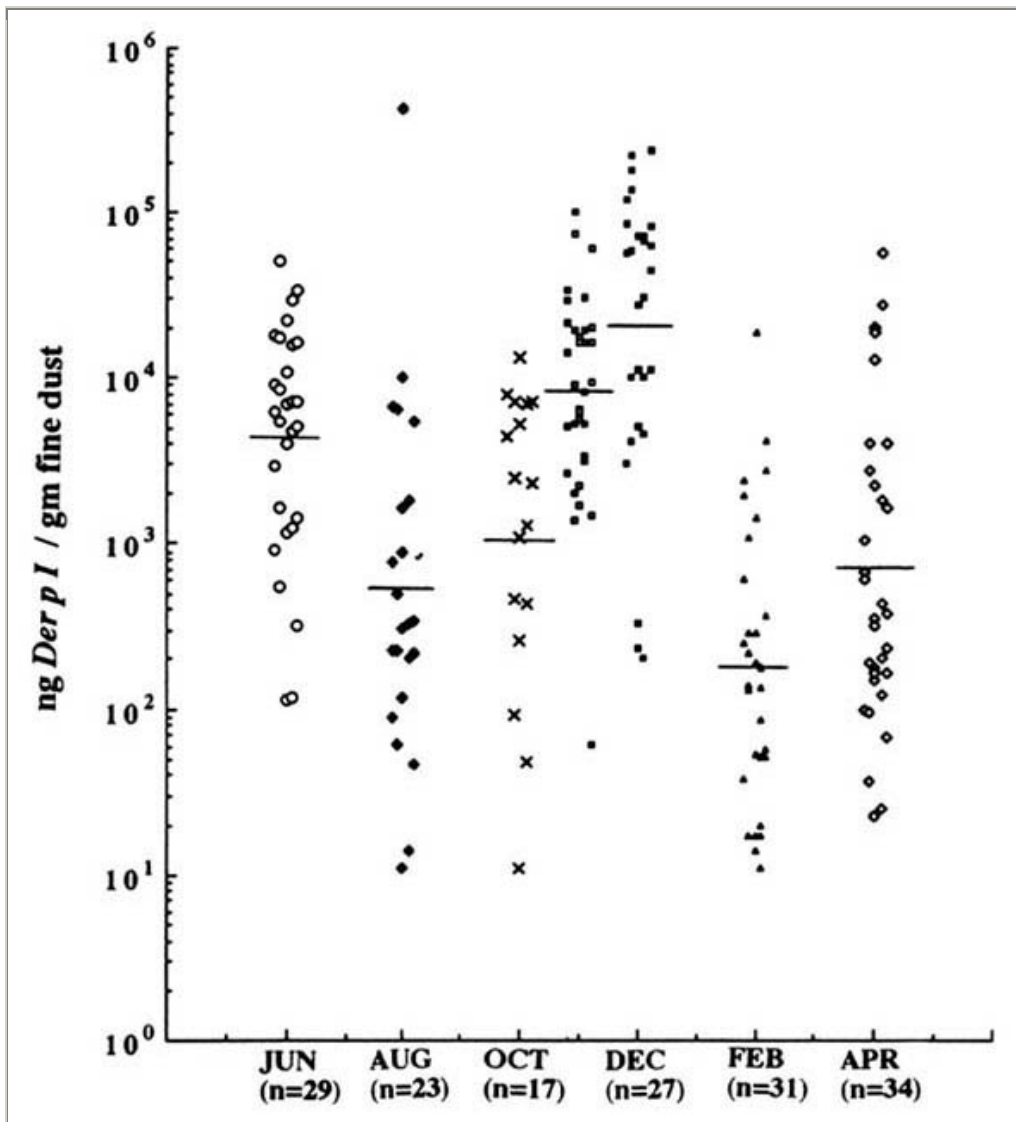
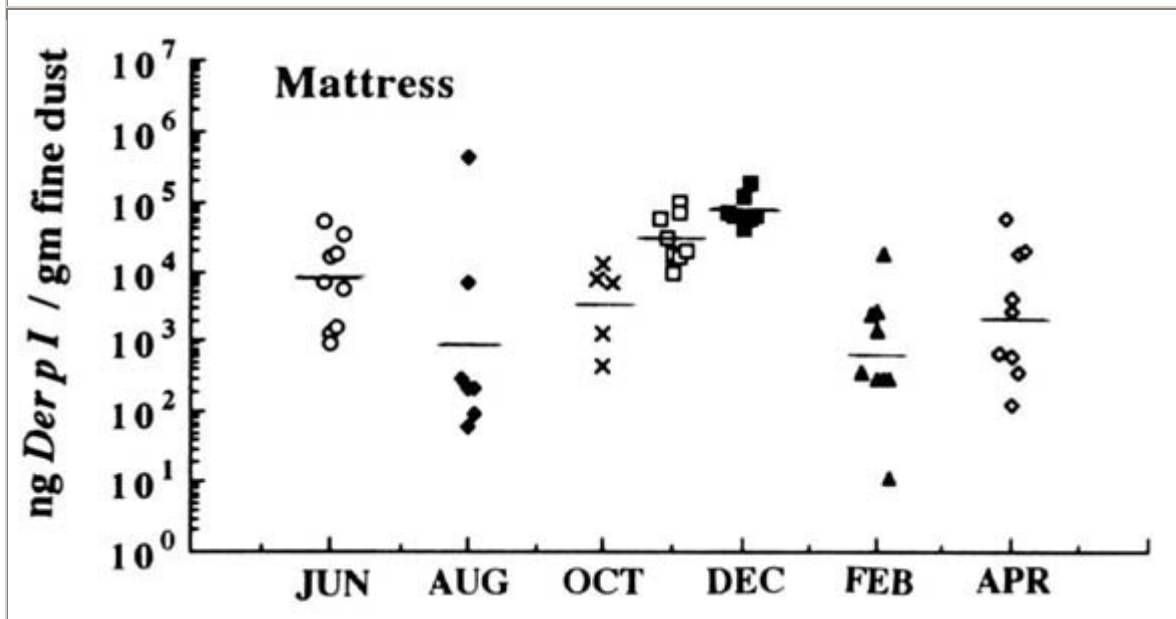
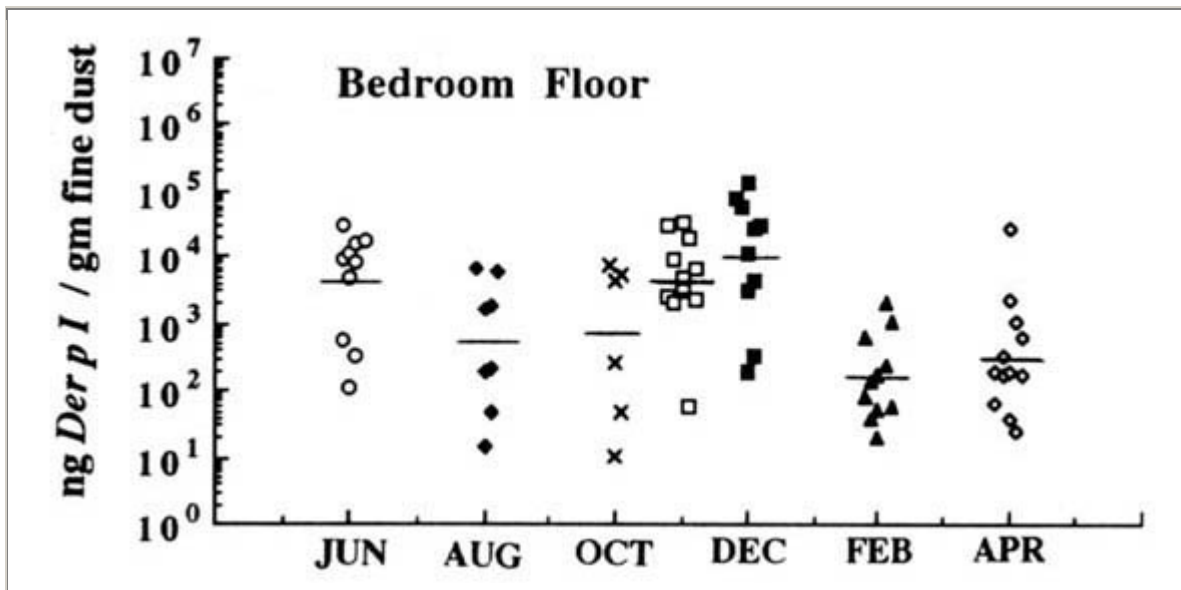


FIG. 2. The seasonal variation of the distributions of *Der p I* concentrations from various parts of the visited homes, including mattresses (two HDM-allergic patients had no mattresses) and the floors of bedrooms and living rooms. The *Der p I* concentration in mattresses was higher than those of the floors of bedrooms and living rooms.





Discussion

Our field study of the *Der p I* antigen in house dust indicates that a large amount of mite allergen is present in the houses in the Taipei area. Remarkable seasonal variation of *Der p I* levels is demonstrated, with peaks occurring in November and December. The pattern of seasonal variation of the *Der p I* allergen observed in Taipei was different from that reported in the United States, with the highest levels in July.³ Furthermore, the house dust samples from mattresses, bedroom floors, and living room floors contained higher concentrations of *Der p I* in June, November, and December than in August, February, and April. In addition, it is important to point out that the occurrence of peaked *Der p I* concentration in November corresponded to the highest hospital admission rate for bronchial asthma in November found in our previous study.¹

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

In summary, the mite allergen *Der p I* content varied with seasons but was not influenced by the change of indoor absolute humidity in the Taipei area. On average, the highest *Der p I* concentration was found in the mattresses, and the pattern of the seasonal variation was similar among mattresses, bedroom floors, and living room floors. Furthermore, more than 90% of the dust samples collected in November and December were found to contain *Der p I* with a concentration higher than 2 µg/gm dust, the proposed critical level for an asthma attack.⁵ Therefore procedures to reduce the mite allergen as much as possible might be a feasible way to prevent the continuing rise in the prevalence of asthma in this area. In addition, the marked seasonal variation of mite allergen content observed in this investigation indicates that monitoring mite allergen levels in individual houses will be of great benefit in studying the relationship between HDM exposure and the occurrence of asthmatic symptoms.

We thank the occupants of the 12 houses who let us use their homes to conduct an extensive sampling throughout the year.

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