

House dust mite fauna in Thailand

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Summary

House dust mites have been shown to be the most important source of allergen in Thailand. The results of our initial mite survey were in conflict with previous data reported 20 years ago. To evaluate the current condition of mite fauna in Thailand, we conducted a larger scale survey of house dust mites in dusts from three different parts of the country. A total of 630 mattress dust samples was collected from various types of housings from central, northern and northeastern parts of Thailand. House dust mites were identified and enumerated by standard techniques and 388 dust samples were analysed further for group I antigen by a two-site monoclonal antibody enzyme-linked immunosorbent assay. House dust mites were identified in 555/630 (88.1%) of dust samples collected; 27.6% of these 555 samples contained over 100 mites per gram of fine dust. *Dermatophagoides pteronyssinus* was the most abundant species found with a mean count of 87.2 mites per gram of dust (range 1–1460). Group I antigen was detected in 380/388 (97.9%) samples analysed and 330 of which (86.8%) contained over 2 µg/gm of group I antigen. The highest density of mites was found in dusts from northern Thailand whereas dusts with highest amount of antigen were those collected from the northeastern part. Some degree of correlation between mite count and mite allergen was observed ($r^2 = 0.133$, $P < 0.001$). No significant difference in the mite count and mite allergen was found among various types of housings. House dust mites are the source of allergens ubiquitously found all over Thailand. Dust from several houses surveyed in this study had significantly high level of group I antigens.

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Introduction

House-dust mite has been shown to be one of the most important and the most ubiquitous allergens involving in the pathogenesis of asthma and allergic rhinitis [1–3]. The most dominant species found in house dusts from all parts of the world belonged to the species *Dermatophagoides* (*pteronysinus* and *farinae*), the majority of which can be recovered from bedroom dust, particularly from mattresses [4–6] followed by dusts from upholstered furniture and carpets [7,8]. In Thailand, 84.4% of adult asthmatics [9] and 67% of asthmatic children [10] were found to be sensitive to mite extracts by skin testings. An

earlier extensive mite survey in Thailand [11], conducted more than 20 years ago, indicated that *Dermatophagoides* spp. were the most common species found throughout the country with the highest counts recovered from samples collected from within the Bangkok Metropolitan area. Due to an apparent increase in the prevalence of allergic diseases in Thailand, a renewed interest in mite allergy within our groups has led to another survey of house dust mites in this country. The initial results of our survey, also conducted in Bangkok (Malainual N., unpublished data), revealed a much lower mean mite count (23 mites/g dust) than previously reported [11]. With further refinement of our techniques on both mite counting and on the analysis of mite antigen, we, herein, report the results of our further efforts in the survey of house dust mite fauna from various parts of Thailand.

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Materials and methods

Dust sample collection

A total of 630 dust samples was collected from bedding in various types of homes in urban areas of 24 provinces of the central, northern and northeastern parts of Thailand (excluding Bangkok Metropolitan Area), during the dry period of 1991–1993. Each sample was obtained by vacuuming the whole bed for 5 min using a Electrolux Model D44A vacuum cleaner (Seige Social, Senlis 60300). A filter bag was attached to the vacuum hose to serve as a dust trap. The filter bag was then labelled, double-sealed to prevent further contamination and stored at 4°C until the time of analysis. The method of collection was uniform throughout the study.

Mite counting and identification

Stored dust samples were weighed and sieved through a 1.0 mm mesh screen to obtain fine dusts; after which they were transferred into vials. With the exception of dust from Central Thailand where the whole amount of dust was used for extraction, mites were extracted with a modified floatation technique as described previously [12,13]. Briefly, 0.1 g fine dust was soaked overnight in 80% ethanol. The supernatant was removed without disturbance to the sediment. Saturated NaCl solution was then added to the sediment and was left over for 10 min; following which the supernatant was gently poured onto a filter paper in a Buchner funnel. The sediment was then rinsed with distilled water. Mites remaining on filter papers were transferred to mounting

medium on glass slides for counting. Mite counting and identification was performed under a stereomicroscope using the pictorial key for mite classification [14,15]. The amount of mites was expressed as number of mites per gram of fine dust as recommended by the first International Workshop on Dust Mite Allergy [1].

A two-site monoclonal ELISA assay for group I mite allergens

Specimens for analysis of group I mite allergen were obtained by extracting 0.1 g of fine dust overnight at 4°C in 2 ml phosphate buffered saline (PBS). The extracted specimen was then centrifuged at 2500 rpm for 20 min and the supernatant was kept frozen for further analysis. The allergen content was analysed using a two-site monoclonal antibody enzyme-linked immunosorbent assay (MoAb ELISA) method as described by Luczynska *et al.* [16]. Monoclonal antibodies 5H8 and 6A8 along with purified *Der p* I and *Der f* I standards were kindly provided by Dr Martin D. Chapman of the University of Virginia, Charlottesville, Virginia, USA. Twofold dilutions of extract from 1:10 to 1:80 in 1% BSA-PBS Tween were assayed and the allergen was quantified by interpolation on to a standard curve constructed with dilutions of purified *Der p* I and *Der f* I allergen contents expressed in µg/g of fine dust. Only dust samples ($n = 388$) from north and northeastern Thailand were analysed for mite antigens since monoclonal antibodies only became available to us after specimens from the central region had been completely analysed and exhausted.

Table 1. Dust samples containing identifiable mites or analysable group I antigen

Part of Thailand	Specimen with identifiable mites/total specimens (%)	Specimen with positive group I antigen/total specimens (%)
(1) Central	227/242 (93.8%)	ND
(2) Northern	189/209 (90.4%)	204/209 (97.6%)
(3) Northeastern	139/179 (77.6%)	176/179 (98.3%)
Total	555/630 (88.1%)	380/388 (97.9%)

ND Not done.

Table 2. Mite fauna in dusts collected in Thailand

Mite species	Total number of mites recovered	% of total mites	Average number of mites recovered per gram dust
Astigmata			
Pyroglyphidae	81414	96.6	87.2
<i>D. pteronyssinus</i>	55877	66.3	61.1
<i>D. farinae</i>	20564	24.4	22.5
<i>E. maynei</i>	421	0.5	0.5
Nymph	4552	5.4	3.1
Glycyphagidae	927	1.1	1.6
Acaridae	253	0.3	0.4
Prostigmata			
Cheyletidae	1433	1.7	2.6
Unidentified specimen	252	0.3	0.4
Total	84279	100	92.2

Statistical analysis

The comparison between mite counts and mite antigen according to regions and between different type of housings were compared by analyses of variance. Correlations between mite counts and allergens was performed using linear regression. All calculations were performed on a MacIntosh II SI computer (Cupertino, CA, USA) using the Statview II program (Calabacus, CA, USA).

Results

Some 555 of the 630 samples were found to contain house dust mites (88.1%) as shown in Table 1. As is shown in Table 1, the central region has the highest prevalence rate of mite recovery (93.8%) followed by the northern region (90.4%) and the northeastern (77.6%), respectively. Group I mite antigens were detected from 380 of the total 388 samples (97.9%) collected from north and northeastern Thailand. When further examined in detail, as in Table 1, no difference in recovery of mite antigens was noted between these two regions (98% each). Also noted in Table 1, the recovery (in %) for the analysable mite antigens from the north and northeastern part were higher than their respective per cent recovery of identifiable mites. The prevalence of various mites species recovered, in total numbers, in percentages and as mean numbers of mites per gram dust are tabulated in Table 2. Over 96% of all mites recovered were pyroglyphid mites with *D. pteronyssinus* constituted the most dominant species (66.3%) followed by *D. farinae* (24.4%). *Euroglyphus maynei* was only occasionally detected as well as mites from families Glycyphagidae, Cheyletidae and Acaridae, collectively known as storage mites [17].

Table 3 shows the mean numbers of pyroglyphid mites and group I antigen in dusts collected from different parts of Thailand. The overall mean level of group I antigens was 11.8 µg/g dust with the antigen from the northeastern region (12 µg/gm) being higher than that from the northern part (7.4 µg/gm). It can also be observed from Tables 1 and 3, that the northeastern part has a lower percentage of mite recovery and lower mean number of mite count than the northern part while the reverse is true for antigen levels although these differences are not statistically significant ($P > 0.05$).

Figure 1 showed the frequency distributions of samples plotted as a function of the number of mite counts (Fig. 1a) and antigens level (Fig. 1b) recovered from the three regions studied. It is quite apparent from this figure that while a small number of samples, predominantly from the north, contained more than 100 mites per gram dust (153/630 or 24.3%), a large majority of samples (330/388 or 85%) were found to contain more than 2 µg/gm.

Distribution of mite counts and antigens, from each

Table 3. Means of pyroglyphid mites and of group I antigens in dusts from different parts of Thailand

	Mean mites/g dust	Mean of group I antigen per gram dust
(1) Central	19.0	ND
(2) Northern	74.1	7.4
(3) Northeastern	60.8	12.0
Overall	42.7	11.8

ND. Not done.

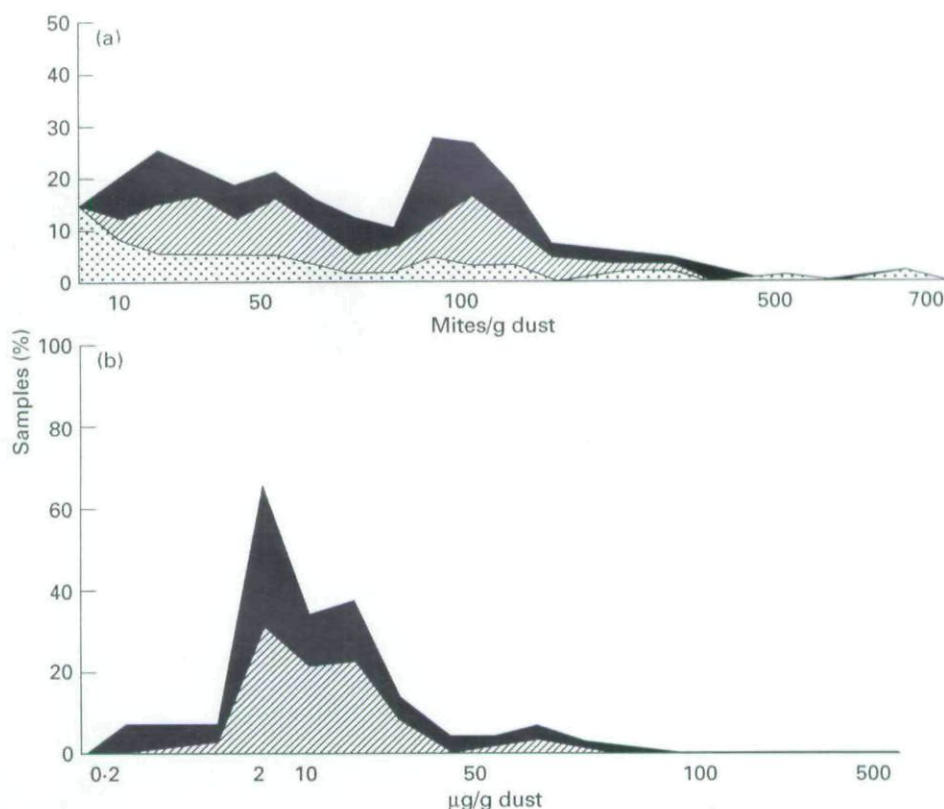


Fig. 1. Area curves showing percentages of dust samples per total samples collected from various parts of Thailand that contained (a) different amount of mites/g of dust and (b) different levels of group I antigen in $\mu\text{g/gm}$ dust. ■. North. ▨. Northeast. ▩. Central.

type of homes from the three regions are illustrated in Fig. 2. Although, the highest numbers of mites were found from slum homes from the north and northeastern areas, statistical analyses failed to reveal any significant differences among the types of dwellings neither upon numbers of mites nor upon group I antigen levels. These results suggested that the house dust mites infestation did not favour any specific type of houses, but might be affected by indoor condition of those types of homes [6].

Table 4 shows the association between the mite counts and mite antigen levels. There was a poor correlation between these two parameters by linear regression ($r^2 = 0.03$, $P < 0.001$). Again from this table it can be noted that 330 of 380 homes (85%) had more than $2 \mu\text{g/gm}$ dust of the group I antigen the postulated level for sensitization [1,2] whereas only 153/630 [24.3%] had more than 100 mites per gram dust.

Discussion

Our study confirmed the previous observations [11] that house dust mites are a ubiquitous source of allergens

found all over Thailand (almost 90% of homes surveyed in this report contained enumerable numbers of house dust mites and about 97% of dusts from these homes had analysable group I antigens). More importantly, the most predominant family of mites found in this report is the pyroglyphids with *Dermatophagoides pteronyssinus* being the most common species of mites recovered (66%). Interestingly enough, *D. farinae*, another species of pyroglyphidae commonly found in areas with lower

Table 4. Number of dust specimens with respect to ranges of mite count and of group I antigen

Group I antigen	Mites number		
	Below 100 mites/g	100–500 mites/g	Over 500 mites/g
Below $2 \mu\text{g/g}$	44	5	1
2–10 $\mu\text{g/g}$	101	33	1
Over 10 $\mu\text{g/g}$	112	81	2

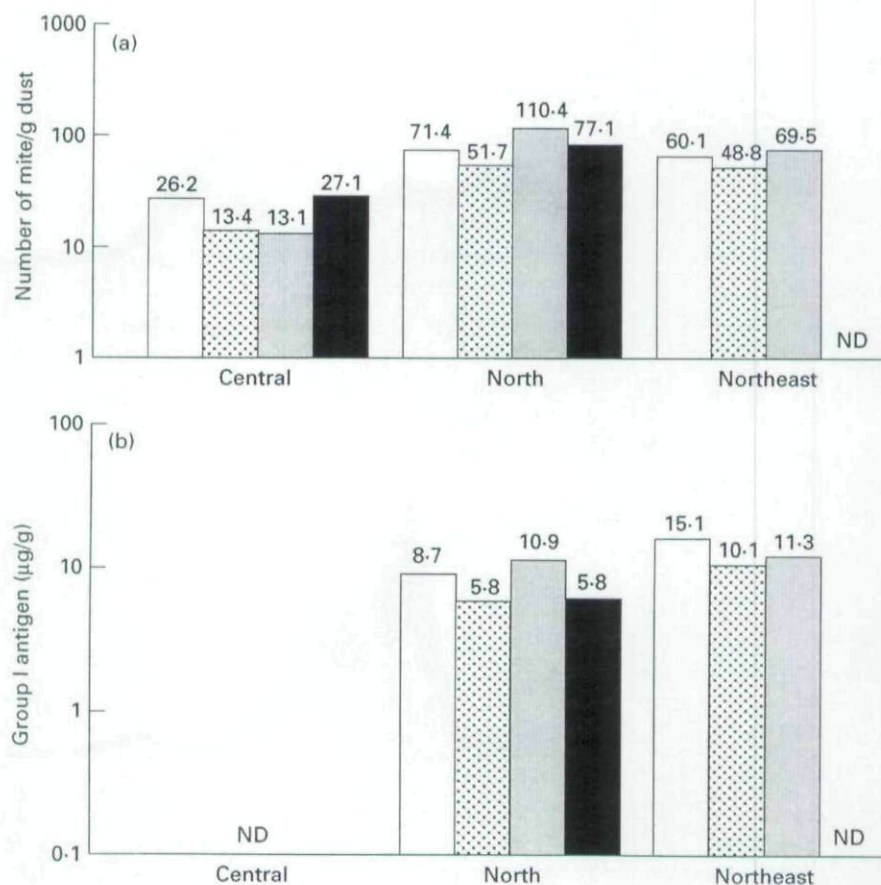


Fig. 2. Mean amount of mites in dusts collected from different types of dwellings categorized according to regions of Thailand. □. Single house. ▨. Shop. ▩. Slum house. ■. Hotel. ND. Not done.

humidity [18,19] than currently present in Thailand (with all year round relative humidity of 73%) was not uncommonly discovered from this study (24.4%, Table 2). This could perhaps be due to infrequent use of mattresses, the lower humidity in the winter time in Thailand and to, as yet, other unaccountable reasons. We have recently completed a similar survey from a house officers' dormitory in our institution in the Bangkok Metropolitan area and found *D. farinae* to be even more common than *D. pteronyssinus* (Vichyanond P. & Chairat P., unpublished data) indicating that other factors rendering variable area prevalences within this country will need to be sought for since data from countries such as India [20] and China [21] have also shown that *D. farinae* rather than *D. pteronyssinus* were their common mite species. *Euroglyphus maynei* and storage mites such as *Blomia tropicalis* and *Lepidoglyphus destructor* were relatively unimportant species in Thailand. These storage mites were reported to be predominant mite species found in several tropical areas of the world such as in the southeastern United States and in South America [22–28]. Although the positive rates for mites identification from these houses were high, mite counts were relatively low as compared

with those reported from other part of the world [6,18]. Moreover, it is quite surprising that mite antigens recovered in our study were high while number of mites were relatively low. It is possible that group I mite antigen (*Der p* I and *Der f* I) commonly found in large quantities in mite faecal particles [29,30] is quite stable for a period of time despite the absence of the mite body [31].

Geographical variations in the density of house dust mites in the Kingdom of Thailand shown in this study could be due to reasons such as differences in altitude, and humidity [32–34]. Most of the dusts collected in our study were collected during a dry season (December) during which humidity was relatively low (65% relative humidity). Our previous experience with mite collections within the Bangkok Metropolitan area has shown that there are seasonal variations in house dust mites recovery in Bangkok and the highest mites could be recovered between the months of August through to October (the rainy and monsoon season) during which the humidity was at its peak. Therefore, mite counts and antigens could have been higher, should this study be carried out on an all year round basis. Lower numbers of house dust mites from the central part of Thailand could have been due to our former technique of employing the whole

amount of dusts collected for mite counting. This technique could result in some mites tightly adhering to large pieces of fibre in the clump which did not release mite bodies into fluid phase during flotation [35] and finally lead to falsely low numbers of mites recovered. Since realizing this shortcoming, analyses were performed with a more standardized method using only 0.1 g of fine dusts resulting in lower numbers of denominators and less problems with mite adherence. Although it is conceivable that mites should thrive better in low socioeconomic conditions due to a high degree of humidity and less frequent cleanings of the household, no statistical significance was found between numbers of mites recovered from various different types of homes studied; although there is a trend for high numbers of mites found in slum houses.

There was no apparent reason to explain differences in our data to those obtained 20 years ago [11]. Most samples obtained in the previous study were from Bangkok (only 15 samples were from other provinces) while all our 630 samples were from provinces other than Bangkok. The method of mite enumeration used in the earlier study [direct counting, 11] was quite different from our more standardized method [13].

In conclusion, we have shown that house dust mite is an ubiquitous allergen found in most homes in Thailand. No special types of homes have been exempted from infestation by house dust mites, the majority of which were pyroglyphids. Number of mites counted in our study are not a good indicator of mite allergen exposure of patients within these homes. Further epidemiological studies such as mite distributions in the homes of asthmatics and allergic individuals will help clarify the apparent rise in the prevalence of allergic conditions in this region.

Acknowledgement

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References

- 1 Platts-Mills TAE, de Weck AL. Dust mite allergens and asthma — A world wide problem. *J Allergy Clin Immunol* 1989; 83:416–27.
- 2 Platts-Mills TAE, Thomas WR, Aalberse RC, Vervloet D, Chapman MD. Dust mite allergens and asthma: report of a second international workshop. *J Allergy Clin Immunol* 1992; 89:1046–60.
- 3 Sporik R, Chapman MD, Platts-Mills TAE. House dust mite exposure as a cause of asthma. *Clin Exp Allergy* 1992; 22:897–90.
- 4 Voorhorst R, Spieksma FThM, Varekamp H, Leupen M, Lyklema AW. The house-dust mite *Dermatophagoides pteronyssinus* and the allergens it produces. Identity with the house-dust allergen. *J Allergy* 1967; 39:325–39.
- 5 Tovey ER, Chapman MD, Wells CW, Platts-Mills TAE. The distribution of dust mite allergen in the houses of patients with asthma. *Am Rev Respir Dis* 1981; 124:630–5.
- 6 Hart BJ, Whitehead L. Ecology of house dust mites in Oxfordshire. *Clin Exp Allergy* 1990; 20:203–9.
- 7 Platts-Mills TAE, Hayden ML, Chapman MD, Wilkins SR. Seasonal variation in dust mite and grass-pollen allergens in dust from the houses of patients with asthma. *J Allergy Clin Immunol* 1987; 79:781–91.
- 8 Bischoff E, Fischer A. A new methods for the assessment of mite numbers and results obtained for several textile objects. *Aerobiologia* 1990; 6:23–7.
- 9 Wongsathayuthong S. House mites and allergic bronchial asthma. *J Med Ass Thailand* 1971; 54:411–3.
- 10 Tuchinda M, Habanananda S, Vareenil J et al. Asthma in Thai children: a study of 2000 cases. *Ann Allergy* 1987; 59:207–11.
- 11 Wongsathayuthong S, Laksana P. House-dust mite survey in Bangkok. *J Med Ass Thailand* 1972; 55:272–86.
- 12 Voorhorst R, Spieksma FThM, Varekamp H. House-dust atopy and the house-dust mite *Dermatophagoides pteronyssinus* (Trouessart 1897). Leiden: Stafleu's Scientific Publication Co 1969.
- 13 Hart BJ, Fain A. A new technique for isolation of mites exploiting the difference between ethanol and saturated NaCl: qualitative and quantitative studies. *Acarologia* 1987; 18:251–4.
- 14 Hart BJ, Fain A. Morphological and biological studies of medically important house-dust mites. *Acarologia* 1988; 29:285–95.
- 15 Colloff MJ, Spieksma FThM. Pictorial keys for the identification of domestic mites. *Clin Exp Allergy* 1992; 22:823–30.
- 16 Luczynska CM, Arruda LK, Platts-Mills TAE et al. A two-site monoclonal antibody ELISA for the quantitation of the major *Dermatophagoides* spp. allergens, Der p I and Der f I. *J Immunol Meth* 1989; 118:227–35.
- 17 Spieksma FThM. Domestic mites: their role in respiratory allergy. *Clin Exp Allergy* 1991; 21:655–60.
- 18 Lang JD, Mulla MS. Distribution and abundance of house dust mite, *Dermatophagoides* spp. in different climatic zones of southern California. *Environ Entomol* 1977; 6:213.
- 19 Feldman-Muhsam B, Mumcuoglu Y, Osterovich T. A survey of house dust mites (Acari: Pyroglyphidae and Cheyletidae) in Israel. *J Med Ent* 1985; 22:663–9.
- 20 Saha GK. House dust mite allergy in Calcutta, India: evaluation by RAST. *Ann Allergy* 1993; 70:305–9.
- 21 Gabriel M, Cunningham AM, Allan WGL, Pickering CAC,

- Wraith DG. Mite allergy in Hong Kong. *Clin Allergy* 1982; 12:157-71.
- 22 Van Hage-Hamsten M, Johansson E, Johansson SGO. The storage mite problem. In: Dust mite allergens and asthma: report of a second International workshop. UCB Institute of Allergy 1991: 96-7.
- 23 Arruda K, Rizzo MC, Chapman MD et al. Exposure and sensitization to dust mite allergens among asthmatic children in Sao Paulo, Brazil. *Clin Exp Allergy* 1991; 21:433-9.
- 24 Llerena LP, Fernandez-Caldas E, Gracia LRC, Lockey RF. Sensitization to *Blomia tropicalis* and *Lepidoglyphus destructor* in *Dermatophagoides* spp.-allergic individuals. *J Allergy Clin Immunol* 1991; 88:943-50.
- 25 Fernandez-Caldas E, Puerta L, Mercado D, Lockey RF, Caraballo LR. Mite fauna, Der p I, Der f I and *Blomia tropicalis* allergen levels in a tropical environment. *Clin Exp Allergy* 1993; 23:292-7.
- 26 Dowse GK, Turner KJ, Stewart GA, Alpers MP, Woolcock AJ. The association between *Dermatophagoides* mites and the increasing prevalence of asthma in village communities within the Papua New Guinea highlands. *J Allergy Clin Immunol* 1985; 75:75.
- 27 Jorge N, Croce J, Baggio D. Acaros da paeira domiciliar da cidade de Sao Paulo. Noto previa. *Rev Bras Alerg Immunopatol* 1980; 2:140-5.
- 28 Hurtado I, Parini M. House dust mite in Caracas, Venezuela. *Ann Allergy* 1987; 59:128-30.
- 29 Tovey ER, Baldo BA. Localization of antigens and allergens in thin sections of the house dust mite, *Dermatophagoides petronyssinus* (Acari: Pyroglyphidae). *J Med Entomol* 1990; 27:368-76.
- 30 Tovey ER, Chapman MD, Platts-Mills TAE. Mites faeces as a major source of house dust allergens. *Nature* 1984; 289:592-3.
- 31 Kort HSM, Kniest FM. Four-year stability of Der p I in house dust under simulated domestic conditions in vitro. *Allergy* 1994; 49:131-33.
- 32 Murray AB, Ferguson AC, Morrison BJ. Sensitization to house dust mites in different climatic areas. *J Allergy Clin Immunol* 1985; 76:108.
- 33 Moyer DB, Nelson HS, Arlian LG. House dust mites in Colorado. *Ann Allergy* 1985; 55:680-2.
- 34 Arlian LH, Bernatein IL, Gallagher JS. The prevalence of house dust mites, *Dermatophagoides* sp., and associated environmental conditions in homes in Ohio. *J Allergy Clin Immunol* 1982; 69:527.
- 35 Bronswijk JEMH van, De Saint Georges-Grédelet D, De Lustgraaf B van. An evaluation of biological methods in house-dust allergen research. *All Immunol* 1978; 24:18-28.

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