

Mite fauna, *Der p I*, *Der f I* and *Blomia tropicalis* allergen levels in a tropical environment

E. FERNÁNDEZ-CALDAS, L. PUERTA*, D. MERCADO*, R. F. LOCKEY and L. R. CARABALLO*

*Laboratory of Immunology, University of Cartagena, Colombia and Division of Allergy and Clinical Immunology, University of South Florida, College of Medicine and James A. Haley Veterans' Hospital, Tampa, Florida, U.S.A.

Summary

Fifty dust samples were collected from the mattresses and bedroom floors of 25 subjects with allergic asthma in Cartagena, Colombia, in order to identify house dust mites and quantitate *Der p I*, *Der f I* and *Blomia tropicalis* allergens. The geometric mean of the total mite density per gram of dust was 418 (range, 40–2280). Twenty-two samples (44%) had more than 500 mites and four, less than 100. *B. tropicalis* and *Dermatophagoides pteronyssinus* were found in 96% and 90% of the samples, accounting for 40.1% and 35.7% of the total mites, respectively. *Cheyletus malaccensis*, *Chortoglyphus arcuatus*, *Pyroglyphus africanus*, *Oribatids*, *Grallacheles bakeri*, *Tarsonemus* spp., *Suidasia* spp., *Dermatophagoides farinae* and unidentified mites accounted for the rest. The geometric mean of the total mites/gram of dust in mattresses (563.9) was significantly higher than in floor dust (309.1), $P < 0.01$. Allergen concentrations and mite numbers were analysed by Spearman rank correlations: *B. tropicalis* mites vs *B. tropicalis* allergen, $r = 0.54$, $P < 0.001$; *D. pteronyssinus* mites vs *Der p I*, $r = 0.52$, $P < 0.001$. A negative correlation was obtained between *B. tropicalis* mites and *Der p I*. Allergens derived from *B. tropicalis* and other domestic mite species may play an important role in sensitization and allergic symptoms in Cartagena, Colombia.

Clinical and Experimental Allergy, Vol. 23, pp. 292–297. Submitted 6 July 1992; revised 23 October 1992; accepted 28 October 1992.

Introduction

The pyroglyphid mites, *D. pteronyssinus*, *D. farinae* and *Euroglyphus maynei* and the glycyphagid mite, *B. tropicalis*, are the predominant mite species in the United States [1]. There seems to be a greater abundance of *D. pteronyssinus* in Europe [2,3]. Other species are commonly described in house dust samples collected in regions with a temperate climate, but their total numbers tend to be small.

There is increasing interest in studying non-pyroglyphid mites as a source of important environmental allergens. These mites are commonly found in farming environments and in house dust in tropical and subtropical regions of the world. Several studies have demonstrated a high prevalence of sensitization to their allergens in farmers and in urban dwellers [4–9]. Studies conducted in tropical and subtropical regions have demonstrated

that the composition of the dust mite fauna in these areas is different from that in the United States and Europe. Studies in Venezuela, Brasil, Colombia and Guatemala have demonstrated that *B. tropicalis* is very abundant in these regions [10–13].

Allergic asthma is common in Cartagena, Colombia [14], which is situated on the north coast of South America in the Caribbean at 10 degrees of latitude North. It has a tropical climate with a mean annual temperature of 28°C and a mean relative humidity of 83% [15]. Skin test and RAST results show that sensitization to *D. pteronyssinus*, *D. farinae*, *Lepidoglyphus destructor*, *C. arcuatus*, *Aleuroglyphus ovatus* and *B. tropicalis* is common in subjects with asthma and/or allergic rhinitis [7,16]. The climatic conditions in this region offer a good environment for the growth of different mite species. A preliminary study suggested the existence of a rich mite fauna and a great abundance of *B. tropicalis* in homes of mite allergic individuals [17]. *B. tropicalis* has minimal to moderate crossreactivity with *D. pteronyssinus* and *D.*

Correspondence: Dr L.R. Caraballo, Laboratory of Immunology, Apartado Aéreo 445, Cartagena, Colombia.

dust suggested by Korsgaard [28] and Peat *et al.* [29] and corroborated in this study.

B. tropicalis allergens (AU/g) were detected in variable concentrations in all dust samples, and a significant correlation was obtained between *B. tropicalis* allergen levels and *B. tropicalis* mite counts. This finding suggests that the contribution of *B. tropicalis* allergens to the allergenicity of the house dust in Cartagena is a strong determinant for sensitization in this population. The good correlation between *B. tropicalis* counts and *B. tropicalis* allergen levels indicates that RAST inhibition, with the appropriate serum pool, is a good method to estimate exposure to this mite. However, until a more specific assay is available to quantitate *B. tropicalis* allergen levels, concentrations that pose a significant risk factor for sensitization and symptoms cannot be established.

It has been proposed that *Der p* I levels greater than 2 µg/g or 100 mites per gram of dust increase the risk of sensitization in genetically predisposed individuals; levels greater than 10 µg/g or 500 mites are a risk factor for the development of asthmatic symptoms [30,31]. However, these values are specific for the *Dermatophagoides* spp. and do not take into account seasonal variations and allergens produced by other mite species, which could significantly contribute to the allergenic load of house dust in this tropical area. The mean *Der p* I level obtained in this study (1.1 ± 1 in mattresses) is very similar to the one obtained by Woods *et al.* in Baltimore. They reported that *Der p* I levels greater than 1.14 µg/g are associated with a 95% or greater probability of having a positive skin test or RAST to *D. pteronyssinus* [32].

Several factors should be considered when explaining the low *Dermatophagoides* spp. allergen levels detected in this study and widespread occurrence of sensitization to *D. pteronyssinus* in this geographical area. Among them, the most important is the fact that dust samples were collected in April, which corresponds to the end of the dry season in Cartagena. Therefore, it is possible that the mite allergen concentration measured reflect the lowest levels of mite allergen exposure during the year. Pronounced seasonal variations in mite counts and *Der p* I equivalents have been demonstrated in North America [33,34]. The seasonal variations of mite allergens, which may account for the low levels of *Der p* I detected in this study, are currently being investigated.

In conclusion, *B. tropicalis* and *D. pteronyssinus* are important environmental allergens in Cartagena and surrounding areas. The immune response to *B. tropicalis* in allergic individuals is comparable to *D. pteronyssinus* and *D. farinae* indicating that *B. tropicalis* should be considered as a mite of clinical importance in Cartagena and in the northern coast of the Caribbean. The high frequency of occurrence and the abundance of *B. trop-*

icalis, *D. pteronyssinus*, *C. arcuatus*, *D. farinae* and *P. africanus* in house dust samples suggest that extracts of all of these mites may be needed for the successful diagnosis and treatment of respiratory allergies in Cartagena, Colombia.

Acknowledgments

This work was supported in part by COLCIENCIAS, the National Program for Research Development (ICFES-BID), Colombia, and Veteran Affairs research funds (U.S.A.).

References

- 1 Arlian LG, Berstein D, Berstein IL *et al.* Prevalence of dust mite in the homes of people with asthma living in eight different geographic areas of the United States. *J Allergy Clin Immunol* 1992; 90:292-300.
- 2 Arlian LG. Biology and ecology of house dust mites, *Dermatophagoides* spp. and *Euroglyphus* spp. *Immunol Allergy Clin North Am* 1989; 9:339-56.
- 3 Voorhorst M, Spijksma FTh, Varekamp H. House-dust atopy and the house-dust mite *Dermatophagoides pteronyssinus*. Leiden: Stafus Scientific Publishing Company, 1969.
- 4 Luczynska CM, Griffin P, Davies RJ, Topping MD. Prevalence of specific IgE to storage mites (*A. siro*, *L. destructor* and *T. longior*) in an urban population and cross-reactivity with the house dust mite (*D. pteronyssinus*). *Clin Exp Allergy* 1990; 20:403-6.
- 5 Iversen M, Korsgaard J, Hallas T, Dahl R. Mite allergy and exposure to storage mites and house dust mites in farmers. *Clin Exp Allergy* 1990; 20:211-19.
- 6 Barardino LD, Angrisano A, Gorli L, Cattaneo M, Lodi A. Allergy to house dust and storage mites in children: epidemiologic observations. *Ann Allergy* 1987; 59:104-6.
- 7 Puerta L, Fernández-Caldas E, Caraballo LR, Lockey RF. Sensitization to *Blomia tropicalis* and *Lepidoglyphus destructor* in *Dermatophagoides* spp. allergic individuals. *J Allergy Clin Immunol* 1991; 88:943-50.
- 8 van Hage-Hamsten M, Machado L, Barros M, Johansson SGO. Comparison of clinical significance and allergic cross-reactivity of storage mites *Blomia kulagini* and *Lepidoglyphus destructor* in Sweden and Brazil. *Allergy* 1990; 45: 409-17.
- 9 Siltan RP, Fernández-Caldas, Trudeau WL, Lockey RF. Allergenicity of the mite *Aleuroglyphus ovatus*. *J Allergy Clin Immunol* 1991; 88:595-603.
- 10 Hurtado I, Parini M. House dust mite in Caracas, Venezuela. *Ann Allergy* 1987; 59:128-30.
- 11 Jorge Neto, Croce J, Baggio D. Acaros da poeira domiciliar da cidade de São Paulo. Nota previa. *Rev Bras Alerg Immunopatol* 1980; 2:140-5.
- 12 Mulla MS, Sánchez-Medina M, Charlet L. Faunistics and taxonomy of domestic Acari from house dust in Colombia. In: Mulla MS, Sánchez-Medina M, eds. *Acaros en Colom-*

- bia: bionomía, ecología y distribución. Su importancia en las enfermedades alérgicas. Bogotá: Editora Guadalupe, 1980.
- 13 García-Ibañez R, Fernández-Caldas E, García-Ramos E, Arango L, Lockey RF. Aeroallergen sensitivity in high altitude Guatemala City [Abstract]. *J Allergy Clin Immunol* 1991; 87:293.
 - 14 Caraballo LR, Cadavid A, Mendoza J. Prevalence of asthma in Cartagena, Colombia. *Ann Allergy* 1992; 68: 525-9.
 - 15 Calendario Metereológico. Instituto Colombiano de Hidrología y Metereología (HIMAT) PE-AM-016 Bogotá, 1988.
 - 16 Puerta L, Fernández-Caldas, Lockey R, Caraballo L. Sensitization to *Aleuroglyphus ovatus* and *Chortoglyphus arcuatus* in *Dermatophagoides* spp. *Clin Exp Allergy*, in press.
 - 17 Caraballo L, Puerta L, Cuadros G. Allergenic role of *Blomia tropicalis* in a Caribbean city of Colombia [Abstract]. *J Allergy Clin Immunol* 1990; 85:248.
 - 18 Arruda LK, Rizzo MC, Chapman MD *et al.* Exposure and sensitization to dust mite allergens among asthmatic children in São Paulo, Brazil. *Clin Exp Allergy* 1991; 21:433-9.
 - 19 Hughes AM. The mites of stored food. *Tech. Bull. No. 9*. London: HMSO, 1961.
 - 20 Krantz GW. Suborder Acaridia. In: Krantz GW, ed. *A manual of acarology*, 2nd ed. Oregon: Oregon State University Book Stores, 1978.
 - 21 Chapman MD, Heymann PW, Wilkins SR, Brown MJ, Platts-Mills TAE. Monoclonal immunoassay for major dust mite (*Dermatophagoides*) allergens content of mite and house dust extracts. *J Allergy Clin Immunol* 1987; 80: 184-94.
 - 22 Swanson MC, Campbell AR, Klauck J, Reed CE. Correlation between levels of mite and cat allergens in settled and airborne dust. *J Allergy Clin Immunol* 1989; 83:776-83.
 - 23 Gabriel M, Cunningham AM, Allan WGL, Pickering CAC, Wraith DG. Mite allergy in Hong Kong. *Clin Allergy* 1982; 12:157-71.
 - 24 Fernández-Caldas E, Fox RW, Bucholtz GA, Trudeau WL, Ledford DK, Lockey RF. House dust mite allergy in Florida. Mite survey in households of mite-sensitive individuals in Tampa, Florida. *Allergy Proc* 1990; 11:263-7.
 - 25 Trudeau WL, Fernández-Caldas E, May JJ, Pratt DS, Lockey RF. Allergenicity of the mite *Chortoglyphus arcuatus* [Abstract]. *J Allergy Clin Immunol* 1990; 85:238.
 - 26 Miyamoto T, Oshima S, Mizuno K, Sasa M, Ishizaki T. Cross-antigenicity among six species of dust mites and house dust antigens. *J Allergy* 1969; 44:228-38.
 - 27 Arlian L, Vyszenski-Moher D, Gilmore A. Cross-antigenicity between *Sarcoptes scabiei* and the house dust mite, *Dermatophagoides farinae* (Acari; Sarcoptidae and Pyroglyphidae). *J Med Entomol* 1988; 25:240.
 - 28 Korsgaard J. Mite asthma and residency. A case-control study on the impact of exposure to house-dust mites in dwelling. *Am Rev Respir Dis* 1983; 128:231.
 - 29 Peat JK, Britton WJ, Salome CM, Woolcock AJ. Bronchial hyperresponsiveness in two populations of Australian schoolchildren. III. Effect of exposure to environmental allergens. *Clin Allergy* 1987; 17:297.
 - 30 Platts-Mills TAE, de Weck AL. Dust mite allergens and asthma—a world wide problem. *J Allergy Clin Immunol* 1989; 83:416-27.
 - 31 Dust mite allergens and asthma: report of a second international workshop. *J Allergy Clin Immunol* 1992; 89:1046-60.
 - 32 Wood RA, Eggleston PA, Mudd KE, Adkinson NF. Indoor allergen levels as a risk factor for allergic sensitization [Abstract]. *J Allergy Clin Immunol* 1989; 83:199.
 - 33 Arlian LG, Bernstein IL, Gallagher JS. The prevalence of house dust mites, *Dermatophagoides* spp., and associated environmental conditions in homes in Ohio. *J. Allergy Clin Immunol* 1982; 69:527-32.
 - 34 Platts-Mills TA, 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.