

Prevalence of dust mites in the homes of people with asthma living in eight different geographic areas of the United States

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San Diego, Calif.

The density and species prevalence of dust mites were determined at various times over a 5-year-period in 252 homes of dust mite sensitive people with asthma who lived in eight geographic areas of the United States (Cincinnati, Ohio; New Orleans, La.; Memphis, Tenn.; Galveston, Texas; Greenville, N.C.; Delray Beach, Fla.; San Diego and Los Angeles, Calif.). The most common dust mites found in the homes were Dermatophagoides farinae (DF), D. pteronyssinus (DP), Euroglyphus maynei (EM), and Blomia tropicalis. All homes in all locations contained Dermatophagoides spp. mites, but few homes were populated exclusively by either DF or DP alone. Most homes (81.7%) were coinhabited by both DF and DP. In coinhabited homes one species was predominant and usually made up at least 75% of the total mite population. Prevalence of the dominant or only species present varied between homes within a geographic area. EM occurred in significant numbers in 35.7% of homes in New Orleans, Memphis, Galveston, Delray Beach, and San Diego. Blomia tropicalis occurred in these same cities but in low densities. For all dust samples, only 13 homes of the 252 sampled had 100 or fewer mites/gm dust, which is considered to be the threshold for sensitivity. Most homes had average mite densities of 500 or more mites/gm dust. The results of the present study suggest a significant and widespread occurrence of both DF and DP. Therefore extracts of both mite species should be considered for diagnostic tests and immunotherapy. Significant levels of EM were present in some areas. Thus sensitivity to EM should be considered in these areas. (J ALLERGY CLIN IMMUNOL 1992;90:292-300.)

Key words: *Dermatophagoides farinae*, *Dermatophagoides pteronyssinus*, *Euroglyphus maynei*, *Blomia tropicalis*, house dust mites, allergenicity, asthma, allergic disease

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Supported by grants AI-20565, AI-21984, AI-21987, AI-21991, and MOI-RR-00073 from the National Institute of Allergy and Infectious Disease (National Institutes of Health, Bethesda, Md.).

Received for publication Nov. 27, 1991.

Revised March 30, 1992.

Accepted for publication April 15, 1992.

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1/1/38699

Abbreviations used

DF: *Dermatophagoides farinae*
DP: *Dermatophagoides pteronyssinus*
EM: *Euroglyphus maynei*
BT: *Blomia tropicalis*
RH: Relative humidity
RAST: Radioallergosorbent test
Der p I: A 24,000 MW allergen of *Dermatophagoides pteronyssinus*

The house dust mites, *Dermatophagoides farinae* (DF) and *D. pteronyssinus* (DP), are important sources of allergens inside homes in humid geographic areas worldwide. Sensitization to inhaled mite allergens and subsequent expression of asthma, allergic

rhinitis, and other allergic diseases appear dependent on the density of mites or mite allergen levels as well as on the specific species responsible.¹ Until now it has not been clear whether or not allergens from DF or DP or both species are important sources of aeroallergens in homes throughout the United States. Generally it has been believed that DF was the predominant species in the United States, whereas DP was the most important mite in England, Europe, and other parts of the world. Hence the Entomological Society of America approved the common names "American house dust mite" and "European house dust mite" for DF and DP, respectively.² Results of surveys during the last decade indicate that this nomenclature was premature and misleading. Extensive studies at several points in time during a year showed that both DF and DP occurred in significant numbers in southwestern Ohio and in different climatic zones of southern California,³⁻⁶ although species prevalence and density varied between homes within geographic areas. Outside these two areas, mite density and species prevalence over time inside homes in the United States were virtually unknown. However, three additional surveys based on studies of 20 homes in Atlanta, Ga., that were sampled twice (heating and nonheating seasons)⁷ and 12 and 45 homes in Columbus, Ohio,⁸ and southeastern Wisconsin,⁹ respectively, each sampled once, also found that both DF and DP were prevalent. On the basis of the Atlanta survey, Smith et al.⁷ suggested that extracts of both species should be considered for skin testing and immunotherapy. However, additional prevalence data on species representation and density in a broader range of locations in the United States are required to support universal implementation of such recommendations.

As part of a long-term study to determine the efficacy and safety of immunotherapy in patients with asthma who were allergic to house dust mites, it was necessary to determine the density and species prevalence of the dust mites and the level of antigen *Der p* I to which these individuals sensitive to mites were exposed over the time course of the study. Since prior limited surveys suggested that both DF and DP could be present in many homes in the United States,³⁻⁹ an extract containing equal concentrations of both mites was used for immunotherapy in the present study. The levels of antigen *Der p* I and the clinical results of the immunotherapy aspects of the study will be reported in another communication. This report will address the mite density and species prevalence in the homes of the patients with asthma who participated in the study. The patients lived in eight different geographic areas of the United States. The study represents the most comprehensive survey to date of dust mite prevalence over time in U.S. homes. The results provide

a scientific basis for using both DF and DP extracts for diagnostic tests and immunotherapy.

METHODS

The dust sampling procedure used for this study was similar to that used previously.³ Dust samples were obtained by vacuum cleaner from three major mite foci^{3,10,11}: mattress surface, carpeted bedroom floor beside the bed, and family room couch or chair or its carpeted floor. Inhabitants were also instructed to follow a standard and uniform housekeeping procedure to minimize bias in dust collection and variability in exposure during this multiyear study. A weekly record of housekeeping was completed on symptom diary forms to monitor this potentially confounding factor.

Two square meters of surface area for each sampling site was vacuumed for 2 minutes. All dust samples were collected on cloth filters (7 cm diameter) that were cut from bed sheets that had a thread count of 180. These filters were inserted into a specially constructed cylindrical dust trap (7 cm diameter $\times$ 7 cm length) that was attached between the end of the hose of a portable Hoover (The Hoover Co., Tarrytown, N.Y.) vacuum cleaner (Model #S1049-022) and the dusting attachment.

Once the dust was collected, the collection filter was folded to form a bag, and the bag of dust was tightly tied to confine the living and dead mites. The dust samples were stored at 4° C until shipped to Dr. Arlian's laboratory where they were also stored at 4° C until analyzed. The low storage temperature maintained the integrity of the live and dead mites, reduced their metabolic rates, and stopped physical activity, reproduction, and development of the live mites.^{3,12} Therefore the mite count and species composition determined at the time the dust samples were analyzed reflected the actual mite condition and composition in the house dust at the time the samples were collected.

All *Dermatophagoides* spp., EM, and BT mites in duplicate 0.05 gm aliquots from each dust sample were determined and extrapolated to mites per gram of dust, with use of procedures described in detail previously.³ For dust samples of less than 0.05 gm, mite counts were determined for the available dust, and then the counts were also extrapolated to mites per gram of dust. Random samples of mites were taken from many dust samples from each house and cleared with lactic acid. Then the species or higher taxonomic mite group of each adult specimen was determined with the use of a compound microscope. Mite specimens were identified to species on the basis of the morphologic characteristics described by Arlian,¹³ Fain,^{12,14} Hughes,¹⁵ Van Bronswijk and Sinha,¹⁶ and Griffiths and Cunningham.¹⁷

The sampled homes of the patients in the asthma study were located in Cincinnati, Ohio, Memphis, Tenn., Greenville, N.C., Delray Beach, Fla., New Orleans, La., Galveston, Texas, and San Diego and Los Angeles, Calif. The dust samples were obtained between July 1986 and September 1990. A total of 252 homes were initially sampled during the patient selection and observation phase of the study before immunotherapy. Forty-four participants withdrew from the study or were not continued in the study after the

TABLE I. Prevalence of specific species of dust mites in 252 homes surveyed in eight locations

Location	No. mite positive homes	Homes with each mite species							
		DF		DP		EM		BT	
		No.	%	No.	%	No.	%	No.	%
Cincinnati, Ohio	48	46	95.8	39	81.3	0	0.0	0	0.0
New Orleans, La.	58	47	81.0	57	98.3	18	31.0	3	5.2
Memphis, Tenn.	31*	29	93.5	24	77.4	4	12.9	1	3.2
Galveston, Texas	32	30	93.8	31	96.9	14	43.8	6	18.8
Greenville, N.C.	36	36	100.0	34	94.4	0	0.0	0	0.0
Delray Beach, Fla.	8	8	100.0	6	75.0	1	12.5	2	25.0
San Diego, Calif.	25	21	84.0	25	100.0	2	8.0	11	44.0
Los Angeles, Calif.	13	12	92.3	12	92.3	0	0.0	0	0.0
Total	251*	229	91.2	228	90.8	39	15.5	23	9.2

*All 32 homes tested contained mites, but species could not be determined in one house because of lack of enough adult specimens, therefore 252 homes were mite positive.

first dust sample collection. The remaining 208 homes were sampled an average of five times during the remainder of the study, with 163 being sampled three to four times during the first year of the study. In all subsequent years of the study all homes were sampled at least once during the peak mite season, with selected homes sampled three to four times. Individual homes were sampled from one to 16 times over the 5-year period. Dust samples were obtained during both the cooling and noncooling or heating seasons.

Patient selection

Patients selected for this study were 16 to 60 years old and had a history compatible with episodic asthma (wheezing, cough, dyspnea, or chest tightness, occurring singly or in combination) with symptomatic and asymptomatic periods, or chronic with prolonged periods of bronchial reactivity persisting days to weeks. In addition to a clinical history of asthma, the patients exhibited increased symptoms after dust mite exposure, showed positive skin test for DF or DP or both and the absence of concomitant and possibly confounding clinical sensitivity to allergens other than house dust mite (e.g., cockroach), and had IgE antibody levels that were clearly detectable by RAST.

RESULTS

A total of 3306 dust samples were collected from which mite density was determined. A total of 37,280 mites were examined for species determination of which 59.4% were adult dust mites and all identified to species (DF, DP, EM, or BT). The remaining mites not identified to species were immature (DF, DP, EM, or BT). In addition, a sampling of occasionally occurring mites were removed from the dust samples and identified to family, genus, or species.

All homes ($n = 252$) in all geographic areas were positive for house dust mites (Table I). The most common mites found in the dust samples were DF, DP,

EM, and BT (Table I). *D. microceras* was not present among the large number of specimens of *Dermatophagoides* spp. that were examined for identification. Predatory mites in the family Cheyletidae were also frequently identified but not quantitated. Many species of storage mites, plant parasites (e.g., Tarsonemidae), animal parasites (e.g., *Sarcoptes scabiei*), and soil mites were occasionally identified.

The percentage of homes in any geographic area where DF or DP were identified ranged from 81% to 100%, and from 75% to 100%, respectively, with a mean of approximately 91% of all homes for DF and DP (Table I). Three areas, Cincinnati, Greenville, and Los Angeles, were populated exclusively by *Dermatophagoides* dust mites. Overall, 15.5% and 9.2% of homes had EM and BT, respectively (Table I). However, homes positive for EM and BT were limited to five geographic regions (New Orleans, Memphis, Galveston, Delray Beach, and San Diego) wherein they comprised 25.3% (39 of 154) and 14.9% (23 of 154) of homes sampled, respectively. EM was most prevalent in homes in New Orleans (31.0%) and Galveston (43.8%). BT was most prevalent in San Diego (44.0%) and Delray Beach (25.0%).

Although all homes sampled contained at least one species of the genus *Dermatophagoides*, very few of the homes contained exclusively one species of *Dermatophagoides* mites (Table II). Of all of the homes sampled, 81.7% (range, 74% to 94%) were coinhabited by both DF and DP. Although all regions showed some homes populated by only one species of *Dermatophagoides* without the other, only Greenville and Delray Beach showed homes without DP, whereas all homes without DF were located only in San Diego. Although more than 74% of homes in each region

TABLE II. Prevalence of *Dermatophagoides* spp. in homes sampled in eight locations

Location	No. of positive homes	Homes (%) containing each mite species					
		DF soley		DP soley		DF + DP	
		No.	%	No.	%	No.	%
Cincinnati, Ohio	48	10	20.8	2	4.2	36	75.0
New Orleans, La.	58	1	1.7	11	19.0	46	79.3
Memphis, Tenn.	31*	7	22.6	1	3.2	23	74.2
Galveston, Texas	32	1	3.1	3	9.4	28	87.5
Greenville, N.C.	36	2	5.6	0	0.0	34	94.4
Delray Beach, Fla.	8	2	25.0	0	0.0	6	75.0
San Diego, Calif.	25	0	0.0	4	16.0	21	84.0
Los Angeles, Calif.	13	1	7.7	1	7.7	11	84.6
Total	251	24	9.6	22	8.8	205	81.7

*All 32 homes tested contained mites, but species were not determined in one house because of lack of enough adult specimens.

TABLE III. Prevalence of all dust mite species in homes coinhabited by *Dermatophagoides* spp. and/or EM and BT*

Location	No. homes	Homes with each combination of mites										DF + DP + BT + EM	
		DF + EM		DP + EM		DP + BT		DF + DP + BT		DF + DP + EM		No.	%
		No.	%	No.	%	No.	%	No.	%	No.	%		
Cincinnati, Ohio	48	0	0	0	0	0	0	0	0	0	0	0	0
New Orleans, La.	58	0	0	3	5.2	2	3.4	0	0	14	24.1	1	1.7
Memphis, Tenn.	31†	1	3.2	0	0	0	0	0	0	2	6.5	1	3.2
Galveston, Texas	32	0	0	0	0	1	3.1	1	3.1	10	31.2	4	12.5
Greenville, N.C.	36	0	0	0	0	0	0	0	0	0	0	0	0
Delray Beach, Fla.	8	0	0	0	0	0	0	2	25.0	1	12.5	0	0
San Diego, Calif.	25	0	0	0	0	2	8.0	8	32.0	1	4.0	1	4.0
Los Angeles, Calif.	13	0	0	0	0	0	0	0	0	0	0	0	0
Total	251	1	0.4	3	1.2	5	2.0	11	4.4	28	11.2	7	2.8

*No homes contained only EM or BT or EM + BT.

†All 32 homes tested contained mites but species not determined in one house due to lack of adult specimens.

were coinhabited by DF and DP, in no region were all of the homes coinhabited; that is, all regions presented some homes in which either DF (range, 0% to 25%) or DP (range, 0% to 19%) was the exclusive mite resident.

Although all homes included in this study contained at least one species of *Dermatophagoides*, more than

22% of all homes contained the house dust mites EM or BT or both as well (Table III). Of the five areas in which BT or EM or both were observed (New Orleans, Memphis, Galveston, Delray Beach, and San Diego) 35.7% of all homes (55 of 154) had either BT, EM, or both. These mites were particularly prevalent in Galveston and San Diego, where 49.9% and 48.0%

TABLE IV. Percentage of coinhabited homes in which DF, DP, EM, or BT was the predominant (most numerous) mite species of the total mite population

Location	No. coinhabited*	Homes with predominant species							
		DF		DP		EM		BT	
		No.	%	No.	%	No.	%	No.	%
Cincinnati, Ohio	36	26	72.2	10	27.8	0	0	0	0
New Orleans, La.	51	11	21.6	37	72.5 [†]	3	5.9 [‡]	0	0
Memphis, Tenn.	24	11	45.8	13	54.2	0	0	0	0
Galveston, Texas	29	10	34.5	17	58.6	2	6.9	0	0
Greenville, N.C.	34	16	47.1	18	52.9	0	0	0	0
Delray Beach, Fla.	6	2	33.3	4	66.7	0	0	0	0
San Diego, Calif.	23	2	8.7	21	91.3	0	0	0	0
Los Angeles, Calif.	11	4	36.4	7	63.6	0	0	0	0
Total	214	82	38.3	127	59.3	5	2.3	0	0

*The total homes evaluated for each location are noted in Table II. 214/251 (85.3%) of homes were coinhabited.

[†]DP did not constitute greater than 50% of the total population for one home.

[‡]EM did not constitute greater than 50% of the total population for 2 homes. For all other homes the predominant species was greater than 50% of total population.

of the homes contained BT or EM or both, respectively. Considering all four mite species, only 14.8% of all homes sampled were inhabited by a single species of house dust mite, with 9.2% having exclusively DF and 5.6% showing exclusively DP. No homes were observed in which either BT or EM was the exclusive mite resident.

Of the 214 homes inhabited by more than one species of house dust mite, 209 (97.7%) were populated predominantly by *Dermatophagoides* mites (DP, 59.4% and DF, 38.3%) (Table IV). Only five homes (three in New Orleans [5.9%] and two in Galveston [6.9%]) showed EM as the most abundant species, and only three of these homes had EM comprising greater than 50% of the inhabitants. None of the homes tested were populated predominantly by BT, although this species did constitute 36% of the total mite population in two of the 23 houses in which BT was present. BT constituted less than 20% of the total mite population in the 21 other houses in which it was found (data not shown).

In most coinhabited homes, one species of mite was clearly most prevalent comprising more than 49% of the mite population. When a *Dermatophagoides* mite was the predominant species, that species typically constituted more than 75% (range, 75.2% to 89.3%) of the total mite population in the home. In contrast, when EM was the most abundant species in a home, it comprised a much smaller percentage of the total mite population (range, 49.3% to 55.8%). In fact, two of the homes in New Orleans actually showed *Dermatophagoides* mites (DF + DP) outnumbering EM, although EM was the most abundant single species.

Profiles of average mite densities (Table V) and of mite densities at the primary mite foci (site with highest mite density for each sample time) (Table VI) were constructed from the data obtained. As can be seen from Table V, 83.3% of all homes tested (210 of 252 homes) had an average mite density (average of all sites sampled and all times) in excess of the 100 mites/gm dust, which is considered to be the threshold for sensitivity. Of the 42 homes with an average of less than 100 mites/gm dust, half still had an average of less than 100 mites/gm when the average mite density was based on only the site with the highest mite count for each sampling date. However, 8 of these 21 homes had at least one sample 100 or more mites/gm (Table VI). Therefore only 13 homes of these people with asthma had fewer than 100 mites/gram dust in all samples collected.

Highest mite densities (primary mite foci) were found in either the carpeted floor beside the bed, family room couch or chair, or the carpeted family room for 77.5% of all times the homes were visited to obtain dust samples. Therefore the mattress was the primary mite focus in the home for only 22.5% of the samples collected during the study.

Considering all dust samples analyzed over the entire time of the study (three sites per sample time) homes in Galveston, Delray Beach, San Diego, and New Orleans had the highest average mite densities (Table V). These same locations and Greenville had the most mites considering only the site with the highest mite density for each sampling time, whereas homes in Memphis had the lowest mite counts (Table VI). Except for Memphis, 50% or more of homes in each location were classified as having high mite levels

TABLE V. Percentage of homes with average specific mite densities (average number of mites per gram of dust for all sampling sites and times for duration of the study)

Location	No. homes	Homes with corresponding mite densities									
		<100		100 - 499		500 - 999		1000 - 1999		≥2000	
		No.	%	No.	%	No.	%	No.	%	No.	%
Cincinnati, Ohio	48	9	18.8	26	54.2	8	16.7	5	10.4	0	0
New Orleans, La.	58	8	13.8	25	43.1	11	19.0	11	19.0	3	5.2
Memphis, Tenn.	32	13	40.6	16	50.0	3	9.4	0	0	0	0
Galveston, Texas	32	3	9.4	13	40.6	8	25.0	6	18.8	2	6.2
Greenville, N.C.	36	4	11.1	21	58.3	5	13.9	5	13.9	1	2.8
Delray Beach, Fla.	8	1	12.5	3	37.5	2	25.0	1	12.5	1	12.5
San Diego, Calif.	25	1	4.0	14	56.0	7	28.0	3	12.0	0	0
Los Angeles, Calif.	13	3	23.1	6	46.2	3	23.1	1	7.7	0	0
Total	252	42	16.7	124	49.2	47	18.6	32	12.7	7	2.8

as evidenced by primary site average mite densities (based on the site in the home where mites were most abundant) that were 500 or greater mites/gm dust (Table VI).

DISCUSSION

The results of this study showed that both DF and DP mites were very prevalent in most homes of people with asthma living in eight humid geographic areas of the United States, but species prevalence in homes varied within and between geographic areas. In addition, EM occurred in significant numbers in homes in some areas and may be an important source of allergens in homes in these areas. BT was found in only a few homes and at low densities, implying that BT may not be an important mite in homes in the United States. A value of 100 mites/gm of dust has been suggested as the threshold for mite density to be clinically important.^{18, 19} Except in Memphis and Los Angeles, more than 90% of the homes had an average mite density over time of greater than 100 mites/gm of dust in the home site with the highest density. It should also be noted that except in Memphis most homes had 500 or more mites/gm of dust in the primary mite foci, which is high by any standard. Thus dust mites were an important source of allergen in most of the 252 homes of people with asthma surveyed. However, the site with the highest mite density for each sampling time was usually the bedroom floor, family room floor, or the couch or chair in most homes

in all geographic locations. Therefore the mattresses were not the primary mite foci in most homes, a finding consistent with that of a previous study of homes in southwestern Ohio.³

Most homes (>74%) in the eight geographic areas sampled were coinhabited by both DF and DP. Few homes were populated by either DF or DP alone (<25%). In coinhabited homes one species was predominant and usually made up greater than 75% of the total mite population in the homes. The dominant or only species present varied between homes within a geographic area. Therefore none of the areas could be clearly categorized as regions of the United States in which one species was the only source of mite allergen. However, DP was the predominant or only species in most homes in New Orleans and San Diego. Likewise in Cincinnati DF was the predominant or only species in most homes. In Memphis, Galveston, Greenville, Delray Beach, and Los Angeles the number of homes with predominantly one species or only one species was about equal. Therefore the data on mite density and species prevalence clearly indicate that both DF and DP are important sources of mite allergens in most homes. Moreover, the variable prevalence of both DF and DP within a geographic area is consistent with the previous findings for mite prevalence in homes in Columbus, Dayton, and Cincinnati, Ohio, Atlanta, Ga., Riverside, Calif., and southeastern Wisconsin.³⁻⁹

Previous studies show that DF and DP are the

TABLE VI. Percentage of homes with average (all sampling times) specific mite densities (mite counts per gram of dust) when considering only the site with the highest mite counts at each sample time

Location	No. Homes	Percentage of homes with corresponding mite densities									
		<100		100 - 499		500 - 999		1000 - 1999		≥2000	
		No.	%	No.	%	No.	%	No.	%	No.	%
Cincinnati, Ohio	48	4	8.3	20	41.7	12	25.0	6	12.5	6	12.5
New Orleans, La.	58	5	8.6	12	20.7	16	27.6	11	19.0	14	24.1
Memphis, Tenn.	32	7	21.9	17	53.1	4	12.5	4	12.5	0	0
Galveston, Texas	32	1	3.1	9	28.1	9	28.1	6	18.8	7	21.9
Greenville, N.C.	36	1	2.8	13	36.1	11	30.6	5	13.9	6	16.7
Delray Beach, Fla.	8	0	0	3	37.5	0	0	3	37.5	2	25.0
San Diego, Calif.	25	0	0	7	28.0	12	48.0	3	12.0	3	12.0
Los Angeles, Calif.	13	3	23.1	3	23.1	2	15.4	5	38.5	0	0
Total	252	21*	8.3	84	33.3	66	26.2	43	17.1	38	15.1

*Eight of these had at least one sample ≥ 100 mites/gm.

sources of multiple species-specific as well as cross-reacting allergens or epitopes.²⁰⁻³⁴ Patients allergic to mites can exhibit varied sensitivity to the various allergens of each species and can even be sensitive to allergens of only one species. Sensitivity to the various allergens of a species varies both between and within patients.^{20-24, 31} Considering the results of species prevalence in the eight locations in the present study and those of previous surveys, and the varied patient sensitivity to the two mites and specific allergens, extracts of both mite species of *Dermatophagoides* should be used for diagnostic tests to determine patient sensitivity. Likewise, immunotherapy should use extracts of both species if the patient is sensitive to both. Use of only one extract by itself may not identify a patient sensitive to mites or provide effective immunotherapy.

The identification of EM in significant numbers in some homes in humid southern areas is most intriguing. This mite is common in homes in England and Europe and can be the most abundant species.³⁵ Only a few records exist for its occurrence in the United States.⁷⁻⁹ Of 1286 mite specimens identified from 54 homes sampled in Wisconsin and Columbus, only five EM specimens were identified.^{8, 9} However, EM was the dominant species in one of 20 homes sampled in Atlanta.⁷ In the present study EM was found in more than 40% of homes in Galveston, and it was the most

prevalent species in five homes in Galveston and New Orleans. These findings combined with the Atlanta study and a few reports of low EM numbers in homes in northern localities suggest that significant EM prevalence occurs mainly in the southern United States. Preliminary studies showed EM is the source of more than 30 antigens at least 15 of which were allergens (Arlian, personal communication). Thirty-two of 32 patients sensitive to dust mites whose RAST was positive for EM and who resided in areas where EM was endemic had serum IgE directed against at least two of these EM allergens. Individual patients had circulating IgE directed against two to eight allergens. Twenty-nine had circulating IgE directed against three or more allergens. Twenty-seven of the 32 patients tested exhibited circulating moderate or high levels of IgE directed against the same allergens. Therefore it appears that several of these antigens are important allergens and at least one allergen was recognized by most patients. These results also suggest that EM extracts may be in demand for use in the United States in these localities for skin testing and immunotherapy. Unfortunately, extracts of EM are not yet commercially available in the United States.

BT is a common dust mite in homes in tropical and subtropical regions throughout the world. Before our survey, its prevalence in homes in the United States

has been relatively unknown. However, BT was reported to be common in mattress and carpet dust in homes in Tampa, Fla., and it was the predominant species in some dust samples.³⁶ Our findings coupled with the reported prevalence of BT in houses in Tampa, Fla. suggest that BT can be an important source of allergen in some houses in the United States if this species is abundant. Although we found BT to be present in homes in five of the eight geographic areas surveyed, it was not an abundant species when the densities of BT in the dust samples were compared with the abundance of DF, DP, and EM.

In the present study dust samples were obtained from mattresses, bedroom floors, and family room carpeted floors or couches. It is important to note that mite density varied greatly between these sampled locations within a home in spite of the fact the homes were located in geographic areas with suitable climatic conditions for mite growth. This intrahome variability probably reflected varied available food (skin scales), climatic conditions to support mite populations (RH, temperature), and physical condition of the habitats within specific homes.^{3, 17, 37-45} For example, variations in temperature alone between 23° C (73° F) and 16° C (61° F) can lengthen the life cycle of DP from 34 to 123 days.¹⁸ Likewise, DP females deposit approximately 3.3 eggs per day at 35° C (95° F) but only 2.5 eggs per day at 23° C (73° F).¹² Obviously, differences in temperature alone in the mite habitat greatly affect the rate at which a population could grow. RH of ambient air in homes is an important factor in the survival of dust mites.³⁷⁻⁴⁵ The lowest RH at which mites are able to maintain water balance and survive is influenced by temperature and ranges from 55% to 75% RH depending on temperature.⁴⁰⁻⁴² Arlian⁴⁵ has reported that temperatures in carpets on slab floors can be much lower than temperatures on mattresses or couches, which can affect population growth. Reasons why a specific site is more favorable to mite breeding than another are not readily clear or predictable because of the multiple and variable contributing factors. Therefore it would be wise to sample mite levels (specific allergen or guanine levels if these are used as an index of the concentration of mite allergen and the relative level of exposure) especially where skin scales are suspected to be in greater abundance. Such areas include the mattress, bedroom floor, and family or TV room floor or couch. Samples taken from low use areas (e.g., floor around periphery of room) give only low mite counts and usually do not give an appropriate index for mite prevalence.

We thank M. Allen, R. Allen, P. Arangie, P. Ferguson, P. Forsythe, J. Gallagher, A. Gilmore, M. Morgan, C. Rapp, J. Voigtlander, D. Vyszenski-Moher, and B. Walden

for assistance with the research and preparation of the manuscript.

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