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Mites in facilities for laboratory animals

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Objectives Two laboratory animal facilities were examined for storage and house-dust mites.

Methods Samples of settled dust or material were investigated microscopically, and all of the found mites were identified.

Results Every fourth sample contained mites. On the average, 86 mites were found in a gram of dust. Measurement with a two-way enzyme-linked immunosorbent assay revealed only one sample containing a minor amount of allergen from *Dermatophagoides pteronyssinus*.

Conclusions It seems that, in addition to house-dust mites, other mites may be important occupational contaminants in animal facilities.

Key terms indoor allergen, laboratory animal workers, pilot study, storage mites.

Occupational environments contain several biological agents and materials that can potentially induce health problems (1), for example, allergens of mites and animals. About one-third of laboratory animal workers has occupational allergy to animal dander, and a third has symptomatic asthma (2–4).

Information about the occupational exposure of laboratory animal workers to rat and mouse urine proteins has recently become available (5–8). House-dust mites, together with cat and dog allergens, have been considered the most important indoor factors increasing the risk of allergic reactions. In addition, storage mites have been documented as a cause of allergic symptoms, especially in cases of rural occupational exposure at sites such as farms, dairy barns, and grain elevators (9–16). However, nothing is known about the occupational exposure of laboratory animal workers to mites. Similarly, the occurrence of mite fauna in dust from laboratory animal facilities has not been studied.

The aim of this study was to survey the mite fauna in two different animal facility centers and determine the common indoor allergen level in the animal facility environment.

Materials and methods

Dust sampling. Two laboratory animal facilities were surveyed for storage and house-dust mites. The settled dust was vacuumed (1 min/m²) (17) or brushed from floors and animal cages, and samples of food and bedding were collected. Samples were also collected from the lounge chairs. Altogether 20 samples (12+8) were collected.

Dust samples for allergen analyses (Der p 1 for *Dermatophagoides pteronyssinus*) were also collected by vacuuming the settled dust onto cellulose acetate or cellulose nitrate filters (Millipore AAWP09025 AA, pore size 0.8 µm, Millipore Corporation, Bedford, MA, USA) (18). Two allergen samples were collected from each facility.

Mite analysis. From each sample, two subsamples of 25 to 50 milligrams of dust were taken for the counting and identification of mites. After the mites were clarified in lactic acid, they were picked out under a stereomicroscope at low magnification (× 13–80). The mites were mounted in Heinze polyvinyl alcohol medium and

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subsequently counted and identified under a microscope ($\times 40\text{--}400$). Mites were identified by a biologist with several years of experience in mite identification. The results were calculated as the number of mites in a gram of dust. If no mites were found in a sample, a detection limit (DL) was calculated by using the equation $1/M$, where M is the mass of dust. For the calculations, a value of $DL/2$ was used for these samples.

Allergen analysis. The Der p 1 content of the dust was analyzed by the two-way enzyme-linked immunosorbent assay, as described earlier (19). All allergen-specific reagents and standards were purchased from Indoor Biotechnologies Ltd, Cardiff, United Kingdom. The detection limit for Der p 1 was 0.080 ng/ml. The results were calculated from the straight part of the standard curves, and the allergen levels were expressed as the mean of duplicate measurements (micrograms of allergen per gram of original dust).

Results

Out of the 12 samples collected from facility A, two (16.7%) contained mites (table 1). On the average, 86 mites were found per gram of dust. Mites were found in samples from the feed storage floor and from a lounge chair. Most of the mites were storage mites, belonging to *Astigmata* species (*Glycyphagidae*, *Acaridae*) or *Prostigmata* species (*Tarsonemus sp.*, *Cheyletus sp.*). Mite allergens were not found in the two collected samples. In facility B, three of the eight samples (37.5%) contained mites. On the average, 87 mites were found per gram of dust. Mites were found in samples from the feed and bedding storage floors and from a lounge chair. *Astigmata* or *Prostigmata* species were again the species most often found. Only one house-dust mite, *Dermatophagoides* species, was found (sample from a staff room chair), comprising 2.6% of the mites found. One of the two allergen samples contained Der p 1 at a concentration of 0.002 g/g.

Discussion

Laboratory animal allergy is a common occupational hazard for people working with laboratory animals. More potential animal allergens, especially for the general population, are the indoor mites (ie, house-dust and storage mites). Thus far, nothing is known about the occurrence of mites in laboratory animal facilities. In our study, 25% of the collected samples contained mites. Mites were found both in samples from staff room chairs and in samples from the storage areas of the two inspected facilities. This finding shows that mites can be found

Table 1. Number of mites (mites/g of dust) and species found in two laboratory animal facilities.

Facility	Sample			Mites/gram of dust			Species ^a
	N	Positive		Mean	SD	Median	
		N	%				
A	12	2	16.7	86	140	56	<i>Glycyphagidae</i> (2), unknown (4)
B	8	3	37.5	87	98	43.5	<i>Acaridae</i> (1), <i>Glycyphagidae</i> (1), <i>Dermatophagoides</i> (1), <i>Tarsonemus</i> (11), <i>Cheyletidus</i> (15), <i>Eriophyidae</i> (1), Unknown (3)

^a Number of mites given in parentheses.

throughout the premises. However, no mites were found in the animal rooms themselves, probably partly due to the small sample sizes and partly due the fact that the rooms are cleaned more frequently and thoroughly than storage rooms and other areas. The mites seem to spread, most likely from animal food or bedding, since the same species were found in both the staff rooms and the storage rooms. Mites spread quickly and thoroughly (20). On the average, 86 mites were found per gram of dust. In two cases (feed storage room and staff room chair in facility B), the mite density exceeded the suggested sensitization threshold of 100 mites/g dust (21). Most of the mites were storage mites, belonging to *Astigmata* or *Prostigmata* species. The levels of dust mite allergen (Der p 1) were low in comparison with the concentrations generally measured in house dust in homes (22–23). Our results suggest that mites may be important allergenic agents also in laboratory animal facilities. Since storage mites were particularly numerous, they may, in fact, be more important indoor allergens than previously believed. Attention should be paid to proper cleaning practices and protection against mites. The allergens from the storage mite *Lepidoglyphus destructor*, such as Lep d 1 and Lep d 2, have been purified and characterized, and a method for measuring allergens in dust samples has been developed (24–28). Furthermore, we need new commercial methods for measuring storage mite allergens in order to study comprehensively the possible role of mites in sensitizing laboratory animal workers.

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