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# EXPOSURE OF WORKERS TO MITES IN FINNISH GROCERIES

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**Abstract:** We assessed the mite exposure of workers in Finnish groceries by collecting samples of settled dust in 5 different grocerys. Mites were counted and identified microscopically. Mite allergen (Der p 1 and Der f 1) content of dust was analyzed with 2-site ELISA. Mites were found in 20-100% of the samples, both from storage and salesrooms. Seven samples (8%) contained more than 100 mites per gram dust and 3 additional samples (6%) more than 500 mites per gram dust, the suggested limits for mite sensitization and acute allergic symptoms, respectively. Most of the mites were storage mites belonging to Astigmata (Acaridae, Glycyphagidae) or Prostigmata (tarsonemids). House dust mites were found only occasionally. One dust sample out of 15 contained Der p 1, and none contained Der f 1.

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## INTRODUCTION

Since the early 1900's, storage mites have been reported to cause both occupational and non-occupational health problems [3, 10]. Asthma and other respiratory diseases caused by sensitization to mites are a problem throughout the world [10]. Storage mites are known to cause occupational sensitization, e.g. farmers, grain workers and bakers [2, 3, 6, 7, 13, 14, 15, 17]. Systematic assessment of mite exposure in other occupations has hardly been carried out.

Mites flourish in warm and damp environments where they feed on protein-rich substances such as grain and fungi. Both house dust mites and storage mites occur in damp dwellings [12, 18]. Several storage mite species have been identified in rural environments in Europe [1, 6]. A well-known fact is that certain foodstuffs (e.g. cheeses, dried fruit, and seeds) can contain storage mites [5]. Thus, it is probable that mites are also frequent in the stores. However, nothing is known about the occupational exposure of Finnish shop assistants to mites. Similarly, the occurrence of mite fauna in dust from stores has not been studied. Because mites can contaminate foodstuffs and favour similar living conditions, it is probable that they are found in grocery shops. The aim of our study was to estimate mite exposure in Finnish groceries both quantitatively and to species level, and to assess the working conditions.

## MATERIALS AND METHODS

**Groceries.** We surveyed the mite fauna in 5 stores in eastern Finland: 4 groceries (S1, S2, S3, and S5) and 1 supermarket (S4). Samples were collected in November-December 2000. The stores differed from each other, both in floor design and size. Generally, the sampling area was in 2 groceries, the restrooms situated on the bottom (S3-S5) or top floor (S1, S2) of the grocery. S4 was the newest of the grocerys and in the best condition. In previous studies, dampness and/or mould has been found in groceries S2 and S5.

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**Sampling.** From stores selling food, 5 standard locations were sampled: 1 cashier's chair, the flour and pet aisles, fruit and vegetable section, and the fresh bread counter. From the storage areas and the restrooms 3-5 samples were taken from each grocerys. Allergen samples were taken from the cashier's chair, the flour aisle, and 1 sample from the storage area of each store.

Dust for mite samples was collected on fiberglass filters (MN 640W) by vacuuming approximately 1 $m^2$ of floor for 1.5-2 minutes, or a chair for 45 seconds. All samples were stored at refrigerator temperature before analysis. The allergen samples were collected on membrane filters (Millipore, AAWP 090 25AA, pore size 0.8 µm, Ø 9 cm) in the same way as the mite samples. These samples were stored at -20ºC before analyses [9, 16, 17]

**Analyses.** From each dust sample, 2 sub-samples of 25-50 mg dust were taken for counting and identification of mites. After cleaning the mites in lactic acid, they were picked out under a stereomicroscope at low magnification (×13-80). The mites were mounted in Heinze PVA medium and subsequently counted and identified microscopically. The results were calculated as the number of mites in a gram of dust. If no mites were found, a detection limit (DL) was calculated for that sample [9, 16, 17].

Concentration of Der p 1 and Der f 1 allergens was determined with 2-site ELISA methods (Indoor Biotechnologies Ltd.). The concentration was presented, as µg/g dust. If no allergen was found in a sample, a detection limit (DL) was calculated for that sample. For the statistical considerations, a value of DL/2 was used for these samples.

## RESULTS

Two-thirds of the collected samples (n=56) contained mites. Differences among the groceries were considerable. All samples from S1 contained mites while only 30% of the samples from S4 contained mites. Similarly, groceries having many positive samples had several samples containing high amounts of mites. On the other hand, stores S4 and S5 that had few mite positive samples, also had low mite densities in those samples.

Of all the allergen samples collected (n=14), only 1 allergen sample (7%) contained Der p 1, and none of the samples contained Der f 1. The concentration of Der p 1 was about 80 times smaller than the concentration suggested causing sensitization (2 µg/g) [11-12].

Altogether, 60% of the samples taken from the standard location at groceries contained mites (Tab. 1). All pet aisle samples contained mites. In 3 cases, the number of mites found exceeded the sensitization limit of 100 mites per gram of dust. On the other hand, only 2 samples from the cashier's chair and 1 sample from the flour aisle contained mites, and in relatively low density. In the storage areas, 4 samples of mites found exceeded the sensitization limit (Tab. 2 and Tab. 3) and 2 of them contained more than 500 mites per gram of dust, the limit for acute allergic symptoms.

**Table 1.** Number of mites (mites/g dust) in the standard five locations.

| Store | Cashier's chair | Pet aisle | Flour aisle | FrVe | Bread | Mean±SD |
|---|---|---|---|---|---|---|
| S1 | 39 | 160 | 32 | 20 | 103 | 70.8±59 |
| S2 | 15 | 1200 | 10* | 47 | 34 | 261.2±525 |
| S3 | 9* | 324 | 8* | 19 | 54 | 82.8±136 |
| S4 | 10* | 21 | 9* | 6* | 10* | 11.2±6 |
| S5 | 9* | 67 | 9* | 33 | 9* | 25.4±26 |
| Mean ±SD | 16.4±13 | 354.4±487 | 13.6±10 | 25±16 | 42±39 | |

*The numbers are DL/2.

**Table 2.** Number of mites in storage area of each store.

| Store | Positive samples/ Samples collected | Mites/gofdust (x±SD) | Range |
|---|---|---|---|
| S1 | 4/4 | 1681±1830 | 20-3272 |
| S2 | 3/4 | 66±6 | 10*-19 |
| S3 | 3/3 | 157±108 | 71-281 |
| S4 | 2/5 | 11±5 | 7*-20 |
| S5 | 3/4 | 13±6 | 7*-19 |

* The numbers are DL/2.

Almost every sixth sample (17.5%) contained more than 100 or 500 mites per gram of dust (Tab. 3). Some storage samples from stores S1, S2, and S3 contained high amounts of mites. The same species of mites were found from different stores. Almost every third sample (32.5%) contained Acaridae and/or *Tyrophagus* sp. Other common mites were Mesostigmata, which were be found in 12% of the samples. Altogether, 949 mites were found. Over 60% of these belonged to Acaridae (*Acarus* sp. and *Tyrophagus* sp.) which are common storage mites. The other abundant group was Prostigmata mites comprising 13% of the mites found. On the other hand, only 1 (0.1%) house dust mite was found. Other rarely found mites were Cryptostigmata (0.3%). Five percent of the mites remained unidentifiable. The relative abundances among species differed slightly from grocery to grocery and from sample to sample. Hypopi and larval mites were found in abundance from samples containing high mite counts, indicating that a viable mite population was present (Tab. 3).

## DISCUSSION

The age and condition of the buildings, as well as the cleaning practices in each grocery can at least partly explain the extent of positive samples and the huge differences in mite numbers. At S1, which is about 10 years old and built on top of a burnt-down building, every sample contained mites. The water used for extinguishing the fire probably soaked the foundations, and the structures may be damp. Furthermore, the subjectively

**Table 3.** Samples containing more than 100 mites per gram of dust.

| Store | Sample | mites/g dust | Species |
|---|---|---|---|
| S1 | Bread | 103 | *Tyrophagus* sp. |
| | Pet aisle | 160 | Acaridae, *Lepidoglyphus* sp., *Lepidoglyphus* hypopus, Tydeidae, Cheyletidae, unknown |
| | Storage | 174 | Astigmata, *Tyrophagus* sp., Mesostigmata, unknown |
| | Storage | 3,259 | Acaridae, *Tyrophagus* sp., *Lepidoglyphus* sp., *Lepidoglyphus* hypopus, *Lepidoglyphus* larva, *Glycyphagus* hypopus, Cheyletidae, *Tarsonemus* sp., Mesostigmata, unknown |
| | Storage | 3,272 | Acaridae, Prostigmata, Tydeidae, Cryptostigmata, Mesostigmata , unknown |
| S2 | Storage | 110 | Acaridae, Glycyphagidae , unknown |
| | Pet aisle | 1,200 | Acaridae, Acaridae hypopus, *Tyrophagus* sp., Glycyphagidae, *Glycyphagus* hypopus, *Lepidoglyphus* sp., Pyroglyphidae, Tydeidae, Cheyletidae, Tarsonemus sp., Mesostigmata, unknown |
| S3 | Storage | 114 | Acaridae, *Tyrophagus* sp., Prostigmata |
| | Storage | 281 | Acaridae, *Tyrophagus* sp. |
| | Pet aisle | 324 | Acaridae, *Tyrophagus* sp., *Lepidoglyphus* sp. |

assessed storage area of S1 was dirty, and dust had probably been collecting in the corners and under the shelves for a long time. These conditions facilitate the proliferation of storage mites, which was seen as high mite numbers. S2 and S5, on the other hand, are older (approximately 20 years old) and actual dampness or mould growth and damage was verified in the premises. The lower mite numbers at S5 compared to S2 are likely to be due to the cleaning and repeated renovations during recent years. Furthermore, the newest and subjectively cleanest grocery S4 had the lowest mite numbers and the least mite positive samples.

The almost complete absence of house dust mites and their allergens suggests that storage mites are more important than house dust mites in groceries. This is in accordance with our previous studies [4]. The high amounts of mites found in the pet food and accessories aisles, and fruit and vegetable section is easily understood. The import of fresh material, as well as dried seeds and hay, is a good source of new mites to these sections [5]. It is not known whether the mites now found represent a true population, or if they are new individuals, continuously replenished from the imported material. The numerous hypopi found, however, suggests that a population might have been established.

It is also possible that mites are transferred from the storage areas to other areas of the groceries [8]. The high mite numbers from the fresh bread section at S1 is probably in accordance with the overall high mite numbers from this particular store, and the mites have at least partly migrated from other locations. Using the same clothing while unloading new goods to the storage area (often dusty) and working at the customers' side of the store may, in fact, contribute to the sometimes high mite numbers found.

Every sixth sample (n=10) contained more than 100 or 500 mites per gram of dust, which are the suggested limits for mite sensitization and acute symptoms, respectively [12]. These values are generated for house dust mites, but can probably also be used - with some reservation - for storage mites. In our study, the high mite numbers can probably be attributed to either moisture/mould damage or lack of cleaning. This is supported by our finding that the employees were annoyed due to the visible dust and dirt and; irritation of the respiratory tract, eyes and skin also was frequently reported (Questionnaire, data not shown). This emphasizes the need for proper cleaning and personal protection. On the other hand, having no mites in a sample does not automatically mean that there are no mites in the premises. Mite densities can be low, or the sampled location may not be ideal for mites to thrive.

## CONCLUSIONS AND IMPLICATIONS

Mites, especially storage mites, are found in groceries, and sometimes in high concentrations. Thus, it is possible for the workers and even the customers to be exposed to mites and their allergens. Mites can be one of the causative factors for the indoor air complaints/problems in these work places. Proper cleaning practices and protection against mites is necessary in order to decrease exposure and minimize the symptom frequency among the workers. To summarize, mites will always be found in groceries, and workers - as well as customers - can be exposed to them.

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