

Storage mites dominate the fauna in Swedish barn dust.

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The mite fauna in hay dust of 16 farms located on the island of Gotland was analysed to establish whether there is a clear relationship between environmental exposure to storage mites and development of allergic symptoms. Eight of these farms belonged to farmers with respiratory symptoms related to barn dust (RS) and eight to healthy farmers (H). All farmers had previously participated in an epidemiological survey of hypersensitivity to respiratory allergens. The symptomatic farmers had not only a positive RAST to storage mites but they developed more than a 20% fall in FEV₁ when challenged with *Lepidoglyphus destructor* (*L. destructor*) extract. The asymptomatic farmers were all negative in RAST to storage mites. Mites were found on all farms and the degree of infestation varied enormously, mite counts ranging from 75-150,000 mites/g dust. Five genera were detected but the different mite species were not represented on all farms. *L. destructor* was the dominating species on 13 of 16 farms. Samples from RS farms contained a significantly higher number of mites than H farms. The results of this study are in good agreement with our earlier studies showing that *L. destructor* is the most important allergen causing symptoms from both upper and lower airways among farmers.

Key words: allergy; barn dust; *Lepidoglyphus destructor*; storage mites.

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CLINICAL ASPECTS

In a mite inventory on farms on Gotland, an island in the Baltic Sea, mites were found on all farms, which indicates that farmers who handle stored hay on a daily basis should be at risk of developing storage mite allergy.

In rural environments repeated exposure to organic dust during work may provoke several types of respiratory disorders. Studies from both Europe (7, 20) and the UK (1, 5) have established that farmers and farm-workers develop IgE-mediated respiratory allergy to storage mites when handling stored hay or grain. Storage mites may also be responsible for work-related symptoms in grain-store workers (2, 15). These mite species are also a problem for people living in damp houses, where they may increase more rapidly and eventually constitute a higher total mite count than the Pyroglyphidae (18). Iversen and co-workers have recently pointed

out that farmers are exposed to storage mites not only at work but also in their damp dwellings (13). Further, Campbell et al. have sampled barn air from dairy barns in North America and demonstrated an abundance of *L. destructor* aeroallergens (3). Thus, these mites are causing inconvenience to many farmers throughout the world.

During the last two decades several studies have shown that storage mites occur in rural surroundings, for instance in grain, straw and hay (5, 6, 14). Barn dust contains a variety of biological material including molds and mites. Storage mites, in particular, infest stored food

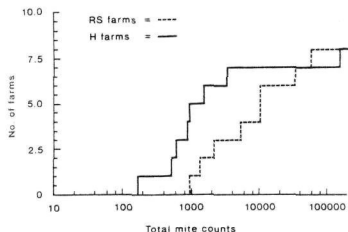


Fig. 1A. The cumulative frequency of mite counts in samples taken from the central part of the hay storages on RS farms (farms belonging to farmers with respiratory symptoms due to storage mite allergy) and H farms (farms belonging to healthy farmers).

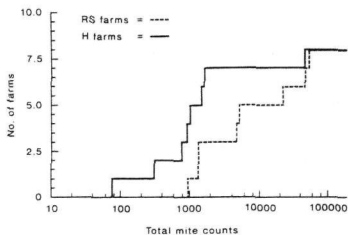


Fig. 1B. The cumulative frequency of mite counts in samples taken from hay located close to the outer wall on RS farms (farms belonging to farmers with respiratory symptoms due to storage mite allergy) and H farms (farms belonging to healthy farmers).

and vegetable products, causing heavy financial losses. Moreover, they are found in stored grain in many parts of the world, above all where the climate is temperate and large quantities of cereal grain are grown and stored (16, 17). Apparently, the weather conditions at harvest are of importance. We have analysed the mite fauna in hay dust to establish whether there is a clear relationship between environmental exposure to storage mites and development of allergic symptoms.

MATERIAL AND METHODS

Sixteen farms on Gotland, an island in the Baltic Sea, were chosen for the study. Eight of these farms belonged to farmers with respiratory symptoms related to barn dust (RS farms) and eight to healthy farmers (H farms). The farms were located all over the island. All farmers had previously participated in an epidemiological investigation of respiratory symptoms. The symptomatic farmers had not only a positive RAST (≥ 0.35 PRU/ml) to storage mites, but in an earlier bronchial provocation study they had developed $> 20\%$ fall in FEV_1 when challenged with *L. destructor* extract. The asymptomatic farmers were all RAST negative to storage mites.

All dust samples were collected on the same occasion in October 1988. The samples came

from two different storage areas, one from hay stored close to an outer wall and the other from the centre. All samples were collected from dust on or near the floor and placed in clean plastic bags. Each sample had a dry weight of 50–100 g. The samples were first sieved (mesh size 1 mm) before live and dead mites were counted under a lens. Lactic acid was added to 100 mg of each sample before counting under a microscope at a magnification of 50. Identification was made according to Hughes (11). The number of mites in each sample was determined and recorded as mites/g dry weight of hay dust.

Statistical analysis

The Mann-Whitney U-test was used to estimate the difference in mite counts between farm owners with storage mite allergy and healthy farmers.

RESULTS

Thirty-two samples were analysed. Mites were found on all farms, but the numbers varied considerably. The geometric means of the total mite count in samples taken from the centre and close to the outer wall on the RS farms were 6362 and 6184, respectively, compared with 1535 and 1084 on the H farms. The two

samples from farms belonging to symptomatic farmers contained a significantly higher number of mites than samples from farms belonging to healthy farmers ($P < 0.05$) (Fig. 1A and B). However, the highest number was found on a farm belonging to a healthy farmer. The degree of infestation varied enormously, mite counts ranging from 75–150,000 mites/g dust. Numbers for the dominant groups are shown in Table 1. *L. destructor* was the dominating species on 13 of the 16 farms. Fig. 2 shows the proportion of *L. destructor* in relation to the total mite count in samples taken from the centre of the hay storages on RS and H farms. In samples with high numbers of *L. destructor*, approximately 90% of the material were hypopi. Tydeidae spp. were the second most common group, although *Glycyphagus domesticus* was the main species on two farms. Predator mites of the genus Cheyletus, especially *Cheyletus erruditus* were common, of other species, *Acarus siro* was the most common. Small numbers of *Tyrophagus putrescentiae* and *Carpoglyphus lactis* also occurred in some samples. It is noteworthy that Dermatophagoides was not found on any farm.

DISCUSSION

Since the late seventies several studies have shown that storage mites are the most important allergens in farming environments to cause symptoms in the upper and lower airways (1, 5, 7, 13, 20). The symptoms frequently occur while working in the barns or immediately afterwards. In Sweden IgE-mediated allergy to storage mites is a far greater problem in rural populations than farmer's lung (7). Early detection is mandatory since symptoms become aggravated with time. Bronchial provocation studies have confirmed that storage mite species provoke asthma (9, 12).

This mite inventory is the first where comparison can be made between the farms of farmers with storage mite allergy and those of farmers without allergic symptoms. The results suggest, firstly, that a great number of mites occur in Swedish barn dust and, secondly, that farms belonging to symptomatic farmers are more heavily infested than those belonging to healthy farmers. *L. destructor* not only appears to be the most common storage mite species on Swedish

Table 1.

Occurrence of the most frequently detected mite groups in hay samples from the central part of the hay storages on RS' and H' farms

	Lepidoglyphus	Glycyphagus	Acarus	Tydeidae	Cheyletus
RS' farms					
1	–	4640	–	560	80
2	53680	–	1840	–	260
3	690	–	–	260	–
4	8230	–	–	900	1070
5	32780	–	–	330	–
6	9380	–	–	630	60
7	310	–	400	620	–
8	1270	–	360	460	30
H' farms					
1	690	–	60	150	40
2	2780	–	30	330	110
3	–	360	20	210	–
4	590	–	–	280	–
5	1260	–	–	230	30
6	480	–	–	30	–
7	110	–	–	60	–
8	140670	–	110	6780	1780

RS' farms = farms belonging to farmers with respiratory symptoms due to storage mites.

H' farms = farms belonging to healthy farmers.

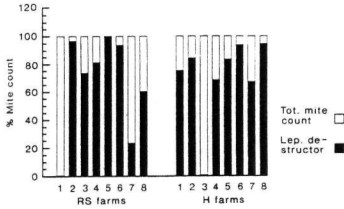


Fig. 2. The proportion of *L. destructor* in samples taken from the central part of the hay storages on RS farms (farms belonging to farmers with respiratory symptoms due to storage mite allergy) and H farms (farms belonging to healthy farmers).

farms, but is also the species most frequently responsible for heavy infestation. However, on two farms, *Glycyphagus* was the main species. Only few mite species were found on the farms, which is in agreement with a Finnish study based on a smaller number of farms (19). *L. destructor* was the most common species in hay storages in the Finnish study and also occurred in high numbers in grain bulk in England and Wales (6). In contrast, Hallas found significant amounts of *Tarsonemus* spp. in stored hay on Iceland, which, according to the author, is unique to the island (10). Cuthbert et al. (5) from Scotland reported high numbers of *Acarus* and *Tyrophagus* in hay and grain dust samples taken from 16 farms. They found almost the same genera as we had in Sweden, but species belonging to the *Glycyphagidae* family were not dominating. Another study from Scotland by Jeffrey and colleagues reported the existence of several genera in barn dust (14). In a recent study, Iversen et al. (13) found high quantities of mites in rural dwellings and farms in Denmark. *L. destructor* was the dominant species in grain and straw, and *Acarus siro* in hay. The study suggests that storage mite allergy is not exclusively due to occupational exposure but also to indoor exposure. In general, all countries in northern Europe have the same mite fauna, probably due to similar climatic conditions.

Barn dust contains both living and dead mites. In contrast to many other studies, we

decided to count both living and dead. The most important probable cause of sensitization is fragments from dead mites or faecal pellets, since such particles are more easily airborne than whole, living mite bodies. Allergen measurements will also mirror the total mite load and not only living mites.

On the basis of an epidemiological survey of 2578 farmers on Gotland we have earlier reported that *L. destructor* is the most common allergen among farmers, with a positive RAST prevalence of 6.2% (7). The present study indicated that *L. destructor* is the dominating mite in barn dust on Gotland farms. This is in accordance with our earlier *in vivo* findings with RAST and confirms that there is an association between exposure to high quantities of storage mites, particularly *L. destructor*, and sensitization to these mites. This sensitization pattern might also explain our data on allergic cross-reactivity between storage and house dust mites (8). Furthermore, since mites were found on all farms, one might expect that all farmers who have hay storages can be exposed. Therefore, farmers who handle stored hay on a daily basis should be aware of the distinct risk of developing storage mite allergy.

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