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Storage mites and allergy

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Storage mites (food mites)

Like house dust mites, storage mites belong to the arachnid class (*Arachnida*) and are distributed worldwide. They are tiny, eight-legged, whitish-coloured arachnids measuring between 0.3 and 0.8 mm, barely visible to the naked eye.

Storage mites are ubiquitous in the environment and are introduced into flats, houses and stables via contaminated food and feed. In most cases, only 1 – 2 % of the mites in house dust are storage mites, as they need a permanent air humidity of 70 %. Below a relative humidity of 60 %, they cannot develop, but if the air humidity is high enough, they gain an advantage over the house dust mites and can reach an enormously large population in a short time. The mould mite is particularly prolific among storage mites, as it can lay more than 100 eggs a day at a humidity of 85 – 95 % and a permanent temperature of 25 °C. Under these optimal conditions, the life cycle is completed in 5 – 6 days. Thus, a flat can be populated with billions of mites in only 1 to 2 months, which can be seen as a whitish to pinkish live/moving dust on smooth surfaces!

Storage mites are saprophytes of hay, grain or stored food (flour, sugar, fruit, nuts, meat) and feed. They are prevalent when feed or foodstuffs are ground and stored in high humidity. They also feed on moulds that grow on food or feed. One gram of pet food or cereal may contain several thousand storage mites. Storage mites can also be found in house dust, kitchen cupboards and pantries. They can feed on wallpaper paste made from methylcellulose or starch and even glue from oil paints stored in damp conditions. It can be a problem in newly built houses that are still damp.

Fig. 1: If treats are left for a longer period of time and become "dusty", then the "dust" contains a lot of storage mites, eggs, larvae and mite faeces.

Picture credits: Dr Regina Wagner

Allergens are mainly found in mite faeces, but parts of the mite's body also have allergenic properties. After breaking the envelope around them, allergens in faeces are released and become airborne particles. Dried faeces are broken down into dust, which is raised when handling food and feed. For this reason, allergy to storage mites is even recognised as an occupational disease in certain groups of workers.

Storage mites are significant pests that are not only found in hay dust, grain stores and silos but also in cereal packages, feed sacks

and flour. In the case of flour, infestation even causes a change in baking quality. Where plant food and feedstuffs are stored or milled with high humidity, mite infestation is exceptionally high. High humidity is associated with high levels of moulds (*Alternaria, Streptomyces* and *Penicillium* species) on which storage mites also feed.

The presence of storage mites is not an indicator of a lack of hygiene and cleanliness. Storage mites do not transmit diseases and do not infest humans or animals. The presence of the mites is often only noticed when a person or animal is allergic to them. Numerous veterinary studies have tested dog feed for storage mites. In one of our studies, storage mites were found in 15.6 % of the samples tested; the positive samples were all expired (i.e. over-stored) feed. Interestingly, this study found that mites stored in the freezer took three days to die. A study that examined 23 bags of dog food did not detect storage mites in any of the bags. Another study saw *Acarus* and *Tyrophagus* mites in feed mills. Examination of 10 bags of dog food in a Spanish research yielded the following results: *Acarus siro* was found in one newly opened (unexpired) bag and five weeks after storage in typical household situations (stored at 71 % humidity and 23 °C), *Tyrophagus* mites were found in 9 of the 10 bags. Identical samples stored under laboratory conditions showed no mites after the 5-week storage period. In an English study, samples of the same dry dog food were stored in 10 different households and three containers (paper bag, sealable plastic bag, sealable plastic box) for 90 days. Dust mite and storage mite levels were significantly higher in the food stored in the paper bags than in the other two containers. The mite load was substantially higher if there was a dog bed or carpet in the storage room.

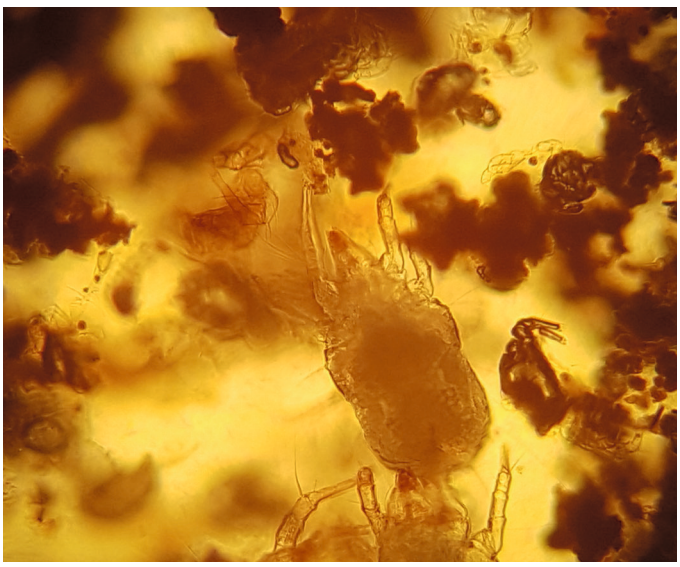

Fig. 2: Microscopic mite detection in the feed.
Picture credits: Dr Regina Wagner

Usually, the allergen is absorbed through the skin transcutaneously. However, a scientific study indicates that inhaling or ingesting the storage mite allergen can also cause clinical signs in the dog. Beagles that were only sensitised to the house dust mite *D. farinae* also reacted to a deliberate provocation with *T. putrescentiae* with corresponding clinical signs. This phenomenon allows conclusions to be drawn about the cross-reactivity of house dust mites and storage mites with each other.

Storage mites cannot be completely eliminated from the environment, but measures can be taken to reduce allergen pressure. Dry storage of food/feed and grain is the number one control measure. For biological control, the cereal predatory mite *Cheyletus eruditus* can be used. Diatomaceous earth, which leads to the desiccation of the mites, has also been used successfully as a biocide. Other control measures are gaseous acaricides.

The occurrence, development and cross-reactions of the most important storage mite species are discussed below:

Acarus siro **(flour mite)**

The main food of the flour mite is, as the name suggests, flour and other cereals (cereal flakes), cheese, hay, nuts and moulds.

The mite development lasts ten days (28 days if the temperature is between 10 and 15 °C), with a life span of 30 to 50 days. In addition to the air humidity, the substrate moisture of infested foodstuffs (at least 14 %) is particularly important.

Cross-reactions: strong with *Tyrophagus*, but only partial with other storage and house dust mites.

Fig. 3: *Acarus siro* *Picture credits: Dr Patrick Bourdeau*

Tyrophagus putrescentiae **(mould mite)**

The mould mite is found where high humidity contributes to mould growth (not always visible to the naked eye!). This mite is mainly found in food and feed with a high protein and fat content. Its main foodstuffs are: wheat flour, soya flour, yeast, cultivated mushrooms, various seeds and fruits, straw, hay, decaying material (compost, manure, leaves, etc.), milk powder, ham, nuts, dried fruit, egg powder and mould.

Mite development lasts 5 to 21 days (the lower the ambient temperature, the longer the development cycle). Optimal conditions are temperatures above 30 °C with humidity above 85 %. The mite can withstand high temperatures, and the female lays about 500 eggs.

Glycyphagus domesticus **(house mite, sugar mite)**

This mite is often found where vegetables or feedstuffs are ground or stored in excessively wet conditions. They also feed on moulds that grow on food. In flats, the mite lives in food and in damp areas (preferably in old upholstered furniture). It is only slightly sensitive to light and, under optimal conditions (relative humidity 65 – 100 %, temperature about 20 – 30 °C), develops in 22 days and has an average lifespan of 50 days.

Cross-reactions: strong with *Lepidoglyphus*, but only partial with other storage and house dust mites.

Fig. 4: *Glycyphagus domesticus* *Picture credits: Dr Regina Wagner*

Lepidoglyphus destructor (plum mite, hay mite)

L. destructor is the most widespread and numerous storage mite, especially in stables. It contains at least 20 allergenic proteins. The primary allergen, Lep d 2, is found in the digestive tract of the mite. Lep d 10 is an allergen homologous to tropomyosin and can cross-react with *Crustacea* (crustaceans). These mites also feed on moulds (especially *Alternaria* and *Penicillium*) and feed. The female mite lays up to 150 eggs and avoids light. Development can occur at temperatures between 3 and 34 °C and relative humidity above 60 %. At a temperature of 25 °C and relative humidity above 60 %, the life cycle lasts 12 to 27 days. However, these mites are relatively sensitive to freezing temperatures. *Lepidoglyphus* lives in cereals and cereal products, nuts, hay and straw, dead insects, and bumblebee and rodent nests.

Cross-reactions: strong with *Glycyphagus*, partial with other storage mites and house dust mites, possible with crustaceans (*Crustacea*). In dogs, cross-reaction with house dust mite (*D. pteronyssinus*) has been demonstrated.

Fig. 5: *Lepidoglyphus destructor* *Picture credits: Dr Patrick Bourdeau*

Valuable tips for storage mite allergy sufferers

- Immediately after opening the original package, transfer the dry food into a re-sealable container (plastic, washable). Discard the fine dust at the bottom.
- Always store dried food and supplies in an airtight container. The most suitable containers are tightly closed plastic containers. Regularly remove fine dust deposits from the container and clean it thoroughly, especially before adding new feed.
- Do not store food in the same room as the dog's bedding.
- Store food at the lowest possible temperatures and in a dry place (relative humidity should not exceed 40 %).
- Freezing may prevent further contamination, but if mites are present, allergens will still be present even if frozen.
- Buy small containers to feed fresh feed at all times.
- There is a higher amount of storage mites in expired feed, so it should be used before its expiry date.
- Use moist or canned feed or homemade food.
- In the agricultural sector, it is essential to strictly separate the working and living areas to prevent the introduction of mites (e.g. consistent removal of work clothing).

Mite allergies occur most frequently in dogs, cats and horses. If clinical signs of atopic dermatitis are present, an allergy test (Fcε-receptor test) should be performed to detect possible sensitisation to mites. Based on the findings, the allergen-specific immunotherapy solution (ASIT) should be prepared. ASIT is the only causal therapy for this allergy and should be the therapy of choice, in addition to allergen reduction, but complete avoidance is very difficult to achieve.

Further reading

Wagner R, Hunsinger B. Allergene bei Tieren. Bad Kissingen: Laboklin GmbH & Co. KG; 2016.
Olivry T, Mueller RS. Critically Appraised Topic on Adverse Food Re-actions of Companion Animals (8): Storage Mites in Commercial Pet foods. BMC Vet Res. 2019 Oct 31;15(1):385.