

IMPORTANCE OF HOUSE DUST AND STORAGE MITES IN CANINE ATOPIC DERMATITIS IN THE GEOGRAPHIC REGION OF GALICIA, SPAIN

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Sensitisation to mites is frequent in atopic dogs. The main mite genus involved in canine atopic dermatitis is *Dermatophagoides*. The importance of storage mite allergens in dogs has been controversial. The aim of this study was to evaluate the sensitisation rates against storage mites (*Lepidoglyphus destructor* and *Tyrophagus putrescentiae*) and house dust mites (*Dermatophagoides farinae* and *D. pteronyssinus*) in atopic dogs from Galicia, a highly humid and temperate region of Spain, using a FcεRIα-based immunoglobulin E (IgE) *in vitro* test. The study was performed on 95 dogs suffering from atopic dermatitis and presenting detectable specific serum IgE levels: 91.6% of the dogs tested positive for storage mites, whereas sensitisation to house dust mites was detected in 87.4%. These results indicate the importance of storage mites in this specific geographic area.

Key words: House dust mite, storage mite, dog, atopy, allergy

Atopic dermatitis is one of the most common skin diseases affecting dogs. Numerous allergens have been suggested to be involved in the pathogenesis of this disease. Classically, house dust mite and epidermal allergens were considered to be of major importance in Europe (Carlotti and Costargent, 1992; Sture et al., 1995; Saridomichelakis et al., 1999). More recently, several studies have confirmed the importance of storage mite allergens in atopic dermatitis of European dogs (Saridomichelakis et al., 1999; Bensignor and Carlotti, 2002).

The frequency of reported mite sensitisation in atopic dogs ranged from 32% to 74% for house dust mites and from 36% to 80% for storage mites, de-

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pending on the country and the method used for detecting the presence of allergen-specific IgE (intradermal or serologic tests) (Carlotti and Costargent, 1992; Sture et al., 1995; Saridomichelakis et al., 1999; Bensignor and Carlotti, 2002).

There are more than 36 species of house dust mite. The species belonging to the Pyroglyphidae family (*Dermatophagoides farinae* and *D. pteronyssinus*) appear to be the most important in canine atopy. The predominant storage mites (nonpyroglyphid mites) belong to the Glycyphagidae (*Lepidoglyphus destructor*) and Acaridae (*Acarus siro*, *Tyrophagus putrescentiae*) families, which are present in cereal products and also in house dust (Prélaud, 2000).

The aim of this study was to determine the prevalence of sensitisation to house dust and storage mites in atopic dogs in Galicia, a humid and temperate region in the northwest of Spain.

Materials and methods

Selection of dogs

Canine atopic dermatitis was diagnosed in 95 dogs that were referred to the Veterinary Clinical Hospital in Lugo (University of Santiago de Compostela) by Galician local general practitioners. The patients came from four different geographic areas of Galicia; A Coruña (n = 34), Lugo (n = 32), Pontevedra (n = 16) and Ourense (n = 13). Data on the average annual climate in Galicia are presented in Table 1.

Table 1

Range of annual climatic averages (1971–2000)
reported from different meteorological stations of Galicia
(Spanish National Institute of Meteorology)

Minimum temperature	6.3–11.4 °C
Maximum temperature	16.8–20.6 °C
Rainfall	817–1909 mm
Relative humidity	66–79%

The diagnosis of atopic dermatitis was based on a combination of clinical symptoms, together with the presence of three out of five of the major criteria proposed by Prélaud et al. (1998) (Table 2). Pruritic non-allergic dermatoses that could mimic atopic dermatitis were excluded through multiple skin scrapings for ectoparasites. Moreover, an acaricidal therapy was performed if sarcoptic mange was suspected and skin scrapings were negative. To prove the presence of allergen-specific IgE in the serum of the selected dogs, a screening test (TOPSCREEN[®],

CMG-Heska) was performed, and only dogs with positive test results were included in the study.

Table 2

Major criteria for canine atopic dermatitis diagnosis proposed by Prélaud et al. (1998)

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- Corticosteroid-sensitive pruritus
 - Erythema of pinnae
 - Bilateral cranial erythematous pododermatitis
 - Cheilitis
 - Appearance of first signs between the ages of 6 months and 3 years
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A variety of breeds was included, of ages ranging from 9 months to 11 years (mean: 3.5 years); 68.4% of the cases were male.

Serological test: evaluation of allergen-specific IgE

Blood samples (2 ml) were taken from each dog. After centrifugation, serum was analysed for allergen-specific IgE. Specific IgE against *Dermaphagoides farinae*, *D. pteronyssinus* and storage mites (a mix of *Lepidoglyphus destructor* and *Tyrophagus putrescentiae*) was detected by an Allercept® test (Heska Corp.), an *in vitro* assay that uses a biotinylated recombinant extracellular domain of the high-affinity Fc-epsilon receptor alpha chain protein (FcεRIα). Optical density (OD) results higher than 150 EA units were considered positive (cut-off established by Heska).

None of the dogs had received topical, oral or injectable glucocorticoids during the 4 weeks prior to the serological assay.

Statistical analysis

Correlations between results of sensitisation to different allergens were assessed using Pearson's correlation coefficient, and the effect of geographic area on sensitisation was studied by a one-way analysis of variance. The Statgraphics Plus 5.1 statistical package was used. The level of statistical significance was set at 0.05.

Results

Of the 95 atopic dogs included in the study, 92 (96.8%) were sensitised to mites. Most of them (84.8% of the dogs sensitised to mites) were positive to both house dust and storage mites. Only 5 dogs (5.3% of atopic dogs) were positive to

house dust mites alone, and 9 (9.5% of the atopic dogs) were monosensitised to storage mites.

The results of all tests are shown in Table 3.

Table 3

Number of dogs showing positive results to mites and percentage of positive reactions

	Dogs	Percentage (%)
<i>Dermatophagoides farinae</i>	4	4.3
<i>D. pteronyssinus</i>	0	0.0
Storage mites	9	9.8
<i>D. farinae</i> and <i>D. pteronyssinus</i>	1	1.1
<i>D. farinae</i> and storage mites	38	41.3
<i>D. pteronyssinus</i> and storage mites	0	0.0
<i>D. farinae</i> , <i>D. pteronyssinus</i> and storage mites	40	43.5
Total	92	100

Eighty-three dogs (87.4% of the atopic dogs) presented specific IgE against at least one type of house dust mite. All of these dogs were sensitised to *D. farinae* and only 41 (43.2% of atopic dogs) were positive to *D. pteronyssinus*.

Specific IgE against storage mites was detected in 87 dogs (91.6% of the atopic dogs).

There were no significant differences in sensitisation to the different mites between dogs originating from different areas of Galicia. However, dogs from Ourense were less sensitised to *D. farinae* (69.2%) than dogs from the other areas (A Coruña: 94.1%, Pontevedra: 81.2%, Lugo: 90.6%), and dogs from Lugo were more sensitised to *D. pteronyssinus* (53.1%) than dogs from the other areas (A Coruña: 38.2%, Pontevedra: 37.5%, Ourense: 38.5%).

Correlations between the OD results obtained for the different allergens are shown in Table 4.

Table 4

Correlation between OD results to different allergens

	<i>D. pteronyssinus</i>	Storage mites
<i>D. farinae</i>	0.45 (P < 0.001)	0.67 (P < 0.001)
<i>D. pteronyssinus</i>	–	0.37 (P < 0.001)

Results presented include Pearson's correlation coefficient (and statistical significance)

Discussion

The present study has assessed the sensitisation rates to different species of mites in dogs in a region where the climate tends to be rainy and temperate (Table 1).

High levels of sensitisation to storage mites (91.6%) and house dust mites (87.4%), mainly to *D. farinae*, were detected in the atopic dogs.

These results are consistent with those observed for the allergic human population of Galicia, where sensitisation to storage mites (86%) is more prevalent than sensitisation to *D. pteronyssinus* (50.4%), which was traditionally considered the main allergen in Galicia (Vidal et al., 2004).

However, a lower level of sensitisation to both house dust and storage mites has been obtained in other studies performed in different European countries (Carlotti and Costargent, 1992; Sture et al., 1995; Saridomichelakis et al., 1999; Bensignor and Carlotti, 2002; Tarpataki et al., 2006), using different tests, where dogs showed positive reactions to at least one aeroallergen. Sensitisation to storage mites was found to be between 37% and 48% (Saridomichelakis et al., 1999; Bensignor and Carlotti, 2002). Similarly, data describing house dust mite sensitisation indicated lower levels than those reported in our study, ranging from 45% to 71% (Sture et al., 1995; Bensignor and Carlotti, 2002). The explanation for this could be the different climate conditions prevailing in Galicia, mainly the extremely high annual precipitation in Galicia in comparison with other European countries.

The lower prevalence of sensitisation to mites in atopic dogs in colder and/or less humid European countries could be explained by the climatic conditions, since a low temperature and, more importantly, a low relative humidity have been associated with a lower number of house dust mites, and active mites do not survive longer than 6–11 days under conditions of relative humidity below 50% (Arlian, 1992).

Curiously, the sensitisation to storage mites found in our study is similar to that reported in a study which determined IgE against storage mites in the sera of atopic dogs from different regions of the USA and Europe (Arlian et al., 2003). In that study, 94% of the atopic dogs were positive to storage mites (*Blomia tropicalis*, *Acarus siro* and *Tyrophagus putrescentiae*), and 83% were positive to *T. putrescentiae*. Furthermore, this study reports that sensitisation to house dust mites is lower than to storage mites (68% and 34% of sera positive to *D. farinae* and *D. pteronyssinus*, respectively), which agrees with our results.

Nonpyroglyphid species of mite are found in both temperate and subtropical climates. These mites require higher levels of humidity than house dust mites for their optimum living conditions. In Galicia, storage mites are frequently found in house dust. One study reported that 71% of house dust samples contained storage mites, mainly *L. destructor* (Vidal et al., 1997), while another detected low concentrations of *L. destructor* allergen in almost all homes studied

and high concentrations of *T. putrescentiae* allergen in all homes studied (Boquete et al., 2000).

As Vidal et al. (1997) note, in order to adapt the composition of immunotherapy, we need to elucidate whether the frequency of sensitisation to storage mites is due to cross-reactions with house dust mites or to multiple sensitisations. Several studies have reported limited or inexistent cross-reactivity between storage mites and mites of the genus *Dermatophagoides* (Vidal et al., 1997). Our results show a significant correlation between house dust mites and storage mites. This correlation is not strong between *D. pteronyssinus* and storage mites, similarly as it has been reported in studies of humans (Vidal et al., 1997), but the correlation between *D. farinae* and storage mites is stronger and higher than that reported in studies of humans (Vidal et al., 1997).

High cross-reactivity among several species of storage mites has been reported (Vidal et al., 1997). This would justify the use of combinations of storage mite allergens in serological tests in order to reduce costs and to increase efficacy, as occurs in human medicine (Mueller et al., 2002). Nevertheless, it has been suggested that atopic dogs positive to storage mites are sensitised to multiple species of mites (Arlian et al., 2003), and preliminary results for atopic dogs using intradermal tests suggest that allergen-specific immunotherapy should be formulated on the basis of single allergen test results (Mueller et al., 2002).

However, the use of combinations of house dust mite allergens in serological tests is not recommended. The strong cross-reactivity between *D. farinae* and *D. pteronyssinus* observed in humans probably does not exist in dogs (Prélaud, 2000), because dust mite allergens relevant to humans are not as important in dogs (Schumann et al., 2001). As reported, the two species do not seem to interbreed, as the major epitopes of *D. farinae* should be absent in *D. pteronyssinus*, which could explain the high frequency of monosensitisation to *D. farinae* in dogs (Prélaud, 2000).

Our results show a significant correlation between *D. farinae* and *D. pteronyssinus*, similar to the OD correlation reported by Foster et al. (2003) using the same test (ALLERCEPT). Nevertheless, the correlation between these two mites was found to be weaker than that reported in studies of humans (Vidal et al., 1997).

Unlike human sensitisations, dogs are more sensitised to *D. farinae* than to *D. pteronyssinus* as reported in all European studies (Carlotti and Costargent, 1992; Sture et al., 1995; Saridomichelakis et al., 1999; Bensignor and Carlotti, 2002; Foster et al., 2003; Tarpataki et al., 2006), in conformity with our results. The ratio between sensitisations to *D. farinae* and *D. pteronyssinus* varies greatly among studies, ranging from 1.06 to 5.37, mainly when sensitisations to *D. pteronyssinus* are low. Our results showed a ratio of 2.02, which is markedly lower than that reported by Foster et al. (2003) using the same serological test. The explanation for these differences could be the modifications made to the OD cut-off of the test (from 350 EA units to 150 EA units) in recent years, which

will have probably increased the sensitivity of the test for both allergens, revealing an increase in positive results for *D. pteronyssinus*.

None of the dogs sensitised to house dust mites were negative to *D. farinae* in this study. This agrees with the results of most European studies (Sture et al., 1995; Bensignor and Carlotti, 2002) which show that sensitivity to *D. pteronyssinus*, in the absence of sensitivity to *D. farinae*, is uncommon.

It has been reported that the *D. farinae* allergen predominates in inland regions and the *D. pteronyssinus* allergen in coastal regions (Macan et al., 2003). Studies performed in Liverpool (UK) showed that Der f 1 levels were generally 100–1000 times lower than Der p 1 levels (Raffan et al., 2005). Similarly, in Galicia, *D. pteronyssinus* is the predominant house dust mite since Der f 1 levels are very low or undetectable (Boquete et al., 2000).

Nevertheless, levels of Der f 1 may not be important as this is not a major allergen for atopic dogs (Schumann et al., 2001). This is supported by the fact that, although Der f 1 was found to be absent in coastal house dust samples, *D. farinae* mites were observed microscopically in those samples (Macan et al., 2003). This could explain the positive reactions to *D. farinae* in dogs from areas with low levels of Der f 1, although other hypotheses have been proposed, e.g. cross-reactions with *D. pteronyssinus* (Raffan et al., 2005) or other mites (Noli, 1998) such as *Otodectes cynotis* and *Sarcoptes scabiei*, greater sensitivity of dogs to *D. farinae* compared with *D. pteronyssinus* (Noli, 1998) or lower allergenicity of *D. pteronyssinus* to dogs compared with *D. farinae* (Schumann et al., 2001).

Our result, that 43% of atopic dogs are sensitised to *D. pteronyssinus*, could be explained by the humid climate of Galicia, as it is similar to other results reported for coastal areas: 66% reported by Foster et al. (2003) in Liverpool and 54% reported for dogs from Thessaloniki (Saridomichelakis et al., 1999) using an intradermal test. However, it is different from other results reported by Sture et al. (1995) in Edinburgh (9%) by intradermal test, which could be explained by the colder climate, or by Foster et al. (2003) in Liverpool (14%) using the same serological test as we did, which could be explained by the lower sensitivity of the test in that study.

The specific profile of aeroallergen sensitisation in a given region has obvious therapeutic implications. In our region, most atopic dogs will benefit from mite avoidance measures such as acaricidal treatment of houses.

In our study, 91.6% of the atopic dogs were positive to storage mites. This would confirm the high prevalence of storage mites in the Galician environment.

Storage mites, mainly *T. putrescentiae*, are found in pet food (Brazis et al., 2004). In human medicine, it has been shown that the ingestion of mite-contaminated food can cause allergic reactions, and two cases have been reported when systemic anaphylaxis developed shortly after consumption of a food contaminated with *T. putrescentiae* (Matsumoto et al., 1996). A study showed that commercial dry dog food was mite free immediately after opening the packages,

but became infested 8 weeks later (Brazís et al., 2004). For that reason, it is recommended that small packages of dry food should be used to feed dogs that are allergic to storage mites.

In conclusion, this study has shown that storage mites should be considered major allergens in Galicia and perhaps also in other humid and temperate regions.

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