

PREVALENCE AND FEATURES OF CANINE ATOPIC DERMATITIS IN HUNGARY

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Medical records of 600 dogs diagnosed with atopic dermatitis were reviewed and evaluated with reference to history, geographical distribution, breed predilection, clinical signs and positive reactions to allergens as determined by intradermal skin testing (IDT) manufactured by Artuvetrin Laboratories^{**}. In 66.6% of dogs, the age of onset of atopic dermatitis was between 4 months and 3 years. Dogs living in the garden suburb of Budapest were more sensitive to house dust mites, fleas and moulds, and dogs from the western part of Hungary were more sensitive to weeds than to other allergens ($p < 0.01$). Positive reactions were most common to *Dermatophagoides farinae* followed by human dander. The breed distribution found in the present study was consistent with that reported in the literature, except for the breeds Hungarian Vizsla, Pumi, French bulldog, Doberman Pinscher and Bobtail which were over-represented among atopic dogs compared to the breed distribution of the general dog population of a large city in Hungary. Breeds with verified adverse reaction to food were Cocker spaniels, French bulldogs, Bullmastiffs, Bull terriers, St. Bernards, Tervurens, West Highland White terriers and American Staffordshire terriers ($p < 0.05$). The clinical signs of atopic dermatitis and their occurrence are in accordance with the data described in the literature.

Key words: Dog, atopic dermatitis, IDT, statistical analysis

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Canine atopic dermatitis occurs all over the world. Approximately 10% of dogs suffer from atopic dermatitis in the USA and Europe. This is the second most common allergic dermatitis after flea allergic dermatitis in dogs. Canine atopic dermatitis (AD) is, basically, an inherited capacity to develop IgE antibodies against environmental allergens, leading to clinical allergic dermatitis. High IgE antibody titres to common allergens, however, are seen in healthy animals. Accordingly, the diagnosis of AD has to be established by the owner's history, the basis of typical clinical findings and exclusion of other diagnoses (Willemse, 1986; Carlotti, 2000). The diagnostic criteria of Willemse are traditionally arranged in the so-called major and minor criteria. If 3 major and 3 minor criteria are established, and diagnoses other than atopy (pyoderma, flea allergic dermatitis, *Sarcoptes* infestation, adverse reaction to food and all the other pruritic skin diseases) have been ruled out, the diagnosis of AD can be made. The diagnostic criteria of Carlotti (Carlotti, 2000) are grouped into major and minor criteria too, but they are somewhat different from those of Willemse (Table 1). Namely, the best compromise for diagnosis of AD in the practice is where three major criteria of Carlotti are satisfied. Considering the criteria, the greater the number that is satisfied, the more specific the diagnosis (but the lower the diagnostic sensitivity) will be.

Table 1

Diagnostic criteria for atopy in dogs according to Willemse (Willemse, 1986) and Carlotti (Carlotti, 2000)

Major criteria of Willemse	Minor criteria of Willemse
Family history	Onset before 3 years of age*
Breed predisposition**	Facial erythema and cheilitis*
Pruritus*	Bilateral conjunctivitis**
Facial and/or digital involvement*	Superficial pyoderma (bacterial folliculitis)**
Chronic or chronically recurrent dermatitis (for more than two years)**	Hyperhidrosis
Lichenification of the flexor surface of the tarsal joint** and/or the extensor surface of the carpal joint	Immediate skin test reactivity to airborne allergens*
	Increased allergen-specific IgE concentration*
	Increased allergen-specific IgG concentration*

*Major criteria of Carlotti: corticosteroid-responsive pruritus (at least at the beginning); otitis externa; inflammation of the internal surface of the pinnae; **Minor criteria of Carlotti: seasonal aggravation of symptoms; variation in severity with environmental changes; aggravation when in contact with the grass (may also result in contact dermatitis)

Then the identification of offending allergens will logically be the next step. For that purpose serological tests or intradermal skin testing (IDT) can be chosen. To generate such data has relevance only if the clinical diagnosis of atopic dermatitis had been established prior to the testing, because a large number of clinically healthy dogs have an increased level of allergen-specific IgE antibodies, too.

In Hungary, IDT has been used for more than 10 years in order to identify causing allergens in canine AD. Serological tests have been routinely available at most for two years only.

The aim of this work was to present a survey about the frequencies of canine AD and the occurrence of characteristic features of the disease based on 600 IDTs in our country. Such a large survey of canine AD has not been published so far in Europe. It is important for the small animal dermatologists' knowledge to have a picture about this region, too. Moreover, a lot of parameters were examined in each case, which allows us to report or state new, statistically proven aspects about AD.

Materials and methods

Dogs ($n = 600$) with subacute or chronic pruritus or recurrent pyoderma were examined by intradermal skin test (IDT). All dogs were referred by veterinary surgeons to the dermatology consultation of the Department and Clinic of Internal Medicine, Faculty of Veterinary Science, Szent István University, Budapest between 1999 and 2003. After taking the signalment and history and performing examinations, the same data were collected in each case. The breed proportion and gender ratio were compared to the dog population of Budapest in 2000 (Bende et al., 2003). Breeds and breed groups were examined, too. Skin scrapings were taken from all the dogs examined during the study. The 8-week-long elimination monodiet and the 3-week provocation diet to prove the adverse reaction to food (ARF) were prescribed if the patient had not had it before. Prior to skin testing all anti-inflammatory drug therapies, including oral and topical glucocorticoids and antihistamines, were discontinued for at least 3 weeks and 10 days, respectively. IDTs were made using allergen solutions manufactured by Artuvetrin Laboratories. The applied allergens (and their frequencies) are shown in Fig. 5.

Calculation of statistical significance was based on Pearson's correlation analysis and/or chi-square test using SPSS Version 12.0 for Windows.

Results

Dogs ($n = 600$) were examined by IDTs in Hungary between 1999 and 2003. Seventy-eight (13%) crossbred/mongrel and 522 (87%) thoroughbred/pedigreed dogs were represented with 79 breeds. The following breeds were

over-represented (Fig. 1): 57 (9.5%) German shepherd dogs, 36 (6%) Hungarian Vizslas, 31 (5.2%) Cocker spaniels, 26 (4.3%) Boxers, 24 (4%) West Highland White terriers, 22 (3.7%) English setters, 22 (3.7%) Poodles. The prevalence of IDT positivity in different breeds of the present study is listed in Table 2 compared to the dog population in Budapest.

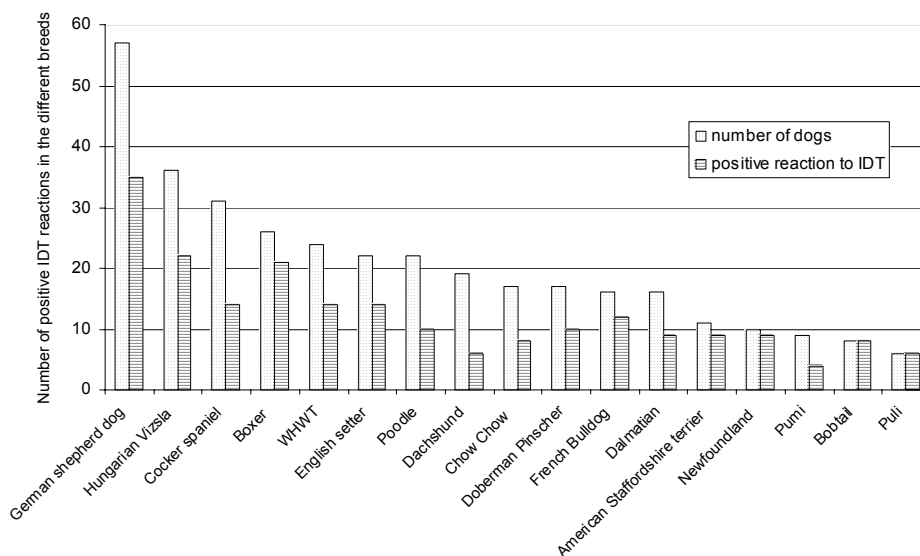


Fig. 1. Breeds and positive intradermal skin tests

There were 316 (52.7%) males, 7 (1.2%) castrated, 238 (39.7%) females and 39 (6.5%) spayed dogs in our survey. The dogs' age varied from 4 months to 12 years.

The dogs were distributed according to their origin to four geographical regions of the country (Fig. 2).

There were 308 (51.3%) dogs kept indoors, 88 (14.7%) kept outdoors, and 204 (34%) kept indoors and outdoors. Twenty-nine % of the patients lived together with other dog(s), 22% with cat(s) and 5.5% with bird(s). Seventy-five % of the patients were fed with mixed food, 16.6% with home-cooked food only and 8.4% with dry or canned food only. The main components of the food were chicken (92.2%), beef (84.7%) and pork (78.3%).

The examination of skin scrapings verified *Staphylococcus intermedius* in 58.4%, *Malassezia pachydermatis* in 28%, *Demodex canis* in 5.8% and *Sarcoptes scabiei* var. *canis* in 1.2% of the cases. *Ctenocephalides* infestation was diagnosed in 59 (9.8%) of all patients, the typical dorsocaudal localisation of skin symptoms for flea allergic dermatitis was seen in 140 (23.3%) patients but only 25 (4.2% of the IDTs) gave positive reactions to flea saliva extract. Three hundred and thirty dogs (55%) improved during the 8-week-long elimination mono-

diet but only 55 (16.7%) of them had verified ARF after the provocation diet. The majority (87%) of the food-allergic dogs were sensitive to chicken and 37% of them to a dry and/or a canned food.

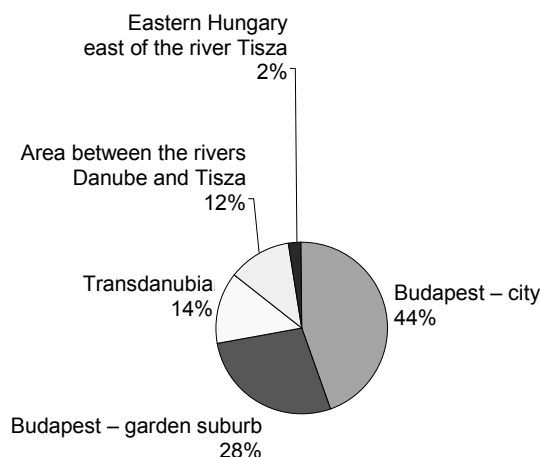


Fig. 2. Geographical distribution of the dogs examined

The majority (44%) of the examinations were performed in the autumn, 21% of the examinations each in the summer and winter, and the lowest number of examinations in the spring (14%). The symptoms began within 1 year before the examination in more than half of the cases (58%). In one-third of the cases the symptoms started before 1 year of age and in another one-third between 1 and 3 years of age. In two-thirds of the cases the onset of symptoms occurred in the spring and summer and in one-third of the patients in the autumn and winter. Pruritus was non-seasonal in 70% of the dogs. Drugs applied before the examination against the symptoms of atopic dermatitis and their efficacy are demonstrated in Fig. 3. The clinical symptoms and their prevalence are listed in Fig. 4.

IDTs were positive for one or more allergens in 373 cases (62.2%), and 3 major and 3 minor symptoms of Willemse were established in 286 cases (47.7%). The majority (272; 72.9%) of dogs with positive IDT were allergic to *Dermatophagoides farinae* house dust mite, 117 (31.4%) were sensitive to human dander and 97 (26%) to *D. pteronyssinus*. Weeds (30; 8%), common mugwort (*Artemisia vulgaris*) (29; 7.8%) and oak (*Quercus robur*) (25; 6.7%) were the most common among seasonal allergens (Fig. 5). The distribution of the 373 positive IDT results is demonstrated in Fig. 6. There were 52 positive reactions to cat epithelia, but only 17 (32.7%) of them were considered to be relevant, since no cats were held together with the dogs in the other positive cases.

Table 2
Prevalence of IDT positivity within breeds, as compared to the dog population in Budapest

Breed	Number of dogs	Positive IDT reactions	Percent (%) of the + IDT	Percent (%) of patient population	Percent (%) of breed within the dog population of Budapest
German shepherd	57	35	61.4	9.5	16.7
Hungarian Vizsla	36	22	61.1	6	3.6
Cocker spaniel	31	14	45.2	5.2	5.9
Boxer	26	21	80.8	4.3	0.9
West Highland White terrier	24	14	58.3	4	1.3
English setter	22	14	63.6	3.7	0.9
Poodle	22	10	45.5	3.7	5.6
Dachshund	19	6	31.6	3.2	8.4
Chow Chow	17	8	47	2.8	0.5
Doberman Pinscher	17	10	58.8	2.8	2.53
French bulldog	16	12	75	2.6	0.2
Dalmatian	16	9	56.3	2.6	1.4
American Staffordshire terrier	11	9	81.8	1.8	1.7
Newfoundland	10	9	90	1.7	0.5
Pumi	9	4	44.4	1.5	0.77
Bobtail	8	6	75	1.3	0.7
Puli	6	5	83.3	1	2.8
60 other breeds	1–5	0–100		0.2–0.8	

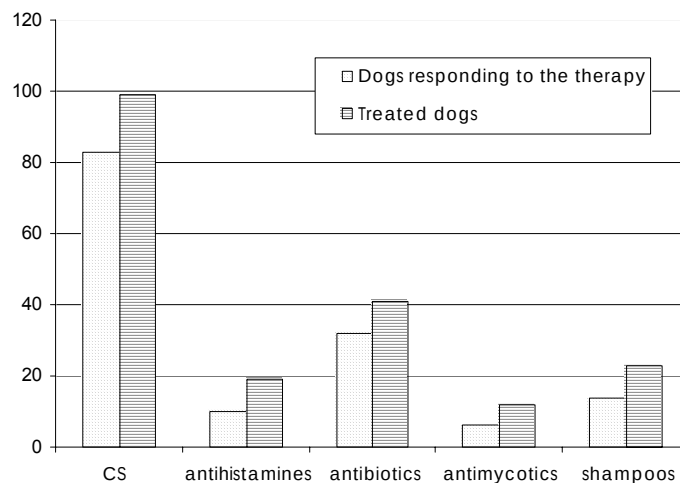


Fig. 3. Pretreatments and their effects on the clinical signs

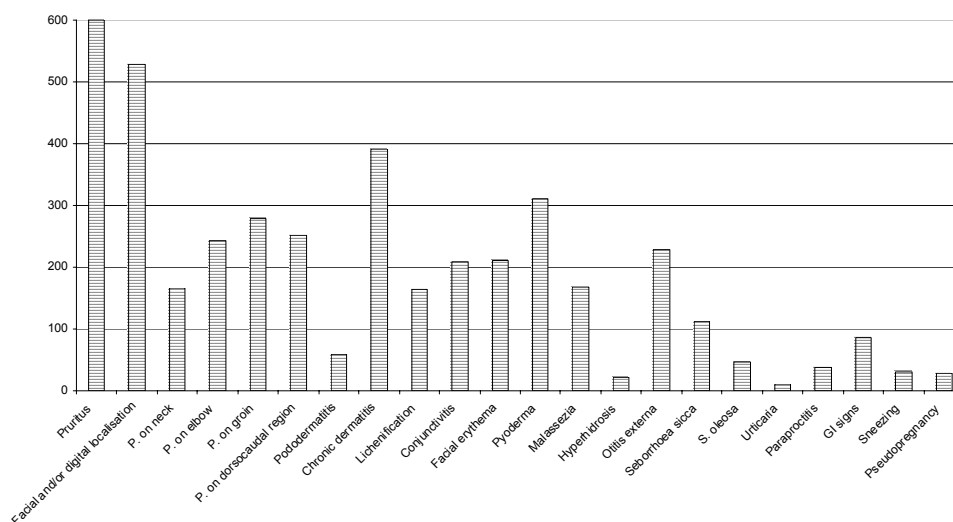


Fig. 4. Prevalence of the clinical symptoms

Correlations

In the followings, all reported correlations and associations were found to be significant ($p < 0.05$) but, for better readability, p values are not displayed.

Geographic location. Dogs living in the garden suburbs of Budapest were more sensitive to house dust mites, flea and moulds, in contrast to dogs from Transdanubia (the western part of Hungary) that were most sensitive to weeds.

Gender. In 24.4% of the females the symptoms started between 6 and 12 months, in 61% of them at less than 2 years of age, in the spayed females be-

tween 2 and 3 years of age, and in the castrated males between 3 and 4 years of age. Males gave more positive IDT reactions than females. Males gave a higher number of positive reactions to dust mites than females. Forty-three percent of the castrated males showed symptoms of seborrhoea oleosa. Spayed female animals more often had paraproctitis and females showed much more facial erythema than did males.

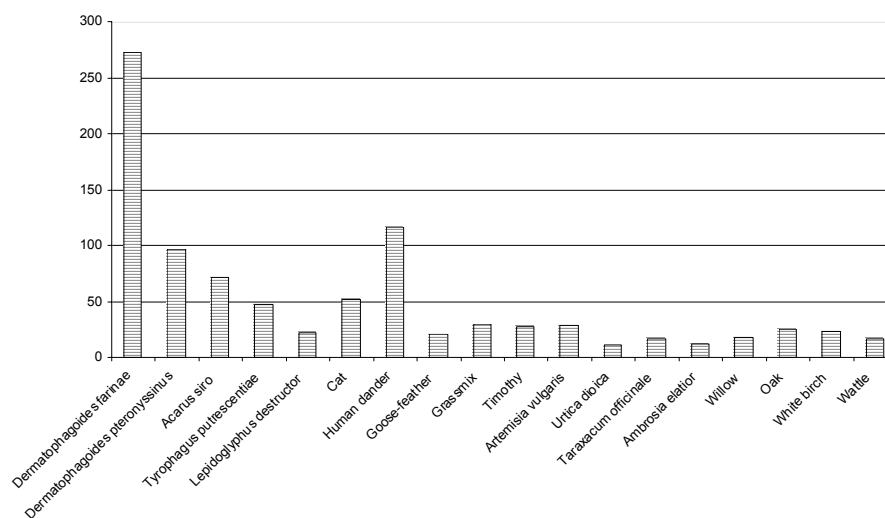


Fig. 5. Distribution of positive reactions to different allergens among the 373 positive IDT results

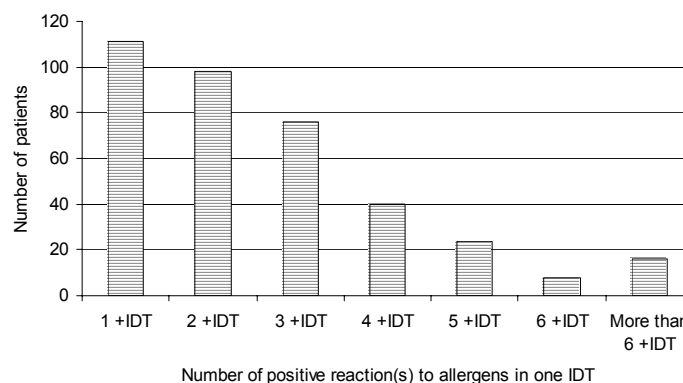


Fig. 6. Number of positive reactions in the 373 IDT-positive patients

Age. Under one year of age, the occurrence of verified ARF, demodicosis, urticaria, folliculitis and gastrointestinal signs (recurrent diarrhoea, flatulence) was higher than at older ages. Between 4 and 5 years of age seborrhoea oleosa and positive reaction to fleas by IDT were more common than at other ages. In

dogs under 3 years of age the symptoms began in winter and spring, as opposed to dogs older than 3 years that started to show symptoms in summer and autumn. Dogs older than 6 years were less responsive to elimination monodiet and gave less positive reactions by IDT, especially to *D. farinae*, than younger ones.

Breed. German shepherd dogs started to show symptoms mostly between 5 and 6 years of age, and were most sensitive to stinging nettle. Hungarian Vizsla started to show symptoms in most cases between 6 and 12 months of age and 83.3% of them responded to the elimination monodiet. Vizslas more often had otitis externa, conjunctivitis and facial erythema than other signs. Cocker spaniels started to exhibit clinical signs most often over 6 years of age, they had much less positive IDT reactions and fulfilled Willemse's criteria less frequently than dogs of other breeds. Cocker spaniels responded well to the elimination monodiet, and 22.6% of them were positive to ARF. Seborrhoea sicca and upper respiratory signs (sneezing, nasal discharge) were more common in this breed than in others. Boxers started to show clinical symptoms typically under 6 months of age, and much less over 3 years of age. Boxers gave a good response to the elimination monodiet and they showed in most cases criteria of Willemse and IDT positivity, especially to house dust mites, moulds, human dander and feather. The familiar occurrence of AD, conjunctivitis, facial erythema and lichenification was higher in Boxers than in other breeds. Seventy-nine % of the West Highland White terriers had verified ARF, they showed characteristic facial erythema and fulfilled Willemse's major criteria. They were more frequently positive to feather than to other allergens. Most of the English setters started to show clinical signs between 2 and 3 years of age and were more frequently positive to wool and timothy than to other allergens. Poodles were most often positive to timothy and willow than to dust mites. They typically had seborrhoea sicca. Dachshunds started to show symptoms most often between 4 and 5 years of age, were the least responsive to elimination monodiet, and did not give positive reactions by IDT even to house dust mites. Doberman Pinschers had seborrhoea sicca and demodicosis more frequently than other skin symptoms. In French bulldogs, the symptoms mostly started under 3 years of age, and these dogs were more commonly positive to ARF, feather and wattle than to other allergens. Both French and English bulldogs were in most cases positive to ARF, moulds and grasses. Bulldogs most often fulfilled the criteria of Willemse, and they often had conjunctivitis, hyperhidrosis, urticaria and staphylococcal pyoderma. Dalmatians frequently fulfilled Willemse's criteria, and they were more often positive to weed pollens and grass pollens than to house dust mites. In Dalmatians, facial erythema and urticaria were more common symptoms than other signs. American Staffordshire terriers more often started to show symptoms between 1 and 2 years of age than at other ages, more often had verified *Sarcoptes* infections, facial erythema, lichenification, symptoms in the elbow and groin region than other clinical signs, were more frequently positive to *D. farinae*, common dandelion and to elimination monodiet. Labrador and Golden retrievers were more often positive to grasses.

Table 3
Correlations between breed groups and different aspects of clinical signs. All reported positive and negative correlations and associations are significant ($p < 0.05$) but, for better readability, p values are not displayed

Breed groups	Onset of symptoms under 3 years of age	Onset of symptoms over 3 years of age	Response to the elimination monodiet	Positive reactions to provocation diet	Positive reactions to grasses	<i>Ctenocephalides</i> infestation
Hungarian breeds	0	0	+	+	+	0
Sheepdogs	-	+	-	-	0	+
Terriers	+	-	+	0	0	0
Scent hounds	-	+	-	-	0	0
Sighthounds	-	+	-	-	0	0
Hunting dogs	0	0	+	+	0	0
Toy breeds	0	0	+	+	0	0

“+”: positive correlation; “0”: no correlation; “-”: negative correlation. The breed groups examined were as follow: *Hungarian breeds*: Hungarian vizsla, Puli, Pumi, Mudi, Kuvasz, Transylvanian hound; *Sheepdogs*: German shepherds, Beaucerons, Briards, Shetland Sheepdogs, Collies, Bob-tails, Border collies, Bearded collies, Tervuerens, Polish Mountain Dogs; *Terriers*: West Highland White terriers, Yorkshire terriers, Cairn terriers, Scottish terriers, Wirehaired fox terriers, Boston terriers, Bull terriers, American Staffordshire terriers; *Scent hounds*: Basset hounds, Beagles, Blue Gascony hounds, Italian hounds, Transylvanian hounds, Griffons, English foxhounds; *Sighthounds*: Afghan hounds, Irish wolfhounds, Greyhounds, Hungarian greyhounds, Italian greyhounds; *Hunting dogs*: Spaniels, Setters, Retrievers, Pointers, Vizslas; *Toy breeds*: Pekineses, Shih-tzus, Lhasa apsos, Bologneses, Havanases, Poodles, Chihuahua, Bulldogs, Pugs, Spitzes

Breed groups. The correlations between breed groups and different aspects of clinical signs are demonstrated in Table 3.

Clinical signs and test results. Three each of Willemse's major and minor criteria were mostly true in Boxers, Dalmatians and French bulldogs, but the IDT most often gave positive reactions in Boxers only.

Verified ARF occurred most frequently in Cocker spaniels, French bulldogs, Bullmastiffs, Bull terriers, St. Bernard and Tervuren, as well as in West Highland White terriers and American Staffordshire terriers.

Discussion

Canine atopic dermatitis has been defined as a hereditary IgE-mediated hypersensitivity to inhalant allergens (Willemse, 1983), whereas Muller and Kirk have described it as a hereditary clinical hypersensitivity state or allergy without indicating whether or not IgE plays an important role (Scott et al., 2001).

Certain breeds are known to have a predilection for canine atopy (Scott et al., 2001). These breeds include Boxers, Gordon and English setters (Griffin, 1993), Irish setters, terriers (West Highland White terriers, Yorkshire terriers, Cairn terriers, Scottish terriers, Wirehaired fox terriers, Boston terriers, Bull terriers, American Staffordshire terriers), German shepherd dogs, Chinese Shar peis, Chow Chow, English bulldog (Koch and Peters, 1996), Lhasa apsos, Shih tzu, Dalmatians, Pugs, Golden retrievers, Labrador retrievers, Cocker spaniels, Poodles (Willemse, 1983), Miniature schnauzers, Belgian Tervuerens, Chihuahuas, Shiba inus and Beaucerons (Scott et al., 2001). In Denmark, canine atopy is seen most frequently among German shepherd dogs, Newfoundlands, Terriers, Boxers, Dalmatians, Shar peis, Golden retrievers, Labradors, American bulldogs, Setters, Lhasa apsos and Pekineses (Kristensen, 2002). Only Kristensen (2002) has suggested that AD can be seen in all breeds, although the disease is very rare in e.g. Doberman Pinscher, Rottweiler, Chihuahua and Pomeranian dogs. In the present study, the breed distribution was in agreement with the breeds listed above, except for Hungarian Vizsla, Pumi, French bulldog, Doberman Pinscher and Bobtail which were over-represented among atopic dogs compared to the breed distribution of the dog population in Budapest. Although the Puli was not over-represented, 5 of the 6 Pulis gave positive IDT reactions. So far, nobody has studied and reported AD and ARF in Hungarian dog breeds.

Canine atopy is reportedly more common in females than in males (Scott et al., 2001), although some studies showed no sex predilections (Willemse, 1983). In the present study, males were over-represented but this does not mean a sex predilection if we compare it to the dog population in Budapest where this ratio is the same. A new feature revealed by the present study is that males gave significantly ($p < 0.01$) more positive IDT reactions than did females.

The age of onset of canine AD found in this investigation was not similar to that described previously (Scott et al., 2001), because 66.6% of our dogs started to show symptoms earlier, between 4 months and 3 years of age, rather than between 1 and 3 years of age. An exception to this general rule are the Akita, Chow Chow, Golden retriever and Shar Pei breeds, as mentioned in the literature (Scott et al., 2001), and in the present study also the Boxers, in which breeds the signs of atopy may appear as early as at 2–6 months of age.

The seasonality of clinical signs was higher (30%) than reported in the literature (20%) (Scott et al., 2001).

In Hungary, the three most frequent positive reactions among non-seasonal allergens occurred to *D. farinae* house dust mite (272; 72.9%), human dander (117; 31.4%) and *D. pteronyssinus* (97; 26%). Regarding the sequence of allergens these results are similar to those reported from Europe, the USA and Japan (Vollset, 1985; DeBoer, 1989; Sture et al., 1995; Masuda et al., 2000; Mueller et al., 2000), where one of the house dust mites and/or human dander are the most common. However, the proportion (%) of positive reactions to human dander was lower and that to house dust mites was higher in our study than the results reported in most veterinary surveys (Vollset, 1985; DeBoer, 1989; Sture et al., 1995; Masuda et al., 2000; Mueller et al., 2000; Zur et al., 2002).

Considering the reactions to pollen extracts, it is not possible to compare the present results with those of most veterinary reports because of the differences in the geographic distribution of pollens between Hungary and other countries (Reedy et al., 1997). The frequencies of pollen allergy found in our study were similar as those obtained in Hungarian studies on humans (Magyar, 2000). Unfortunately, weed pollens (common mugwort, common dandelion and common ragweed) play an important role in human and canine atopic diseases in Hungary.

In order to judge the relevance of positive skin reactions, it is necessary to correlate these reactions with the history of exposure. The irrelevant reactions to animal dandruff extracts, which were common in this study for cat epithelia, might indicate future atopic reactions, as they reflect the presence of skin-sensitising antibodies only at the moment of testing. In addition, these reactions might be the result of cross reactivity among similar dandruff proteins (Willemse, 1983).

The clinical signs and their occurrence observed in this study are in accordance with other data described in the literature (Vollset, 1985; DeBoer, 1989; Sture et al., 1995; Masuda et al., 2000; Mueller et al., 2000; Zur et al., 2002).

Several of the correlations described in the Results chapter are not compared with other data of the literature, because – to the authors' knowledge – these results have not yet been published by others. The knowledge of these data may help in the clinical management of AD and in the breeding of atopic dogs. It is important to know e.g. that Dalmatians show a significantly higher number of

positive reactions to seasonal allergens (grasses) than to house dust mites, because in general there is an association between the month of birth and the incidence of canine atopy. Dogs born during the onset of the pollen season more commonly suffer from atopy than control dogs (Zunic, 1998). This finding suggests that dogs may be particularly susceptible to primary sensitisation during the first 4 months of life, which was supported by the study about the high-IgE beagle model. Birth during the non-pollen season would tend to decrease the incidence of sensitisation. This could be a point in the breeding of all breeds (German shepherd, Poodle, Bulldog, American Staffordshire terrier, Labrador and Golden retrievers, Hungarian breeds) that showed significantly higher positivity to seasonal allergens.

Breeds commonly having verified ARF (Cocker spaniel, French bulldog, Bullmastiff, Bull terrier, St. Bernard, Tervuren, West Highland White terrier and American Staffordshire terrier) should preferably be fed a hypoallergenic diet in order to prevent the clinical signs of ARF.

The authors hope that with this large survey conducted in Hungary they can help small animal dermatologists get an insight into canine AD in this region, too.

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