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Canine atopic dermatitis: a retrospective study of 266 cases examined at the University of California, Davis, 1992–1998. Part I. Clinical features and allergy testing results

GILA ZUR,*§ PETER J. IHRKE,†§ STEPHEN D. WHITE†§ and PHILIP H. KASS‡

*Koret Veterinary Teaching Hospital, School of Veterinary Medicine, The Hebrew University of Jerusalem, PO Box 12 Rehovot 76100, Israel
Departments of †Medicine and Epidemiology and ‡Population Health and Reproduction, and §Davis Dermatology Group, School of Veterinary Medicine, University of California Davis, CA 95616, USA

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Abstract The medical records of 266 dogs diagnosed as having atopic dermatitis were reviewed. Statistical data were evaluated referable to breed predilections, clinical signs and positive reactions to allergens. Positive reactions were most common to house dust mites (more common with clinical signs in the fall) followed by moulds (more common with clinical signs in the fall and spring). Dogs with positive reactions to moulds, trees or cultivated plants were more likely to have skin and ear yeast infections. Dogs with positive reactions to cultivated plants were more likely to have otitis externa and pedal lesions. Positive reactions to house dust were more common in dogs with early onset of signs and in those tested early in the disease. Dogs had more positive reactions to weeds when allergy tests were performed in the summer and fall. Positive reactions to flea antigen were highly correlated with the clinical diagnosis of flea allergy dermatitis.

Keywords: atopic dermatitis, dog, ELISA, FAD, IDST, *Malassezia*, otitis externa.

INTRODUCTION

Atopy is defined as an inherited tendency to develop IgE antibodies. Canine atopic dermatitis is the clinical disease seen in atopic dogs that results from the release of inflammatory mediators, thereby causing clinically relevant allergic reactions to environmental antigens. Canine atopic dermatitis is one of the most common and frustrating canine skin diseases managed by veterinary dermatologists and general practitioners.[1–5] Canine atopic dermatitis is believed to be a type I hypersensitivity reaction.[1–3,6–8]

The primary clinical presentation of canine atopic dermatitis is pruritus with secondary skin lesions that usually result from self-trauma. Most dogs manifest pruritus by rubbing the face and licking or chewing at the feet. Skin lesions occur most commonly on the ventral abdomen and in the inguinal and axillary regions. Lesions described in the literature include excoriations, variable alopecia due to self-trauma, erythematous macules, papules, pustules, hyperpigmentation and lichenification.[1,2,9] The intensity of skin lesions can range from mild to severe. Secondary infection with bacteria or yeast is common. Otitis externa is noted in ≈ 55% of dogs diagnosed with atopic dermatitis.[3]

Willemse's criteria of major and minor features of canine atopic dermatitis currently enjoy widespread acceptance.[10] Utilizing these criteria, a clinical diagnosis of atopic dermatitis is made using a combination of history and clinical signs. Pruritus may or may not be seasonal and usually commences between 1 and 3 years of age. A good response to anti-inflammatory dosages of corticosteroids is commonly noted. Compatible skin lesions localized to the sites mentioned above plus positive reactions obtained from either intradermal skin testing or *in vitro* allergy testing are additional criteria. It is generally accepted that positive intradermal skin test or *in vitro* test results are only indications that a dog has sensitizing antibodies to the allergens under investigation; they do not 'prove' that the clinical signs present are due to atopic dermatitis. False-positive, as well as false-negative, reactions are known to occur with both IDST and *in vitro* testing.[2] However, these tests do delineate allergens that initiate a positive response and therefore are used as criteria for allergen selection for specific immunotherapy (hyposensitization); they may also aid in selecting allergens for potential avoidance.[1,3,10–12]

We performed a retrospective evaluation of data from 266 dogs diagnosed as having canine atopic dermatitis at the Veterinary Medicine Teaching Hospital of the University of California at Davis (UCD-VMTH) during the years 1992–98. The diagnosis of canine

Correspondence: Peter J. Ihrke, Department of Medicine and Epidemiology, School of Veterinary Medicine, University of California at Davis, Davis, CA 95616, USA. E-mail: pjihrke@ucdavis.edu

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atopic dermatitis was established according to the criteria of Willemse and utilized history, clinical signs and positive allergy testing either by intradermal skin testing (IDST) (the majority of the cases) or *in vitro* enzyme-linked immunosorbant assay (ELISA) testing. Other pruritic skin diseases were ruled out or diagnosed concurrently according to traditional protocols. To our knowledge, this is the first report on a large number of dogs with atopic dermatitis of this nature in a geographical region (Northern California, USA) lacking distinct seasonal variation. This study reports the signalment and clinical features of canine atopic dermatitis and the results of allergy testing.

MATERIALS AND METHODS

The medical records of 266 dogs diagnosed between 1992 and 1998 as having canine atopic dermatitis were reviewed. For the purposes of this study, only dogs that had positive results obtained by IDST, *in vitro* allergy tests (ELISA or RAST) or both were included. All dogs were tested after other possible causes for pruritus had been excluded or controlled (flea allergy dermatitis, bacterial pyoderma, food hypersensitivity, *Malassezia* dermatitis, etc.). Allergy testing was performed a minimum of 4–6 weeks after short-term glucocorticoid treatment was terminated for IDST and a minimum of 2 weeks after corticosteriod termination for ELISA testing. Therapy with antihistamines was discontinued a minimum of 2–3 weeks prior to IDST. Intradermal skin testing was not performed until 2 weeks after any topical corticosteroid therapy had been discontinued.

Data from the medical records were evaluated for parameters including breed, sex, age of onset of clinical signs, seasonality of clinical signs and the seasons involved. (Whenever clinical signs were initially seasonal and later progressed to involve the entire year, the season in which clinical signs were initially noted was recorded.) Clinical signs evaluated included distal limb pruritus and/or lesions, otitis externa and skin and ear infections with *Malassezia* sp. Yeast infection was diagnosed by the finding of more than two to three yeast per high-powered, oil-emersion field using either Diff-Quik® (American Scientific Products, Gibbstown, NJ, USA) or Harleco HemaColor® (EM Diagnostic Systems, Gibbstown, NJ, USA) stain on cytologic preparations.

The presence or absence of concurrent flea allergy dermatitis was determined. Flea allergy dermatitis was diagnosed based on supportive clinical signs including compatible lesions, regions of the body affected, the presence of fleas and beneficial response to stringent flea control. The presence or absence of concurrent food hypersensitivity also was noted. Diagnosis was based on ascertaining diminished pruritus while utilizing a restricted, elimination diet in all 52 dogs with nonseasonal pruritus and in 96 dogs with seasonal exacerbation in pruritus in which it was suspected that food allergy may have been playing an additive role. In all circumstances, exacerbation of pruritus upon dietary re-challenge with the initial diet was a requisite to making the diagnosis of food allergy. Various home-cooked diets were utilized contingent on the prior exposure of the dog. Fish and potatoes was the most common diet employed. Most of the dogs were fed on this diet for 6–8 weeks and than re-challenged with their former diets. Additional parameters included the age of the dog when tested and the season when the testing was performed.

Intradermal skin testing was performed according to standard methods.[1,9,10,13,14] Dogs were sedated with xylazine hydrochloride and atropine (0.4-.2 mg kg^{-1} and 0.04 mg kg^{-1} IV, respectively). All the allergens for IDST were obtained from Greer Laboratory (Greer Laboratories, Lenoir, NC, USA). All allergens were purchased as concentrates, stored in the original glass vials in a standard refrigerator, in temperature of $\approx 0–4$ °C, and rediluted every 2–3 weeks. Saline was used as the negative control and histamine (1:100 000 w/v) as the positive control. Fifty-eight allergens (Table 1) regionalized to Northern California based on frequency of occurrence were administered to each dog. Approximately 0.05–0.1 mL of each allergen and the controls were injected intradermally into an area clipped on the lateral thorax. Intradermal skin testing results were interpreted 15 min after injection, and were subjectively graded on a scale of 0–4 according to the approximate diameter, height, firmness and erythema of the wheal. The negative control was graded as '0' and the positive control was graded as '4'. All '3' and '4' results were considered clinically relevant.

Fifty-one ELISA allergy tests were performed by Greer Laboratories utilizing 2 mL serum specimens. Five sera specimens were sent to IDEXX Laboratory (Westbrook, ME, USA). ELISA results were interpreted according to the established grading methods of each laboratory. Scores of '2' and above were considered clinically relevant. Two hundred and ten dogs were allergy tested by IDST only and 39 dogs were allergy tested by ELISA only. Both tests were performed in 17 dogs.

The allergens were grouped for statistical analysis (Table 1). Statistical analysis was performed twice: once considering the number of positive reactions within each allergen group (for example, the number of different weeds to which a dog had positive reactions), and once considering the whole group as one unit (whether or not a dog had positive reactions to any weeds). An attempt was not made to correlate the results of allergy testing with clinical signs, i.e. establish the relevancy of the allergy test reactions, unless hyposensitization was initiated.

Chi-squared tests of homogeneity were used to evaluate the distribution of one variable against different levels of another variable.[15] A Kruskal–Wallis analysis of variance was used to compare ordinal response scores between two or more independent groups of patients.[16] Logistic regression was used to evaluate

Table 1. Allergens used in tests and their division into Groups

	Final concentration for IDST injections (1000 PNU mL^{-1} unless otherwise noted)
Dust mites*†	
*Dermatophagoides pteronyssinus**	1:1000 w/v
*D. farinae**	1:1000 w/v
House dust*†	250 PNU mL^{-1}
Miscellaneous	
Sheep epithelium*	500 PNU mL^{-1}
Cat epithelium*	
Mixed feathers*	500 PNU mL^{-1}
Pyrethrum*†	
Tobacco*	
Tree & shrub pollens	
White Alder*† *Alnus rhombifolia*	
Olive*† *Olea europea*	
Orange*† *Citrus sinensis*	
Calif. Black Walnut* *Juglans californica*	
Arizona Ash* *Fraxinus velutina*	
Eucalyptus*† *Eucolyptus globulus*	
Red Mulberry*† *Morus rubra*	
Box Elder* *Acer negundo*	
Acacia*† *Acacia* spp.	
Almond* *Prunus dulcis*	
English Walnut* *Juglans regia*	
Calif. Black Oak*† *Quercus keloggi*	
Arizona Cypress* *Cupressus arizonica*	140 PNU mL^{-1}
Monterey Pine* *Pinus radiata*	
Red Alder*† *Alnus rubra*	
White Birch*† *Betula populifolia*	
American Elm* *Ulmus americana*	
Fremont Cottonwood* *Populus fremonti*	
Calif. White Oak*† *Quercus lobata*	
Red Maple* *Acer rubrum*	
3 Maple Mix*:	
Silver Maple *Acer saccharinum*	
Sugar Maple *Acer saccharum*	
Red Maple* *Acer rubrum*	
Western Sycamore* *Platanus racemosa*	
Black Willow* *Salix nigra*	
Chinese Elm* *Ulmus pumila*	
Red C*† *Juniperus virginiana*	
White Mulberry* *Morus alba*	
Privet*† *Ligustrum vulgare*	
Pepper tree† *Schinus* spp.	
Palm† *Cocos plumosa*	
Green/White Ash† *Fraxinus* spp.	
Black Cottonwood† *Populus trichocarpa*	
American Elm† *Ulmus americana*	
Red Oak† *Quercus rubra*	
Ponderosa Pine† *Pinus ponderosa*	
Black Walnut† *Juglans nigra*	
Grass pollens	
7 Grass Mix*:	
Kentucky Blue *Poa pretensis*	
Orchard *Dactylis glomerata*	
Red top *Agrostis alba*	
Timothy *Phleum pratense*	
Sweet Vernal *Anthoxanthum odouratum*	
Meadow Fescue *Festuca elatior*	
Perrenial Rye *Lolium perenne*	
Bermuda*† *Cynodon dactylon*	
Johnson*† *Sorghum halepense*	
Kentucky Blue*† *Poa pretensis*	
Quack† *Agropyron repens*	
Ryegrass† *Lolium* spp.	
Fescue† *Festuca* spp.	
Orchard† *Dactylis glomerata*	
Timothy† *Phleum pratense*	

Table 1. *continued.*

	Final concentration for IDST injections (1000 PNU mL^{-1} unless otherwise noted)
Weed pollens	
Dandelion*† *Taraxacum officinale*	
Western Ragweed*† *Ambrosia psilostachya*	
English Plantain*† *Plantago lanceolata*	
Russian Thistle*† Salsola pestifer	
Yellow Dock*† *Rumex crispus*	
Lambs Quarter*† *Chenopodium album*	
Red Sheep Sorrel*† *Rumex acetosella*	
Rough Pigweed*† *Amaranthus retroflexus*	
Firebush† *Kochia scoparia*	
Cockelebur† *Xanthium commune*	
Mugwort† *Artemesia* spp.	
Scale† *Atriplex* spp.	
Sage† *Artemesia* spp.	
Cultivated plants	
Alfalfa* *Medicago sativa*	
Corn* *Zea mays*	
Cultivated oat* *Avena sativa*	
Mustard* *Brassica* spp.	
Perennial Rye* *Lolium perenne*	
Sugar Beets* *Beta vulgaris*	
Cultivated Wheat* *Triticum aestivum*	
Moulds	
Mucor plumbeus†*	
Aspergillus niger†*	
Pullularia pullulans†*	
Penicillium notatum†*	
Penicillum digitatum†	
Fusarium moniliforme†*	
Hormodendrum hordei†*	
Curvularia specifera†*	
Alternaria tenius†*	
Mould Mix 1*:	
Alternaria tenius, *Aspergillus niger*, *Helmithosporium sativum*, *Hormodendrum hordei*, *Penicillium notatum*	
Mould Mix 2*:	
Curvularia specifera, *Fusarium moniliforme*, *Mucor plumbeus*, *Pullularia pullulans*, *Rhizopus nigricans*	
Rhizopus†*	500 PNU mL^{-1}
Cladosporium†	
Cephalosporium†	
Botrytis†	
Stemphylium†	
Cephalothecium†	
Helmithosporium†	
Insects	
Deer Fly* *Chrysops* spp.	
House Fly* *Musca domestica*	
Fire Ant* *Solenopsis* spp.	200 PNU mL^{-1}
Black Ant* *Camponotus pennsylvanica*	200 PNU mL^{-1}
Amer. Cockroach* *Periplaneta americana*	
Mosquito* *Culicidae* spp.	
Culicoides* *Culicoides* spp.	1:5000 w/v
Flea*† *Ctenocephalides felis*	1:1000 w/v

This Table 1ists the allergens that were used throughout the 7-year period of the study. Small changes were made within groups during that time, such that dogs were usually tested with the same individual allergens. *IDST. †ELISA.

the functional relationship, if any, between putative explanatory and outcome variables.[17] Values of $P < 0.05$ were considered statistically significant. The occurrence of the different breeds presented in this study with atopic dermatitis was compared with the occurrence of these particular breeds in the general population of dogs presented to the VMTH-UCD during the same years. Confidence intervals of 95% were used to evaluate for breed predilections.

RESULTS

Breeds

Thirteen different breeds, with five or more dogs of each breed, were included in the study for a total of 151 dogs; 94 dogs were of 51 other breeds with only one to four dogs of each breed. Twenty-one dogs were identified as mixed-breed dogs. The Labrador Retriever, Golden Retriever, German Shepherd Dog, Cocker

Table 2. Breed distribution

Breed	Current study	Hospital population
Labrador Retriever +	15 (11.0–19.9)	9.3
Golden Retriever +	8.6 (5.6–12.7)	5.5
German Shepherd Dog	5.6 (3.2–9.1)	4.8
American Cocker Spaniel	4.5 (2.4–7.7)	3.4
West Highland White Terrier +	3.8 (1.8–6.8)	0.6
English Springer Spaniel +	3.0 (1.3–5.8)	1.2
Dachshund	2.6 (1.1–5.3)	1.4
Doberman Pinscher	2.6 (1.1–5.3)	1.7
Chinese Shar-Pei +	2.6 (1.1–5.3)	0.7
Dalmatian	2.2 (0.8–4.8)	1.5
Bull Terrier +	2.2 (0.8–4.8)	0.25
Bichon Frisé +	1.9 (0.6–4.3)	0.4
Tibetan Terrier +	1.9 (0.6–4.3)	0.25
Mixed-breed dogs –	7.9 (5.0–11.8)	24

Frequency in percentage of the 13 most common breeds and mixed-breed dogs as they appear in this study in comparison to the frequency of the same breeds in the total hospital admissions from 1992 to 1998 (95% confidence intervals). Dog breeds beyond the confidence intervals are bolded with (+) indicating the breed was seen more that expected and (–) indicating less than expected.

Spaniel and West Highland White Terrier were the five breeds most commonly diagnosed as having atopic dermatitis (Table 2). Among these five breeds, the proportion of atopic dogs that were Labrador Retrievers, Golden Retrievers and West Highland White Terriers was higher than expected ($P < 0.05$). Other breeds with higher than expected percentages referable to the hospital population included the English Springer Spaniel, Chinese Shar-Pei, Bull Terrier, Bichon Frisé and Tibetan Terrier. Conversely, mixed-breed dogs had lower than expected percentages of dogs diagnosed as having atopic dermatitis. The proportion of atopic dogs that was Labrador Retrievers (15.0%) was 62% higher ($P < 0.05$) than expected based on the proportion of the VMTH population of dogs seen during the same period. Conversely, the proportion of atopic dogs that was mixed breed (7.9%) was 67% less ($P < 0.05$) than expected based on the proportion of the VMTH population of dogs seen during the same period.

Sex

There were 139 female (52%) and 127 male dogs (48%) in the study. The same percentages were found in the total hospital population of dogs in the same period.

Age

Age of onset of atopic dermatitis ranged from as young as 2–3 months (nine dogs) to as old as 8 years (one dog) with a mean of 1.66 years. Ninety-five per cent of the dogs exhibited signs of atopic dermatitis at < 5 years of age. The age at which the allergy testing was performed ranged from 1 year or less (three dogs) to 11 years (one dog). The median was 4.3 years.

Seasonality of clinical signs

Data were collected regarding seasonality of clinical signs from 136 (51%) dogs. Fifty-two dogs had clinical signs noted in all four seasons and were deemed nonseasonal. Eighty-four dogs exhibited a clear seasonal distribution, at least early in the disease. Nineteen (23%) of the seasonally affected dogs exhibited clinical signs in the fall, 9 (11%) in the winter, 41 (49%) in the spring and 66 (79%) in the summer.

Labrador Retrievers were more prone to show seasonal clinical signs, whereas Cocker Spaniels were more prone to continuous, nonseasonal clinical signs ($P = 0.046$). Statistically significant differences were not noted between specific breeds presented in particular seasons, but Labrador Retrievers and Doberman Pinschers presented more frequently in fall, Cocker Spaniels in winter, and Dachshunds in spring than would be expected from a random distribution of seasonality. Labrador Retrievers presented less often in the spring and there were no Cocker Spaniels showing clinical signs (0/8) limited to the summer. Statistically significant associations were not noted between the seasonality of clinical signs and the age of onset or the sex of the dog.

Clinical signs

Otitis externa was present in 60% of the dogs. Many dogs (124/160, 77.5%) exhibited otitis externa associated with *Malassezia* yeast infection. Dalmatians were at greatest risk for otitis externa ($P = 0.0467$), whereas mixed breed dogs had the least risk ($P = 0.0467$). The Golden Retriever, American Cocker Spaniel and the Chinese Shar-Pei had otitis externa more than expected based on a random distribution but this was not statistically significant. Otitis externa due to *Malassezia* was seen most commonly in the Chinese Shar-Pei and was statistically less common ($P = 0.0102$) in the Dachshund, Bichon Frisé and mixed-breed dogs. Age or sex predilections were not noted for either otitis externa, or otitis externa specifically due to yeast.

Seasonality did not have a statistically significant effect on the development of otitis externa, and otitis externa did not show a predilection for developing more often in any particular season. There was a highly significant reverse correlation ($P = 0.0025$) between showing seasonal clinical signs and having yeast infection

of the ears, i.e. dogs that had clinical signs of a nonseasonal pattern had greater tendency to have ear infection with yeast. Dogs that showed clinical signs in fall and winter also were more prone to otitis due to yeast ($P = 0.0082$ and 0.0060, respectively).

Distal limb pruritus and/or lesions were present in 76% of the dogs. Although not statistically significant, all of the Bull Terriers (7/7) had pedal lesions. Distal limb pruritus or lesions were not correlated with the age of onset, sex or seasonality of clinical signs, or with any particular season. Correlation with positive reactions to allergens is described in 'Allergens' below.

Concurrent *Malassezia* dermatitis was found in 38% of the dogs in the study. There was no statistically significant correlation between this finding and the age of onset of the disease, sex or breed. West Highland White Terriers presented with *Malassezia* dermatitis only slightly more often than expected based on a random occurrence rate (6/10). There was marginal significance ($P = 0.0723$) between seasonality of signs and skin infection with yeast. Similar to the finding with otitis externa due to yeast, dogs with nonseasonal clinical signs were more prone to *Malassezia* dermatitis. Looking at particular seasons, dogs that had clinical signs in winter were at higher risk for *Malassezia* dermatitis ($P = 0.029$).

Flea allergy dermatitis (FAD) was diagnosed concurrently in 50% of the dogs with atopic dermatitis. Although not statistically significant, FAD was found more frequently in German Shepherd Dogs (10/15) and less frequently in West Highland White Terriers and Chinese Shar-Peis (2/10 and 1/10, respectively). Age or sex predilections were not noted. FAD had no influence on the seasonal presentation of the clinical signs of atopic dermatitis. There was a very highly significant positive correlation between the clinical diagnosis of FAD and positive reactions to flea extract in allergy testing ($P < 0.0001$). One hundred and thirty-five dogs were diagnosed with concurrent FAD. Seventy-two dogs (53%) had positive immediate reactions to fleas with IDST. However, 47% presumably had false-negative results. Six of eight dogs (75%) had positive reactions to flea antigen with ELISA testing. Owners of dogs that were tested with IDST were asked to report any delayed type reactions, however, minimal additional information was acquired.

Concurrent food hypersensitivity was documented in only 7% of the dogs with atopic dermatitis in our study. Breed or sex predilections were not noted. Concurrent food hypersensitivity had no statistically significant influence on the age of onset of clinical signs of canine atopic dermatitis, or on the seasonality or nonseasonality of the clinical signs of canine atopic dermatitis.

Allergens

Ninety-nine different allergens in 10 groups were utilized for testing during the 7 years evaluated (Table 1). Correlation between positive reactions to each group and the various clinical signs is presented in Table 3.

Table 3. Association between clinical signs and seasonality of clinical signs and positive reactions to different allergen groups

Allergen group number of dogs with (%) positive reactions	Dust mites $N = 189$ (71%)			House dust $N = 126$ (47%)			Moulds $N = 160$ (60%)			Trees $N = 142$ (53%)			Insects $N = 123$ (46%)			Weeds $N = 121$ (45.5%)			Miscellaneous $N = 99$ (37%)			Grasses $N = 94$ (35%)			Cultivated plants $N = 79$ (30%)		
	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c	a	b	c
otitis externa	115	61	43	78	62	29	39	65	15	91	64	34	80	65	30	74	61	28	59	60	22	62	66	23	74	68*	28
foot lesions	142	75	53	97	77	36	118	74	44.5	111	78	42	100	81	37	94	77.5	35	78	79	29	75	80	28	54	87†	20
yeast otitis	89	47	33	59	47	22	82	51†	31	78	55†	29	69	56	26	63	52.5	24	48	49	18	51	54	19	49	61.5†	18
yeast dermatitis	72	38	27	43	34	16	70	44†	27	64	45†	24	53	43	20	51	42	19	39	39	14.5	41	44	15	42	53†	16
nonseasonal clinical signs	64	34‡	24	49	39	18	69	43	26	64	45‡	24	49	40	18.5	48	40	18	45	45	17	42	45	16	39	50	15
seasonal clinical signs	125	66‡	47	77	61	29	91	57	34	78	55‡	29	74	60	28	73	60	27	54	55	20.5	52	55	19	40	50	15
clinical signs in fall	87	46*	33	64	51	24	99	62†	37	89	63	34	63	51	24	65	53.5	24	62	65*	24	56	60	21	40	51	15
clinical signs in winter	74	39‡	28	61	48	23	82	51	31	74	52‡	28	60	49	23	58	48	22	47	47	17.5	50	53	19	49	61†	49
clinical signs in spring	110	58	41	79	63	30	120	75*	45	105	74‡	39.5	86	70	32	87	72	33	74	75*	28	71	75	26.5	57	72	21
clinical signs in summer	159	84	60	100	80*	38	136	85	51	121	85	45	103	84	39	104	86	39	87	88	33	81	86	30	65	82	24

a, number of dogs affected within this allergen group; b, % of dogs affected within this allergen group; c, % of total dogs in study. *$P < 0.05$; †$P < 0.01$; ‡$P < 0.1$.

House dust mites were the most common allergens to yield positive testing results. One hundred and eighty-nine dogs exhibited positive reactions; 136 dogs had positive reactions to both mite preparations. Breed, age or sex predilections were not noted. Correlation was not noted with the age when tested or with the season when the test was performed. When clinical signs were present during fall, there were fewer positive reactions to house dust mites ($P = 0.0198$). The same trend, but only marginally significant, was noted for the dogs with clinical signs in winter ($P = 0.0855$).

Positive reactions to house dust antigen were noted in 126 dogs. Breed or sex predilection were not noted but there was an age preference for early ages of onset ($P = 0.012$), and for the age when tested, in that older dogs tended to show fewer positive reactions to house dust antigen ($P < 0.05$). Correlation was not found between positive allergic reactions to house dust antigen and allergy to fleas or food. The season when the testing was performed had no influence on reaction to house dust antigen, although dogs tested in fall showed less positive reactions than expected based on a random seasonal distribution (21 observed vs. 27 expected). Of the 189 dogs that had positive reactions to house dust mites, 117 dogs (62%) also had positive reactions to house dust. Seventy-five per cent of the dogs that were positive to house dust were also positive to dust mites.

We found that 75 dogs had positive reactions to both fleas and house dust mites. Forty per cent of the dogs that had positive reactions to house dust mites also had positive reactions to flea antigen and 73% of those dogs that had positive reactions to flea antigen also had positive reactions to house dust mites.

Positive reactions to different moulds were found in 160 dogs (60%) making this the second most common group after dust mites. Nineteen dogs that were allergic to moulds had positive reactions to *Rhizopus* or mould mix #2 only. The separating of these dogs does not change the fact that moulds are the second most common antigen to cause positive reactions in our study.

There was a breed predilection for German Shepherd Dogs and for Dachshunds, while West Highland White Terriers were at significantly lower risk for positive reactions to mould allergens ($P = 0.043$). There was no statistically significant correlation between positive reactions to moulds and either age or sex. The seasonality of clinical signs was important, as exhibiting clinical signs in the fall and spring was highly correlated with positive reactions to moulds ($P = 0.0058$ and 0.025, respectively). With clinical signs in winter, dogs had more positive reactions to moulds than expected based on a random pattern of distribution, but this was not statistically significant. Dogs that had positive reactions to mould allergens were more prone to have ear and skin infections with yeast ($P = 0.0046$ and 0.0066, respectively).

Positive reactions to tree allergens were quite common in this study as they were found in 142 dogs. Age, breed or sex predilections were not noted. The season of testing had no influence on positivity of reaction to tree allergens. Findings of yeast infection in the ears or on the skin were significantly correlated with positive reactions to tree allergens ($P = 0.0069$ and 0.0076, respectively).

One hundred and twenty-one dogs (45.5%) had positive reactions to weeds. Age, breed and sex predilections or other correlations were not noted.

Almost half of the dogs studied (123 = 46%) showed positive reactions to various insects. Age or breed predilections were not found. Female dogs had marginally significantly ($P = 0.057$) more positive reactions. There was significant correlation between positive reactivity to insects and otitis externa due to yeast ($P = 0.0080$). Dogs with more positive reactions to different insects were more prone to have otitis externa due to yeast. There was a slightly less than significant positive correlation ($P = 0.0694$) between the clinical diagnosis of FAD and positive reactions to other insects.

One hundred and two dogs had positive reactions to flea antigen. Breed, age or sex predilections were not noted, although older dogs showed a tendency to be flea-positive in allergy testing. Positive reactions to fleas did not correlate with otitis externa, pedal lesions, yeast infection in ears or yeast infection of skin, food allergy, seasonality of clinical signs or the season in which the dog was tested. Among the dogs that had positive reactions to fleas, 75 dogs (73%) also had positive reactions to dust mites.

Various 'miscellaneous' inhalant allergens (sheep's epithelium, cat epithelium, mixed feathers, pyrethrum and tobacco) were found positive in 99 dogs. Sex, breed or age predilections were not noted. Dogs that exhibited clinical signs in fall and spring were significantly more likely to have positive reactions to these miscellaneous allergens ($P = 0.043$ and 0.05, respectively).

Ninety-four dogs exhibited reactions to between one and nine different grasses. Female dogs were more likely to have positive reactions to grass allergens ($P = 0.0514$). Age or breed predilections were not seen. The season in which testing was performed had a highly significant influence on the reaction to grass allergens ($P = 0.0036$), as positive responses were more commonly noted when testing was performed during the summer and fall.

Positive reactions to the pollen of different cultivated plants were the least common reactions noted in this study, as they were seen in only 79 dogs. Significant ($P = 0.0027$) breed differences were noted with an increased likelihood of reactions to cultivated plants in the Labrador Retriever and a reduced likelihood in the Dachshund. There also was a marginal significance ($P = 0.063$, odd 0.68) indicating that if signs began at a young age, the dog was more likely to have positive reactions to cultivated plants. The age when tested had no influence. Sex predilection was not seen. Positive reactions to cultivated plants were significantly correlated with otitis externa ($P = 0.041$), ear and skin infections with yeast ($P = 0.0001$ and 0.0013, respectively) and distal limb pruritus and/or lesions ($P = 0.008$). A

highly statistically significant association was seen between dogs showing clinical signs in winter and a decreased likelihood of positive reactions to cultivated plants ($P = 0.0005$). The season in which testing was performed had no statistical correlation.

DISCUSSION

For easy reference, we have summarized the most clinically relevant findings in Table 4.

Breeds

Confidence intervals were used as a method of evaluating the variability of the proportions of the affected dogs. Because the breed population of the VMTH is very large, these proportions can be viewed as parameters. Thus, if the proportions from the VMTH fall outside the confidence limits, this may be viewed as a significantly ($P < 0.05$) higher lower^{-1} proportion of dogs of a particular breed affected relative to the breed distribution of the entire VMTH patient population.

The proportion of Labrador Retrievers, Golden Retrievers, West Highland White Terriers, English Springer Spaniels, Chinese Shar-Peis, Bull Terriers, Bichon Frisés and Tibetan Terriers diagnosed as having atopic dermatitis was higher than expected ($P < 0.05$). As indicated above, three of these breeds, the Labrador Retriever, Golden Retriever and West Highland White Terrier, were also among the five most common breeds diagnosed as having atopic dermatitis. Breeds that were not common in the general hospital population such as the West Highland White Terrier, Chinese Shar-Pei, Bull Terrier, Bichon Frisé, and the Tibetan Terrier also showed an increased frequency for presenting with atopic dermatitis.

Similarities are noted between the breed predilections noted in our study and a previous report documenting dog breeds at risk for being presented to the dermatology service at UCD-VMTH in Northern California.[18] That study found that among the common breeds, the Golden Retriever, Doberman Pinscher, Dalmatian and Dachshund were at greater risk for the development of skin disease. The Chinese Shar-Pei, among the uncommon breeds, was at greater risk for developing skin disease. In this previous study, mixed-breed dogs also were at lower risk for the development of skin disease, in general. Breed predilections for a common skin disease such as canine atopic dermatitis coupled with possible associated predilections for other allergic skin diseases and the commonly resultant secondary infections may have led to the increased frequency of skin disease in general noted in these breeds in Northern California.

A survey of 1000 dogs diagnosed in private practices as having atopic dermatitis based on clinical signs plus ELISA testing results indicated that the Golden Retriever, Labrador Retriever, Cocker Spaniel, German Shepherd Dog and West Highland White Terrier were the five most common breeds seen with atopic dermatitis.[19] Interestingly, these were also the five most commonly seen breeds diagnosed with atopic dermatitis in our study. Of notable difference, their field survey found mixed-breed dogs to be the most common breed category of dogs with atopic dermatitis. Because the total number of dogs seen in participating practices was not given (which would have allowed comparison with the general hospital population) their large number of mixed-breed dogs with atopic dermatitis simply may reflect the biases of their general population.

The frequencies of presentation of dog breeds with atopic dermatitis vary among other surveys. The Chinese Shar-Pei, West Highland White Terrier, Dalmatian, Golden Retriever and Labrador Retriever were over represented in other studies as well.[1,4] Other breeds with fewer than five dogs each in our study that were reported as common breeds for CAD in previous studies include the Cairn Terrier, Scottish Terrier, Shi Tzu and the Boxer.[1,13,16]

German Shepherd Dogs, Cocker Spaniel dogs and Dachshunds were found frequently in our study but were within the confidence intervals of the general hospital population. The frequency or relative risk of the German Shepherd Dog with respect to atopic dermatitis is controversial. Some reports have indicated that this breed is predisposed to develop atopic dermatitis.[4,5,13,16,19] Differences in statistical frequency of occurrence such as this may be due to variable population numbers in different geographical regions or differences in genetic pools in different regions of the world.

Table 4. SUMMARY of Findings in Dogs with Atopic Dermatitis: Clinical Signs and Allergy Testing

1. Labrador Retrievers, Golden Retrievers and West Highland White Terriers were statistically over-represented.
2. Ninety-five per cent of the dogs exhibited signs of atopic dermatitis at less than 5 years of age.
3. Labrador Retrievers were more, and Cocker Spaniels less, prone to show seasonal clinical signs.
4. Otitis externa was present in 60% of the dogs.
5. Dogs that had positive reactions to mould allergens were more prone to have ear and skin yeast infections, and dogs that had clinical signs in winter were at higher risk for *Malassezia* dermatitis. The former finding may indicate the presence of a hypersensitivity to the yeast that cross-reacts with mould allergens; the second finding is interesting in view of the fact that a higher mould count may be present during the winter.
6. The most common positive reactions of allergen groups, in descending order, were: house dust mites, moulds, house dust, trees, weeds, insects (not including fleas), fleas, miscellaneous inhalants (sheep's, wool, cat epithelium, etc.), grasses, cultivated plants.
7. Dogs with clinical signs present during fall or winter were less likely to have positive reactions to house dust mites; the reasons for this phenomenon are not known.
8. The season of testing had no influence on positivity of reaction to weed, tree, cultivated plant, or flea allergens, but there was a highly significant seasonal influence on the reaction to grass allergens, with positive responses more commonly noted when testing was performed during the summer and fall.

Sex

Our results did not support the predilection for female dogs suggested by others.[1,3,11,14] However, our results did indicate, as have others, that female dogs show an increased reactivity to some allergens.[1] In our study, there was a significant increase in the number of female dogs with positive reactions to grasses, and some increase in the number of female dogs with positive reactions to insects. One study showed that normal intact female dogs had higher serum IgE levels than intact male dogs.[20] This might explain why females were found to have a predilection for atopic dermatitis in some studies. However, most of the atopic dogs in previous studies were probably neutered, as was the case in our study.

Age

The average age of development of atopic dermatitis in our study was 1.66 years. Ninety-five per cent of the dogs showed clinical signs commencing at less than 5 years of age, and nine dogs began clinical signs before 6 months of age. These findings are similar to previous reports.[1,3,5,9,10,16,19]

Seasonality

A definite seasonality of clinical signs was seen in 62% of the dogs in our study, whereas 38% showed no seasonality of clinical signs from the onset of disease. Our study indicates a higher percentage of seasonal clinical signs than has been reported previously.[2,5,19] These results were unexpected as most of our patients lived in environments without extreme seasonal changes. We found a higher percentage (40%) of dogs that first manifested their pruritus in winter than in a previous report (20%).[1] This may be due to the mild winters in much of Northern California where most of our dogs live, enabling the presence of higher winter allergenic loads that may not exist in regions with more extreme seasonal temperature fluctuations.

Clinical signs

Sixty per cent of the dogs in our study had otitis externa. This percentage is higher than previously reported in other studies.[1,3,10,12] *Malassezia* was the causative agent in 77.5% of these dogs. This is also a higher frequency than reported previously.[21] This might be explained in part by the chronicity of our referral cases plus the current enhanced appreciation for the pathogenicity of *Malassezia*.

Distal limb pruritus and/or lesions were present in 76% of the dogs in this study. We were especially interested in this clinical sign as it is commonly viewed as a primary feature of canine atopic dermatitis. It has been theorized that this site predilection may relate to the percutaneous absorption of environmental allergens.[4,11,22,23] Distal limb involvement was found to be much more common in our study than reported previously.[3]

Malassezia dermatitis was a common finding in this study, affecting 38% of dogs with atopic dermatitis. This emphasizes the importance of cytology as a tool in evaluating pruritic patients. *Malassezia* populations have been shown to be greater in atopic dogs than non-atopic dogs.[24] We did not note any breed predilections for *Malassezia* dermatitis, including the West Highland White Terrier. This may indicate that a correlation does not exist between the susceptibility of the West Highland White Terrier to canine atopic dermatitis and the genetic keratinization defect/epidermal abnormality that leads to enhanced susceptibility to secondary yeast infections.[25]

Clinical signs of pruritus in the winter were found to correlate with secondary yeast infection. A possible explanation for this phenomenon may be that impaired skin barrier function or other cutaneous differences noted in allergic animals plus self-trauma in a highly humid microenvironment can favour yeast growth. Winter (December to March) in the Central Valley of Northern California is the season with the highest average relative humidity (United States National Weather Service. Cumulative data through 1993: http://iwin.nws.noaa.gov/). The *Malassezia* organisms documented in this retrospective study were not speciated. A recent study indicates that various species of the genus *Malassezia* may cause dermatitis in the dog.[21] Nonseasonally affected dogs with atopic dermatitis, in general, are considered to have more severe clinical signs.[1,2] Our results support this finding as nonseasonally affected dogs were more prone to yeast infection of both ears and skin.

In correlation with the theories of allergic threshold and the summation of effects of multiple coexistent allergies,[1,2,4,11] 50% of the dogs in this study had concurrent flea allergy dermatitis (FAD). This study was performed in a geographical region endemic for fleas where FAD is the most common skin disease seen in both dogs and cats. Interestingly, FAD did not seem to contribute to a seasonality of clinical signs in dogs with atopic dermatitis. It may have been that the smaller population of fleas that survive winters in Northern Californian contribute to maintaining pruritus throughout the year. The highly significant correlation between the clinical diagnosis of FAD and positive reactions to flea allergen in the allergy tests ($P < 0.0001$) in our study is noteworthy. This finding supports both the IDST and the ELISA as highly reliable tools in confirming a diagnosis of FAD. Some previous reports agree with this finding,[1,4,9,26,27] whereas others differ.[12,28,29] Unfortunately, we lack data regarding delayed hypersensitivity to flea antigens as under-reporting likely lead to false-negative reactions.[2] Efforts have been made to identify and purify the exact fraction of the allergens in the saliva of fleas in order to achieve more accurate test results.[30] Concurrent flea allergy is very common in dogs with atopic dermatitis, and positive reactions to flea antigen were found in up to 80% of atopic dogs in previous studies performed in flea-endemic areas.[1,4,14,31] Although our region is considered as moderately endemic for fleas, we had a lower percentage of positive test results. Northern California

is an area endemic for fleas, however, higher flea populations are frequently encountered in Southern California and in the southeastern US. Another explanation for the relatively lower rate of positive flea reactions may be that we included a higher proportion of dogs that were treated using the newer generation of flea-control products that were not available during previous studies. In addition, dogs that improved on newer flea-control products, even if atopic, may not have been skin tested because of diminished pruritus. Seventy-three per cent of the dogs that had positive reactions to flea antigen were also positive to dust mites. This may suggest a cross-reactivity between these antigens in allergy testing.

More than half of the dogs in our study were fed elimination diets. In this study, food allergy was diagnosed concurrently in only 7% of the dogs with atopic dermatitis. This is similar to other previous data.[9,32]

Allergens

Allergens were chosen for testing based on those encountered most frequently in Northern California. The allergens were considered in groups, rather than individually, for statistical analysis. The groups included dust mites, house dust, moulds, trees, grasses, weeds, cultivated plants and miscellaneous allergens. We chose this method of evaluation for multiple reasons. First, because there are some differences in individual allergens utilized between intradermal skin testing and ELISA testing, grouping allergens enabled us to minimize the effect of this variability. In addition, there were some differences between individual allergens utilized during the 8 years studied in each methodology employed. Grouping allergens allowed us to minimize the effect of these variables.[2] Studies showing cross-reactivity between individual allergens within a particular group suggest that these allergens could be considered together in data comparisons.[12,33] Utilizing groups will make it easier to compare our results with other studies because individual allergens within groups may vary contingent upon different geographical regions. An example would be the comparison of our results with those of an Australian retrospective study in which the allergens were associated with other parameters as groups of allergens.[34] Allergen grouping also facilitated statistical analysis.

Similar to other reports, house dust mites are the most common allergens to cause positive reactions in allergy testing in Northern California (71%).[1,4,9,12–14,34,35] Seventy-two per cent of the dogs that had positive reactions to house dust mites were positive to both mites tested. This corroborates a previous study of specificity in skin testing for the two species of house dust mites, and disputes a suggestion to incorporate both mites together in allergy tests.[35,36] There is only one report known to the authors in which dust mites were not found to be a common allergen in dogs.[37] The concentration of house dust mites that was used in our tests was 1:1000 w/v, similar to previous reports.[2,13]

Unlike other reports in atopic dogs and reports in atopic persons, in our study, reactions to house dust was not as common as reactions to house dust mites, although it appeared in a similar or greater percentage than reported by others.[3,6,9,13,16] The concentration of house dust that was used in our tests was 250 PNU mL^{-1}, similar to that recommended by others.[2,13]

Seventy-five per cent of the dogs that had positive reactions to house dust also had positive reactions to house dust mites, whereas 62% of dogs with positive reactions to house dust mite also gave positive responses to house dust antigen. If we consider these mites as a component of the house dust, these results indicate that testing for house dust only may miss 40% of the mite-positive dogs. Further, testing for mites only may miss 25% of dogs that have positive reactions to house dust, presumably due to allergic reactions to other components of house dust.

Forty per cent of the dogs that had positive reactions to house dust mites also had positive reactions to flea antigen and 73% of those dogs that had positive reactions to flea antigen also had positive reactions to house dust mites. These data contribute to the belief that there is cross-reactivity between fleas and house dust mites.

Positive reactions to house dust were less common than positive reactions to trees and moulds. Reactions to trees and moulds were found to be far more common in Northern California than reported by others elsewhere.[3,4,13,16,34,38,39] However, there are other studies that showed similar results in which positive reactions to moulds were very common[5,19] and positive reactions to house dust were uncommon.[19] In our study, no attempt was made to identify the rate of occurrence of false-positive results, which may have contributed to the relatively high number of positive reactions to some allergens.[4,10,38,40] *Rhizopus* is considered by some authors to cause false-positive results.[2] Even by eliminating the number of dogs that had positive reactions to *Rhizopus* only, moulds still remain the second most common antigen group yielding positive reactions.

Almost 50% of the dogs in this study had positive reactions to various insects. The fact that reactions to insects were almost as common as reactions to house dust, together with the marginally significant connection between positive reactions to insects and the diagnosis of flea allergy dermatitis, supports the suggestion that there is cross-reactivity between other insects and fleas.[41] Positive results specifically to flea extract were less common than to other insects. Another study[42] found that insect-positive reactions were similar in allergic and normal dogs and suggested that they had either no clinical relevance or reflected only cross-reactivity. That study did find that flea allergen caused a greater number of positive reactions in allergic dogs than in control dogs. In a study from Australia, positive reactions to insect were not high (19.9%), and were lower than positive reactions to fleas and to the two house dust mites (30.8, 53.4 and 54.1%, respectively).[34]

Previous reports have generally not indicated breed differences in response to intradermal skin testing.[1] However, in our study, there were significant breed differences in response to some allergens: cultivated plants had a higher incidence of positive reactions in the Labrador Retriever and a very low incidence in the Dachshund. Mould reactions were found to be more commonly positive in the German Shepherd Dog and the Dachshund and less commonly in the West Highland White Terrier. The significance of these breed differences is not known. With regard to IDST, breed difference could alter threshold on the skin, which may explain the different reactions we found in different breeds. However, a previous survey on ELISA results showed that the Shih Tzu, German Shepherd Dogs, Dalmatians and Beagles had more positive reactions to moulds.[19]

Age of onset of clinical signs and the age of the dogs when tested have been reported previously[1,16,43] to influence allergy testing, as older dogs had fewer positive reactions. We found that age did have a significant effect on testing with two allergens. There were more positive reactions to house dust when clinical signs began at a younger age and there were fewer positive reactions to house dust when testing was performed in older dogs. The same correlation was found between cultivated plant pollens and the age of onset. An earlier study[38] found that nonatopic dogs had more positive reactions to some allergens at younger ages, whereas older dogs had more positive reactions to other allergens. We suggest that reluctance to test older dogs should not be based on the possibility of lessened test results but that other factors such as cost, coexistent health problems, expected longevity and response to hyposensitization be considered.

As mentioned previously, most allergens elicit the same rate of positive reactions in male and female dogs. Females showed more positive reactions to grasses and insects. In one report,[38] normal (without atopic dermatitis) female dogs were found to react more to certain allergens than did male dogs. In that report, 9.2% of the females reacted to weed mix compared with 2.9% of the males, with 4 and 2% of the females reacting to grass mix and cotton, respectively, whereas none of the males reacted. Perhaps sporadic findings like these, with no apparent clinical implication, have led to the premise that female dogs are more susceptible to allergies and show more positive reactions.

Dogs that exhibited clinical signs in fall and winter showed fewer positive reactions to dust mites. In other studies[44,45] in which dust mites were counted from households, dust mites reached maximum concentration in late summer and the beginning of fall. One cannot say that allergies to dust mites are more common in indoor dogs, because if true, one would expect more positive reactions to dust mites, not fewer, in fall and winter in Northern California (during the rainy season), when dogs are commonly housed indoors. However, this may explain why dogs that showed clinical signs in the summer had fewer positive responses to house dust – they spent more time outdoors.

Dogs that exhibited clinical signs in the fall and spring, and, to a lesser extent, in winter, had the highest number of positive reactions to moulds. A previous study which looked at dogs with atopic dermatitis in Oregon (the state immediately to the north of California) found that moulds were at their highest counts in the fall, winter and spring.[5] In our study, we did not differentiate between the various moulds so we cannot comment on our results on the varying prevalence of outdoor and indoor moulds as was done by others.[39]

Clinical signs in winter and spring correlated positively with reactions to trees. Most trees pollinate in spring, but in northern California, there are multiple species of trees that pollinate in the winter as well.[2]

Our results show that clinical signs in winter are much less likely to be due to cultivated plant pollens. Although the geographical region of most of the dogs in this study does not have profound seasonal differences, winter does represent a season with less of a cultivated plant pollen burden.[2]

In this study, results of positive reaction of only one group of allergens were significantly correlated with the season of the test. Dogs that were tested in the summer and fall were more likely to have positive reactions to grass. The season of the test had no influence on positive reactions to flea antigens, thus it is doubtful if flea allergy may indeed have any effect on test results of dogs tested during the flea season.[19] Other authors have suggested that the season when allergy testing is performed has an influence on positive reactions.[19,38,39,46–48] Two common opinions are that either testing should be performed at the same season as the clinical signs or shortly thereafter or, in contrast, only after the problematic allergy season is over.

Cultivated plant pollens play a role in the common clinical signs associated with atopic dermatitis. These signs include otitis externa, distal extremity pruritus and/or lesions and yeast infections of ears and skin. It is tempting to explain the pedal pruritus as a result of direct percutaneous absorption of the cultivated plant pollens,[4,11] but this cannot explain the other clinical findings that were also significantly correlated.

Positive reactions to moulds were found to be very highly correlated with yeast infection, both of the ears and the skin. This result suggests several possibilities. The yeast itself may elicit a hypersensitivity reaction, and cross-react with mould allergens. This would favour the hypothesis that *Malassezia* induces a hypersensitivity response and thus adds to the pruritic, allergic load in dogs with atopic dermatitis.[49,50] Alternatively, dogs that are allergic to moulds simply may be more prone to develop yeast infections. In our study 45 of the dogs (28%) that had positive reactions to moulds had positive reaction to *Rhizopus*. Eleven of these dogs (12%) were positive only to this mould. Many dermatologists[2] acknowledge the likelihood of false-positive reactions to this allergen. Whether *Rhizopus* is simply an irritant or these highly positive reactions are caused by cross-reactivity between this mould and *Malassezia* remains uncertain.

The total number of allergy tests performed at the UCD-VMTH declined substantially during the 7 years studied. The numbers of allergy tests performed during the period of this study were: during 1998, 12 IDST, 16 ELISA; 1997, 19 IDST, 27 ELISA; 1996, 13 IDST, 9 ELISA; 1995, 29 IDST, 18 ELISA; 1994, 37 IDST, 9 ELISA; 1993, 28 IDST; and 1992, 80 IDST, 2 ELISA. These numbers can be compared with former years, with 92 IDST in 1991 and 86 in 1990.

This finding has multiple possible explanations:

1 *In vitro* tests became popular among nonspecialist veterinarians, who consequently referred fewer dogs for allergy testing to UCD-VMTH.
2 The growing number of dermatology specialists in private practice in Northern California affected this segment of the caseload.
3 Newer topical therapies improved the management of the pruritic patient, causing owners to prefer these treatments to specific immunotherapy, thus the option of allergy testing was chosen less often.
4 New and more effective flea control products might have reduced the pruritic load in dogs with atopic dermatitis and concurrent flea allergy such that owners did not seek further treatment.
5 The diagnosis and treatment of *Malassezia* dermatitis secondary to underlying atopic dermatitis reduced the number of pruritic dogs referred for allergy testing and hyposensitization.

The reliability and reproducibility of serological allergy tests remain controversial.[7,8,12,20,51–60] Some investigators believe that IgE measurements in dogs are unreliable for the diagnosis of atopic dermatitis because high serum levels of IgE may lead to false-positive results. These high levels of serum IgE are believed to be caused by ascarid infestation.[1,57] This has not been accepted by others.[55] In this study, we did not compare results of IDST with results of ELISA tests except with regard to the flea antigen, in which both were found to be in significant correlation with the clinical signs of FAD. Other authors do not agree with this finding.[51] On a clinical basis, it is perhaps most important to compare efficacy of hyposensitization based on the two test modalities.[61,62]

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Résumé Les dossiers médicaux de 266 chiens présentant une dermatite atopique ont été évalués. Des données statistiques ont été obtenues quant à la race, les signes cliniques, et les réactions aux tests d'allergie. Les réactions positives étaient plus fréquentes pour les acariens des poussières (fréquemment en présence de signes cliniques en automne), et pour les moisissures (fréquemment en présence de signes cliniques en automne et au printemps). Les chiens présentant des réactions positives aux moisissures, aux arbres ou aux plantes étaient plus à risque pour les levuroses cutanées ou auriculaires. Les chiens présentant une réaction positive aux plantes présentaient plus fréquemment une otite externe ou des lésions podales. Les réactions positives à la poussière de maison étaient plus fréquentes chez les chiens dont la dermatose était précoce, et chez ceux testés rapidement après l'apparition des signes cliniques. Les chiens ont présenté plus de réactions positives aux pollens d'herbacées quand les tests étaient réalisés en été ou en automne. Les récations positives à l'extrait de puce étaient hautement corrélés avec le diagnostic clinique de dermatite par allergie aux piqûres de puces.

Resumen Se revisaron los registros médicos de 266 perros diagnosticados de dermatitis atópica. Los datos estadísticos se evaluaron según preferencia racial, síntomas clínicos y reacciones positivas a alérgenos. Las reacciones positivas fueron especialmente a los ácaros domésticos (más frecuentemente con síntomas en otoño) seguidas de las reacciones a moho (más frecuentemente con síntomas clínicos en otoño y primavera). Los perros con reacciones positivas a moho, árboles o plantas cultivadas tenían más probabilidad de desarrollar infecciones cutáneas y óticas por levaduras. Los perros con reacciones positivas a plantas cultivadas tenían más probabilidad de sufrir otitis externa y lesiones podales. Las reacciones positivas a ácaros domésticos fueron más frecuentes en perros con una presentación prematura de síntomas y en aquellos analizados en una fase inicial de la enfermedad. Los perros mostraron más reacciones positivas a malas hierbas cuando las pruebas de alergia se realizaron en verano y otoño. Las reacciones positivas a alérgeno de pulgas se correlacionaban claramente con el diagnóstico clínico de dermatitis alérgica a pulgas.

Zusammenfassung Die Patientendetails und Untersuchungsergebnisse von 266 mit atopischer Dermatitis diagnostizierten Hunden wurden überprüft. Rasseprädispositionen, klinische Veränderungen und positive Reaktionen gegen Allergene wurden statistisch bewertet. Positive Reaktionen gegen Hausstaubmilben (häufiger mit klinischen Veränderungen im Herbst) waren am häufigsten, gefolgt von Schimmelpilzen (häufiger mit klinischen Veränderungen im Frühling und Herbst). Hunde mit positiven Reaktionen gegen Schimmelpilze, Bäume oder Nutzpflanzen hatten häufiger eine Haut- oder Ohreninfektion mit Hefen. Hunde mit positiven Reaktionen gegen Nutzpflanzen hatten häufiger eine Otitis externa und Läsionen an den Pfoten. Positive Reaktionen gegen Hausstaubmilben waren häufiger bei Hunden mit frühzeitigem Krankheitsausbruch und bei Hunden, die in den Frühstadien der Erkrankung getestet wurden. Hunde, die im Sommer und Herbst getestet wurden, hatten häufiger Reaktionen gegen Unkräuter. Positive Reaktionen gegen Flohallergen korrelierten sehr gut mit einer klinischen Diagnose Flohbissallergie.