

ORIGINAL ARTICLE

Seasonal Dynamics of House Dust Mites in Dust Samples Collected From Sleeping Places in North-Western Poland

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Impacts

- The dominant species in tested dust samples was *Dermatophagoides farinae*, with its highest mean concentration recorded in the third quarter.
- The greatest mean concentrations of *Dermatophagoides pteronyssinus* and *Chortoglyphus arcuatus* were in the first quarter, and *Cheyletus* sp. in the fourth quarter.
- *Dermatophagoides farinae* and *D. pteronyssinus* achieved the highest mean concentration in the non-heating season, and *Cheyletus* genus during the heating season.

Keywords:

Allergenic mites; Poland; population structure; seasonal dynamics

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Summary

The most common families of mites found in house dust are Pyroglyphidae, Glycyphagidae and Acaridae; all are a source of many antigens responsible for allergic diseases. The aim of this study was to examine the seasonal dynamics of allergenic mite populations in dust samples collected from sleeping places in apartments in north-western Poland. The mites were isolated from the dust using a saturated saline floating method. In 132 dust samples we determined: *Dermatophagoides farinae*, *Dermatophagoides pteronyssinus*, *Euroglyphus maynei*, *Hirstia* sp., *Chortoglyphus arcuatus*, *Lepidoglyphus destructor*, *Gohieria fusca* and *Cheyletus* sp. The greatest frequency was observed for *D. farinae*, *D. pteronyssinus*, *Ch. arcuatus* and *Cheyletus* sp., in the fourth quarter and *D. farinae* in the third quarter. Smaller coefficients of dominance were found for *D. pteronyssinus*, *Ch. arcuatus* and *Cheyletus* sp., and their greatest mean concentrations were found in the first and fourth quarters. Given the division of the year into heating and non-heating seasons, mites *D. farinae* and *D. pteronyssinus* achieved the highest mean concentration in the first season, and *Cheyletus* sp. in the second season. The analysis of the participation of developmental stages showed that the adults of *D. farinae* were more prevalent than juveniles in the first, second and third quarters, and imago stages of *D. pteronyssinus* were more numerous in relation to juveniles in the first, third and fourth quarters. The results confirm the high incidence of house dust mites in sleeping places in north-western Poland dwellings; the best conditions for the development of these mites, mainly *D. farinae* and *D. pteronyssinus*, occur in the fourth quarter and are the least favourable in the second quarter. In many cases, these results are consistent with data from other parts of Poland collected by various authors.

Introduction

Allergenic mites, occurring both in house dust and stored foods, are one of the most important aetiological agents

of allergic reactions (Palyvos et al., 2008). Extracts from the bodies and faeces of mites are particularly rich in allergens (Fain et al., 1990; Tovey and Baldo, 1990; Platts-Mills et al., 1992); in humans, mites may cause allergies

such as atopic asthma (*asthma bronchiale*), runny nose (*rhinitis*) and atopic dermatitis (*eczema atopicum*). Mites may also be involved in the pathogenesis of urticaria (*urticaria dermatitis*) and inflammation of the cornea and conjunctiva (*keratoconjunctivitis*) (Mumcuoglu et al., 1988; Fain et al., 1990; Platts-Mills et al., 1992; Boulet et al., 1997; Aalberse, 1998; Arlian, 2002). It is estimated that about 5% of the human population is allergic to dust mite allergens (Suggars, 1987).

House dust mites are prevalent throughout the world, and are numerous especially in temperate climate zones. Among other things, they are found in samples of dust collected in homes, farm stores, commercial stores, public utility facilities (hospitals, libraries, student houses, theatres, schools, hotels, offices, buildings, military), as well as in public transportation: airplanes, passenger trains, cars, cabins and ocean-going vessels (Colloff, 1987a,b, 1998; Babe et al., 1995; Zock and Brunekreef, 1995; Arlian, 2001, 2002; Racewicz, 2001; Solarz, 2004a; Palyvos et al., 2008). In most homes, hundreds or even tens of thousands of mites per gram of dust have been reported in samples collected from upholstered furniture, bedding and carpets (Suggars, 1987). It was found that exposure to dust containing more than 100 mites per gram of dust increases the risk of allergic symptoms in allergic individuals (Custovic and Chapman, 1998; Korsgaard, 1998; Munir, 1998).

In Poland, as well as in countries with similar climatic conditions, the majority of house dust mites belong to the family Pyroglyphidae. This family has 47 species, of which the most frequent in Poland are *Dermatophagoides farinae* Hughes, *Dermatophagoides pteronyssinus* (Trouessart) and *Euroglyphus maynei* (Cooreman) (Racewicz, 2001; Solarz, 2001; Henszel et al., 2009, 2010).

A population of house dust mites depends on various environmental factors, including temperature and relative humidity. These arthropods live at temperatures from -18 to 50°C , while the optimum temperature for their development is 25°C (Hallas and Korsgaard, 1998). It has been noted that relative humidity above 60% favours the proliferation of mites (Fain et al., 1990), while humidity below 45% usually excludes their presence. The most resistant to low humidity is *D. farinae*, often detected in homes with central heating (H) (Hallas, 1991). In countries with a moderate climate, the optimum temperature and humidity for the proliferation of mites occur in early autumn – from August to mid-October (Fain et al., 1990). During the H seasons, the number of house dust mites decreases (Fain et al., 1990; Arlian, 1991).

Standard monitoring of mites uses a method of direct separation of mites from dust samples. Such monitoring may be a basis for the determination of seasonal dynamics of mites [in quarters or in H and non-heating (NH)

seasons], and of the examination of the age structure of populations belonging to the family Pyroglyphidae. The results of such studies may have practical importance in estimating human exposure to these mites, as some researchers have already confirmed (Pope et al., 1993).

Although there are quite a number of reports on the prevalence of house dust mites in Poland, they relate only to certain areas of the country, mostly in the central and southern parts (Solarz, 1997, 2001, 2004a,b). It is therefore justified to examine house dust mites in north-western Poland; accordingly, the objective of this study was to investigate the seasonal dynamics of allergenic mites population in dust samples collected from the sleeping places in apartments of north-western Poland, taking into account the quarters and H and NH seasons. The analysis was based on the coefficients of dominance and frequency, and concentration of mites per gram of dust, for selected taxa of mites (*D. farinae*, *D. pteronyssinus*, *Chortoglyphus arcuatus* and *Cheyletus* sp.) over four consecutive quarters. Furthermore, this study determined the age structure of *D. pteronyssinus* and *D. farinae* in different seasons.

Materials and Methods

Sampling

From 33 apartments in West Pomerania, Poland, dust samples were collected from 132 sleeping places (couches, beds and mattresses). These samples were taken once each quarter during the years 2004–2007, using a vacuum cleaner (Germany, 1000 W) with a 10×10 cm cotton filter for the collection of dust and mites. Each time vacuuming covered a different surface area of 1 m^2 in 2 min. The material for analysis was divided in two ways – taking into account four quarters of the year, and H and NH seasons; H season lasted from October to March, and NH season from April to September each year.

Isolation of mites

Dust samples were weighed and put into saturated NaCl solution with the addition of a few drops of detergent and left for 24 h. Then the supernatant fluid was filtered a few times using a coarse blotting paper filter then placed in a Petri dish and soaked with saturated NaCl solution. After 1–2 days, dishes were viewed under stereoscopic microscopy ($40\times$ magnification) to detect mites. This scheme was adopted following Arlian et al. (1983). Isolated mites were determined using acarological keys (Hughes, 1976; Fain et al., 1990; Colloff, 1991, 1998; Colloff and Spijksma, 1992; Solarz, 2004b) and an Olympus light microscope (BX51/BX52 Olympus, Tokyo, Japan) (Boczek, 1999). The acarological analysis took into account only intact specimens as it was assumed that

damaged mites were already dead before the collection of the material.

Conditions in the surveyed apartments

In the rooms where the acarofauna composition was examined, temperature and humidity were measured once a month over the years 2004–2007. Based on that data, mean temperature and humidity were calculated. Temperature (T) in the surveyed apartments was measured using a mercury thermometer. Relative air humidity (RH) was measured using a hygrometer (Haar-hygrometer, Fischer GmbH, Drebach, Germany) at the height of 0.4–0.7 m. The highest mean temperature was recorded during the period from July to September (24.5°C) and the lowest in the period from April to June (19°C). The highest relative humidity was in the fourth quarter of the year, from October to December (90.0%), and the lowest in the second quarter, from April to June (68.0%).

Over the years 2004–2007 in the examined rooms, the temperature measured in H and NH seasons was similar and was 21°C over a year. Relative humidity was about 6% higher in H season (83%) than in NH season (77%).

Statistical analysis

Statistical analysis was based on three main coefficients: dominance (D), frequency (F) and concentration (C). Coefficient of dominance (D) reflects the percentage of specimens of particular species or genus among all identified specimens in a sample. Coefficient of frequency (F) expresses the percentage of samples within a given taxon. Concentration coefficient (C) determines the number of mites per gram of dust. Descriptive statistics for the concentration of the dust mites that were most frequent in the examined dust samples (*D. farinae*, *D. pteronyssinus*, *Ch. arcuatus* and *Cheyletus* sp.) include the mean ($\bar{x}$),

standard deviation (SD), coefficient of variation (V) and minima and maxima. Statistical evaluation concerned the presence of allergenic mites in the dust, depending on their occurrence in each quarter of the year and in the H and NH seasons. Comparisons of means were carried out in pairs, and the differences were deemed statistically significant at $P \leq 0$. Analyses used STATISTICA 8 software (StatSoft, Poland). In general, the distribution of the mite quantity in the samples did deviate from the expected normal distribution and therefore in the statistical analysis a Student's t -test was used, and to establish a link between the chosen parameters we used Pearson's correlation coefficient.

Results

In the examined samples of dust from the sleeping places in apartments in north-western Poland, more than half of the isolates belonged to the order Astigmata, family Pyroglyphidae. These were the species: *D. farinae*, *D. pteronyssinus*, *E. maynei* and *Hirstia* Hull. Other dust mites from the same order were also isolated, but from two different families: family Chortoglyphidae – *C. arcuatus* (Troupeau), and family Glycyphagidae – *Gohieria fusca* (Oudemans) and *Lepidoglyphus destructor* (Schrack). In addition, we recorded the presence of order Prostigmata, family Cheyletidae – *Cheyletus* Latreille.

Seasonal variations of mites in dust samples over four consecutive quarters of the year

Out of the 132 samples of dust from sleeping places in 33 flats in West Pomerania from 2004 to 2007, the highest number of positive samples of house dust mites were reported in the fourth quarter and the lowest in the second quarter, 63.6% and 6.1%, respectively (Table 1). In the tested samples, a total of 1081 specimens were

Table 1. Number of specimens, the total number of mites collected and coefficients of frequency (F) and dominance (D), for mites isolated from dust in sleeping places located in 33 homes in north-western Poland in each quarter (first: January–March, second: April–June, third: July–September, fourth: October–December) during the years 2004–2007

Taxon	Number of specimens					F (in %)				D (in %)			
	First	Second	Third	Fourth	Total	First	Second	Third	Fourth	First	Second	Third	Fourth
<i>Dermatophagoides farinae</i>	110	42	204	333	689	12.1	6.1	30.3	60.6	69.6	85.7	76.4	54.9
<i>Dermatophagoides pteronyssinus</i>	16	–	19	59	94	3.1	–	6.1	21.2	9.5	–	7.1	9.7
<i>Euroglyphus maynei</i>	–	–	–	1	1	–	–	–	3.0	–	–	–	0.2
<i>Hirstia</i> sp.	–	–	–	6	6	–	–	–	6.1	–	–	–	1.0
<i>Chortoglyphus arcuatus</i>	25	–	–	21	46	9.1	–	–	15.1	15.8	–	–	3.5
<i>Lepidoglyphus destructor</i>	–	–	–	8	8	–	–	–	3.0	–	–	–	1.3
<i>Gohieria fusca</i>	–	–	12	–	12	–	–	6.1	–	–	–	4.5	–
<i>Cheyletus</i> sp.	8	7	32	179	226	3.0	3.0	9.1	48.5	5.1	14.3	12.0	29.5
Total	159	49	267	607	1082	18.2	6.1	33.3	63.6	100	100	100	100

Table 2. Mean concentrations of selected taxa of mites per gram of dust collected from sleeping places in different quarters (first: January–March, second: April–June, third: July–September, fourth: October–December) during the years 2004–2007 (n – number of samples, $\bar{x}$ – mean, SD – standard deviation)

Taxon	Concentration of mites per gram of dust in quarters							
	First		Second		Third		Fourth	
	n	$\bar{x} \pm \text{SD}$	n	$\bar{x} \pm \text{SD}$	n	$\bar{x} \pm \text{SD}$	n	$\bar{x} \pm \text{SD}$
<i>Dermatophagoides farinae</i>	4	13.90 $\pm$ 6.80	2	7.45 $\pm$ 0.35	10	26.75 $\pm$ 17.42	20	19.03 $\pm$ 27.15
<i>Dermatophagoides pteronyssinus</i>	1	13.50 $\pm$ 0.00	0	–	2	12.95 $\pm$ 4.31	7	11.21 $\pm$ 2.05
<i>Chortoglyphus arcuatus</i>	3	5.50 $\pm$ 1.90	0	–	0	–	5	4.46 $\pm$ 2.49
<i>Cheyletus</i> sp.	1	3.90	1	4.40	3	13.57 $\pm$ 11.90	16	18.23 $\pm$ 10.65

collected representing the following species: *D. farinae*, *D. pteronyssinus*, *E. maynei*, *Ch. arcuatus*, *G. fusca*, *L. destructor*, along with representatives of genera *Hirstia* and *Cheyletus*. All these species and genera (with the exception of *G. fusca*) were present in the fourth quarter. In quarters 1 and 3, four taxa were found: *D. farinae*, *D. pteronyssinus*, *Ch. arcuatus*, *Cheyletus* sp. and *D. farinae*, *D. pteronyssinus*, *Cheyletus* sp., *G. fusca*, respectively. In the second quarter only mites from species *D. farinae* and genus *Cheyletus* were recorded.

As measured by the coefficient of frequency, the taxa *D. farinae*, *Cheyletus* sp., *Ch. arcuatus* and *D. pteronyssinus* were found most frequently in samples from the fourth quarter, 60.6%, 48.5%, 15.1% and 21.2%, respectively. The taxa *D. farinae* and *Cheyletus* sp. were detected with the least frequency in the second quarter, 6.1% and 3.0%, respectively (Table 1).

Dermatophagoides farinae was a dominant species in samples of dust from the West Pomeranian apartments (Table 1). Coefficients of dominance for this species in each quarter ranged from 55% in the fourth quarter to almost 86% in the second quarter of the year. The largest and smallest coefficients of dominance of the second most commonly identified taxon – genus *Cheyletus* – were observed in different quarters, with the maximum in the fourth quarter (29.5%), and the minimum in the first quarter (5.1%). Coefficients of dominance for other taxa did not exceed 10%, with the exception of *Ch. arcuatus* in the first quarter ($D = 15.8\%$).

Only two taxa were found in all four quarters of the year: *D. farinae* and *Cheyletus* sp. Based on data for these two taxa, we characterized the dynamics of changes in their frequency over the consecutive quarters of the year (Table 1). The greatest number of samples in which we found *D. farinae* and *Cheyletus* sp. were reported in the fourth and third quarter (*D. farinae*, in 60.6% and 30.3% samples, and *Cheyletus* sp. in 48.5% and 9.1%, respectively), and the fewest samples in the first and second quarter (*D. farinae* 12.1% and 6.1%, and *Cheyletus* sp. 3% and 3%, respectively).

The four taxa with the highest concentrations found in the examined dust, *D. farinae*, *Cheyletus* sp., *Ch. arcuatus* and *D. pteronyssinus*, were analysed for the mean concentration of mites per gram of dust (Table 2). The greatest mean concentration of *D. farinae* was found in the third quarter and the lowest in the second quarter (approximately 27 and 7 specimens per gram of dust). Differences in the concentration of mites of this species in the four quarters of the year were confirmed statistically ($P \leq 0.01$). Similarly, the highest mean concentration of mites of the genus *Cheyletus* was recorded in the third and fourth quarter (usually 14–18 mites per gram of dust). In the first and second quarters, the mean concentration of these mites was about four mites per gram of dust. Individuals from other taxa of mites were present only in single samples, with the exception of *D. pteronyssinus*, where the mean concentration in the first, second and third quarters was similar, and amounted to 11–13 mites per gram of dust.

The dynamics of changes in the number of house dust mites in heating and non-heating seasons

This study also examined possible effects of conditions prevailing in the surveyed apartments in H and NH seasons on the concentrations of selected taxa of mites, namely *D. farinae*, *D. pteronyssinus*, *Cheyletus* sp. and *Ch. arcuatus* (Table 3). In NH season, the mean concentration of *D. farinae* was more than 21% higher than in H season, a change confirmed statistically ($P \leq 0.01$). A similar relationship was observed for *D. pteronyssinus*, as the mean concentration in NH season was more than 11% higher than in H season. However, due to too few positive samples from NH season for *D. pteronyssinus* ($n = 2$), a comparative statistical analysis was not carried out. In contrast to the two described species of mites, genus *Cheyletus* was more than 35% higher mean concentration mites per gram of dust collected in H season than in NH season, but this difference was not statistically confirmed. *Chortoglyphus arcuatus* was found only in samples from H season, and the mean concentration of

Table 3. Mean concentrations of selected taxons of mites per gram of dust collected from sleeping places during the heating (H; October–March) and non-heating (NH; April–September) seasons (n – number of samples, $\bar{x}$ – mean, SD – standard deviation) during the years 2004–2007

Taxon	H season		NH season	
	n	$\bar{x} \pm \text{SD}$	n	$\bar{x} \pm \text{SD}$
<i>Dermatophagoides farinae</i>	24	18.7 $\pm$ 24.87	12	23.53 $\pm$ 17.46
<i>Dermatophagoides pteronyssinus</i>	8	11.50 $\pm$ 2.06	2	12.95 $\pm$ 4.31
<i>Chortoglyphus arcuatus</i>	8	4.85 $\pm$ 2.21	0	–
<i>Cheyletus</i> sp.	17	17.38 $\pm$ 10.88	4	11.27 $\pm$ 10.74

Table 4. The dynamics of changes in the number of developmental stages of mites *Dermatophagoides farinae* and *Dermatophagoides pteronyssinus* in the consecutive quarters (first: January–March, second: April–June, third: July–September, fourth: October–December) of over the years 2004–2007

Taxon	Developmental stage	Number of taxons			
		First	Second	Third	Fourth
<i>D. farinae</i>	Larvae and nymphs	33	15	83	180
	Imago				
	♀	49	19	77	89
	♂	28	8	44	64
<i>D. pteronyssinus</i>	Larvae and nymphs	7	–	5	28
	Imago				
	♀	8	–	9	18
	♂	1	–	5	13

individuals of this species did not exceed five mites per gram of dust.

The dynamics of changes in the number of developmental stages of *Dermatophagoides farinae* and *Dermatophagoides pteronyssinus* over the consecutive quarters of the year

Data on the dynamics of changes in the number of developmental stages of two species of mites, namely *D. farinae* and *D. pteronyssinus*, in four consecutive quarters are presented in Table 4. In all four quarters, we identified all forms of *D. farinae*, both juvenile forms (larvae and nymphs) and adult forms (imago). More imago specimens than larvae and nymphs were recorded in the first, second and third quarters (130%, 80% and 45%, respectively). However, in the fourth quarter the number of juveniles exceeded the number of adult *D. farinae* (by about 17%). The number of collected specimens of this species in each quarter ranged from 15 to 180.

The adults of another analysed species – *D. pteronyssinus* – prevailed numerically over the juvenile stages in

quarters first, third and fourth (by 28%, 180% and 10%, respectively), but the numbers of collected specimens were small, ranging from 5 to 31.

Discussion

In this study, the highest number of positive samples (63.6%) and greatest taxonomic richness of mites (7 out of 8 taxa) was observed in the fourth quarter, when the relative humidity in the tested apartments was the highest (90%). By contrast, in the second quarter, which saw the lowest relative air humidity (68%) in the examined apartments, the number of mites was the lowest and representatives of only two taxa were found, namely *D. farinae* and genus *Cheyletus*. A similar acarofauna composition in house dust was observed in southern and northern Poland (Racewicz, 2001; Solarz, 2001). Also, the frequency of *D. farinae*, *D. pteronyssinus*, *Ch. arcuatus* and *Cheyletus* sp. was the highest in the fourth quarter. By contrast, in the second quarter, which saw the lowest relative air humidity (68%) in the examined apartments, the number of positive samples was the lowest and representatives of only two taxa were found, namely *D. farinae* and genus *Cheyletus*.

In the dust samples collected from flats in north-western Poland, the dominant species was *D. farinae*, which corresponds to reports by Solarz (2001) and Racewicz (2001) from other parts of Poland. A distinctly greater dominance of *D. farinae* in relation to other taxons could have resulted from its higher resistance to environmental conditions, including the low relative air humidity (Dusbábek, 1975; Arlian, 1989; Solarz, 2001), confirmed by the observation that in the second quarter the air humidity was the lowest, also this species reached the greatest dominance coefficient.

Dermatophagoides farinae was the most common taxon in house dust samples from north-western Poland. The frequency of this species ranged from 6.1% in the second quarter to 60.6% in the fourth quarter. A similar mean value of *D. farinae* frequency was found in house dust samples from southern and northern Poland (Solarz, 1998; Racewicz, 2001). Much higher coefficients than in this paper were found in Korea, Israel and Russia (63–75%) (Ree et al., 1997; Mumcuoglu et al., 1999; Zheltikova et al., 2007). The mean concentration of *D. farinae* in north-western Poland ranged from ~8 to ~27 (in the third quarter) mites per gram of dust. It is notable that in southern and northern Poland the highest house dust concentrations of *D. farinae* were found in the fourth quarter (Solarz, 2001; Aloszko et al., 2004), which is similar to reports from Denmark and Japan (Harving et al., 1993; Hashimoto et al., 1993).

The frequency of *D. pteronyssinus* in the cities of north-western Poland in the first and fourth quarters ranged from ~3% to ~21%, respectively. This species

occurred with similar frequency in cities of northern Poland (Racewicz, 2001), but in the south and central parts of the country it reached a significantly higher value, up to 44% (Samolinski et al., 1989; Solarz, 1998). The house dust samples from Great Britain, Brazil and Israel revealed an even higher frequency of this species, between 44% and 85% (Hewitt et al., 1973; Mumcuoglu et al., 1999; Silva et al., 2005). *Dermatophagoides pteronyssinus* has similar concentration values in first, third and fourth quarters and ranged from about 11 to 13 mites per gram of dust from apartments of north-west Poland. But in house dust samples collected in the second quarter this species was not found, probably caused by the low relative air humidity (68%) in the examined rooms. In the case of *D. pteronyssinus*, the optimal condition of development is relative humidity from 75% to 80% (Dusbábek, 1975; Arlian, 1989). Similar mean concentrations of *D. pteronyssinus* (the highest in the fourth quarter) in the analogous material were observed in southern and northern Poland (Solarz, 1997; Aloszko et al., 2004). Much higher mean concentrations (500 and more mites per 1 g of dust) than in this paper were found in Brazil and Malaysia (Mariana et al., 2000; Silva et al., 2005).

Taking into consideration two species: *D. farinae* and *D. pteronyssinus* examined in north-western Poland, we observed that their highest mean concentrations occurred in the NH season, although the relative air humidity in the H season was slightly higher. This is consistent with the results from Northern Poland (Racewicz, 2001).

Mites from the taxons *Ch. arcuatus* and *Cheyletus* sp. are included in the group of storage mites, but they are also found in house dust in our and other studies (Wharton, 1976; Arlian et al., 1992; Hubert et al., 2006).

In this research, the presence of *Ch. arcuatus* was noted only in the first and fourth quarter (Tables 1 and 2). The lack of *Ch. arcuatus* in the second and third quarters could have been caused by the low relative air humidity. It was shown that the representatives of the family Chortoglyphidae are more sensitive to humidity and temperature than mites from the family Pyroglyphidae (Bronswijk, 1981; Feldman-Muhsam et al., 1985; Fain et al., 1990). In others regions of Poland *Ch. arcuatus* was not found in house dust at all or observed only sporadically (Racewicz, 2001; Solarz, 2001).

The frequency of genus *Cheyletus* in house dust samples from Szczecin and the surrounding areas, and from other parts Poland, Turkey and Chile was usually quite low (2–6%) (Franjola and Malonnek, 1995; Racewicz, 2001; Solarz, 2001; Akdemir and Gürdal, 2005). The highest frequency of this taxa, was found in Puerto Rico and Brazil (20–34%), i.e. in parts of the world that have a high relative air humidity (Montealegre et al., 1997; Baqueiro et al., 2006).

The frequency and concentration of the *Cheyletus* mites can be affected, in addition to relative air humidity and temperature, by the availability of prey (other mites) as the this genus includes many predatory species (Palyvos and Emmanouel, 2009).

Sporadically, house dust samples from Szczecin and the surrounding area contained mites from several other taxa: *E. maynei*, *Hirstia* sp., *L. destructor* and *G. fusca*. Their presence was observed only in the 4th quarter, when relative air humidity was the greatest and reached 90%. In other parts of Poland, these taxa were also rarely identified (Racewicz, 2001; Solarz, 2001). In some European countries (Great Britain, Netherlands, Scandinavian countries) the frequency of *E. maynei* was about 12%, which most likely was connected with the higher relative air humidity (Colloff, 1987b; Mehl, 1998; Spieksma and Dieges, 2004).

In addition to research on the occurrence of mites in house dust, there are also some reports on the dynamics of occurrence of individual development stages (larva, nymph and imago). In house dust samples from north-western Poland, we noted that the adult stages of *D. farinae* and *D. pteronyssinus* were more numerous than juveniles, although larvae and nymphs of *D. farinae* outnumbered adults in the fourth quarter. It could have been due to an increase in the population of *D. farinae* in the third quarter when the conditions for development were their best. The preponderance of the mature stages over larvae and nymphs of the two aforementioned species in Poland has also been ascertained (Solarz, 1998; Racewicz, 2001), and in the US (Arlian et al., 1983, 1992). In Czechoslovakia the dominance of juvenile stages (nymphs) of the aforementioned species was demonstrated in the first and fourth quarters (Dusbábek, 1975). It could be suggested that it may have a relationship with the emergence of *D. farinae* protonymph resistant to adverse environmental conditions, including low humidity.

Our results confirm the high incidence of house dust mites in sleeping places in flats of north-western Poland and the impact of environmental conditions including temperature and air humidity on the composition of the dust mite acarofauna. This study, aiming at the determination of the prevalence of mites, their age structure and seasonality, may be of great epidemiological importance, particularly in the assessment of exposure to these mites.

In many cases, these results were consistent with data from other parts of Poland, as reported by various authors.

Conclusions

1 The dominant species in the tested dust samples was *D. farinae*, with its highest mean concentration recorded in the second quarter.

2 The greatest mean concentrations of *D. pteronyssinus* and *Ch. arcuatus* were in the first quarter, and *Cheyletus* sp. in the fourth quarter.

3 *Dermatophagoides farinae* and *D. pteronyssinus* achieved highest mean concentration in the NH season, and *Cheyletus* genus during the H season.

4 The analysis of developmental stages of *D. farinae* and *D. pteronyssinus* in the various quarters of the year showed that:

- adults of *D. farinae* dominated over the juvenile stages (larvae and nymphs) in first, second and third quarters;
- imago stages of *D. pteronyssinus* were more numerous in relation to juvenile stages in quarters first, third and fourth, i.e. in all seasons of the year when the presence of this species was detected.

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