

## The risk of exposure to parasitic mites and insects occurring on pets in Southern Poland

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**ABSTRACT.** Companion animals, including pets, can be infested by many species of parasitic mites and insects, which can pose a threat to the health of both animals and humans. The aim of this study is to evaluate the risk of exposure of companion animals to various species of external parasites which can be transferred to humans and cause many skin diseases. External parasites were collected in 2012–2014 from the patients of veterinary clinics in the provinces of Silesia and Malopolska (Southern Poland). Parasitic mites and insects were collected using preparation needles. Parasites were classified to species and life stage under a Stemi 2000-C stereomicroscope (Zeiss) or an ECLIPSE E-200 optical microscope (Nikon). They were then analysed by an Optika Vision Pro system (Nikon). In total, 77 samples were taken: 62 from the Malopolska and 15 from Silesia. A total of 999 specimens of parasitic mites and 225 specimens of parasitic insects were isolated from the samples. The dominant mite species was *Otodectes cynotis* var. *cati* (Astigmatina, Psoroptidae) with 855 isolated specimens (85.6% of the total number of isolated mites). *Polyplax spinulosa* was the predominant parasitic insect species: 209 specimens were identified, constituting 92.9% of all examined insects. Our findings indicate that companion animals and their owners have a high risk of exposure to ectoparasites.

**Key words:** ectoparasites, companion animals, parasites of pets, risk of exposure, Southern Poland

### Introduction

Companion animals, including pets, play an important role in society, enhancing the psychological and physiological welfare of their owners [1,2]; however, they can be infested by many species of parasitic mites and insects, which can pose a threat to the health of both animals and humans. Infestations of parasitic insects and mites are a common occurrence in pets, resulting in such bothersome symptoms as discomfort, pruritus or allergic reactions. Some of the most widespread external parasites of animals are *Demodex canis*, *D. cati*, *D. gatoi*, *Otodectes cynotis*, *Sarcoptes scabiei*, *Psoroptes ovis*, *Cheyletiella yasguri*, *Chirodiscoides caviae*, *Columbicola columbae*, *Polyplax spinulosa*, *Ctenocephalides felis*, *Ceratophyllus gallinae* and *Gliricola porcelli*; these being responsible for the most common parasitic diseases of the skin, such as

sarcoptosis, otodectosis, flea and lice infestations, demodecosis and cheyletiellosis [3,4].

*D. canis* is a widespread animal parasite carried in almost 80% of dogs. Infection most commonly occurs by direct contact [5], with the predisposing factors for the development of demodecosis in animals being young age, the presence of metabolic disorders, malnutrition, systemic infections and tumors, as well as decreased natural immunity [5,6]. The parasites typically occur in the hair follicles and sebaceous glands, although sometimes they can enter the lymph nodes, internal organs and blood [7–10].

Another group of parasitic mites which can constitute a threat to animal and human health are the skin mites of the genera *Sarcoptes* and *Psoroptes* [11,12]. *Sarcoptes scabiei* parasitizes the deep layers of the epidermis and burrows into the *stratum corneum*, while the dermal mite *Psoroptes* exists on

Table 1. Dominance and frequency of the parasitic mites detected in the examined probes from pets

Mite species	Dominance		Frequency	
	N	D (%)	n	F (%)
<i>Otodectes cynotis</i> var. <i>cati</i>	855	85.6	43	63.2
<i>Demodex canis</i>	52	5.2	6	8.8
<i>Otodectes cynotis</i> var. <i>canina</i>	44	4.4	7	10.3
<i>Cheyletiella yasguri</i>	35	3.5	4	5.9
<i>Sarcoptes scabiei</i> var. <i>canina</i>	8	0.8	5	7.4
<i>Notoedres cati</i>	2	0.2	1	1.5
<i>Ophionyssus natricis</i>	2	0.2	1	1.5
<i>Chirodiscoides caviae</i>	1	0.1	1	1.5
<b>Total number</b>	<b>999</b>	<b>100</b>	<b>68</b>	<b>100</b>

Explanations: N – number of specimens collected; n – number of positive probes; D (%) – percent of the total number of mites collected; F (%) – frequency of the particular species of parasitic mites in relation to all probes examined (n = 68).

the epidermis and at the base of hair follicles. The main route of infection for the Sarcoptidae family is by direct contact with the infested animals.

Many insect ectoparasites can infest vertebrates, causing skin lesions and allergic reactions; some key examples are *Columbicola columbae*, *Polyplax spinulosa*, *Ctenocephalides felis*, *Ceratophyllus gallinae* and *Gliricola porcelli*. Some external parasites, fleas for example, can also participate in the transmission of zoonotic pathogens. Such species include *Bartonella henselae*, *B. bovis*, *B. ovis*, *Borrelia burgdorferi* sensu lato, *Yersinia pestis*, *Rickettsia typhi*, *R. felis*, *Francisella tularensis*, *Burkholderia maleli*, *Bacillus anthracis* and *Dipylidium caninum*, which can transmit diseases such as plague, murine typhus, tularemia, cat-scratch disease and dipylidiasis [13–16].

The aim of this study is to evaluate the risk of exposure of humans and companion animals to species of transferrable external parasites which can cause skin disease.

## Materials and Methods

Parasitic mites and insects were collected in the period 2012–2014 from the patients of veterinary clinics in the provinces of Silesia and Malopolska, Southern Poland. Skin scrapings or hairs were taken from 77 infested pets and other companion animals. Deep skin scrapings from the head, earlobes, limbs, snout and abdomen were collected using a surgical scalpel according to the character of the skin lesions.

The material was placed on slides with the

Table 2. Dominance and frequency of the parasitic insects detected in the examined probes from pets

Species of insects	Dominance		Frequency	
	N	D (%)	N	F (%)
<i>Polyplax spinulosa</i>	209	92.9	2	22.2
<i>Gliricola porcelli</i>	7	3.1	1	11.1
<i>Columbicola columbae</i>	5	2.2	2	22.2
<i>Ctenocephalides felis</i>	3	1.3	3	33.3
<i>Ceratophyllus gallinae</i>	1	0.4	1	11.1
<b>Total number</b>	<b>225</b>	<b>100</b>	<b>9</b>	<b>100</b>

Explanations: N – number of specimens collected; n – number of positive probes; D (%) – percent of the total number of mites collected; F (%) – frequency of the particular species of parasitic insects in relation to all probes examined (n = 9).



Fig. 1. *Columbicola columbae* – imago

addition of paraffin oil or Hoyer's fluid [17]. Parasitic mites and insects were collected using preparation needles, and classified to species and life stage under a Zeiss Stemi 2000-C stereomicroscope or a Nikon ECLIPSE E-200 optical microscope. They were then analyzed by a Nikon Optika Vision Pro system. Photographs were taken with a digital camera.

The dominance and frequency of parasitic mites (Table 1) and parasitic insects (Table 2), in the samples were calculated based on the obtained data. The coefficient of dominance (D) represents the percentage of specimens of a particular species or genus of all the identified specimens in the sample. The coefficient of frequency (F) expresses the percentage of samples within a given taxon.

## Results

The results are presented in Tables 1–4. A total of 62 animals from Malopolska and 15 animals from Silesia were positive for parasitic mites or insects (Table 3). In all, 999 specimens of mites and 225 specimens of insects were collected (Table 4).

### Parasitic mites

Among the mites, the dominant species was *Otodectes cynotis* var. *cati* (Astigmatina, Psoroptidae) with 855 isolated specimens,

representing 85.6% of the total number of isolated mites. Of the remaining species, the most numerous was *Demodex canis* (Prostigmata, Demodecidae) (Fig. 3): in total, 52 specimens of this species were isolated, constituting 5.2% of all collected mites.

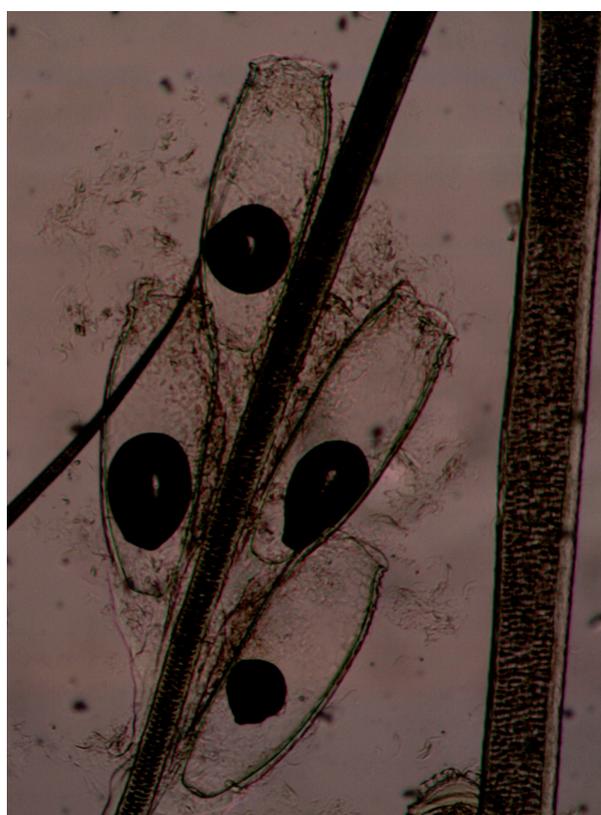


Fig. 2. *Polyplax spinulosa* – eggs

Table 3. The list of parasitic species of mites and insects collected from the analyzed domestic animals on the territory of Malopolska and Silesia Provinces

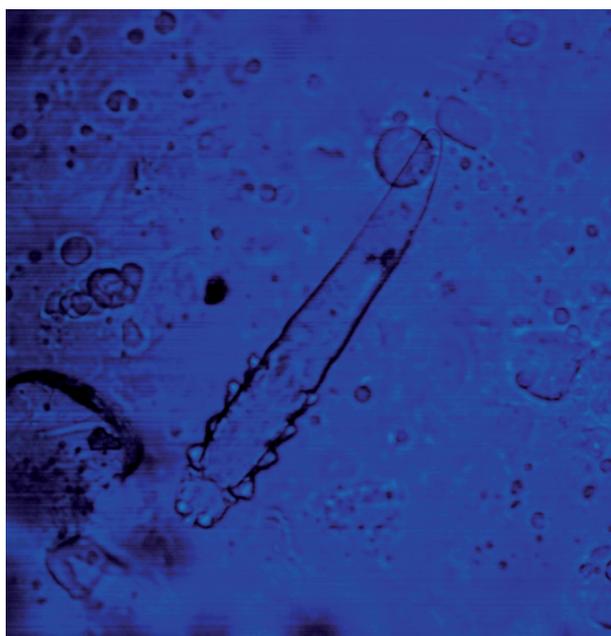
Locality (Province)	Species (disease provoked)	Domestic animal species	Number of studied animals
Zembrzyce (Malopolska)	<i>Chirodiscoides caviae</i> ( <i>chirodiscoiduscaviae</i> )	<i>Cavia porcellus</i>	1
	<i>Otodectes cynotis</i> var. <i>cati</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Felis catus</i>	4
	<i>Cheyletiella yasguri</i> ( <i>cheyletiellosis</i> )	<i>Canis familiaris</i>	1
Marcówka (Malopolska)	<i>Otodectes cynotis</i> var. <i>canina</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Canis familiaris</i>	1
Kurów (Malopolska)	<i>Otodectes cynotis</i> var. <i>canina</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Canis familiaris</i>	1
	<i>Otodectes cynotis</i> var. <i>cati</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Felis catus</i>	2
Mucharz (Malopolska)	<i>Demodex canis</i> ( <i>demodecosis</i> )	<i>Canis familiaris</i>	1
Stryków (Malopolska)	<i>Demodex canis</i> ( <i>demodecosis</i> )	<i>Canis familiaris</i>	1
Budzów (Malopolska)	<i>Otodectes cynotis</i> var. <i>cati</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Felis catus</i>	1
	<i>Otodectes cynotis</i> var. <i>canina</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Canis familiaris</i>	2
	<i>Columbicola columbae</i>	<i>Columba livia</i>	1
Sucha Beskidzka (Malopolska)	<i>Sarcoptes scabiei</i> var. <i>canina</i> ( <i>sarcoptosis, scabies</i> )	<i>Canis familiaris</i>	2
	<i>Otodectes cynotis</i> var. <i>cati</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Felis catus</i>	10
	<i>Notoedres cati</i> ( <i>notoedrosis, sarcoptosis, scabies</i> )	<i>Felis catus</i>	1
	<i>Polyplax spinulosa</i>	<i>Rattus</i> sp.	1
Stryżawa (Malopolska)	<i>Otodectes cynotis</i> var. <i>cati</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Felis catus</i>	4
	<i>Sarcoptes scabiei</i> var. <i>canina</i> ( <i>sarcoptosis, scabies</i> )	<i>Canis familiaris</i>	2
Skawica (Malopolska)	<i>Otodectes cynotis</i> var. <i>canina</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Canis familiaris</i>	1
	<i>Otodectes cynotis</i> var. <i>cati</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Felis catus</i>	2
	<i>Cheyletiella yasguri</i> ( <i>cheyletiellosis</i> )	<i>Canis familiaris</i>	1
Bieńkówka (Malopolska)	<i>Demodex canis</i> ( <i>demodecosis</i> )	<i>Canis familiaris</i>	1
Lachowice (Malopolska)	<i>Otodectes cynotis</i> var. <i>cati</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Felis catus</i>	1
	<i>Demodex canis</i> ( <i>demodecosis</i> )	<i>Canis familiaris</i>	1
Tarnawa Dolna (Malopolska)	<i>Sarcoptes scabiei</i> var. <i>canina</i> ( <i>sarcoptosis, scabies</i> )	<i>Canis familiaris</i>	1
	<i>Otodectes cynotis</i> var. <i>cati</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Felis catus</i>	2
Zawoja (Malopolska)	<i>Otodectes cynotis</i> var. <i>cati</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Felis catus</i>	4
Białka (Malopolska)	<i>Otodectes cynotis</i> var. <i>cati</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Felis catus</i>	2
Maków Podhalański (Malopolska)	<i>Otodectes cynotis</i> var. <i>cati</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Felis catus</i>	3
Krzyszów (Malopolska)	<i>Demodex canis</i> ( <i>demodecosiscanis</i> )	<i>Canis familiaris</i>	2
	<i>Otodectes cynotis</i> var. <i>cati</i> ( <i>otodectosis s. otitis externa parasitaria</i> )	<i>Felis catus</i>	2

Table 3. cd

Locality (Province)	Species (disease provoked)	Domestic animal species	Number of studied animals
Kuków (Malopolska)	<i>Columbicola columbae</i>	<i>Columba livia</i>	1
Las (Silesia)	<i>Otodectes cynotis</i> var. <i>cati</i> ( <i>otodectosis</i> s. <i>otitis externa parasitaria</i> )	<i>Felis catus</i>	2
Będzin (Silesia)	<i>Otodectes cynotis</i> var. <i>cati</i> ( <i>otodectosis</i> s. <i>otitis externa parasitaria</i> )	<i>Felis catus</i>	4
	<i>Otodectes cynotis</i> var. <i>canina</i> ( <i>otodectosis</i> s. <i>otitis externa parasitaria</i> )	<i>Canis familiaris</i>	2
	<i>Cheyletiella yasguri</i> ( <i>cheyletiellosis</i> )	<i>Canis familiaris</i>	2
	<i>Ctenocephalides felis</i> ( <i>ctenocephalidosis</i> )	<i>Felis catus</i>	2
	<i>Ctenocephalides felis</i> ( <i>ctenocephalidosis</i> )	<i>Canis familiaris</i>	1
	<i>Ceratophyllus gallinae</i> ( <i>ctenocephalidosis</i> )	<i>Columba livia</i>	1
	<i>Gliricola porcelli</i> ( <i>gliricolosis</i> )	<i>Cavia porcellus</i>	1
	<i>Ophionyssus natricis</i>	<i>Boa constrictor constrictor</i>	1
	Zawiercie (Silesia)	<i>Polyplax spinulosa</i>	<i>Rattus</i> sp.

The third most numerous species was *Otodectes cynotis* var. *canina* from the family Psoroptidae (44 specimens, 4.4% of the total count), and the fourth was *Cheyletiella yasguri* (Prostigmata, Cheyletidae), with 35 specimens of this species present in the examined samples (3.5% of the total population).

In addition, the following species of parasitic mites were present: eight specimens of *Sarcoptes scabiei* var. *canina* (Astigmatina, Sarcoptidae) (0.8% of the total mites), two specimens of *Notoedres cati* (Astigmatina, Sarcoptidae) (0.2%), two specimens of *Ophionyssus natricis* (Mesosti-

Fig. 3. *Demodex canis* – imagoFig. 4. *Ceratophyllus gallinae* – female

gmata, Macronyssidae) (0.2%) and one *Chirodiscoides caviae* (Astigmatina, Atopomelidae) (0.1%) (Table 1).

### Parasitic insects

A total of 225 parasitic insects were isolated from the collected and examined probes (Table 2). *Polyplax spinulosa* (Fig. 2) was the predominant species; a total of 209 specimens were identified, which constituted 92.9% of all examined insects. In addition, seven specimens of *Gliricola porcelli* (3.1% of the total number of collected insects), five of *Columbicola columbae* (2.2%) (Fig. 1), three of *Ctenocephalides felis* (1.3%) and one female of *Ceratophyllus gallinae* (0.4%) (Fig. 4) were identified. In addition, *Ctenocephalides felis* was

Table 4. Numbers of the particular species of parasitic mites and insects (including eggs) collected from examined pets in relation to the host species

Host species	Parasite species	Number of specimens (including eggs)
<i>Felis catus</i> (N=46)	<i>Otodectes cynotis</i> var. <i>cati</i>	855
	<i>Notoedres cati</i>	2 (only eggs)
	<i>Ctenocephalides felis</i>	2
<i>Canis familiaris</i> (N=23)	<i>Otodectes cynotis</i> var. <i>canina</i>	44 (including 2 eggs)
	<i>Sarcoptes scabiei</i> var. <i>canina</i>	8
	<i>Demodex canis</i>	52
	<i>Cheyletiella yasguri</i>	35
	<i>Ctenocephalides felis</i>	1
<i>Cavia porcellus</i> (N=2)	<i>Chirodiscoides caviae</i>	1
	<i>Gliricola porcelli</i>	7
<i>Rattus</i> sp. (N=2)	<i>Polyplax spinulosa</i>	209 (including 204 eggs)
<i>Columba livia</i> (N=3)	<i>Columbicola columbae</i>	5
	<i>Ceratophyllus gallinae</i>	1
<i>Boa constrictor constrictor</i> (N=1)	<i>Ophionyssus natricis</i>	2

found in three samples (33.3% of all studied probes). Of the remaining parasitic insects, *Polyplax spinulosa* was found in 22.2% of the samples, *Columbicola columbae* in 22.2%, *Ceratophyllus gallinae* in 11.1% and *Gliricola porcelli* in 11.1% (Table 2).

A list of parasitic mites and insects with their hosts and their source is given in Table 3. A detailed list of parasitic mites and insects collected from the examined animals, including eggs of those parasites, is presented in Table 4.

## Discussion

Besides ticks, several acarine genera are of medical and veterinary concern; some of these are *Demodex*, *Sarcoptes*, *Psoroptes*, *Chorioptes*, *Psorergates*, *Knemidocoptes* and *Otodectes* [18]. The most common individual group of parasitic mites identified in the present study was *Otodectes cynotis* var. *cati* (85.6%); out of the 46 examined cats, 43 were infected by this species. In a previous study on infected cats, Lefkaditis et al. [19] report an intensity of infection ranging from three to almost 150 individual mites per animal. In turn, Akucewich et al. [20] report a 22.5% prevalence of *O. cynotis* in cats from Florida, Tonn [21] a 33% prevalence in Oklahoma, and Sotiraki et al. [22] a 25.5% prevalence in Greece. Our findings suggest

that *O. cynotis* can be considered a widespread parasitic mite species in domestic cats living in a temperate climate.

*Demodex canis* was the second most prevalent species in the collected material. Its prevalence in dog populations varies. In Poland, its prevalence has been found to range from 39% to 85% [7], with infection usually being asymptomatic [7,8,23]. Canine demodecosis is one of the most common skin diseases in veterinary practice, but symptoms usually arise when a high level of mite infection is correlated with diminished host resistance [9,10].

Many species of parasitic insect from the genera *Ctenocephalides*, *Ceratophyllus*, *Polyplax*, *Gliricola* and *Columbicola* were found in the present study, these ranging from irritating pets to threats to the health of humans or animals. Two species of flea were identified: *Ctenocephalides felis* (three specimens) and *Ceratophyllus gallinae* (one specimen). Both flea species were found on their specific hosts. *C. felis* was removed from two cats (*Felis catus*) and a dog (*Canis familiaris*), while *C. gallinae* was collected from a rock pigeon (*Columba livia*). Although studies have found flea infestations to occur at various frequencies, *C. felis* is by far the most prevalent species collected from cats [20,24–28]. A study from Mexico found a 30.3% prevalence of external parasites on cats, where 92% of those constituted *C. felis*, and only 8% infested

with *C. canis* [29]. A Hungarian study found fleas from three species, *C. felis*, *C. canis* and *Pulex irritans*, on dogs and cats [30]. Current published data indicates that *C. gallinae* and *C. felis* are common ectoparasites which facilitate the transmission of many pathogenic factors between animals and humans, and actively participate in the induction of allergy in domestic animals and the people in direct contact with them.

The dog infested by *C. felis* in our study suffered from intense skin itching, and mechanical damage to hair and oozing skin wounds were observed; these symptoms are characteristic of Flea Allergic Dermatitis (FAD). Allergic skin lesions could also occur in humans, the most often in form of irritating red spots [13–16].

Another predominant species was found to be *Polyplax spinulosa*, which an Iranian study found to be highly prevalent on laboratory rats in two animal houses (80%). A higher rate of infestation (100%) was reported among the rats of the science college than those of the medical college (60%). The high rates of infestation observed in both the present and the Iranian study can be attributed to poor sanitary conditions in the rat breeding areas and the use of inappropriate antiparasitic preparations [31]. Little information currently exists in the literature regarding infestations by the other species of insects identified in the present study.

## Conclusions

1. All of collected parasitic mites play a significant role in causing allergies and skin diseases in humans and animals.

2. All of the identified parasitic insects cause skin symptoms in companion animals, especially pets.

3. Companion animals and humans have a high risk of exposure to the ectoparasites found in this study.

4. In domestic animals from studied areas, most infections were caused by the mites *Otodectes cynotis*, *Sarcoptes scabiei* var. *canina*, *Notoedres cati*, *Chirodiscoides caviae*, *Demodex canis* and *Cheyletiella yasguri*.

5. In domestic animals from studied areas, most infections were caused by the insects *Polyplax spinulosa*, *Gliricola porcelli*, *Columbicola columbae*, *Ctenocephalides felis* and *Ceratophyllus gallinae*.

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