

(RESEARCH ARTICLE)



## Regional features of the course of demodicosis in dogs

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### Abstract

Demodicosis is one of the most common diseases in dogs. We have analyzed the epizootological features of the course of demodectic invasion in dogs. In the process of research, territorial, age, breed, sex, seasonal features of the distribution of canine demodicosis, clinical forms of its manifestation were studied. When making a diagnosis, the generally accepted laboratory diagnostic method was used. In the conditions of the Kamenetz-Podolsk region, the share of demodicosis of all pathologies of the skin of dogs is 24.6%. Clinically, 69.9% of the animals had local demodicosis, and its most common forms were scaly (35.4%), mixed (21.2%) and pustular (18.6%). The highest morbidity rate was observed in female short-haired breeds (Bulldog, Rottweiler and Pug) at the age of 7-12 months, there were two peaks in the incidence of dogs in March - 31.1% and in October-November (37.8-34.1%).

**Keywords:** Dogs; Demodicosis; Clinical forms of demodicosis; Epizootological features of demodicosis

### 1. Introduction

It is known that skin diseases are one of the most common pathologies in dogs (Mueller et al., 2020; Rahman et al., 2021). Approximately a quarter of all dog owners' visits to veterinarians are related to skin disease, and in many cases, skin condition is an indicator of the overall health of the animal (Zhou et al., 2020; Prosyanyi et al., 2022).

In the etiology of skin diseases in dogs, dermatitis of parasitic origin is recorded quite often, which is due to the uncontrolled growth in the number of stray animals, the relatively low effectiveness of treatment, the ecology of large cities, and a number of other factors (Fourie et al., 2019; Parwari et al., 2022). Urban dog populations are intensively affected by negative factors, including a high level of stress, an unsatisfactory ecological situation, feeding with dry and other concentrated feeds, and uncontrolled breeding. These factors contribute to the emergence and spread of skin diseases in animals, including demodicosis (Becskei et al., 2018). In large cities, when examining dogs with skin lesions, demodicosis is detected in 21.4 – 67.4% of cases (Becskei et al., 2018; Horne, 2019).

It has now been established that demodicosis invasion in dogs has a variety of clinical manifestations - from single skin lesions to systemic pathology involving internal organs in the process (Perego et al., 2019; O'Neill et al., 2020; Parwari et al., 2022).

Taking into account the practical significance of this problem, one of the areas of our research was to conduct epizootological monitoring of canine demodicosis and study the features of its course on the territory of Ukraine.

### 2. Material and methods

Experimental studies were carried out in 2020-2022 in veterinary medicine clinics in the cities of Kamianets-Podilskyi and Khmelnytskyi (Ukraine).

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Diagnosis of demodicosis and other acarosis was carried out in a complex way: according to the clinical course of invasions and according to the results of laboratory tests. From the epizootological data, the extensiveness of invasion, the seasonality of outbreaks, the age, breed and sex susceptibility of animals to demodicosis were taken into account.

Clinical studies of dogs were carried out by examining experimental animals taking into account the area of skin lesions, the nature of pathological changes and localization of the inflammatory process. They paid attention to the tousledness, shine of the hair cover, the presence of baldness, and in the case of peeling - hyperemia, elasticity of the skin, thickening, and the presence of crusts. If clinical signs of demodicosis were detected during the examination, the diagnosis was confirmed microscopically.

When taking the material for the detection of Demodex mites, the method of deep (before the appearance of blood) skin scrapings was used at the border of the affected and healthy skin from at least 3-4 places. In the case of the pustular form, the material was obtained with a sterile needle. Acarological studies were carried out by conventional laboratory methods (Zeibig, 2012; Zajac et al., 2021).

Statistical analysis was performed using ANOVA. Data are presented as  $x \pm SD$  (mean  $\pm$  standard error). The reliability of the obtained data was assessed by the F-criterion with significance levels  $P < 0.05$ ,  $P < 0.01$ ,  $P < 0.001$  (taking into account the Bonferroni correction).

### 3. Results

Table 1 presents the results of a retrospective analysis of dog skin pathologies for the period 2020-2022.

**Table 1** Analysis of dermatopathology of dogs during 2020-2022

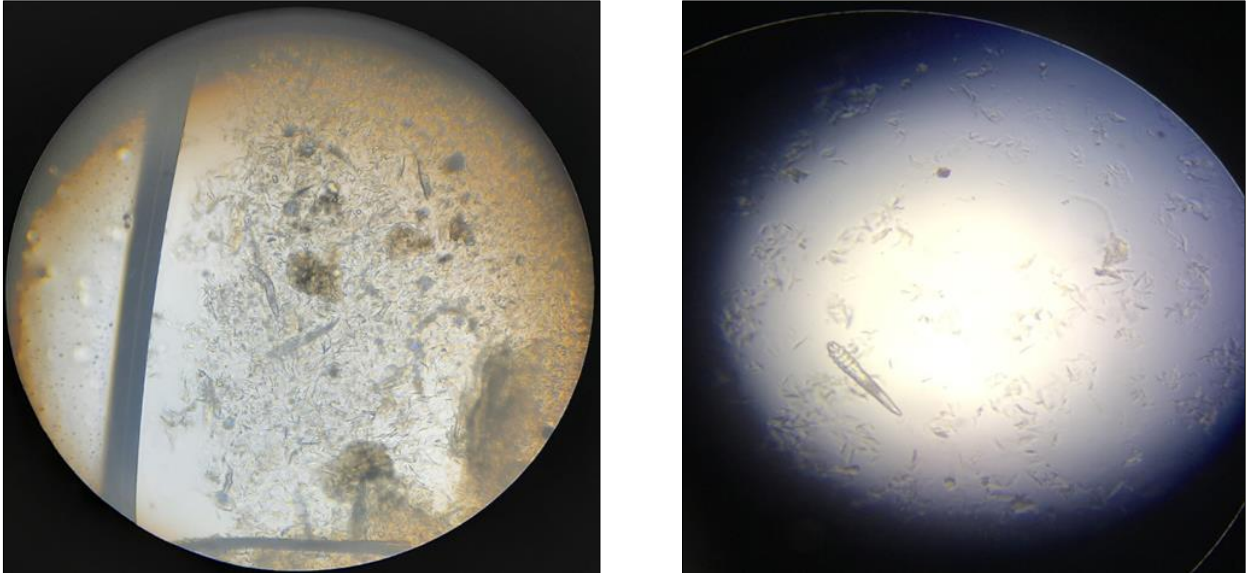
Skin diseases	2020		2021		2022	
	n	%	n	%	n	%
Flea allergy dermatitis	24	5.7	28	6.1	18	3.9
Dermatophytoses	108	25.7	104	22.7	122	26.2
Seborrhea	14	3.3	12	2.6	22	4.7
Contact dermatitis	28	6.7	36	7.9	36	7.7
Demodecosis	62	14.8	70	15.3	74	15.9
Sarcoptosis	12	2.9	10	2.2	12	2.6
Otodectosis	56	13.3	66	14.4	50	10.7
Food allergy	12	2.9	16	3.5	22	4.7
Drug allergy	12	2.9	16	3.5	26	5.6
Atopic dermatitis	46	11.0	56	12.2	50	10.7
Pyoderma	20	4.8	22	4.8	18	3.9
Other skin pathologies	26	6.0	22	4.8	16	3.4

In general, skin pathologies are quite common among dogs. At the same time, in dynamics over the past 3 years, their number has increased by 1.11 times. Among all skin pathologies, dermatophytosis occupies a leading place. If in 2020 their share was 25.7%, then in 2022 it increased by 0.5%. Also, over the past three years, the number of cases of dermatitis associated with allergies to feed components and allergies to medicines has increased by 1.8 and 2.7%, respectively.

Atopic and contact dermatitis are quite common among dermatopathologies, in particular, in 2020, these pathologies were detected in 10.7 and 7.7% of dogs, respectively. A significant place in the dermatopathology of dogs is also occupied by allergies associated with flea bites (3.9 – 6.1%), pyoderma (3.9 – 4.8%) and seborrhea (2.6 – 4.7%).

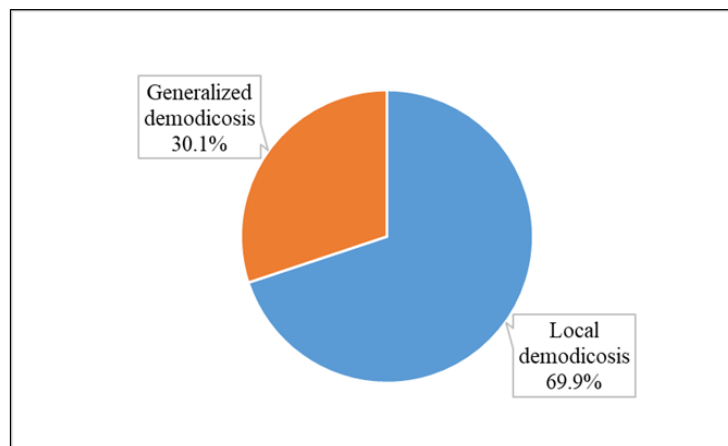
Sarcoptic mange, otodectosis and demodicosis were found among the acarosis pathologies of the skin of dogs. Moreover, if the first of them was registered in isolated cases, then the last two received mass distribution. In particular, data for 2022 show that among all skin pathologies, otodectosis was found in 10.7% of cases and demodicosis in 15.9%.

Atopic dermatitis also occupies a significant percentage in the general pathology of the skin, accompanied by the appearance of foci of papular infiltration, multiple scratching, thickening of the skin epidermis with the formation of a significant number of folds, hemorrhagic crusts, and severe itching. In 113 dogs (24.6%), specific clinical signs of demodicosis were revealed, and in deep scrapings a significant number of eggs, immature individuals and adults of the causative agent of demodicosis (Fig. 1).



**Figure 1** Demodex canis from affected skin areas of dogs

The clinical aspects of demodectic infestation showed that in most cases (69.9%) local demodicosis was registered in the region (Fig. 2), which most often manifested as a scaly form.



**Figure 2** Frequency of occurrence of demodicosis

In this case, lesions were often localized in the head and limbs (Fig. 3A). And yet, 30.1% of cases of demodicosis accounted for generalized demodicosis. In the generalized form (Fig. 3B), demodectic lesions covered much larger areas of the skin and the process was very often complicated by a bacterial infection (pyodemodectosis). Microbiological analysis of scrapings allowed us to identify mainly *Staphylococcus pseudintermedius*, less often (in severe cases) *Pseudomonas aeruginosa* and *Proteus mirabilis*.



**Figure 3** Clinical manifestation of demodicosis

The analysis of the manifestation of characteristic specific signs revealed by us in demodectic infestation is given in table. 2.

**Table 2** The incidence of clinical forms of demodicosis, n = 113

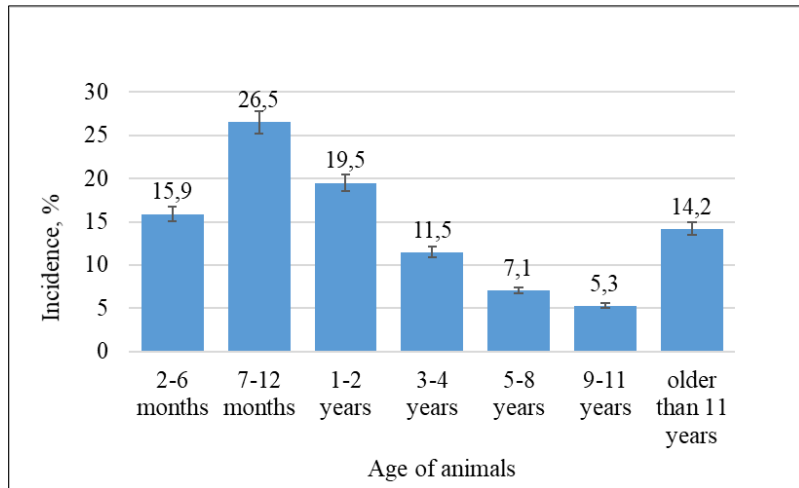
Clinical forms	Number of affected dogs	
	n	%
Scaly	40	35.4
Pustular	21	18.6
Papular	19	16.8
Pododemodectosis	9	8.0
Mixed demodicosis	24	21.2

We observed the scaly form in about a third of cases of clinical demodicosis. Pustular and papular forms of demodectic invasion were registered much less frequently. A mixed form of demodicosis was noted by us in 21.2% of cases. It developed at the age of 3-18 months, usually as a result of incorrectly carried out, belated or in the absence of treatment.

In the mixed form, all areas of the skin (head, limbs, torso) were affected. In all parts of the body of sick dogs, pyoderma and bacterial folliculitis were manifested with the presence of numerous whitish abscesses. The general condition of the dogs was depressed, they were emaciated, inactive, had a poor appetite. As a result of complication of demodectic invasion by bacterial microflora, pustular dermatitis with erosive skin lesions occurred. This resulted in an unpleasant odor. Sometimes demodicosis manifested itself in the form of pododemodectosis.

Analyzing the clinical manifestation of demodicosis, it should be noted that, regardless of the form of manifestation, most often the skin in dogs was affected in the region of the eyelids, cheeks, lips and chin, somewhat less often in the region of other parts of the head, neck, chest and forelimbs.

We have found that canine demodicosis most often affects animals aged 7-12 months (Fig. 4). A fairly high level of demodicosis invasion (19.5%) was also found in dogs 1-2 years of age. In total, almost half of all cases of spontaneous demodicosis occur in dogs aged 7 months to 2 years. The morbidity of dogs under 1 year old is probably due to the fact that at this age the animals are exposed to stressful situations (vaccination, ear cutting, teeth changes, etc.). Conditions that increase susceptibility to demodicosis are, in particular, infectious pathologies, helminths, ricketts, metabolic disorders and other factors.

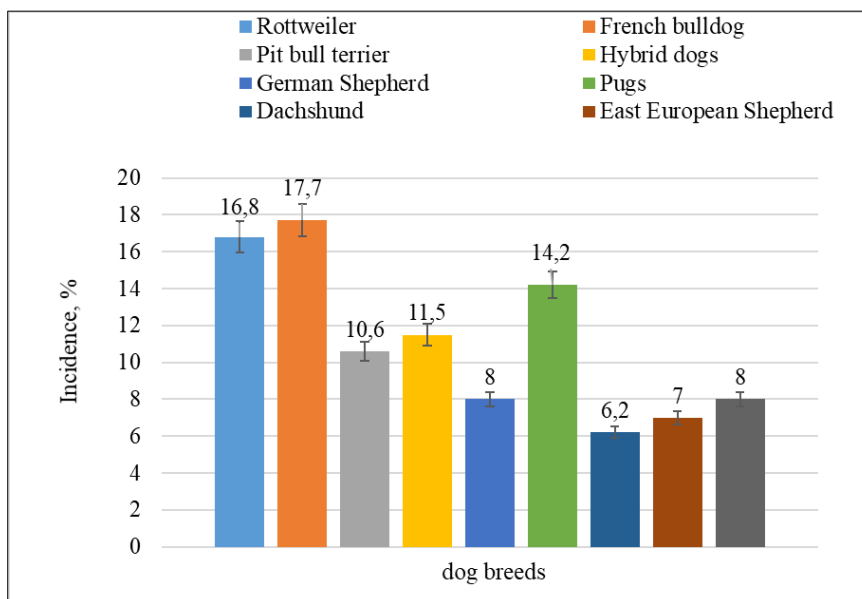


**Figure 4** The prevalence of demodicosis in dogs depending on age, n = 113

In older dogs, the disease was less common and usually mild. With the age of animals, the extensiveness of demodectic invasion gradually decreases, and only in animals over 11 years old it sharply increases to 14.2%, which is explained by a decrease in the body's resistance at this age. In puppies, the extent of invasion was significantly less, which can be explained by the rather low possibility of contact with the source of invasion in animals under 2 months of age. Own research has established the sexual susceptibility of dogs to demodicosis (Table 3).

**Table 3** The tendency of dogs to demodicosis, depending on the sex

Animal sex	Number of affected dogs	
	n	%
Males	45	39.8
Females	68	60.2



**Figure 5** The tendency of dogs to demodicosis, depending on the breed, n =113

The data obtained showed a higher sensitivity of females compared to males by 1.51 times. This is probably one of the reasons for the wide spread of demodicosis in the territory of this region, since it is the females who transmit Demodex

canis vertically to newborn puppies from the first days of their life. The data of our own research indicate that in the breeds of dogs examined during the period of the experiment, French bulldogs (17.7%), Rottweilers (16.8%), and pugs are most often affected by demodicosis. (14.2%), outbreeds and crossbreeds (11.5%) and pit bull terriers (10.6%) (Fig. 5). Of the 113 cases of animals with demodicosis, 80 were in these breeds. The incidence of demodicosis in other breeds was significantly less. They accounted for only 8% of all detected cases. These are such breed groups as Boxers, English Bulldogs, Collies, Dobermans, Pekingese, Poodles, Cocker Spaniels, Great Danes, Terriers.

According to the results of our studies, the tendency of dogs to demodicosis was analyzed depending on the length of the coat (Table 4). It was found that demodicosis is more common in short-haired dog breeds (66.4% of all identified cases).

**Table 4** Distribution of dogs with demodicosis by coat type

Dog coat types	Number of affected dogs	
	n	%
Long-Haired	38	33.6
Short-Haired	75	66.4

The share of long-haired breeds accounted for only about a third of all animals affected by Demodex.

An analysis of the monthly dynamics of demodicosis invasion over the study period showed that demodicosis was recorded on the territory of the Kamenetz-Podolsk region during the year (Table 5). However, in some months there was an increase in the incidence, characteristic of the seasonal manifestation of the disease.

**Table 5** Seasonal features of the distribution of demodicosis in dogs

Month	A total of animals with skin pathology were studied		The number of dogs affected by demodicosis	
	n	%	n	%
January	32	100	5	15.6
February	40	100	9	22.5
March	45	100	14	31.1
April	45	100	12	26.7
May	33	100	8	24.2
June	32	100	5	15.6
July	34	100	5	14.7
August	30	100	6	20.0
September	41	100	10	24.4
October	45	100	17	37.8
November	44	100	15	34.1
December	38	100	7	18.4

We recorded an increase in the extensiveness of demodectic invasion in March (31.1%), April (26.7%), October (37.8%) and November (34.1%). Of 113 animals infested with Demodex, about half fell ill during these months. The minimum peak of demodectic invasion was found in January (15.6%), June and July, 15.6 and 14.7%, respectively.

#### 4. Discussion

To date, the epizootological features of demodicosis in dogs in the regions of Ukraine have not been sufficiently studied, and they especially need to improve the treatment regimen for sick animals, which would take into account pathogenetic features and changes in biochemical parameters (Fourie et al., 2015; Kássia et al., 2019; Kumar & Shekhar, 2020).

It is known that demodicosis has become a real problem among dogs at the moment. Therefore, the study of this problem, in particular, issues of epizootology require analysis and specific reference to a certain territory.

According to the results of our own research, a much higher percentage (24.6% of all dog skin pathologies) of demodectic animals was found. Some researchers also draw attention to the significant prevalence of demodectic infestation of dogs in Ukraine (Prosyanyi et al., 2022) and other countries (Sgarbossa et al., 2017; Kumar & Kumar, 2020).

The clinical aspects of demodectic infestation have shown that in most cases on the territory of Ukraine, local demodicosis is registered, which most often manifests as a scaly form. In our opinion, this is due to the timely treatment of such animals and a wide selection of effective acaricidal agents, which allows controlling the spread of demodicosis. However, the presence of a significant number of homeless and stray animals on the territory of the district determines the focal and stationary nature of this infestation in dogs. And yet, 30.1% of cases of demodicosis accounted for generalized demodicosis. At the same time, as a rule, it had a manifestation in the form of pustular, papular or mixed demodicosis. The last form was the most difficult with pronounced itching, swelling of the skin in the affected areas, the presence of crusts on it, often dark brown in color, thickening of the skin, erosions and secretions of pus or blood. Wetting eczema, hyperpigmentation, loss of skin integrity, and pyodermic lesions were found in most animals, which were associated with the development of secondary microflora. At the same time, the process often spread to the entire body of the animal. According to researchers (Jaheen et al., 2022), the degree of severity of the course of demodicosis in dogs was directly proportional to the form of the infestation.

According to scientists (Lopes et al., 2019; Erawan et al., 2019; Vargo & Banovic, 2021), in recent years, due to the increase in the number of dogs and cats, as well as the increase in the population of homeless animals (sources of invasion), the maintenance of carnivores at a low level of veterinary care, a trend towards an increase in the spread of acarosis was noted. At the same time, indicators of the extensiveness of demodectic infestation in connection with age, breed, physiological and seasonal characteristics in dogs are insufficiently clarified and require clarification. We found that, in general, almost half of all cases of spontaneous demodicosis were found in animals aged from 7 months to 2 years. In older dogs, the extent of demodectic infestation gradually decreases and only in older animals it sharply increases to 14.2%, probably due to a decrease in the body's resistance level in this age period.

Studying the epizootological features of demodectic infestation of dogs, the researchers established certain sex-age features of its manifestation. In particular, out of 424 patients with canine demodicosis, 135 (31.8%) of them were older than 6 months, 101 (23.8%) - from 1 to 2 years old, 61 (14.4%) - older 2 years and only 19 (4.5%) younger than 2 months. The results of the obtained data showed that male dogs are more prone to demodectic infestation compared to females. In terms of age, dogs from 6 months to 1 year are most susceptible to demodicosis. Males suffer from demodicosis 1.14 times more often than females (Erawan et al., 2019). The data of our studies on the age-related sensitivity of dogs to demodicosis are consistent with the above. As for gender dependence, on the contrary, we found a tendency for females to be more susceptible to demodicosis.

At the same time, according to other data (Rahman et al., 2021), a small predominance among animals with demodicosis of bitches was noted - 114 (50.4%) out of 226 examined dogs.

Different resistance of males and females to acarosis is due, according to some authors (Becksei et al., 2018; Horne, 2019), by the difference in their hormonal activity.

The data of our own research testify to the existing breed characteristics of the sensitivity of dogs to demodicosis. French Bulldogs, Rottweilers and Pugs were the most prone to invasion. Outbred crossbreeds, pit bull terriers, dachshunds and East European shepherds had an average sensitivity. The vulnerability of other breed groups was significantly less. Meanwhile, according to the information of researchers (Sgarbossa et al., 2017; Gazi et al., 2019), the most affected were dogs of mixed breeds and outbreds (50.00%) and dogs of hunting breeds - kurtshaar, yag terrier, fox terrier (42.05%). Other authors [perhaps another source 18] indicate that in Ukraine among dogs suffering from demodicosis, shepherd dogs make up 25.4%, outbred dogs - 16.9%, boxers - 4.2%, Dobermans - 5.6%, bullter - 8.5%, Rottweilers - 5.8%, others - 37.8%. It is known that the best places for the localization of demodexes are the sebaceous glands and hair follicles.



Therefore, the greater sensitivity of dogs with short hair revealed by us can be explained by the better development of the sebaceous glands in them. The hair follicles of short-haired dogs are also more favorable for ticks (Carvalho et al., 2019).

Studying the monthly dynamics of lesions of dogs with demodicosis, we identified certain fluctuations in the indicator of the extensiveness of invasion. The minimum values of this indicator had a direct correlation with the maximum high and minimum low ambient temperatures. In our opinion, elevated air temperatures and dry environment are not optimal for the active reproduction of *Demodex canis*. In addition, during the warm period, as a rule, animals feel most comfortable and have a high level of resistance to adverse factors. With the beginning of autumn, the incidence of demodicosis in dogs begins to rise, reaching a maximum rise in October. In winter, a rather low level of infestation of animals with demodexes was also found, which is probably primarily due to the low temperature regime of this period and the low activity of ticks. In March, the level of invasion increased sharply, and then the incidence curve fell to the minimum values in July.

The increase in the frequency of cases of demodicosis in the spring and autumn periods can be explained by seasonal molting, a decrease in the level of resistance of the animal body, and optimal conditions for the development of demodexes in the animal body during these periods of the year.

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## 5. Conclusion

- Demodicosis of dogs in certain regions of Ukraine is registered in 24.6% of cases of all skin pathologies.
- In most cases (69.9%) we found local demodicosis. Scales (35.4%), mixed (21.2%) and pustular (18.6%) prevailed among the clinical forms of demodicosis.
- The degree of invasion by *Demodex* depends on the age of the dogs. Animals aged 7-12 months (26.5%) had the highest extent of invasion, and 9-11-year-old animals had the lowest (5.3%).
- French Bulldogs (17.7%), Rottweilers (16.8%) and Pugs (14.2%) have the highest tendency to demodicosis.
- The incidence of demodicosis in short-haired dog breeds was 66.4%, long-haired - 33.6%. Among infested animals, females are affected 1.26 times more often than males.
- The highest peak of infection was found in October (37.8%), November (34.1%) and March (31.1%).

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## Compliance with ethical standards

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### *Disclosure of conflict of interest*

The authors declare that they have no conflict of interest.

### *Statement of ethical approval*

Ethical issues (including plagiarism, consent to publish, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy) have been checked by the authors.

### *Information about the observance of bioethical standards*

Experimental studies were carried out in compliance with the requirements of the Law of Ukraine No. 3447 - IV of February 21, 2006 «On the protection of animals from cruelty» and in accordance with the basic principles of the «European Convention for the Protection of Vertebrate Animals used for Experimental and Scientific Purposes» (Strasbourg, 1986), National Congress on Bioethics «General moral principles of experiments on animals» (Kiev, 2001).

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## References

- [1] Becskei, C., Cuppens, O., & Mahabir, S. P. (2018). Efficacy and safety of sarolaner against generalized demodicosis in dogs in European countries: a non-inferiority study. *Veterinary dermatology*, 29(3), 203-e72. <https://doi.org/10.1111/vde.12526>



- [2] Carvalho, F. C. G., Lopes, N. L., Machado, M. A., Merlo, A., & Fernandes, J. I. (2019). Efficacy of oral sarolaner for the treatment of generalized demodicosis in dogs. *Brazilian Journal of Veterinary Medicine*, 41(1), e102219-e102219. <https://doi.org/10.29374/bjvm.102219>
- [3] Erawan, G. M. K. I., Puspaeni, N. K. J., & Anthara, M. S. (2019). Efficacy of fluralaner for the treatment of demodicosis on crossbred dog. *Indonesia Medicus Veterinus*, 8(5), 552-564. <https://doi.org/10.19087/imv.2019.8.5.552>
- [4] Fourie, J. J., Liebenberg, J. E., Horak, I. G., Taenzler, J., Heckerroth, A. R., & Frénais, R. (2015). Efficacy of orally administered fluralaner (Bravecto™) or topically applied imidacloprid/moxidectin (Advocate®) against generalized demodicosis in dogs. *Parasites & vectors*, 8(1), 1-7. <https://doi.org/10.1186/s13071-015-0775-8>
- [5] Fourie, J. J., Meyer, L., & Thomas, E. (2019). Efficacy of topically administered fluralaner or imidacloprid/moxidectin on dogs with generalised demodicosis. *Parasites & vectors*, 12(1), 1-5. <https://doi.org/10.1186/s13071-018-3230-9>
- [6] Gazi, U., Taylan-Ozkan, A., & Mumcuoglu, K. Y. (2019). Immune mechanisms in human and canine demodicosis: A review. *Parasite immunology*, 41(12), e12673. <https://doi.org/10.1111/pim.12673>
- [7] Horne, K. (2019). Canine demodicosis. *Small Animal Dermatology for Technicians and Nurses*, 147-157. <https://doi.org/10.1002/9781119108641.ch11>
- [8] Jaheen, A. H., Kubesy, A. A., Rakha, G. M., Salem, S. I., & El-Sherif, M. A. (2022). Diagnostic value of procalcitonin, C-reactive protein, and leukocyte count in canine ehrlichiosis and canine demodicosis. *Comparative Clinical Pathology*, 31(3), 529-536. <https://doi.org/10.1007/s00580-022-03350-4>
- [9] Kássia, R. B. F., Leite, M. C., Matos, F., Rodrigues, M. C., & Melo, E. (2019). Demodicosis in dogs attended in a university veterinary hospital. *Ciência Animal*, 29(3), 11-21.
- [10] Kumar, P., & Shekhar, S. (2020). Occurrence of dermatological disorders and Haemato-biochemical alteration, treatment of Demodicosis in dogs. *Journal of Entomology and Zoology Studies*, 8(2), 126-132.
- [11] Kumar, S. K. B., & Kumar, B. (2020). Hemato-biochemical changes and spatial distribution of lesions on body surface in demodicosis affected dogs. *The Pharma Innovation Journal*, 9(4), 178-180. <https://doi.org/10.22271/tpi.2020.v9.i4c.4587>
- [12] Lopes, N. L., Carvalho, F. C. G., Berman, R., Machado, M. A., Trivisol-Medeiros, C. D. M. B., & Fernandes, J. I. (2019). Efficacy of fluralaner against canine generalized demodicosis. *Brazilian Journal of Veterinary Medicine*, 41(1), e101719-e101719. <https://doi.org/10.29374/2527-2179.bjvm101719>
- [13] Mueller, R. S., Rosenkrantz, W., Bensignor, E., Karaś-Tęcza, J., Paterson, T., & Shipstone, M. A. (2020). Diagnosis and treatment of demodicosis in dogs and cats: Clinical consensus guidelines of the World Association for Veterinary Dermatology. *Veterinary dermatology*, 31(1), 4-e2. <https://doi.org/10.1111/vde.12806>
- [14] O'Neill, D. G., Turgoose, E., Church, D. B., Brodbelt, D. C., & Hendricks, A. (2020). Juvenile-onset and adult-onset demodicosis in dogs in the UK: prevalence and breed associations. *Journal of Small Animal Practice*, 61(1), 32-41. <https://doi.org/10.1111/jsap.13067>
- [15] Parwari, M., Mandali, G. C., & Parmar, J. M. (2022). Comparative Efficacy of Different Treatment Regimens of Miticidal Drugs in the Clinical Management of Canine Generalized Demodicosis. *Indian Journal of Veterinary Sciences & Biotechnology*, 18(1), 13-16. <https://doi.org/10.21887/ijvsbt.18.1.3>
- [16] Perego, R., Spada, E., Foppa, C., & Proverbio, D. (2019). Critically appraised topic for the most effective and safe treatment for canine generalised demodicosis. *BMC veterinary research*, 15(1), 1-7. <https://doi.org/10.1186/s12917-018-1767-7>
- [17] Prosyanyi, S., Borshuliak, A., & Horiuk, Y. (2022). Therapeutic efficacy of the drug Simparica® for demodicosis in dogs in the Kamianets-Podilskyi, Ukraine. *World Journal of Advanced Research and Reviews*, 13(1), 012-018. <https://doi.org/10.30574/wjarr.2022.13.1.0756>
- [18] Rahman, M., Bostami, M. B., Datta, A., Sabuj, A. A. M., Rana, E. A., Mannan, A., ... & Chowdhury, M. Y. E. (2021). Estimation of the prevalence and determination of risk factors associated with demodicosis in dogs. *Journal of advanced veterinary and animal research*, 8(1), 116. <https://doi.org/10.5455/javar.2021.h493>
- [19] Sgarbossa, R. S. A. S., Sechi, G. V., Pacheco, B. D., Lucina, S. B., Paulo, M. R., dos Santos Monti, F., & de Farias, M. R. (2017). The epidemiological and clinical aspects of Demodex injai demodicosis in dogs: a report of eight cases. *Semina: Ciências Agrárias*, 38(5), 3387-3393. <https://doi.org/10.5433/1679-0359.2017v38n5p3387>

- [20] Vargo, C. L., & Banovic, F. (2021). Localized Demodicosis in a Dog After Fluticasone Propionate Treatment for Chronic Bronchitis. *Topics in Companion Animal Medicine*, 45, 100578. <https://doi.org/10.1016/j.tcam.2021.100578>
- [21] Zajac, A. M., Conboy, G. A., Little, S. E., & Reichard, M. V. (2021). *Veterinary clinical parasitology*. John Wiley & Sons.
- [22] Zeibig, E. (2012). *Clinical parasitology: A practical approach*. Elsevier Health Sciences.
- [23] Zhou, X., Hohman, A., & Hsu, W. H. (2020). Review of extralabel use of isoxazolines for treatment of demodicosis in dogs and cats. *Journal of the American Veterinary Medical Association*, 256(12), 1342-1346. <https://doi.org/10.2460/javma.256.12.1342>.