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STUDY REGARDING THE ROLE AND MEDICAL AND SOCIAL IMPLICATIONS OF *DEMODEX SPP*. PARASITISM IN DOGS AND HUMANS

STUDIU PRIVIND ROLUL ȘI IMPLICAȚIILE MEDICALE ȘI SOCIALE ALE PARAZITISMULUI CU *DEMODEX SPP*. LA CÂINE ȘI LA OM

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ABSTRACT

Canine demodicosis is one of the most prevalent diseases caused by ectoparasite species of the *Demodex* genus, found in the pilosebaceous follicles. In human patients, demodicosis evolves as blepharitis or papular-pustular dermatosis, frequently located in the facial area. The study was conducted on a group of 110 dogs and 17 human patients, respectively. The present study focused on highlighting and describing the role of the *Demodex spp.* mites on the skin of dogs and humans from a morphological, epidemiological, clinical, histopathological, and diagnostic perspective as well as highlighting the importance of the medical and social implications. The results of the research show the fact that demodicosis remains a multi-factor disease, which can be undoubtedly confirmed by the presence of the mite in various life stages, visible both through skin scrapes performed from lesions and through histopathological sections that reveal the presence of mite fragments. Regardless of the disease history and evolution, epidemiological factors, or applied therapeutic protocol, the presence of the *Demodex spp.* mite in skin lesions has medical and social implications.

Keywords: *Demodex spp*., diagnostic, medical-social implications

REZUMAT

Demodicoza canină este una dintre cele mai prevalente ectoparazitoze produsă de speciile genului *Demodex* ce parazitează foliculii pilosebacei. La pacienții umani, demodicoza evoluează sub forma unei blefarite sau ca o dermatoză papulo-pustulară localizată frecvent în regiunea facială. Studiul s-a realizat pe un lot alcătuit din 110 câini, respectiv pe un grup 17 de pacienți umani. Studiul prezent a urmărit evidențierea și descrierea rolului acarianului *Demodex spp.* în pielea câinilor și a oamenilor din perspectiva morfologică, epidemiologică, clinică, diagnostică, histopatologică, dar și a importanței implicațiilor medicale și sociale.

Rezultatele cercetării relevă faptul că demodicoza rămâne o boală multifactorială a cărei diagnosticare clinică poate fi confirmată indubitabil prin evidențierea stadiilor evolutive ale acarianului în raclatele cutanate efectuate din leziuni, precum și a fragmentelor de acarieni prezente în secțiunile histopatologice. Indiferent de evoluția și istoricul bolii, de factorii epidemiologici sau de protocolul terapeutic aplicat, prezența acarianului *Demodex spp.* în leziunile cutanate are implicații medicale și sociale.

Cuvinte cheie: *Demodex spp*., diagnostic, implicații medico-sociale

The apparent easiness of exploring a visible organ such as the skin, where lesions are accessible for clinical exams, is decreased by the lack of specific cutaneous semiology. Thus, multiple skin conditions can have identical lesion expressions or, on the contrary, a dermatosis can be clinically translated through lesions that differ between individuals, species, or from one moment to another. The fact that demodicosis-affected skin has specific reactivity and that the clinical signs are greatly influenced by intrinsic and extrinsic factors equally are often overlooked (11, 13, 15, 17).

The mite found in the pilosebaceous follicles causes one of the most frequent depilating, non-pruritic skin conditions which can often become pustular due to bacterial complications (19). *Demodex* mites can be found in humans and several domestic and wild animals, mostly as skin symbionts (7). In human patients, demodicosis evolves as a papular-pustular dermatosis, frequently located in the face area, as a primary disease (”sui generis” condition) (18) or associated with a local or systemic immune suppression (12, 26, 35). The diagnostic and treatment of this ectoparasitic disease concern both the veterinarian practitio-

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ner and the human doctors equally. The skin scrape and the histopathological examination are the medical procedure recommended by most authors however, videodermoscopy and molecular identification of *Demodex* species make the subject of recent research studies (3, 14, 16, 36). Regarding treatment, the multitude of scientific research is highly generous, starting from naturist treatments to innovative molecules, from the preparation of skin using non-irritating and non-invasive substances to the state of the art molecules (4, 5, 20, 24, 28, 29, 31). In the described context, the present study focused on highlighting and describing the role of the *Demodex spp.* mite on the skin of dogs and humans from a morphological, epidemiological, clinical, histo-pathological, and diagnostic perspective as well as highlighting the importance of the medical and social implications.

MATERIALS AND METHODS

The study was conducted over a one year, at the Parasitic Diseases Clinic of the Faculty of Veterinary Medicine in Timisoara in collaboration with the Danny flor Timișoara dog shelter „Victor Babeș" University of Medicine and Pharmacy and Timișoara Municipal Clinical Hospital. A group of 110 dogs with erythematous, alopecic, pustular lesions and a group of 17 human patients showing clinical signs such as erythematous-squamous dermatitis, pustules and blepharitis were kept under surveillance. The medical conduct consisted of a clinical exam and laboratory exams: skin scrape, microscopic examination, trichogram, scotch tape test, skin biopsies, histopathology, culture media seeding, and bacteriology exam.

The following procedures were undertaken for the human patients: skin scrape,microscopic exam, trichogram and eyelash and eyebrow hair examination using clarifying fluid. An epidemiological survey was conducted targeting the following: age of the human and animal patient, disease history, previous diagnostic and treatment, other diseases (internal or/and external), various factors that led to a decrease of the body's general immunity and of the skin immunity, description of the context in which the first lesions appeared on the skin of human patients and the identification of stress factors that might have triggered the disease.

RESULTS AND DISCUSSIONS

GROUP I – 110 DOGS

Etiological diagnostic

The presence of the mite, in all its evolutionary stages (egg, larva, nymph and adult) was highlighted in 104 dogs (94.54%) (Fig. 1) following the examination of skin scrapes performed from dry, localized or generalized lesions and from pyodemodicosis lesions, clarified using paraffin oil /lactophenol.

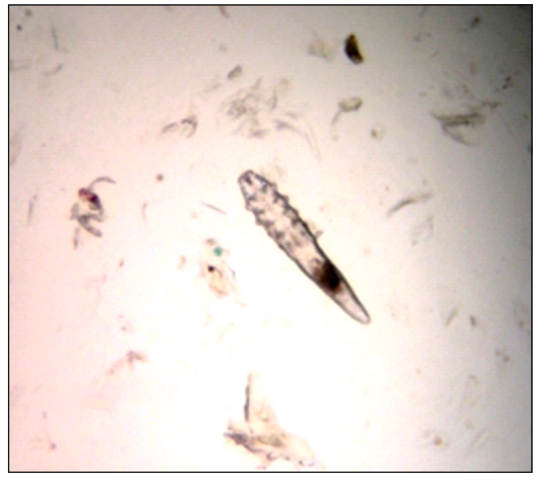

Fig.1. *Demodex canis*

The examination of the affected dogs using the trichogram method allowed the highlighting of the mite in 7 dogs with generalized, dry lesions (6.36 %). The scotch tape method revealed the presence of the mite in 5 dogs with generalized, dry lesions (4.54%). In dogs with pyodemodicosis lesions, the highlighting of the *Demodex* mites was possible only through skin scrapes. Skin scrapings from 6 dogs did not show the presence of the mite so we performed a histopathological exam from skin biopsies (5.45%) (Fig. 2).

Epidemiological diagnostic

The results of the epidemiological survey conducted on 110 dogs reveal the implication of the following favouring factors in the onset of the disease and the aspect of the clinical manifestations (Fig. 3):

✓Primary factors

• Microclimate and body condition: they are major determining factors, a number of 87 cases being in precarious shape and coming from flawed microclimates (79.09%).

• Age: 79 of the cases were young animals (71.81 %), and 31 were adults (28.18%)

• Other skin conditions: Flea-bite hypersensitivity (17 cases – 15.45%), malasseziosis (8 cases – 7.27 %), food hypersensitivity (11–10%), bacterial folliculitis (13–11.81%), ringworm infestation (7–6.36%).

• Vaccination/deworming history: the vaccination /deworming protocols were not properly applied in 21 (19.09%) dogs.

✓Secondary factors

• Breed, length of hair coat, physiological conditions (gestation /lactation), various previous treatments (antibiotherapy, corticotherapy) and surgical procedures (ovariohysterectomy) have had a certain influence on the onset of clinical signs and the evolution of the disease.

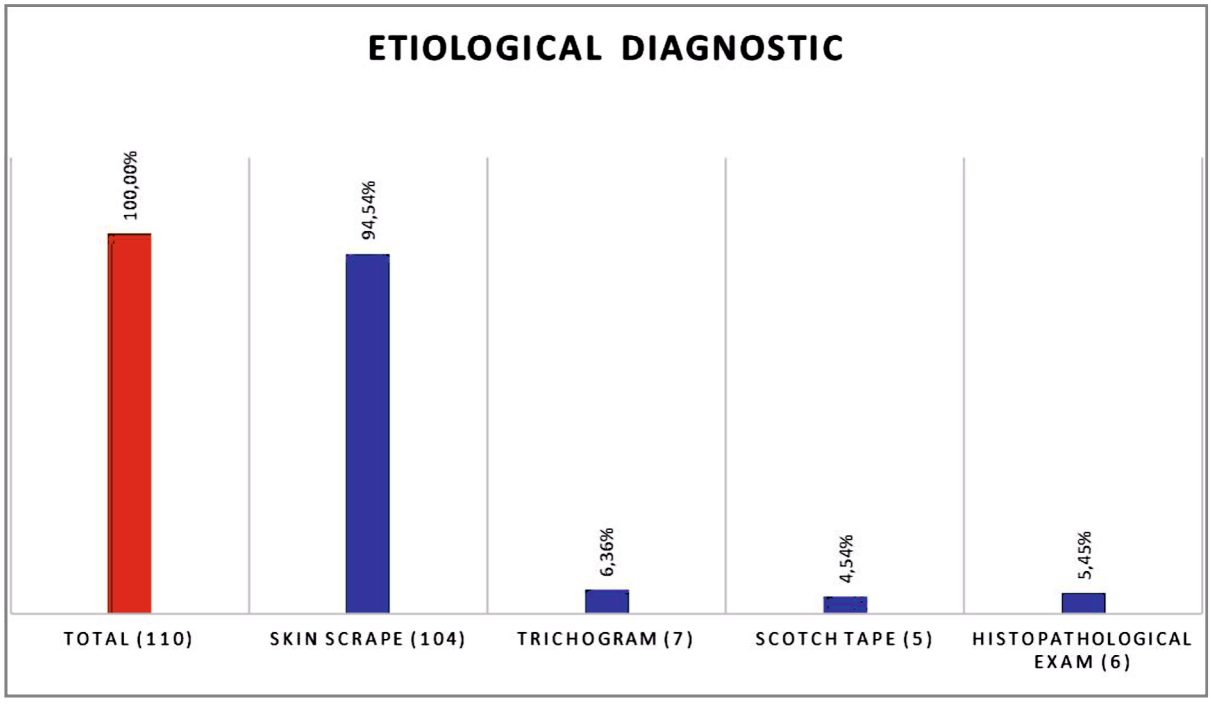

Fig. 2. Evaluation of methods used for etiological diagnostic

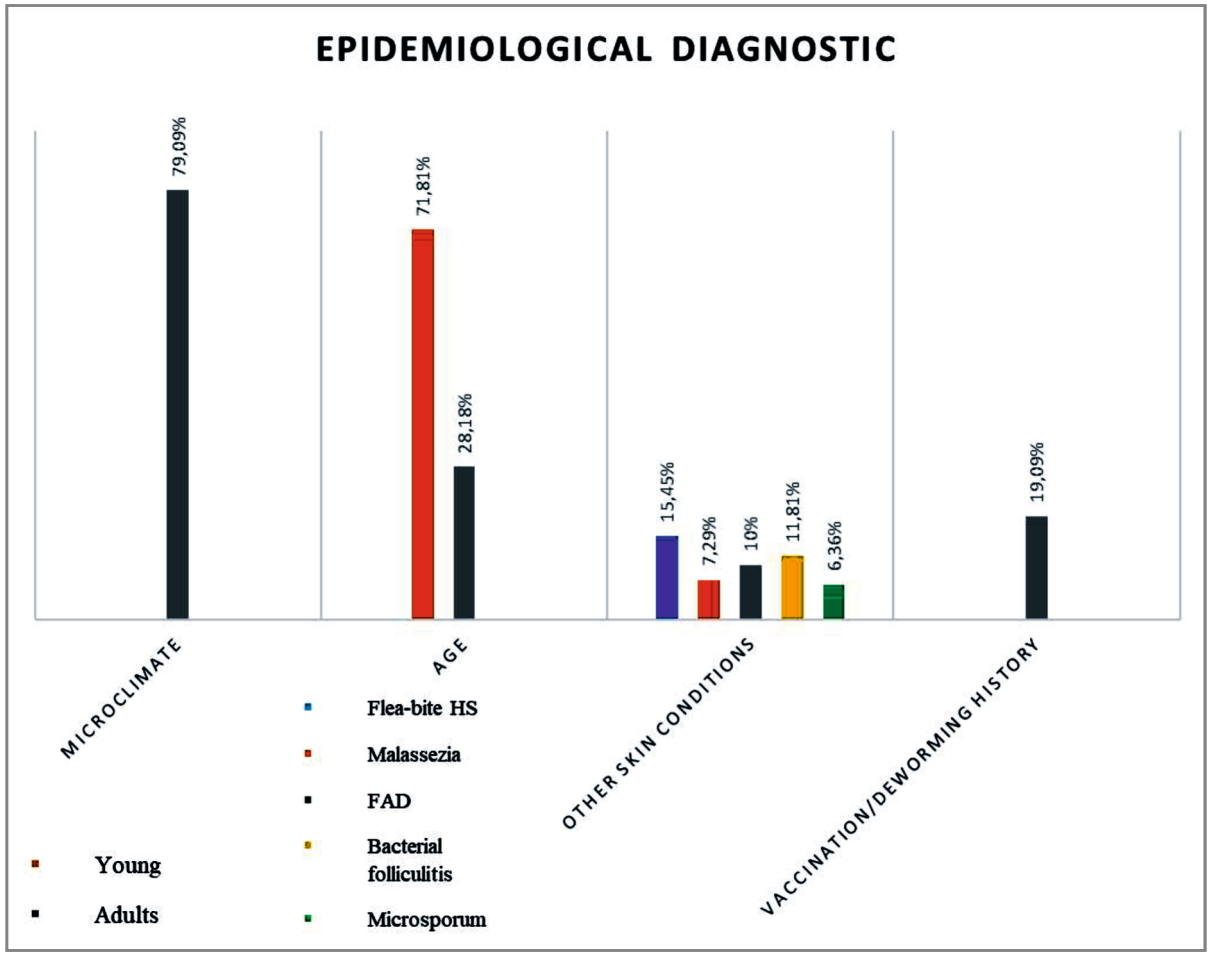

Fig. 3. Evaluation of factors implicated in the epidemiology

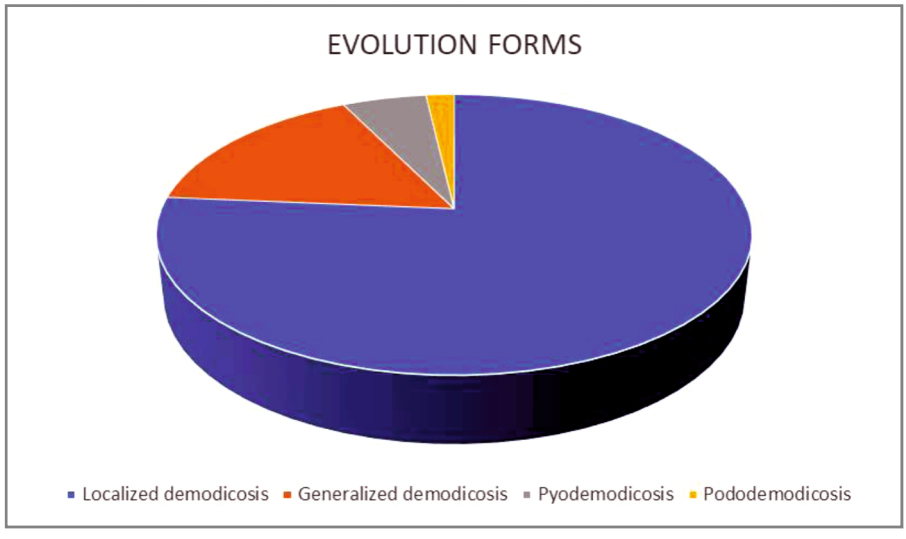

Fig. 4. Forms of evolution in demodicosis

Clinical diagnostic

The dermatological investigations have led to the identification of the following lesions: *erythema*, the primary lesion in demodicosis; *desquamation* fine, pityriasis like scales; *alopecia* and *hyperpigmentation* were present; *hyperseborrhea* was remarked in various aspects, from simple comedones to greasy aspect of the skin; *pustules* appeared as small, white collections; deep pustules were noticed upon palpation under the skin,giving a „sand-like" sensation and accompanying superficial pustules; *lichenification* completed the clinical picture of dogs that had hyperkeratosis, hyperseborrhea and hyperpigmentation as main clinical signs; *crusts, ulcers, erosions, fissures, abscesses, phlegmons* were seen in patients with severe forms of the disease; *pruritus* was absent in most cases but it was reported in dogs with pyodemodicosis.

Clinical evolution forms were diagnosed in 110 dogs affected by demodicosis and they can be classified as follows: localized demodicosis (LD) - 84; generalized demodicosis (GD) - 18; pyodemodicosis (DP) - 6; pododemodicosis (PO) – 2. (Fig. 4, 5, 6, 7, 8)

Fig. 5. Localized demodicosis (LD)

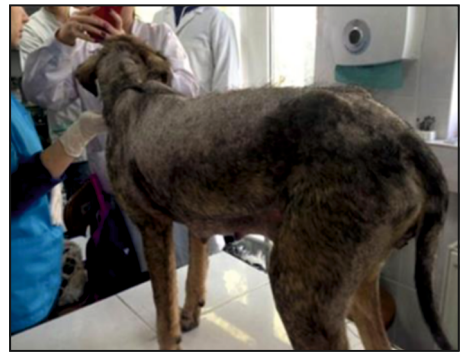

Fig. 6. Generalized demodicosis (GD)

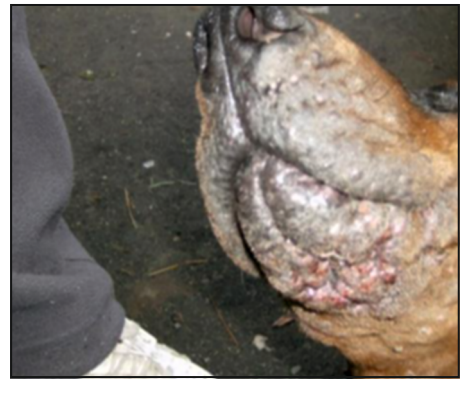

Fig. 7. Pyodemodicosis (DP)

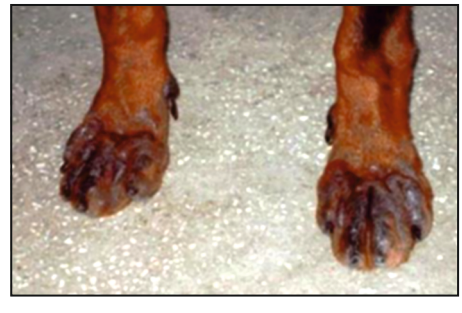

Fig. 8. Pododemodicosis (PO)

Histopathological diagnostic (skin biopsy)

The histopathological preparations from canine demodicosis lesions revealed: follicular hyperkeratosis, mural hyperkeratosis, perifolliculitis, perifollicular granulomas,plasmacytic infiltrations (B lymphocytes), purulent inflammatory infiltrations (neutrophils in high numbers), giant-cells infiltrations, interstitial oedema of the conjunctive tissue, follicular melanosis; *Demodex canis* present in the hair follicle and absent in the sebaceous gland; sebaceous gland is atrophied due to the dermal inflammatory infiltrate (Fig. 9).

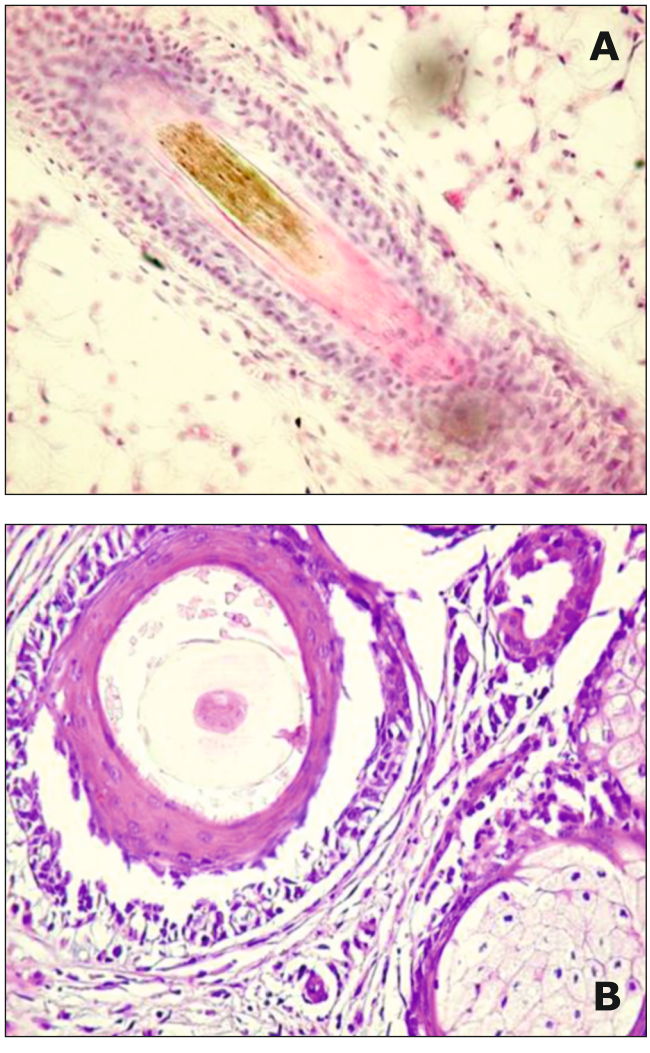

Fig. 9. Pyodemodicosis histopathology exams (HEA and Tricrom-Masson staining)
A – longitudinal section through the follicle without parasites; **B** – follicle with *D. canis* parasites, mural folliculitis and peri-folliculitis lesions

GROUP II – 17 HUMAN PATIENTS

Etiological diagnostic

Microscopic examination of skin scrapes clarified in paraffin oil /lactophenol, from dry lesions or lesions with bacterial complications located on the face of patients, showed the presence of the mite in all its life stages (egg, larva, nymph and adult) in all 17 patients (100%) (Fig. 10).

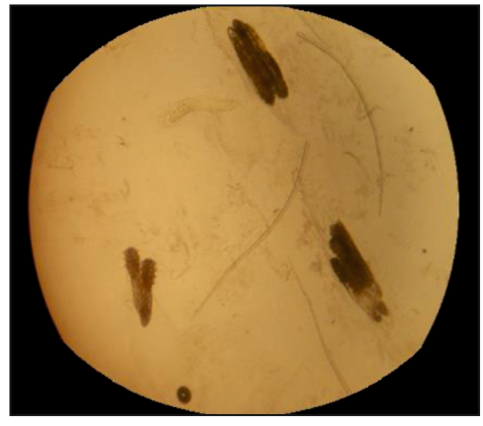

Fig. 10. *Demodex folliculorum*

The trichogram exam was performed with the permission of the patients. It was performed in two male patients from the group. It allowed the highlighting of the mites in one of the patients (5.88%). Scotch tape tests could not be performed because the patients did not comply with this diagnostic method.

The mite was observed in eyelash and eye-brow hair samples, clarified with paraffin oil and lactophenol, from 5 out of 17 patients (29.41%).

Demodex spp was visible only through skin scrapes and samples collected from pustular purulent secretions in patients with pyodemodicosis lesions.

Skin biopsy was not eligible because none of the patients agreed to this method.

Epidemiological diagnostic

Following epidemiological surveys conducted on the 17 human patients, we observed the followings:

• age: 15 out of 17 patients were in the 30-35 years age category (88.23%); two patients were 71 years old, respectively 73 years old (11.76%).

• sex: 7 patients were women (41.17%), 10 were men (58.82%).

• Disease history: 5 patients suffered from chronic illnesses (29.41%), and one of the patients suffered from an autoimmune disease (5.88%).

• Previous treatments: 12 patients came to our clinic after having followed various treatments, especially corticotherapy (70.58%).

• Travelling abroad: 8 people from the group had travelled to exotic countries (23.52%).

• Cohabitation with animals: 6 of the examined patients were pet owners (35.29%) (Fig. 11).

Clinical diagnostic

The clinical diagnostic showed the presence of the following symptoms: erythema, hyperseborrhea, white,

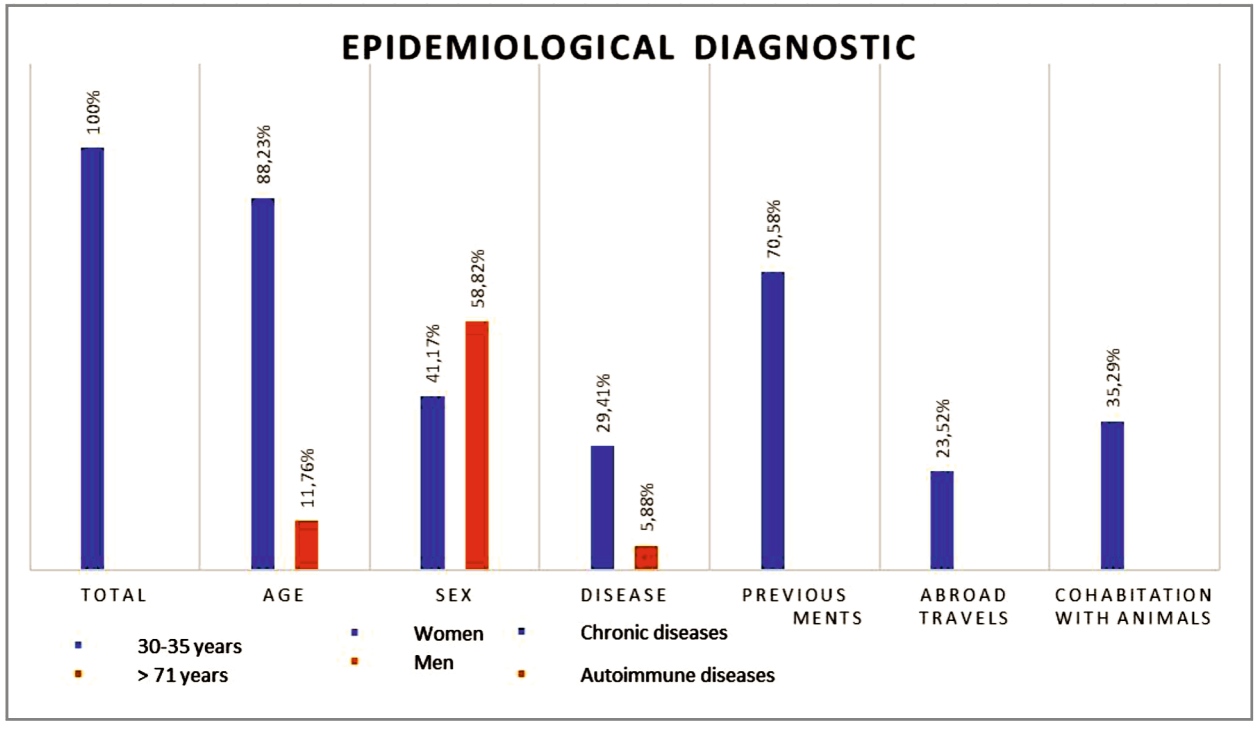

Fig. 11. Evaluation of factors implicated in the epidemiology

superficial pustules, with white, yellowish content; deep pustules (violet pustules). We have diagnosed blepharitis, a pathognomonic symptom of ocular demodicosis characterized by the presence of cylindrical scales at the base of eyelashes, hyperaemia and epiphora. Pruritus was absent in the facial location and it was only noticed in eyebrows, sideburns and at the hair border. Lesions were generally distributed on the face area, being more concentrated in the T area, nose and cheeks, extended throughout the temporal area. Completely exceptional locations included the scalp, occipital area, neck, arms and chest. A frequent location for the disease was the eyelash and eyebrow area, without affecting the face (Fig. 12, 13).

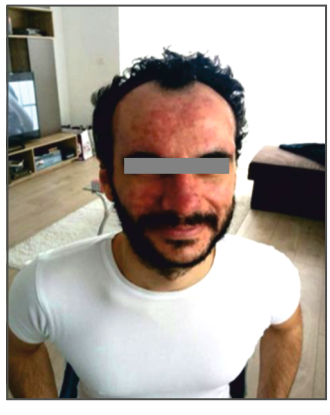

Fig. 12. Facial lesions with bacterial complications

The results of the study show the fact that demodicosis remains a highly prevalent ectoparasitic disease in the context of canine skin disease as many researchers claim (6, 9). The epidemiological factors that influence receptivity, onset and clinical evolution of this mite-caused disease are age, precarious microclimates, immune suppression caused by pathological states, climate factors and inadequate treatments.

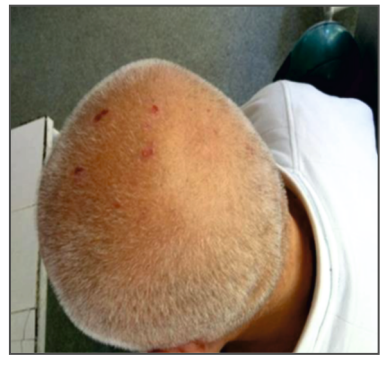

Fig. 13. The mite is present in the scalp of a 71-year-old patient

Mederle et al. (25) define canine demodicosis as a multi-factor disease: none of the factors signaled in its epidemiology can solely trigger the multiplication of the mites and the clinical manifestation of the disease; not even the immune factors, be it a primary immune suppression (based on lymphocytic dysfunction or a genetic defect of T lymphocytes), or a secondary one (following corticotherapy, post-weaning stress, severe immune suppressive diseases).

According to current research, demodicosis symp-

toms are undergoing permanent changes, under the influence of various favouring factors -an aspect which leads to confusion in the clinical approach and represents an obstacle in diagnostic (11, 13, 38).

The present study shows that microscopic examination of skin scrapes and the presence of pathognomonic histopathological lesions along with mite fragments, confirm the presence of *Demodex spp* more accurately than the trichogram and the scotch-tape test.

Research in the field of human demodicosis is controversial. The role of the mite in triggering the diseases and in the evolution of the disease is accepted by most authors (1, 2, 23, 37, 39), however, some authors state that the presence of *Demodex spp* on human skin is mostly asymptomatic, thus considering the mite as a normal skin resident (7, 33). The factors that interfere and can influence the outburst of a clinical episode are various but immune-suppression is accepted as being the main factor (8, 15, 17, 22, 32).

The results of the present study join those obtained by researchers that evoke the relevance of intrinsic, epidemiological factors in the clinical approach, diagnostic and therapy of human demodicosis. The age of patients, the presence of associated illnesses, the hormonal status and comorbidities are the main factors in the picture of the epidemiological survey. Alongside there are improper treatments, even with contra-indicated substances or according to improper protocols. The transmission of *Demodex* from dogs to humans remains a controversial issue. There are no molecular studies that certify this transmission. There are however some references of cross-infestations be-tween humans and sick animals. Turkish authors (10) report a possible transmission of the *Demodex* mite from a dog with alopecia areas to its owner who started showing pruritus, papules and crusts after 3-4 weeks following the diagnostic of the disease in the animal. *D. canis* can be suspected of bearing a zoonotic characteristic but the statement is not backed by molecular research. Molecular and phylogenetic research directed towards *D. caprae* have demonstrated that this is an independent species and, similar to *D. folliculorum*, it is more close, from a phylogenetic point of view to *D. canis* and less to *D. folliculorum* or *D. brevis* (40). Starting from the accepting ubiquitous parasitism, the pathogenic potential of the mites towards humans was ignored. However, some studies certify a statistical association between the density of the mites, the erythematous facial lesions, facial pruritus, and chronic blepharitis (1, 18, 23).

Opinions regarding the evaluation of diagnostic methods are divided. Some authors consider the skin scrape as the main laboratory method while others propose the trichogram, scotch-tape method or direct examination of eyelashes or eyebrow hairs as candidates for diagnostic methods of the mite in human and dog skin (3, 23, 25, 26). The present study supports the skin scrape and its microscopic examination as primary and doubtless diagnostic methods.

A novel, non-invasive method for human skin, currently lacking validation, is videodermoscopy which helps us obtain the confirmation of the diagnostic following the highlighting of the mite opisthosoma and by highlighting the erythematous-squamous lesions (21).

The *Demodex* mite, following morphological, epidemiological, clinical and histopathological characterisation, has medical and social implications through its presence on the skin of humans and dogs, flowing from results of epidemiological surveys conducted on each patient that was taken into study. The questions from owners of demodicosis-affected dogs related to the transmission of the disease to family members, the social rejection of human patients suffering from severe, visible facial lesions caused by *Demodex,* directing human patients towards psychological therapy or the denial expressed by owners of dogs diagnosed with severe, clinical forms to accept hospitalization, the length and the cost of the treatment are the main aspects evoking the implications of the *Demodex* mite in the life of human and animal patients.

The necessity of molecular identification of *Demodex* mites present in the skin of dogs and humans alike, followed by the certification of possible transmission, is obvious (14, 16, 27, 30, 34).

CONCLUSIONS

Demodicosis remains a multi-factor disease.

The synergy between immune factors and other factors is determinant in breaking the symbiotic balance between the parasite and the host.

The highlighting of various life stages of the mites in skin scrapes performed from lesions as well as the presence of mite fragments in the histopathological sections undoubtedly confirm the clinical diagnostic of demodicosis. Regardless of the disease evolution and history, of the epidemiological factors or the applied therapeutic protocol, the presence of *Demodex spp.* mite in skin lesions has medical and social implications.

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