ESCCAP

EUROPEAN SCIENTIFIC COUNSEL COMPANION ANIMAL PARASITES®

# 2 Superficial Mycoses in Dogs and Cats

ESCCAP Guideline 02 Fourth Edition – February 2019

ESCCAP
Malvern Hills Science Park, Geraldine Road, Malvern,
Worcestershire, WR14 3SZ, United Kingdom

First Edition Published by ESCCAP in March 2008



A catalogue record for this publication is available from the British Library.

**ISBN: 978-1-907259-73-9**

## TABLE OF CONTENTS



# 2 Superficial Mycoses in Dogs and Cats

**ESCCAP Guideline 02 Fourth Edition – February 2019**

## TABLES



## FIGURES



## IMAGE ACKNOWLEDGEMENTS


ESCCAP would like to thank the following for permitting their images to be reproduced within this guideline:

- L'Ecole Nationale Vétérinaire d'Alfort (ENVA).
- Department of Infectious Diseases and Immunology, Faculty of Veterinary Medicine, Utrecht University.

# INTRODUCTION

Dermatophytosis, and *Malassezia* otitis and dermatitis, represent the superficial mycoses of greatest significance in companion animals. Although the dermatophytes and yeasts belonging to the genus *Malassezia*[1] both develop in the stratum corneum of mammalian skin, there are important differences in the epidemiology, pathogenesis and clinical consequences of infection.

Dermatophytes are significant due to their zoonotic potential and the concern of owners of pets with sometimes severe inflammatory skin disease. They encompass ecologically and phylogenetically related filamentous fungi belonging to the family Arthrodermataceae which are able to use keratin as a sole nutrient source. Some of these organisms are parasites; they develop in skin and hair and cause cutaneous lesions. The disease is called dermatophytosis or "ringworm" and is recognised as one of the most common infectious dermatoses in pets. More than 20 different dermatophyte species have been isolated from dogs and cats. The most commonly isolated pathogens are *Microsporum canis* (especially in cats), *Trichophyton mentagrophytes, Microsporum gypseum* and *Microsporum* (*Nannizzia*) *persicolor* (Table 1).

*Malassezia* yeasts are normal commensals and occasional pathogens of the skin for many warm-blooded animal species. The non-lipid-dependent species *M. pachydermatis* is a very common cause of otitis externa and pruritic dermatitis in dogs, either primary or secondary to an underlying disease. The same species is regularly recovered from the skin of cats along with other *Malassezia* species (Table 2).

This guideline aims to give an overview of dermatophytes and yeasts belonging to the genus *Malassezia*, their significance and, importantly, suggests rational control measures to treat pet carnivores and prevent animal and/or human infection.

The guideline is divided into six sections:

1. **Consideration of pet health and lifestyle factors**
2. **Control of dermatophytosis in dogs and cats**
3. **Environmental control of dermatophyte transmission**
4. **Control of *Malassezia* dermatitis in dogs and cats**
5. **Owner considerations in preventing zoonotic disease**
6. **Staff, pet owner and community education**

[1] The name *Malassezia* is used to designate all the yeasts of the genus.

# 1: CONSIDERATION OF PET HEALTH AND LIFESTYLE FACTORS

The occurrence of dermatophytosis or *Malassezia* dermatitis is influenced by a vast number of factors relating to the animals themselves and environmental issues including overcrowding. Some factors may dictate more intensive monitoring and/or treatment, while others may suggest a less aggressive approach.

When recommending a management programme for dermatophytosis, veterinarians should consider the following:

- Kittens, puppies and aged animals are at greater risk than other animals. Pregnant or lactating bitches and queens are frequently infected by dermatophytes without symptoms and may transmit the infection to the offspring. The number of antifungal drugs that can be used safely in pregnant animals is limited.
- All breeds of dog and cat are susceptible to the infection. However, Dalmatians, poodles, Jack Russell terriers, Manchester terriers and Yorkshire terriers may be at an increased risk for generalised dermatophytosis. Persian and other long-haired cats also have a predisposition to dermatophytosis. In fact, no racial factors have been evidenced at present but contamination is more frequent in long-haired cats.
- Familial predisposition has been suggested in cats.
- Any debilitating disease may play a role by making dogs and cats more susceptible to dermatophyte infection. This kind of disease should be systematically identified and, if possible, treated before commencing specific antifungal treatment. In cats, an association between retrovirus infection (feline immunodeficiency virus (FIV) or feline leukaemia virus (FeLV)) and dermatophytosis has been suggested.
- Ectoparasites (such as fleas, ticks or mites of the genus *Cheyletiella*) or pruritus (associated with secondary infections) may be sources of cutaneous microtrauma that can predispose dogs and cats to dermatophytosis.
- Increased temperature, humidity and behavioural changes due to stress are predisposing factors for dermatophytosis.
- Cats living in catteries or shelters, stray or feral cats and cats living with other cats or dogs may be at greater risk of acquiring dermatophytes and may require special consideration.
- Dogs in kennels, living outdoors, stray dogs and hunting dogs may be at greater risk of acquiring dermatophytes and may require special consideration.
- Cats and dogs which regularly attend shows or field trials may be easily contaminated.
- Too frequent washing and/or the use of harsh soaps can predispose to dermatophytosis.
- Common dermatophyte species (*Microsporum canis, Trichophyton mentagrophytes, M. gypseum* and *M. persicolor*) have a very wide distribution in all European countries. Dermatophytosis is probably more prevalent in least developed countries or in areas in which there are large populations of free-roaming dogs and cats.

When recommending a management programme for *Malassezia* dermatitis and/or otitis externa, veterinarians should consider the following elements:

- All breeds of dogs and cats are susceptible to *Malassezia* dermatitis. However, several investigations indicated that some breeds are predisposed to the development of abnormally high numbers of *Malassezia* yeasts. In dogs, this includes basset hounds, dachshunds, cocker spaniels, Shar Pei, poodles, bulldogs and West Highland white terriers. In cats, Devon Rex, peterbald and Sphynx are more frequently colonised by *Malassezia* yeasts.
- Atopic dermatitis is the most frequently diagnosed concurrent disease in dogs with *Malassezia* dermatitis. However, it seems important to appreciate that not all dogs with atopic dermatitis have *Malassezia* dermatitis, and that *Malassezia* dermatitis occurs in association with disorders other than atopic dermatitis.
- Ectoparasites (such as ear mites or fleas) or pruritus associated with secondary infection may lead to *Malassezia* overgrowth. *Malassezia* yeasts are sometimes isolated from cats with head and neck pruritus syndrome.
- Any debilitating disease may play a role in making dogs and cats more susceptible to *Malassezia* dermatitis. In cats, the isolation of *Malassezia* has been associated with retrovirus infections, paraneoplastic syndromes, thymoma, and diabetes mellitus. Based on these findings, *Malassezia* overgrowth may be considered as a marker of (sometimes life-threatening) underlying diseases in some cats.

# 2: CONTROL OF DERMATOPHYTOSIS IN DOGS AND CATS

## 2.1. Diagnosis

Dermatophytes invade hair shafts and cornified epithelium. Consequently, dermatophytosis usually presents as patchy areas of alopecia on the face, ears or forelegs (Figures 1 to 4). The condition is typically considered non-pruritic but some animals (especially adult cats) may be moderately to intensely pruritic. Uncommon clinical manifestations include folliculitis, feline miliary dermatitis, feline acne, pemphigus-like syndromes and pseudomycetoma.

Dermatophytosis should be considered in the differential diagnosis of many skin diseases and diagnostic aids are required.

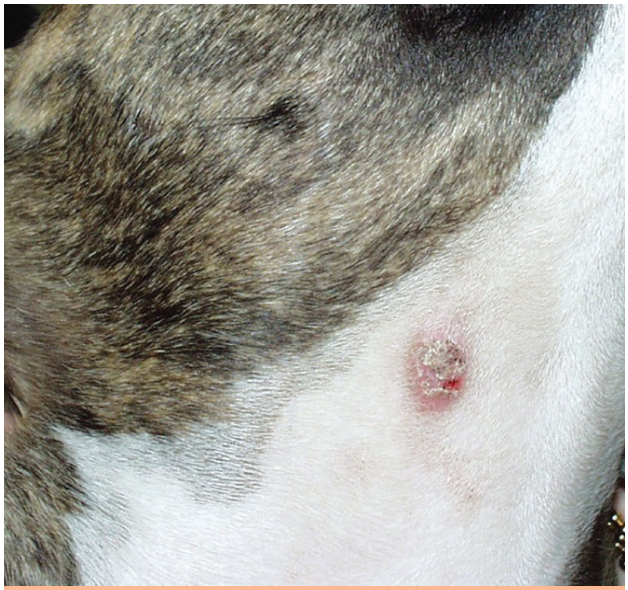

**Figure 1: Typical circular scaly lesion in a dog infected by *Microsporum canis***

**Figure 2: Facial lesions in a dog infected by *Microsporum* (*Nannizzia*) *persicolor***

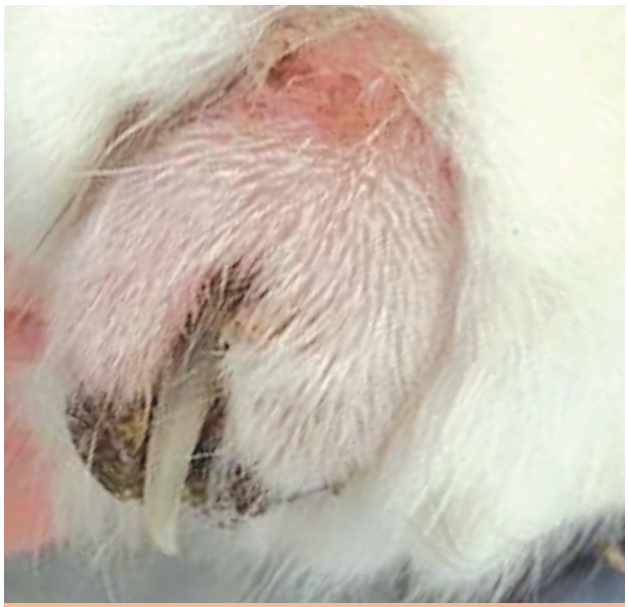

**Figure 3: Dermatophytosis around a cat's claw**

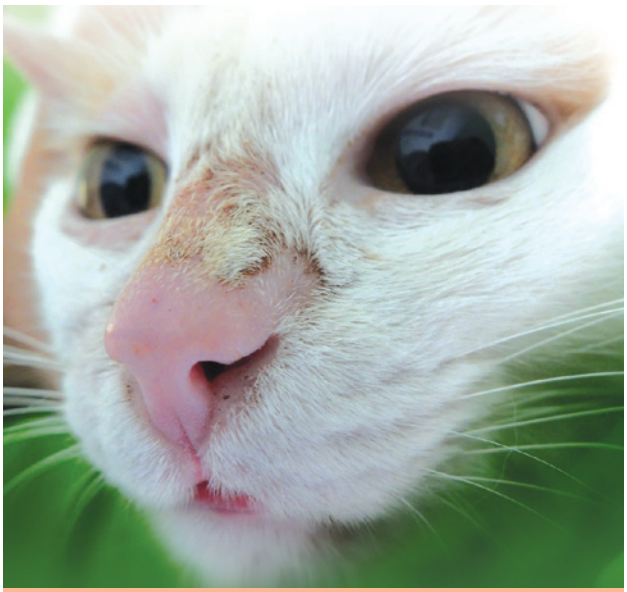

**Figure 4: Facial lesions in a cat infected by *Microsporum canis***

Examination of the haircoat with an ultraviolet lamp (Wood's lamp) is a good screening method for dermatophytosis in dogs and cats. When exposed to the light, hairs invaded by some dermatophyte species, including *M. canis*, glow yellow–green (Figure 5). Hairs infected by other dermatophyte species never fluoresce and some topical medications may mask fluorescence. Thus, negative results following Wood's lamp examination do not rule out dermatophytosis. The observation of fluorescence should be confirmed by microscopic examination of hairs (even though the recognition of infected hairs is not always easy and may require an experienced eye). Hairs should be collected through skin scrapings (from the edge of an alopecic area or fluorescent area during Wood's lamp examination). After digestion with a clearing solution (such as potassium hydroxide or chlorolactophenol), infected hairs present as enlarged and swollen structures with a rough and irregular surface (Figure 6). The hair surface typically demonstrates clusters or chains of fungal spores (2–4 µm for *M. canis*).

Mycological culture remains the most reliable technique for confirming dermatophytosis in dogs and cats. Sample collection may be obtained through skin scrapings, plucking hairs (under Wood's lamp) or brushing the haircoat with a sterile toothbrush, a little piece of sterile carpet or a dust-catching cloth. Several media (like Sabouraud dextrose agar) are suitable for mycological cultures. Colonies of dermatophyte species such as *M. canis* may develop in a few days (Figure 7). Dermatophyte test media (DTM) are regularly used in veterinary medicine. However, only a very few attempts have been made to evaluate the performance of such media with samples collected from animals and the use of DTM alone without microscopic identification of macroconidia (Figure 8) is not recommended for the diagnosis of animal dermatophytoses. The material collected from the animals should be sent to a laboratory with an expertise in veterinary mycology. In the laboratory, specific identification is made by microscopic examination of the fungal colonies. The number of fungal colonies may help distinguish between mechanical carriers and infected animals. Mechanical carriage is due to the contamination of/from the environment and is usually associated with a limited number of dermatophyte colonies in culture. Infection leads to a massive production of spores (arthroconidia) and is usually associated with a very high number of dermatophyte colonies in culture.

The detection of dermatophytes by PCR is now possible for dogs and cats in Europe. The commercially available panel includes *Microsporum* spp., *Microsporum canis* and *Trichophyton* spp. real-time PCR tests and it performs with high sensitivity and specificity. The results might be available in a few days.

**Figure 5: Positive Wood's lamp examination**

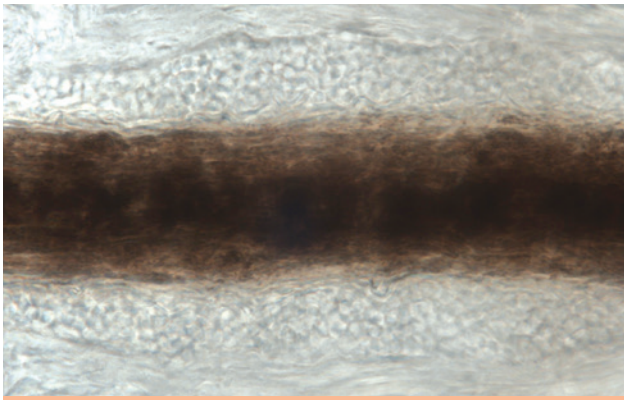

**Figure 6: Infected cat hair**

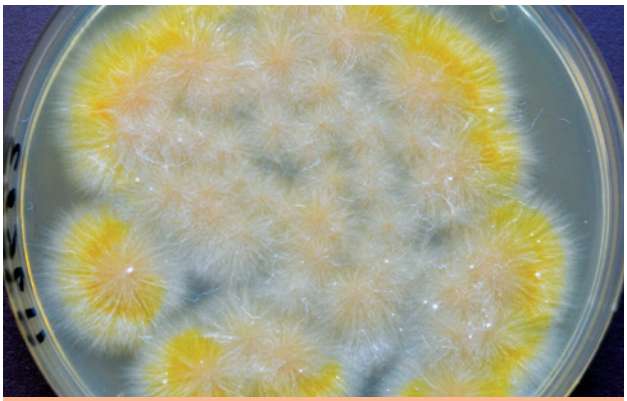

**Figure 7: Developing colonies of *Microsporum canis***

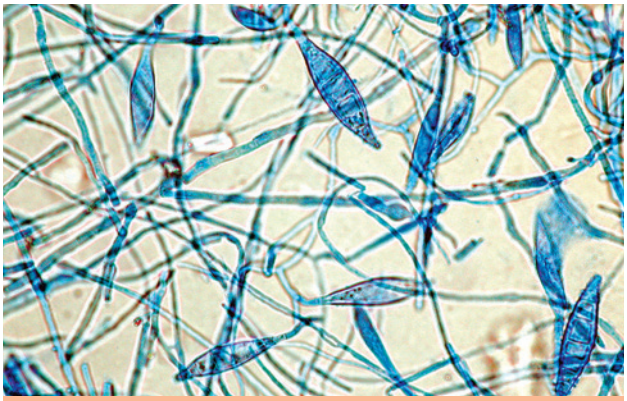

**Figure 8: Spindle-shaped *Microsporum canis* macroconidia**

## 2.2. Treatment Procedures

Antifungal treatment should be systematically recommended to shorten the course of the infection and to reduce dissemination of infective material into the environment. Infective material is composed of small pieces of hair covered by microscopic fungal spores (called arthroconidia). Infective material is easily spread and can remain viable in the environment for up to 18 months under optimal conditions of temperature and humidity. Infected animals (with or without clinical signs) and contaminated environments represent long-term sources of exposure to other animals and owners. Systemic antifungals are supposed to contribute to speed up the resolution of the infection, whereas topical antifungals are required to reduce the risk of transmission and environmental contamination.

Important therapeutic measures include:

- The combination of systemic and topical treatment. Conventional systemic treatment relies on oral antifungal drugs: griseofulvin, itraconazole or terbinafine (Table 3). Griseofulvin is no longer licensed for animal use in most European countries. The micronised formulation of griseofulvin should be administered orally at 25 mg/kg bodyweight twice daily with a fatty meal, to promote drug absorption. Haematological and gastrointestinal adverse effects may occur and are probably more common in cats. Griseofulvin is teratogenic and should not be given to pregnant animals. The principal licensed alternative for systemic therapy of dermatophytosis is itraconazole. Itraconazole is safer than ketoconazole, which may cause anorexia, vomiting, hepatotoxicity as well as interfering with steroid hormone metabolism. Itraconazole is licensed for use in cats with *M. canis* dermatophytosis using an alternate-week dosing schedule, reflecting its incorporation rate into stratum corneum and hair. For concurrent topical treatment, many products have been proposed (Table 4). The decision to use topical therapy should be based upon the owner's ability and willingness to pour or sponge the product over the entire hair coat of the infected animal. Spot treatment of lesions is not recommended. The frequency of topical treatment should be at least twice a week.
- An appropriate duration of treatment. Combined systemic and topical treatment should be continued for at least 10 weeks. However, longer treatment regimens are used purely off-license and need to be carried out at the vet's discretion on a case-by-case basis. The general recommendation is to stop antifungal administration after two negative cultures (2 weeks and 6 weeks after the end of the treatment). If lesions persist after 8 weeks of treatment, veterinarians should suspect (i) that the treatment is not being administered correctly by the owner (ii) that an underlying disorder is interfering with the normal action of the immune system, or (iii) that the animal has a genetic background that makes it more susceptible to dermatophyte infection. The presence of resistant strains is regularly suspected but resistance of dermatophytes to antifungal drugs has only been proved in very few instances and this hypothesis should not be considered as the most likely in cases of treatment failure. Lack of or insufficient environmental control is most often the reason for the recurrence.
- The clipping of the hair coat, especially in severely infected animals, long-haired cats or in multi-animal households. Clipping makes topical therapy application easier by allowing better distribution to the skin. In households with one or two pets, spot clipping of lesions may be enough. Clipping must be performed carefully to prevent spreading of the infection via skin wounds and in an area that can be easily disinfected (see Section 3). Infected hairs should be burned or placed in a plastic biohazard bag and autoclaved. Disposable clothing should be worn to limit infection from animal to human. In cats, clipping the coat may require sedation. All whiskers should be clipped.
- Complete separation of infected animals from non-infected ones.
- Hygiene measures especially environmental decontamination (see Section 3).

Susceptibility to currently available antifungal drugs may vary according to the dermatophyte species. Consequently, the specific identification of the dermatophyte is important to guide the choice of the drugs and for a better understanding of the epidemiology of the infection and for preventing new contamination.

In catteries and animal shelters, dermatophyte infection is very difficult to eradicate and creates a significant health hazard for personnel and any other in-contact individuals. The cost of antifungal drugs and the reluctance of the breeders to admit that their colony is infected usually account for lack of compliance with treatment. Most recommendations for the control of dermatophytosis in catteries are based on the concept of a total treatment programme, which associates the use of reliable diagnostic tools, both topical and systemic treatment of all of the cats and environmental decontamination procedures. Interruption of breeding programmes and showing agendas may also be recommended, as well as the isolation of new animals.

Not all of the drugs discussed in this section are available in the different European countries. Please check local availability and regulations.

## 2.3. Prevention

Although the risk of dermatophyte infection is greater for puppies, kittens and aged or debilitated animals, the infection is not strictly age- or health status-related, and so the risk continues throughout life (see Section 1). Consideration should be given to provide all dogs and cats with appropriate dermatophyte management throughout their lives.

The main risk of infection is from contact with infected animals or contaminated environments. The best way to avoid infection is to prevent this contact. This prophylactic strategy is very simple but not always feasible because infected animals do not necessarily show obvious clinical signs. Asymptomatic carriers are frequently observed in feline populations. These animals may correspond to mechanical carriers or infected cats that could develop clinical signs in a few days or weeks.

To protect in-contact animals, the use of antifungal drugs has been proposed. Oral antifungal drugs have not proved to be appropriate. Topical treatments are more valuable. Rinses or shampoos containing enilconazole or miconazole are licensed for dogs and cats in most European countries. The general recommendation is to apply an antifungal shampoo or rinse to the entire body of any dog or cat, which has been in contact with an infected animal or a contaminated area. Under optimum conditions, infective fungal spores germinate within 6 hours on the skin of dogs and cats, so the preventive application of antifungal drug should be performed in the day following the presumptive contamination.

Efforts to develop vaccines to prevent dermatophytosis in dogs and cats continue. There are only a few products which are currently commercialised in some central and eastern European countries. These vaccines may contain different dermatophyte species (*Microsporum canis* and *Trichophyton mentagrophytes* for example). Investigations proving that these vaccines are protective against challenge exposure are still lacking. Consequently, the use of these vaccines for the prevention of dermatophytosis in dogs and cats should not be recommended.

In dog and cat breeding establishments as well as in animal shelters, the main risk is represented by the introduction of an infected animal. Management plans usually include screening, monitoring and treatment procedures. At the point of entry, animals should be carefully examined, vaccinated against major (life threatening) infectious disease and treated for ectoparasites and intestinal worms. The animals should also be screened for dermatophytosis via Wood's lamp examination, fungal culture or PCR. Animals should then be transferred to a quarantine ward until the results of the cultures or PCR are known. The provision of a separate area for the treatment of animals with dermatophytosis is preferable. Treatment decisions should be made according to the results of the fungal cultures. Colony-forming unit counts combined with clinical examination can help to differentiate mechanical carriers from infected animals. A positive culture can result from contaminated fur. Spores are everywhere in the environment and therefore also on the fur of healthy animals, sometimes qualified as mechanical carriers. Careful interpretation of the quantified result is required: 'sporadic' or 'some' colonies may be contamination while 'many' to 'very high numbers' is mostly associated with mechanical carriers.

Mechanical carriers should be treated with a single topical application of an antifungal drug before introduction to the colony. Infected animals are kept in quarantine and treated using a combination of systemic and topical antifungal drugs. These animals are not introduced to the colony until two negative fungal cultures have been obtained.

## 3. ENVIRONMENTAL CONTROL OF DERMATOPHYTE TRANSMISSION

Dermatophytes are transmitted through microscopic spores, which are formed via fragmentation of fungal hyphae on the infected skin or hair. The presence of these spores in the environment increases the risk of exposure, potential reinfection and prolonged treatment of humans and animals. Minimising contamination of the environment can be obtained via clipping of affected lesions, topical antifungal therapy and routine cleaning.

Vacuuming alone will not decontaminate the surfaces but is recommended to remove gross debris including hairs covered by infective spores.

Recent studies demonstrate that undiluted bleach and 1% formalin could kill all dermatophyte spores in the environment. However, because of its caustic properties, undiluted sodium hypochlorite (household bleach) is not recommended for use in households. Sodium hypochloride solution at 1:10 dilution and enilconazole solution were also proven to be active. None of the other products tested demonstrated sufficient efficacy.

An enilconazole smoke fumigant formulation for disinfection of farm buildings, including poultry houses, is available in most European countries. This kind of formulation is not licensed for household use and should not be used with humans or animals present. Use of this formulation would be completely off-label and therefore may not comply with animal shelter and cattery laws.

Brushes, combs, rugs and cages should be carefully washed and if possible, treated with a solution of enilconazole or 1:10 dilution of sodium hypochlorite.

Vehicles used for transporting animals should also be treated.

In animal shelters or breeding establishments, contact plates or air samplers can be used to sample environmental surfaces and check that disinfection has been effective. Commercially available dust-catching cloths may also be used to monitor the environment for contamination.

Further information about environmental decontamination is available in the review from Moriello *et al.* (Vet Dermatol 2017; 28: 266–e68).

## 4. CONTROL OF *MALASSEZIA* DERMATITIS IN DOGS AND CATS

### 4.1 Diagnosis

*Malassezia* dermatitis should be suspected in animals with inflammatory skin diseases characterised by erythematous and/or greasy lesions, especially when lesions involve intertriginous areas. In dogs, it may mimic or complicate atopic dermatitis and dietary sensitivity. Hyperpigmentation and lichenification are frequently observed in animals with chronic disease and are particularly common in West Highland white terriers. Atopic dogs with otitis externa show erythematous vertical ear canals and pinnae with varying degrees of lichenification and scaling, accompanied by a yellow or brownish ceruminous discharge. Although skin lesions may be confined to one area, multiple regions are usually affected, especially the limbs, ventral neck, abdomen, ears and face (Figures 9 and 10).

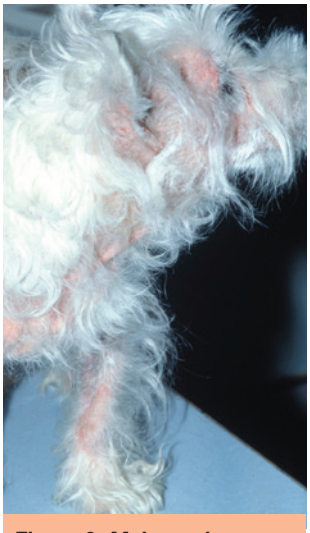

**Figure 9: *Malassezia* dermatitis in a dog**

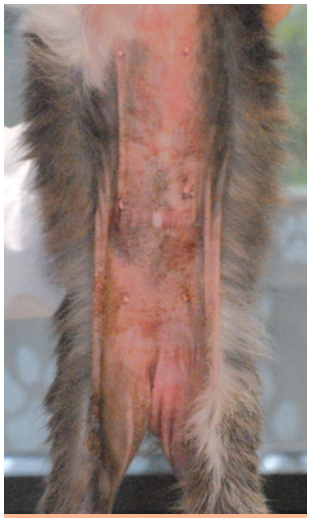

**Figure 10: *Malassezia* dermatitis in a cat**

The diagnosis of *Malassezia* dermatitis is based on clinical signs, presence of elevated numbers of yeast organisms in lesioned skin (Figure 11) and a clinical and mycologic response to antifungal therapy. The tape strip technique is convenient and reliable: clear adhesive tape is pressed onto the surface of the skin, to collect stratum corneum cells and any superficial microbes. Because a small population of yeasts might create disease in sensitised animals, and in view of the variations in the numbers of yeasts between different canine breeds and anatomic sites, trial therapy should be given whenever *Malassezia* yeasts are readily identified in cytologic specimens obtained from skin lesions.

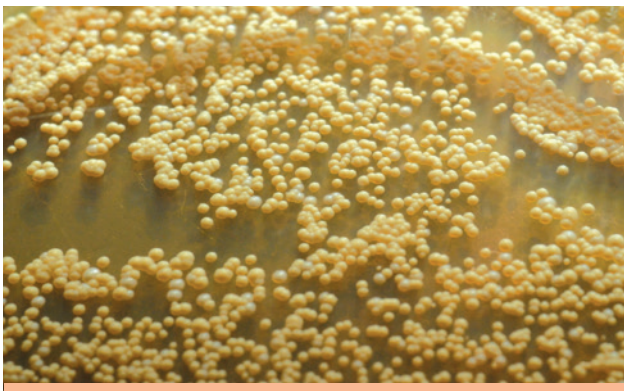

**Figure 11: *Malassezia* yeast colonies**

## 4.2. Treatment Procedures

Topical treatments licensed for canine *Malassezia* otitis externa in veterinary medicine generally contain either azole antifungal drugs (principally clotrimazole, miconazole, ketoconazole or posaconazole, nystatin or terbinafine). These are normally combined with antibiotics and a glucocorticoid, reflecting the need to control concurrent bacterial infection and reduce inflammation and proliferative pathologic changes (e.g. stenosis) of the ear canal. Combined antibacterial and antifungal drug administration may also prevent the switch from bacterial to yeast infection, or vice versa, that may be encountered when antibacterial or antifungal monotherapy is used in dogs with otitis externa or otitis media. When there is excessive cerumen, the ears should be cleaned with an appropriate cleanser prior to commencing topical treatment. Animals with *Malassezia* otitis should receive a complete dermatologic evaluation, because failure to identify and correct predisposing, primary and perpetuating factors may result in persistent or recurrent disease, or look like treatment failure.

Because *Malassezia* is located within the stratum corneum, topical therapy alone may be sufficient to resolve the clinical signs of infection, provided the pet owner is able to administer the treatment appropriately and according to the veterinarian's instructions. An evidence-based review of the treatment of *Malassezia* dermatitis in dogs concluded that there was good evidence for the twice-weekly use of a 2% miconazole/2% chlorhexidine shampoo. There was fair evidence for the use of oral ketoconazole (10 mg/kg bodyweight, once daily) and oral itraconazole (5 mg/kg bodyweight, once daily) for 3 weeks. Itraconazole is preferable to ketoconazole because it is better tolerated. As in dermatophytosis, the keratinophilic and lipophilic properties of this drug enable intermittent administration, with the advantage of reducing both costs and the potential for adverse effects and potentially improving compliance. Severe claw fold infections may require longer treatment or higher doses, and otitis externa cases may not respond adequately. As with otitis externa, identification and correction of predisposing, primary and perpetuating factors is essential for successful management. Many dogs or cats with *Malassezia* dermatitis require regular maintenance therapy to prevent relapse. Clinical and cytologic assessments should be repeated to determine the efficacy of antifungal therapy and to establish whether there is evidence of concurrent diseases. Relapsing infection is common when primary causes and predisposing factors are not identified or corrected.

## 5. OWNER CONSIDERATIONS IN PREVENTING ZOONOTIC DISEASES

In cases of dermatophytosis, important preventive measures for pet owners include:

- Practicing good personal hygiene (dermatophytes are zoonotic)
- Controlling dermatophyte infection through regular diagnostic testing and/or repeated proper treatments (see under 2.2.)
- Minimising exposure, especially of children or immunocompromised people, to potentially contaminated environments or infected animals

People in contact with infected animals should be advised of the risks and made aware that there are specific risk groups.

Although *M. pachydermatis* is not normally isolated from human skin, there have been several reports of *M. pachydermatis*-associated fungaemia in infants in neonatal intensive care units and in adults with serious internal diseases. Heightened awareness of the potential for the transfer of *Malassezia* yeasts to humans and the application of molecular typing methods might lead to the recognition of more cases in the future. The renewed emphasis on hand hygiene in hospitals after the emergence of nosocomial infections with multidrug-resistant bacterial pathogens should help prevent the development of zoonotic *Malassezia* infections.

## 6. STAFF, PET OWNER AND COMMUNITY EDUCATION

Protocols for the control of dermatophyte infection should be communicated to the entire veterinary practice team and applied consistently. Awareness of dermatophyte infection, including clinical manifestations in people and particularly children, should be created in the medical profession through information brochures. Cooperation between the medical and veterinary profession ought to be encouraged and its benefits underlined in the case of zoonosis.

Pet owners should be informed about the potential health risks of dermatophyte infection, not only to themselves but also to family members and all people living in regular contact with their pets. Brochures in veterinary practices, pet shops, posters or specific websites are useful tools to achieve this. Responsible dog and cat ownership can help to prevent some public health concerns.

**Table 1: Characteristics of major dermatophyte species infecting dogs and cats in Europe**

| Dermatophyte species | Potential hosts | Source of contamination | Zoonotic agent |
|---|---|---|---|
| *Microsporum canis* | Cats, dogs and many other mammals (including humans) | Cats most frequently | Yes |
| *Microsporum gypseum* | Dogs, horses | Soil (geophilic dermatophyte) | Yes (but very rare) |
| *Microsporum* (*Nannizzia*) *persicolor* | Small rodents (moles), dogs and cats | Small rodents | Yes (but very rare) |
| *Trichophyton mentagrophytes* | Small rodents, rabbits, dogs and cats | Small rodents | Yes |
| *Trichophyton erinacei* | Hedgehogs, dogs | Hedgehogs | Yes |
| *Trichophyton rubrum* | Humans, dogs (very rare) | Humans (pet owner) | The dog is contaminated by its owner (and not the opposite) |

**Table 2: Characteristics of *Malassezia* species recovered from the skin of animals**

| Species | Potential animal hosts | Related diseases | Potential zoonotic agent |
|---|---|---|---|
| Non-lipid-dependent species* | | | |
| *Malassezia pachydermatis*** | Dogs, cats and many other mammals, birds | Otitis and dermatitis in dogs and cats | Yes |
| Lipid-dependent species* | | | |
| *Malassezia sympodialis* | Cats and other mammals | Otitis | Status unknown |
| *Malassezia globosa* | Cats and other mammals | Otitis | Status unknown |
| *Malassezia slooffiae* | Cats, pigs and other mammals | Otitis, dermatitis | Status unknown |
| *Malassezia nana* | Cats and cattle | Otitis | No |
| *Malassezia caprae* | Goats | Dermatitis | No |
| *Malassezia equina* | Horses | Dermatitis | No |
| *Malassezia cuniculi* | Rabbits | Unknown | No |

* Non-lipid-dependent *Malassezia* yeasts grow on routine mycological media (like Sabouraud dextrose agar) without lipid supplementation whereas lipid-dependent yeasts require lipid-supplemented media (like Dixon's medium). Thirteen lipid-dependent species are now recognised: *M. furfur, M. sympodialis, M. globosa, M. obtusa, M. restricta, M. slooffiae, M. dermatis, M. japonica, M. yamatoensis, M. nana, M. caprae, M. equina* and *M. cuniculi*

** Some strains of *M. pachydermatis* have shown lipid-dependent characteristics

**Table 3: Systemic antifungal drugs recommended for the treatment of dermatophytoses in dogs and cats**

The availability and recommended dose of the drugs may vary according to the European countries.

| Antifungal drugs | Antifungal groups | Dosage and frequency of administration | Comments on use | Adverse effects |
|---|---|---|---|---|
| **Itraconazole** | Azole | • 5 mg/kg bodyweight administered every 24h | • the drug is registered for use in cats but not in dogs<br>• because of its high lipophily, the drug has been proved to be effective in an alternate-week regimen (one week off and one week on)<br>• the absorption is improved if given with food | • at regular dosages, adverse effects are very seldom observed<br>• the drug should not be administered to pregnant dogs and cats (even if teratogenic effects have been reported only in rodents and at very high doses) |
| **Griseofulvin** | Polyene | • 25 mg/kg bodyweight administered every 12h (micronised form)<br>• 5 mg/kg bodyweight administered every 12h (ultramicronised form) | • in many countries, the drug is no longer used and is not registered for use in dogs and cats<br>• the drug should be administered with a fatty meal (the fat enhances absorption) | • the drug is highly teratogenic and must not be administered to pregnant dogs and cats<br>• gastrointestinal disorders are sometimes observed<br>• myelosuppression has been documented in FIV-infected cats |
| **Terbinafine** | Allylamine | • 20–40 mg/kg bodyweight administered every 24h | • the drug is commonly used for the treatment of dermatophytosis (especially onychomycosis) in humans but it is not registered for use in cats and dogs | • no teratogenicity has been reported in rodents or rabbits and the drug can be used in pregnant women<br>• vomiting, facial pruritus, macular or papular skin reaction may sometimes be observed in cats |

## Other drugs

**Ketoconazole** (5 mg/kg bodyweight administered every 12h or 10 mg/kg bodyweight SID) is registered for use in dogs (but not in cats) in some European countries. This drug is considered as a less effective treatment option (than griseofulvin, itraconazole or terbinafine) and it has more potential for adverse side effects. Ketoconazole is teratogenic and must not be administered to pregnant dogs and cats. Anorexia, vomiting and diarrhoea are sometimes observed. Ketoconazole has hepatotoxic effects, including elevated serum alanine transaminase activity. It interferes with the metabolism of other drugs and with steroid hormone metabolism.

**Lufenuron** is a chitin synthesis inhibitor commonly used for the prevention of flea infestations in dogs and cats. Since chitin is a component of fungal cell walls, several recent studies have investigated whether lufenuron has useful antifungal activity. The first retrospective study was conducted in Israel and suggested that lufenuron treatment was strongly associated with recovery in many dogs and cats with a number of fungal infections, including dermatophytosis. However, the results of other investigations were contradictory and increasing scepticism about the efficacy of lufenuron rapidly occurred. To date, the use of lufenuron is not recommended for the treatment of superficial mycoses in dogs and cats. Lufenuron is not registered for use in the prophylaxis or treatment of dermatophytosis.

**Table 4: Topical antifungal drugs for the treatment of superficial mycoses in dogs and cats**

The availability and the dose of the drugs may vary according to the European countries.

| Antifungal drugs | Antifungal groups | Dosage and frequency of administration | Comments on use | Adverse effects |
|---|---|---|---|---|
| **Shampoos** | | | | |
| **Miconazole + chlorhexidine** | Imidazole + disinfectant | 2% miconazole and 2% chlorhexidine twice weekly | • lathering or rubbing process may macerate fragile hairs and increase the release and dispersal of spores | • no adverse effects have been documented |
| **Ketoconazole + chlorhexidine** | Imidazole + disinfectant | 1% ketoconazole and 2% chlorhexidine twice weekly | • lathering or rubbing process may macerate fragile hairs and increase the release and dispersal of spores | • no adverse effects have been documented |
| **Rinses** | | | | |
| **Enilconazole** | Imidazole | 0.2% solution twice weekly | • the entire body must be treated and the antifungal agent left to dry on the skin<br>• careful application (using sponges and by patting rather than rubbing) is recommended<br>• after application, the coat and skin can be dried with a hairdryer | • topical application of enilconazole is well tolerated (including by cats) |
| **Lime sulphur** | | 1:32 or 1:16 twice weekly | • lime sulphur is commonly used in the USA but is not available in all European countries<br>• the entire body must be treated and the antifungal agent left to dry on the skin<br>• careful application (using sponges and by patting rather than rubbing) is recommended<br>• it can bleach dark clothing and can oxidate silver and gold jewellery | • lime sulphur has an offensive odour and may stain light-coloured hair<br>• oral ulceration has sometimes been observed in cats therefore they should be collared to prevent them from licking the solution |

Captan, povidone-iodine, and chlorhexidine (alone and at a concentration lower than 3%) have been found to be ineffective against dermatophytes in both *in vitro* and *in vivo* studies.

## APPENDIX 1 – BACKGROUND

ESCCAP (European Scientific Counsel Companion Animal Parasites) is an independent, not-for-profit organisation that creates guidelines and promotes good practice for the control and treatment of parasites in and on companion animals. With the proper advice, the risk of diseases and parasitic transmission between animals and humans can be minimised. ESCCAP aspires to see a Europe where companion animal parasites no longer threaten the health and wellbeing of animals and humans.

There is a great diversity in the range of parasites and their relative importance across Europe and the ESCCAP guidelines summarise and highlight important differences, which exist in different parts of Europe and, where necessary, specific control measures are recommended.

**ESCCAP believes that:**

- Veterinarians and pet owners must take measures to protect their pets from parasitic infections
- Veterinarians and pet owners must take measures to protect the pet population from risks associated with travel and its consequent potential to change local parasite epidemiological situations through the export or import of non-endemic parasite species
- Veterinarians, pet owners and physicians should work together to reduce the risks associated with zoonotic transmission of parasitic diseases
- Veterinarians should be able to give guidance to pet owners regarding risks of parasite infection and diseases and measures which can be taken to minimise these risks
- Veterinarians should attempt to educate pet owners about parasites to enable them to act responsibly not only for their own pet's health but for the health of other pet animals and people in their communities
- Veterinarians should wherever appropriate use diagnostic tests to establish parasite infection status in order to provide the best possible advice

**To achieve these objectives, ESCCAP produces guidelines in different formats:**

- A detailed guideline for veterinary surgeons and veterinary parasitologists
- Translations, extracts, adaptations and summarised versions of guidelines which address the varied requirements of European countries and regions

Versions of ESCCAP guidelines can be found at www.esccap.org

### *Disclaimer:*

Every effort has been taken to ensure that the information in the guideline, which is based on the authors' experience, is accurate. However, the authors and publishers take no responsibility for any consequence arising from the misinterpretation of the information herein nor is any condition or warranty implied. ESCCAP emphasises that national, regional and local regulations must be borne in mind at all times before following ESCCAP advice. All dosages and indications are provided for guidance. However, vets should consult individual data sheets for details of locally-approved treatment regimens.

ESCCAP
EUROPEAN SCIENTIFIC COUNSEL COMPANION ANIMAL PARASITES®

**ISBN: 978-1-907259-73-9**

ESCCAP Secretariat
Malvern Hills Science Park, Geraldine Road, Malvern,
Worcestershire, WR14 3SZ, United Kingdom

0044 (0) 1684 585135
info@esccap.org
**www.esccap.org**



# 2 Superficial Mycoses in Dogs and Cats

**ESCCAP Guideline 02 Fourth Edition – February 2019**