

## DERMATOPHYTOSIS

Animal Group(s) Affected	Transmission	Clinical Signs	Severity	Treatment	Prevention and Control	Zoonotic
Mammals	Direct contact with infected hairs or animals; contaminated fomites or environment; or natural environment (soil).	Lesions can appear different in each species, but most consistently observed is an area of alopecia with grey-white scaling, crusting, and mild erythema. Lesions may or may not be pruritic.	Generalized dermatophytosis can be difficult to cure, but mortality is low.  In healthy hosts and low burden of disease, dermatophytosis can be self-limiting.	Standard of care for treatment involves systemic antifungal agents in combination with topical therapies.  Environment where affected animal has been must be de-contaminated especially for <i>Microsporum canis</i> .	<p>Holding period for newly introduced animals.</p> <p>Isolation of affected animals until mycological cure.</p> <p>Protective clothing and good personal hygiene after handling infected animals.</p> <p>De-contamination of all fomites, including environment.</p> <p>Vaccines have not been shown to be an effective prevention except in cattle and horses.</p>	Yes-specific species carry higher potential for zoonosis than others.

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**Sheet completed on:** 10 September 2013

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**Susceptible animal groups:** All mammals can be affected

- Avian species-rare, mostly seen in domestic fowl.
- Reptiles-although uncommonly affected, reports have been made in lizards, snakes (green anacondas, *Eunectes murinus*), chameleons, and an iguana.
- Pocket Pets-rabbits, guinea pigs, hedgehogs, less commonly rats and mice.

Often animals with compromised or underdeveloped immune systems will be more commonly affected. Young, stressed, elderly, or ill animals are more likely to develop infection after exposure. Animals with compromised

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skin barriers such as allergic patients, genetic predispositions (Yorkshire terriers and Persian cats), or long hair coats may also be more likely to develop infection after exposure.

**Causative organism:** Three genera - *Microsporum*, *Epidermophyton*, and *Trichophyton* are associated with this disease. They can be categorized into anthrophilic (adapted to humans), zoophilic (adapted to animals), and geophilic (normally live in environment, but occasionally are infectious). Both *Microsporum* and *Trichophyton* are anthrophilic and zoophilic, whereas only one species of *Epidermophyton* (*E. floccosum*) has been known to cause disease in humans (anthrophilic). All genera have species that are geophilic.

Overall, the most common species that affect domestic animals are *Microsporum canis*, *M. gypseum*, and *Trichophyton mentagrophytes*. *Microsporum canis* is the most common causative agent in dogs and cats, but can be routinely found in horses, rabbits, cattle, sheep, goats, camelids, and swine. *Microsporum gallinae* occurs in domestic birds, and uncommonly in wild birds. *Microsporum nanum* is the most commonly isolated species in swine, although *T. mentagrophytes*, *T. verrucosum*, and *M. canis* also have been isolated. *Microsporum gypseum* has been found in many different species of animals, but it is mostly geophilic.

*Trichophyton equinum* is the most common cause of dermatophytosis in horses. It has also been reported in dogs, cats, goats, and sheep. *Trichophyton mentagrophytes* is common in many species, such as cattle, horses, pigs, dogs, cats, and especially rabbits, rodents-including guinea pigs. *T. mentagrophytes* var. *erinacei* occurs in the European and African hedgehog. *Trichophyton verrucosum* is the most common cause of dermatophytosis in cattle, goats, and sheep. It has been reported in horses, donkeys, and South American camelids. *Trichophyton simmii* affects non-human primates. *Trichophyton* spp. are the species most commonly isolated from reptiles.

**Zoonotic potential:** Dermatophytosis poses a large risk to humans especially when working in shelters or multi-animal facilities. *M. canis* appears to be the most commonly reported dermatophyte in humans. It is rare for *M. gypseum* or *T. mentagrophytes* to be transmitted to humans, but it does occur. *T. rubrum*, the cause of athlete's foot in humans, has been reported to cause reverse zoonosis in dogs and cats.

**Distribution:** Worldwide. The causative agent that predominates in any one particular area can vary depending on the climate, geographic locations, and other factors such as concentration or livestock, pets, or exotic animals present. Humid, warm, tropical, and subtropical areas appear to have higher incidence.

**Incubation period:** 1-4 weeks in animals; 4-14 days in humans. Asymptomatic carriers are known to occur in domestic short hair cats.

### **Clinical signs:**

**Canine/Feline** - Variable pruritus which can be more pruritic when complicated by secondary bacterial infections. Areas of peripherally expanding alopecia, scale, crust, and follicular papules, with facial lesions being most common. Fungal kerions -an exudative, well circumscribed nodular furunculosis- are often associated with dermatophytosis in dogs. Clinical signs in feline are highly variable.

**Equine**-One or more patches of scaling and crusting with erythema-early lesions can appear as papular urticaria. Lesions are most often seen in the saddle and tack areas (thorax, head, and shoulders). Pruritus is usually minimal, but occasionally severe to a degree suggestive of ectoparasitism.

**Bovine**-Non-pruritic periocular lesions that is found mostly in calves. Discrete patches of alopecia with scaling white-grey crusts; papules and nodules can be present as well. Fungal kerions can be seen in cattle. Lesions are most commonly seen on the head, neck, and pelvis. For bulls, the dewlap and intermaxillary space will often be affected.

**Caprine/Ovine**-Pruritus is rare. Alopecia, scale, erythema, and yellowish-grey crusting most often seen on the face, pinna, neck, and limbs. Udders and teats can become affected as well.

**Porcine**-Lesions are diffuse, but seen mostly behind the ears and on the trunk. Annular areas of red to brown discoloration with superficial orange-brown crusting. Alopecia and pruritus are rare.

**Pocket Pets**-Pruritic, scale, crusts, and alopecic areas often on the face, neck and limbs. Ears are often affected in rabbits.

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**Reptiles-** Blisters that rupture into brown/yellow crusts, proliferative growths or nodules-often described as appearing 'necrotic'.

**Avian-** Alopecia (loss of feathers, although feathers are not infected) and scale, white crusts or plaques and hyperkeratosis. Feather plucking and self-mutilation can also occur.

**Post mortem, gross, or histologic findings:** Post-mortem and gross findings are the same as clinical signs and skin lesions present ante-mortem. The most common histopathological findings include: 1) perifolliculitis, folliculitis, and furunculosis more specifically, infiltrative lymphocytic mural folliculitis, suppurative luminal folliculitis, and pyogranulomatous furunculosis; 2) hyperplastic or spongiotic superficial perivascular or interstitial dermatitis with prominent parakeratotic or orthokeratotic hyperkeratosis of the epidermis and hair follicles; 3) intraepidermal pustular dermatitis (suppurative, neutrophilic epidermitis). Arthroconidia and hyphae can be detected in hair shafts with H&E staining, but special staining such as Periodic acid-Schiff (PAS) and Gomori's methenamine silver (GMS) lends for an easier detection.

**Diagnosis:** Diagnosis includes multiple techniques. It is important to note that ectoparasites, bacterial pyoderma, and *Malassezia* dermatitis should be ruled out when approaching diagnostic testing for dermatophytosis.

- Wood's lamp is not reliable and will not provide a definitive diagnosis for dermatophytosis. Only about 50% of *M. canis* infections fluoresce with the Wood's lamp-this technique is helpful in identification of hairs/areas to pluck or brush for cytological evaluation and culture.

- Trichograms and cytological evaluation of scale can reveal arthrospores and hyphae in 40-70% of cases and provides a preliminary diagnosis.

- Fungal culture is considered the gold standard for diagnosis of dermatophytosis. Culture of dermatophytes using Sabouraud's dextrose agar or Dermatophyte Test Media (DTM) is the most reliable way to confirm dermatophytosis and can determine the specific dermatophyte involved. The most reliable procedure includes using a toothbrush to brush hairs and contact of the bristles with the test media to ensure that an aerobic environment is present. Plucking of suspected infected hairs and applying them to the test media can also be beneficial for culture.

- It is important to note that *T. equinum* requires nicotinic acid (vitamin B3) for growth on fungal cultures

- Skin biopsy is not often used, but can be helpful with fungal kerions and negative cultures results.

**Material required for laboratory analysis:** Infected hairs (can be detected with Wood's lamp) for trichograms, cytological evaluation, and culture. Test media such as Sabouraud's dextrose agar, DTM, Mycobiotic Agar (Difco, Detroit, MI), Mycosel Agar (BBL, Cockeysville, MD), Sab-duets (Hardy Diagnostics, Mountainview, CA), and Derm Duet (Hardy Diagnostics, Mountainview, CA) can all be used for culture.

**Relevant diagnostic laboratories:** Most clinics will grow and review cultures in-house. A recent study showed that incubation at slightly higher temperatures (24-27°C) resulted in a more rapid color change on DTM cultures. Most commercial laboratories (Idexx, Antech) and veterinary schools will offer culture.

**Treatment:** End point of treatment should be two to three negative culture results at consecutive weekly intervals (mycological cure). Overall, treatment for dermatophytosis in all animals should include a combination of systemic and topical antifungals. If lesions are minimal, less than 2-3 lesions, then considering topical therapy alone is valid.

Clipping of the fur, especially in long coated cats or severely infected animals, should be performed. It both decreases the burden of infection and allows for easier topical application of shampoos.

This approach particularly is recommended in multi-cat facilities while in single animal households it is not necessarily needed.

Effective topical agents include 2% combined Miconazole/Chlorhexidine shampoo (allowing at least 10 minutes contact time, though longer treatments may be necessary, especially with *M. canis*), and Lime Sulfur (1:16 dilution) or 0.2% Enilconazole dips/sprays which should not be removed by rinsing. The animal's entire body

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should be treated twice weekly with topical therapies. Systemic antifungal treatments include griseofulvin, itraconazole, terbinafine, fluconazole, and ketoconazole. For the majority of host species, griseofulvin appears to be efficacious and safe and in horses, no other antifungals are approved for oral use in US. The dose for large animal species of griseofulvin is widely variable. As a high evidence of spontaneous resolution is presented in large animals, their dermatophytosis often will be left untreated.

Itraconazole, fluconazole, ketoconazole and terbinafine are often used in small domestic carnivore with itraconazole the treatment of choice for cats. Varying dosages, duration, and regimens available for all the azole drugs and pulsed regimens with itraconazole and terbinafine have been shown to be effective in some species as one week one and one week off, or two days/week.

**Prevention and control:** Spores can remain viable in the environment and be infective for months to years. With the exception in cattle and horses, vaccines are not efficacious at preventing disease in other species. In Europe (Soviet Union and Scandinavia), a modified live *Trichophyton verrucosum* vaccine for cattle and modified live *Trichophyton equinum* have been shown to be effective. The vaccine is administered intramuscularly in calves at one and three weeks of age and in horses intramuscularly twice at 14 day intervals. The vaccine for cattle can have protection against *T. verrucosum* for up to 4-5 years.

Control of dermatophytosis includes proper hygiene, routinely disinfecting facilities, tools, housing, bedding, and toys, reducing fomites by using proper protective gear, limiting handling and number of people handling infected patients, and isolating infected patients. Vacuuming facilities helps to remove any dander, scale, or infected hairs that could be lingering in the environment. In equine medicine the tack and gear used in infected horses, should be solely used in those individuals.

Isolation of newly acquired animals for 2-4 weeks. Fungal culture of all newly acquired animals is recommended as well to reduce asymptomatic carriers. For cats, the application one preventative topical treatment (with any of the above mentioned therapies) is recommended before introduction to avoid asymptomatic carriers.

**Suggested disinfectant for housing facilities:** Three major steps for decontaminating housing facilities are:

- 1) Mechanically remove all debris, fur, and fomites from facility (as described above).
- 2) Thoroughly wash all surfaces with water and detergent.
- 3) Disinfect with 5% Sodium Hypochlorite (chlorine bleach). A 1:100 dilution is effective and less irritating to humans and animals. This application should be allowed to sit for 10 minutes.

Other topical disinfectants include 1% Formaldehyde Solution (Formalin) and Enilconazole Environmental Spray (concentrate diluted to 0.2%).

**Notification:** None

**Measures required under the Animal Disease Surveillance Plan:** None

**Measures required for introducing animals to infected animal:** Healthy non-infected animals should never be introduced to infected animals. As stated above, not all contact results in disease, but exposing a healthy animal to an infected animal is not recommended. Animals should only be allowed to interact once mycological cure has been achieved.

**Conditions for restoring disease-free status after an outbreak:**

- Treating all infected animals and achieving mycological cure.
- Disinfecting housing facilities adequately (see above).
- Following isolation protocols for newly acquired animals.

**Experts who may be consulted:**

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