Dermatophytosis (ringworm) is a superficial fungal infection of the skin and hair coat. In cats and dogs, the three most common pathogens are *Microsporum canis*, *Microsporum gypseum*, and *Trichophyton* spp., with *M. canis* being the most prevalent in both species. As many as 90% of cats with dermatophytosis are infected by *M. canis*, and although this is a contagious skin disease and is a known zoonosis, it is treatable, curable and not life-threatening. However, because of the highly contagious nature of this disease, variable clinical presentations and higher occurrence in the most adoptable population of cats (i.e., kittens), an accurate and timely diagnosis is needed to facilitate disease identification and treatment.

**Transmission and pathogenesis**

The primary method of transmission is via direct contact with another infected animal. In some cases, the disease can be contracted via contact with contaminated fomites. Key to establishment of the disease is damage to the skin, because healthy skin is a natural barrier to infection. Predisposing factors include but are not limited to the following: age extremes (very young or very old), geographic areas (more common in warm humid regions), concurrent systemic diseases, physiological stress and overcrowding. The primary infective unit is the arthrospore, which is shed from infected hairs. Skin lesions develop when a critical mass of infective material contacts the skin, defeats natural host defenses and starts to germinate. The superficial skin and hair are infected, and as the pathogen grows, it produces more infective spores. This results in hair loss, erythema (redness) and scaling of the skin. The incubation period from infection to visible lesions is 1–3 weeks, depending upon where the lesions are located.

**Diagnosis**

Diagnostics to diagnose or rule out dermatophytosis are commonly performed because of the variable clinical signs. Wood’s lamp examinations combined with direct examination of fluorescing hairs are commonly used screening tools, which can be diagnostic; however, the standard of care is to confirm the organism via fungal culture. In addition, not all infections are caused by *M. canis*. The most widely used confirmatory test is a fungal culture and is considered the gold standard. Several dermatophyte growth media include a color indicator, which aids in identifying suspect colonies; however, many common nondermatophyte fungi may also cause color change, and if microscopic examination is not performed to confirm, there is a high risk of false-positive results. One other major problem with fungal cultures is that it can take 7–21 days to determine if a sample is culture positive or culture negative. This lag time may result in spread of the disease from an infected animal to another susceptible host or unnecessary treatment of an animal if the decision is to treat pending results. Both situations can have serious health consequences. In people, this situation is further compounded by a higher rate of false-negative cultures as a result of daily hygiene practices. Because of the need for a faster and more accurate diagnostic test, diagnosis in people is increasingly being made via molecular testing with polymerase chain reaction (PCR). This technology is now available for use in veterinary patients.

**Introducing the Ringworm (Dermatophyte) RealPCR™ Panel for diagnosis of dermatophytosis**

The Ringworm (Dermatophyte) RealPCR™ Panel is a fast and accurate diagnostic tool for dermatophytosis in cats and dogs. The panel includes *Microsporum* spp., *Microsporum canis* and *Trichophyton* spp. real-time PCR tests and performs with greater than 95% sensitivity and 99% specificity. Most important, results are available in 1–3 working days. Increasingly, real-time PCR tests are being used for the diagnosis of onychomycosis (fungal infection of the nail) in people, replacing fungal culture because of its high specificity, sensitivity and fast turnaround time.

**Diagnostic accuracy of the Ringworm (Dermatophyte) RealPCR Panel**

The diagnostic accuracy of the Ringworm (Dermatophyte) RealPCR Panel was determined using DNA from characterized *Trichophyton* and *Microsporum* species. The assay accurately detected *Trichophyton* spp., *Trichophyton mentagrophytes*, *Microsporum* spp., *Microsporum canis* and *Microsporum gypseum*. Notably, the assay did not pick up DNA from closely related fungal and yeast organisms, including *Aspergillus*, *Cryptococcus*, *Candida* and *Malassezia* species. In a direct comparison to culture using 82 diagnostic samples, real-time PCR detected all culture-positive samples. In addition, the RealPCR panel detected an additional 11 samples that were missed by culture. These additional positives were confirmed by sequence analysis. This indicates a high diagnostic sensitivity and specificity for the real-time PCR as reported in similar human studies.
How to use the Ringworm (Dermatophyte) RealPCR™ Panel results

Ringworm suspected (dermatophytosis)
   Lesions present with or without positive Wood’s lamp examination

Ringworm (Dermatophyte) RealPCR™ Panel (test code 3565)

- **Negative PCR**
  - No detectable disease at time of sampling
  - Consider other differentials
  - If suspicion remains high, consider fungal culture

- **Positive PCR Microsporum canis or Trichophyton spp.**
  - Treat
  - At least 2 weeks after completion of therapy and resolution of clinical lesions, perform a Ringworm (Dermatophyte) RealPCR™ Panel with Reflex Culture (if Indicated) (test code 3685)
  - If PCR positive, fungal culture will be performed at no additional cost

- **Positive PCR Microsporum spp. and negative Microsporum canis**
  - Microsporum gypseum or nonpathogenic Microsporum spp.
  - Fungal Culture (test code 405) can be performed to speciate M. gypseum may resolve spontaneously; if necessary, treatment generally curative

- **Negative PCR Culture not indicated**
  - Treatment effective

- **Positive PCR and negative culture**
  - Treatment effective
  - Positive PCR detecting nonviable spores

- **Positive PCR and positive culture**
  - Still infected and/or viable spores on hair coat because of lack of disinfection
  - Reexamine and repeat Wood’s lamp examination
  - Reassess compliance with topical therapy and/or need to repeat systemic therapy

- **Positive PCR Microsporum canis or**
  - Positive PCR and negative culture
  - Treatment effective
  - Positive PCR detecting nonviable spores

- **Positive PCR Microsporum spp.**
  - Microsporum gypseum or nonpathogenic Microsporum spp.
  - Fungal Culture (test code 405) can be performed to speciate M. gypseum may resolve spontaneously; if necessary, treatment generally curative
When to use the Ringworm (Dermatophyte) RealPCR™ Panel

The Ringworm (Dermatophyte) RealPCR Panel should be used in animals when dermatophytosis is a likely differential diagnosis or needs to be ruled out. However, because of the highly variable clinical manifestation of this disease, it is strongly recommended that suspected infection in pets should not be ignored, even when there are atypical lesions. When the history and clinical signs are compatible, a positive PCR test can confirm infection. In addition, when paired with a reflex fungal culture for confirmation of viable spores, it can be used to monitor response to treatment.

Specimen collection guidelines

Ideal specimen depends on the clinical manifestation:

- Use a soft bristle toothbrush to comb the suspect lesion. Comb the lesion until there are visible hairs with follicles in the bristles. Submit the toothbrush in a sterile container or new ziplock plastic bag.
- Pluck hair with follicles, lift or remove crusts and/or perform skin scrapings from the active border of suspect lesion. Plucked hairs and/or crusts can be submitted in a red-top tube or empty, sterile tube.
- Collect nails with nail bed scrapings or clippings in sealed fungal envelope or sterile container. Nail sampling is recommended only when nails are abnormal.
- Collect aspirated purulent material from suspect fungal mycetoma in a sterile container.
- If no distinct lesions are present, use a soft bristle toothbrush to perform a thorough coat brushing until there are visible hairs with follicles in the bristles; no less than 30 strokes and include the face and ears. Submit the toothbrush in a sterile container or new ziplock plastic bag.

Keep specimens refrigerated. If submitting a panel that includes a fungal culture, please submit an additional specimen for culture. Collect specimens prior to antifungal treatment or at least 2 weeks after withdrawal of antifungals.

Ordering information

<table>
<thead>
<tr>
<th>test code</th>
<th>test name and contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>3565</td>
<td>Ringworm (Dermatophyte) RealPCR™ Panel</td>
</tr>
<tr>
<td>3685</td>
<td>Ringworm (Dermatophyte) RealPCR™ Panel with Reflex Culture (if Indicated)</td>
</tr>
</tbody>
</table>

Turnaround time

The IDEXX nationwide network of reference laboratories provides daily courier service or IDEXX-Direct® service to pick up your specimens and forward them to our IDEXX Molecular Diagnostics Laboratory in California. IDEXX RealPCR tests are run daily, Monday–Friday. Specimens received on Saturday or Sunday are processed on Monday. You can expect results within 1–3 working days, depending on shipping time.

Contacting IDEXX

Laboratory Customer Support
If you have any questions regarding test codes, turnaround time or pricing, please contact our Laboratory Customer Support Team at 1-888-433-9987.

Expert feedback when you need it
To help you successfully manage your patients with dermatophytosis, IDEXX offers complimentary dermatology consultations. Please call for a consultation at 1-888-433-9987.

References

5. Data on file at IDEXX Laboratories, Inc. Westbrook, Maine USA

The information contained herein is intended to provide general guidance only. As with any diagnosis or treatment, you should use clinical discretion with each patient based on a complete evaluation of the patient, including history, physical presentation and complete laboratory data. With respect to any drug therapy or monitoring program, you should refer to product inserts for a complete description of dosages, indications, interactions and cautions.

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