

The Most Persistent Fungus Among Us

Ringworm is one of the easiest zoonotic diseases to contract—and, in the shelter environment, one of the hardest to get rid of. Here's a primer on causes, symptoms, and effective controls

BY LILA MILLER, D.V.M.

Ringworm, or dermatophytosis, is one of the most common infectious skin diseases of young and long-haired cats. Although it's not fatal and can be managed in a home setting, its long-term survival skills, contagiousness, and tendency to evade diagnosis make it exasperating for shelters.

Despite its name, ringworm is caused by a fungus, not a worm. Although three types of fungi can cause ringworm in dogs and cats, *Microsporum canis*, or *M. canis*, is responsible for 98 percent of cat cases and 70 percent of dog cases. This highly contagious fungus lives in the superficial layers of skin, hair, and claws of infected animals. The fungus is not present normally in the skin, and it should always be considered a cause of disease when found in conjunction with clinical lesions. Aside from humans, rabbits and guinea pigs are among the other species *M. canis* readily infects. It doesn't infect dogs nearly as often as cats, who contract the majority of cases encountered in shelters.

Ringworm presents a dilemma for many organizations: The clinical disease is often so mild that some shelter employees find it difficult to consider euthanasia, yet the cost and labor involved in diagnosis, treatment, isolation, and complete decontamination of the environment can be prohibitive for many organizations. Even placing ringworm-infected animals into foster care situations carries high risk, especially because the disease is zoonotic (meaning it is contagious to people), and contamination may not be contained to one area. And sending ringworm-positive animals home with adopters can ruin a shelter's reputation and result in decreased adoptions, especially if the disease spreads to humans.

Examine your budget and resources carefully before making a decision that may adversely affect your operations for months. If you decide you have the capacity to hold and treat ringworm-positive animals, read up on the disease and the recommendations outlined below.

The Spread

Usually transmitted through direct contact with infected hairs, ringworm can spread to cats who never develop clinical signs of the disease themselves. Other means of transmission include anything that can harbor infectious spores, including hands, clothing, toys, cat carriers, brushes, flea combs, collars, bedding, carpet, scratching posts, furniture, litter boxes, dishes, clipper, and cleaning equipment. Air currents and dust particles may also carry spores. Even fleas have been implicated as possible agents for spreading the disease.

The average incubation period for ringworm is two to four weeks, but cats can develop lesions at any time from four days to six weeks following infection. Ringworm is not transmitted until after birth, so you're not likely to see it in kittens less than two weeks old. It's most common in kittens, longhaired cats, cats who fail to groom themselves, or cats who are immunocompromised because of stress, malnutrition, endo- or ectoparasitism, feline leukemia (FeLV), feline immunodeficiency virus (FIV), pregnancy, lactation, or other conditions.

Ringworm occurs more readily in the kind of overcrowded, humid, or poorly ventilated environment common to many shelters. Excessive bathing or moisture on the skin—which is often caused by routine cage cleaning—can predispose cats to infection. Prolonged antibiotic or steroid use can increase a cat's likelihood of developing ringworm, as can the harboring of



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other skin diseases. Grooming helps cats physically remove spores, so cats who fail to groom themselves are more likely to contract the disease.

The duration of immunity after recovery from infection is unknown, but cats can be reinfected if exposed to enough spores.

The Signs

The disease itself is often mild, consisting of localized lesions only. In most healthy, shorthaired animals living in a stress-free environment, it resolves on its own in about three months.

Clinical signs vary. Although the classic one is a circular area of hair loss (alopecia) with crusts and scaling, ringworm



Humid environments and excessive bathing can predispose cats to ringworm infection.
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may cause large areas of alopecia, with or without scaling or with broken, frayed hairs. The primary disease does not normally cause pruritis (itching), although this may sometimes be seen. Lesions may be symmetrical, and the skin may be reddened. Lesions often appear on the face, head, ears, paws (especially the nailbeds), forelimbs, and tail. Ringworm may be implicated in other skin diseases such as feline acne (found on the chin) or “stud tail” (the term describing an accumulation of greasy secretions from glands located at the top of the tail).

Ringworm can be confused with other skin diseases, especially staphylococcal infections, but you should suspect its presence in any young cat or kitten with alopecia and non-itchy skin lesions. Associated signs may include vomiting, constipation, hairball problems, and excessive grooming and shedding.

Up to 50 percent of people exposed to cats with ringworm may develop the

disease; children, seniors, immunocompromised people, and people with breaks in their skin are more likely to contract it. Shelter workers should use common sense when handling any animal with skin lesions, particularly kittens. They should wear gloves and wash hands frequently to avoid spreading the disease or contracting it themselves.

The Diagnosis

Making an accurate diagnosis of ringworm cases can take up to two weeks, using one or more of three methods that can be performed by a shelter: the Wood’s lamp for screening, a fungal culture, and a direct examination of infected hairs under the microscope.

The Wood’s lamp is an ultraviolet light with a wavelength of 360 nanometers that causes about 50 to 80 percent of *M. canis* strains to fluoresce as a bright apple or yellow green. Although widely used, this is not a very reliable screening

method, since not all fungal strains fluoresce. Negative results for suspicious lesions therefore can’t be trusted and need to be cultured as well. To further complicate matters, many other things can cause fluorescence, such as dandruff, kitten milk replacer, seborrhea (oily skin conditions), and doxycycline (a commonly used antibiotic). This renders positive results uncertain, too.

For these reasons, shelters should use Wood’s lamps for screening purposes only; they are not appropriate stand-alone diagnostic tools. When using a lamp (preferably an electric one), warm it up in a dark room for 5 minutes and then hold it within 1 to 2 inches of the suspected lesion for at least another 5 minutes.

A fungal culture is the most accurate method for diagnosing ringworm. For the best disease management, conduct in-house tests on the hairs of cats with suspicious lesions and on the hairs of cats who’ve been exposed to contaminated animals and surfaces. Once the cats are thought to be cured and the environment is considered decontaminated, take more cultures to verify success.

To perform a culture, collect representative samples of infected hair by gently plucking them off the cat. In the absence of distinct lesions, use a toothbrush or gauze sponge to obtain a broad sampling of hairs, replacing the brush or sponge with a new one for each animal. After wiping the coat with a damp cloth to remove superficial contamination from stray spores, run the brush vigorously over the coat 30 times or until the brush contains ample hair and scales. Place the collected material firmly in the culture medium (culture plates are preferable to containers) without disrupting the medium. Use dermatophyte test medium (DTM), sold under the names Derm Duets or Sabouraud’s Sab duet.

Place culture plates in a darkened, humid area, observing them daily at an above average room temperature for at least 10 days. To make a tentative positive diagnosis, look for a red color change in the culture media and the growth of a white or pale-colored fungus to occur virtually at the same time. To confirm this

is truly ringworm, the fungal growth on the culture medium should be examined under the microscope. To accomplish this, briefly, a piece of clear acetate tape should be placed on top of the colony, sticky side down, and then transferred onto a slide with a drop of lactophenol blue stain to help identify the characteristic structures.

Unfortunately, toothbrush cultures cannot distinguish between true clinical disease and mechanical contamination of a cat. Once ringworm has gained a foothold in the shelter environment, toothbrush cultures may yield many false positives. This necessitates further testing of cats with suspicious lesions to confirm diagnosis; while biopsy and histopathology are options for confirmatory testing outside the shelter, direct examination of the hairs is the only other practical test that can be performed on-site.

Direct examination of hairs requires accurate sampling and the ability to recognize infected hairs under the microscope. But it's easier to develop this skill than

previously thought. Potassium hydroxide (KOH) is frequently recommended as a clearing solution for the hairs before examination, but mineral oil works well also. Pictures of the fungus for identification can be found in dermatology textbooks or at doctorfungus.org. A detailed description of the procedure is outlined in texts such as *Muller and Kirk's Small Animal Dermatology*.

For assistance in determining what to do when a fungal culture shows the presence of ringworm, visit <http://giveshelter.org/resources/dermatophyte.php>, which includes research by Karen Moriello, D.V.M., D.A.C.V.D., and Sandra Newbury, D.V.M., and recommendations about handling ringworm in the shelter.

The Question of Treatment

The treatment of ringworm is controversial, with recommendations from clinicians and dermatologists changing periodically. The disease generally takes four to six weeks to cure—or even several months if appropriate steps are not taken.

Treatment can be protracted and costly, exposing many cats, humans, and other species to the disease.

The impact of an outbreak can be devastating if environmental decontamination is not thorough and treatments are not carefully performed and confirmed. Before administering treatments to animals who test positive, perform a thorough physical exam to detect other underlying health problems, and screen for FeLV, FIV, and internal parasites. Treat animals for ticks and fleas as well.

Place cats with clinical signs and cats who've been exposed to diseased animals into isolation as soon as possible. Avoid placing them in the same area as cats with upper respiratory or other infectious diseases. The isolation room should be as stress-free as possible. Because ringworm is zoonotic and highly contagious, staff members need to take extra precautions in the presence of the disease. While socialization and handling are important to increasing the adoptability of kittens, you

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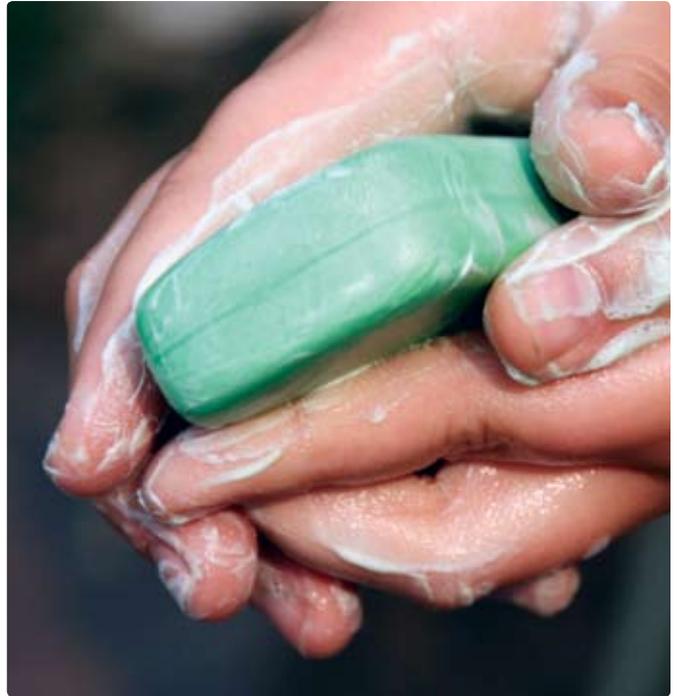




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M. canis is a survivor and can hang around for months or even years if the environment is not fully decontaminated. The only easily accessible disinfectant that reliably kills it is a solution of 1 part bleach to 10 parts water. ISTOCKPHOTO.COM/FRANCES TWITTY



People can also get ringworm. To prevent its spread among both animals and humans, shelter workers should wear gloves and wash hands frequently. ISTOCKPHOTO.COM/ALANDJ

may have to restrict less critical socialization activities.

Treatment and culture protocols take a minimum of 30 days if you follow these recommendations:

- Provide systemic treatment with itraconazole (use the brand-name drug Sporanox, not the generic one) at 5-10 mg/kg daily or 25 mg per adult cat. (Griseofulvin and ketoconazole are toxic, and terbinafine is expensive.)
- Perform lime sulfur dips twice a week, using a dilution of 8 ounces per gallon of warm water. The cat should not be wet first, and the solution should not be rinsed off. The solution must soak through to the skin. Although it has a terrible odor and will turn the coat yellow, both the odor and color will disappear. Lime sulfur dips are safe for pregnant animals, young animals (2 to 3 weeks old), and nursing queens, but wipe off the teats of the queen before returning the kittens. Keep kittens warm after treatment.
- Clip longhaired, matted, or severely affected animals only with a No. 7 or No. 10 clipper blade. Don't let the hair fly all

over; gather it up and dispose of it in a tightly closed bag. Avoid clipper burn or other injuries to the skin, as this will exacerbate the problem. Sanitize clipper blades after use, and do not use them on healthy animals even after they've been cleaned.

- Culture cats weekly after commencing treatment. Regardless of the appearance of the cat, at least 2 to 3 consecutive negative cultures must be obtained before a cat is considered cured. Skin lesions often disappear before a cat is truly cured and before he is no longer infectious, so a visual examination is not sufficient. Treatment and culture protocol will take a minimum of 30 days.

Many products marketed to treat ringworm don't work. Lufenuron, otherwise known as Program, has been shown to be ineffective. Tea tree oil may be toxic to cats. Bleach should not be used on the skin, and chlorhexidine and miconazole shampoos are ineffective when used alone.

Prevention and Control

Highly resistant to inactivation, ringworm can survive for months to years in the en-

vironment, endangering the lives of current and future shelter residents. A vaccine for ringworm was introduced in the 1990s but later pulled off the market; though it prevented the development of lesions in some cats, it did not prevent infection.

If you discover the fungus in your shelter, isolate all infected and exposed animals immediately. Ideally, you should keep animals undergoing treatment in an isolation area that's separated from animals who are just being cultured pre- and post-treatment. Designate certain staff to handle only the animals in the ringworm ward, or require staff to handle ringworm-positive animals last before changing clothes and washing hands.

Separate kittens from adult cats. You can dip cats in lime sulfur as a prevention method, especially upon admittance to a building where environmental contamination is present or suspected.

M. canis fungal spores can survive in the environment for 18 months or longer in dust, ventilation ducts, heating and air filters, carpets, drapes, and floors. Although it has been previously reported that many disinfectants inactivate *M.*

canis, current research shows that the only agents that kill ringworm spores are a 1-percent formalin solution, a solution of 1 part bleach to 10 parts water, or enilconazole. Commonly used shelter disinfectants, such as quaternary ammonium products and the typical solution of 1 part bleach to 32 parts water, are not effective in killing *M. canis*. At least one study has shown that despite labeling to the contrary, the disinfectant Trifectant is not effective against *M. canis* (although the manufacturer disputes this and says further studies will corroborate its claim). The only disinfectant that reliably kills *M. canis* and is easily accessed by U.S. shelters is the 10-percent bleach solution. Steam heat (higher than 110 F) will also kill ringworm. To reach the temperatures necessary to kill spores, use commercial washers, dryers, and steam cleaners when laundering or cleaning.

Environmental cleanup is essential to controlling a ringworm outbreak. Clean and disinfect all potentially contaminated surfaces and objects. Physically remove hair, dirt, and other infected material, and clean the area with detergent. Launder clothing, bedding, and other fabrics in hot water and bleach. Discard carpets, drapes, scratching posts, and other materials that cannot be steam-cleaned or disinfected. Repeated cleaning to remove infected material is invaluable. Discard vacuum cleaner bags after use, and replace furnace and HEPA filters. Use Swiffers or damp mops on all surfaces, taking care to avoid stirring up hair, dirt, and dust. After rinsing, apply a 1:10 bleach solution; allow it to sit for 10 minutes before rinsing, and apply the bleach again the next day or at least twice a week.

To remove and kill as much infected material as possible, it's a good idea to repeat these cleaning steps and reapply disinfectants. Once you consider the disinfection process complete, test the environment, especially the ventilation ducts, to determine whether you've successfully decontaminated. Perform fungal cultures on material collected from the Swiffers. Skipping this step risks leaving ringworm spores in the environment for months to come. AS



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