

Ringworm Protocol



Key Facts:

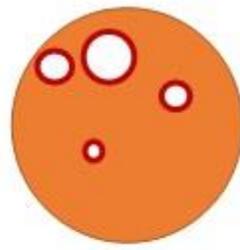
- Dermatophytosis (Ringworm) is a fungal infection affecting the skin and hair of animals. It is zoonotic, meaning it can affect people as well, and therefore is a public health concern.
- It is highly infectious, contagious, as well as challenging and time consuming to treat.
- There are three common species of ringworm: *Microsporum canis*, *Trichophyton metagrophytes*, and *M. gypseum*. *M. canis* is spread via contact with infected animals and contaminated environment, while the other two species are less common and spread via rodents and soil contamination.
- Ringworm spores are very durable in the environment and can persist on surfaces for months to years.
- Not all animals exposed to ringworm will develop lesions, but cats and immunocompromised (young, old, ill, stressed) animals are more susceptible to infection.

Recognition of Disease

- All cats should be screened with a Wood's Lamp at intake. Any cat with lesions *must* be screened at intake.
 - Wood's lamps pick up the majority of cases (>50%), but only *M. canis*. A negative Wood's lamp does not rule out ringworm, the animal still may be positive.
- Common places to screen carefully are: eyes, ears, paws and tail
 - Lesions commonly have:
 - Alopecia (loss of hair)
 - Crusting
 - Erythema (redness)
 - Lesions do not have to be circular!

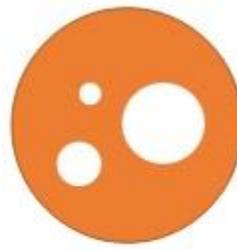
Diagnosis

- Wood's Lamp
 - Under a Wood's lamp, the hair shafts will glow bright apple-green. This color cannot be washed off or brushed away.
 - Examine underneath any crusted areas – skin crusts may hide areas of fluorescence.
 - Be careful because other items may glow as well, such as doxycycline (bright yellow), urine (yellow) and other medications. These can often be washed away and do not glow the characteristic apple-green color.
- Culture
 - Animals that display lesions that fluoresce under Wood's lamp will be cultured.
 - Culture samples are collected by using a toothbrush and brushing the hair sample into the agar plate.
 - Cultures are placed in the incubator and checked daily by a medical team member or the veterinarian
 - A positive culture is one which has growth and a red color change occurring at the same time. Ringworm is usually flat, white and lacey in appearance. Other contaminants or excessive growth can cause color change. Cultures may be confirmed by a veterinarian under a microscope.



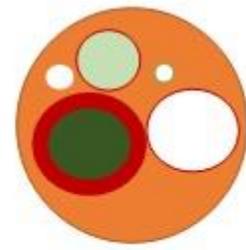
White colonies
Red color change

POSITIVE



White colonies
No color change

NEGATIVE



Green or mixed colors
Or heavy growth

NEGATIVE

- Read DTM daily, noting growth and color change. Record number of colonies (if applicable) when growth is significant.
- Considered negative test if no growth after **10 days** on **initial** DTM.
- For positive growth, a pathogen score should be recorded:
 - P1: 4 or fewer colonies on the plate
 - P2: 5-9 colonies on the plate
 - P3: 10 or more colonies on the plate
- P score interpretation and follow-up at 7+ days:
 - P1: Examine with wood's lamp
 - "Dust mop": if no lesions, dip and clear from isolation.
 - Incubator: will have subtle lesions; check face, ears, paws carefully. Continue isolation and treatment.
 - P2: Continue isolation and treatment.
 - P3: Continue isolation and treatment.
- PCR - options for PCR testing of hair are available through the diagnostic lab and will only be tested at the discretion of the veterinarian.
- Any diagnostic tests used should be documented in the shelter software in a timely manner.

Notification

- Animal care staff who observe suspicious lesions should alert a manager, medical staff or clinic staff.
 - If a positive Wood's lamp has already been identified, the animal should be moved into the ringworm isolation ward and a lifesaving plea (without a deadline) should be sent to the rescue department.
 - A positive test result should be recorded in the shelter software and be listed as a condition/diagnosis.
- Animals in foster care may be treated at the discretion of the foster team with approval by the veterinarian. That pet must be kept separate from other fosters and pets.

- Animals that have been diagnosed immediately after adoption (<5 days) may receive treatment from the clinic staff (after a discussion of disease risk and course of treatment) and shall follow up with their primary veterinarian. Adopters also have the option to follow up with their primary veterinarian.

Treatment

Who are candidates for treatment? Given the small isolation space we have for ringworm, we should be selective about which cats would benefit from treatment. The ideal candidates are:

- Otherwise healthy kittens, puppies and adult cats
- Easy to handle/medicate
- Behaviorally sound (not so stressed they will decline in the shelter)
- Feral cats are not a candidate for treatment but are a candidate for RTF

Treatment consists of both topical and oral antifungal medication. Any cats on property or in foster care, should be using the medication prescribed by the medical team.

- Lime Sulfur Dip
 - Topical (on the skin) therapy is a key component in treating ringworm
 - Kittens/puppies should be at least 2-3 weeks old before receiving lime dip treatments
 - These animals may need supplemental heat to stay warm after dipping
 - Dips should occur twice weekly, at a concentration of 8oz lime sulfur to 1 gallon of warm water.
 - The animal should be completely soaked to the skin with a spraying tool (i.e. spray bottle or garden sprayer), not submerged in the dip solution.
 - The more sensitive areas (around the face and ears) should be sponged with a wet lime sulfur soaked washcloth, as these areas are typically the most difficult to resolve.
 - Do not rinse off the dip, but simply towel dry them. It is very important to keep animals warm after their lime sulfur dip treatments.
- Oral Medications
 - ****Cats should be re-weighed weekly to determine if dosage needs to change**
 - Terbinafine - 40mg/kg PO SID x 3 weeks. This is a tablet that has to be cut to size for cats
 - See dosing chart below
 - If an animal becomes lethargic or inappetent (not eating) or has severe diarrhea during treatment, please alert the med staff.
 - *Itraconazole* - 5mg/kg (0.5ml/kg) PO SID x 3 weeks. For cats and dogs, treatment will consist of daily treatment for three straight weeks.
 - Due to the increased amount of time, pulse-therapy (one week on-one week off) will not be followed.
 - If an animal becomes lethargic or inappetent (not eating) during treatment, please alert the med staff.
 - See dosing chart below
- Any positive animals **cannot be scheduled for spay/neuter** until at least three weeks of treatment have passed and the animals have been re-evaluated by medical/foster staff.
- All treatment prescribed should be documented in petpoint in a timely manner

PPE in Isolation

- In the ringworm isolation room, the following PPE should be worn at all times.
 - Bouffant cap

- Isolation Gown or White Suit
- Shoe Covers
- When handling animals:
 - Gloves should always be worn when handling animals, and should be changed between kennels

Housing and Decontamination

- For cats/dogs in individual kennels (stainless steel banks)
 - The run/kennel will be disinfected following our normal disinfection protocol (Rescue for 10min soak time). Make sure to clean out any organic material first (urine/feces, debris, litter, etc)
 - Blankets and toys need to be immediately removed and laundered.
 - Any dens or other hard items (toys, wire kennels) will need to be cleaned with Rescue.
- For animals in communal rooms:
 - Affected animals should be moved out of the room and isolated. Follow procedures for alerting management/medical staff.
 - All other animals in the room need to be carefully inspected for lesions. If no other lesions are noted:
 - All animals will be lime dipped once.
 - The room will be deep-cleaned and bedding replaced.
 - No additional animals will be placed in the room for 5 days.
 - Animals should be checked daily for development of new lesions.
 - If lesions are noted on multiple animals:
 - On a weekend - follow the steps above for removing affected animals and deep-cleaning room. Limit traffic into room: assign one person to clean, do not allow adopters/fosters/volunteers in. Alert medical/clinic staff.
 - On a weekday- remove all cats with lesions; alert the medical/clinic staff so decisions can be made whether to shut down room or proceed on animals.
 - For any rooms that are ringworm positive or ringworm exposed:
 - Staff should wear isolation gowns and shoe covers
 - Gloves should be worn
 - Any mopping/cleaning supplies should not be used in other rooms.
 - Rooms should be cleaned last
- Floors in isolation or exposed rooms should be dusted with a swiffer mop and followed by a mop with Rescue or bleach/water diluted 10:1.

Re-evaluation and clearing from isolation

- Fungal cultures should be checked for growth daily.
 - Colony counts and pathogen scores should trend down over time, indicating therapeutic progress.
 - DTM should be obtained using the toothbrush collection method, starting after 1-2 weeks of any treatment (including topical, dips, oral, etc.) and repeated weekly.

- If pathogen scores/colony counts are not decreasing, then consult DVM to troubleshoot.
- Do DTM's on day of lime dip **before** lime dip is done.
- Read DTM daily.
- Positive DTM consists of white fluffy growth AND color change in the medium at the same time. Contaminants are common.
- The patient is considered negative when an animal has **one negative DTM grown out to 14 days and the following DTM negative at 7 days**
- If housing/facilities allow, cats with one negative at 7 days (second culture has just been collected) should be housed separately from cats continuing to test positive.
- If animals are released for adoption:
 - It is important to maintain transparency and ensure new owners are well informed about the resolved ringworm infection. This is especially important as some adopters may be immune-compromised, which may be unknown to the shelter at the time of adoption.
 - Already owned animals in the new home may have a risk of exposure (albeit likely a low risk if the infection is resolved). Adopters should be given a copy of the animal's medical record, which would show all the ringworm treatments they received.

Dosing Charts

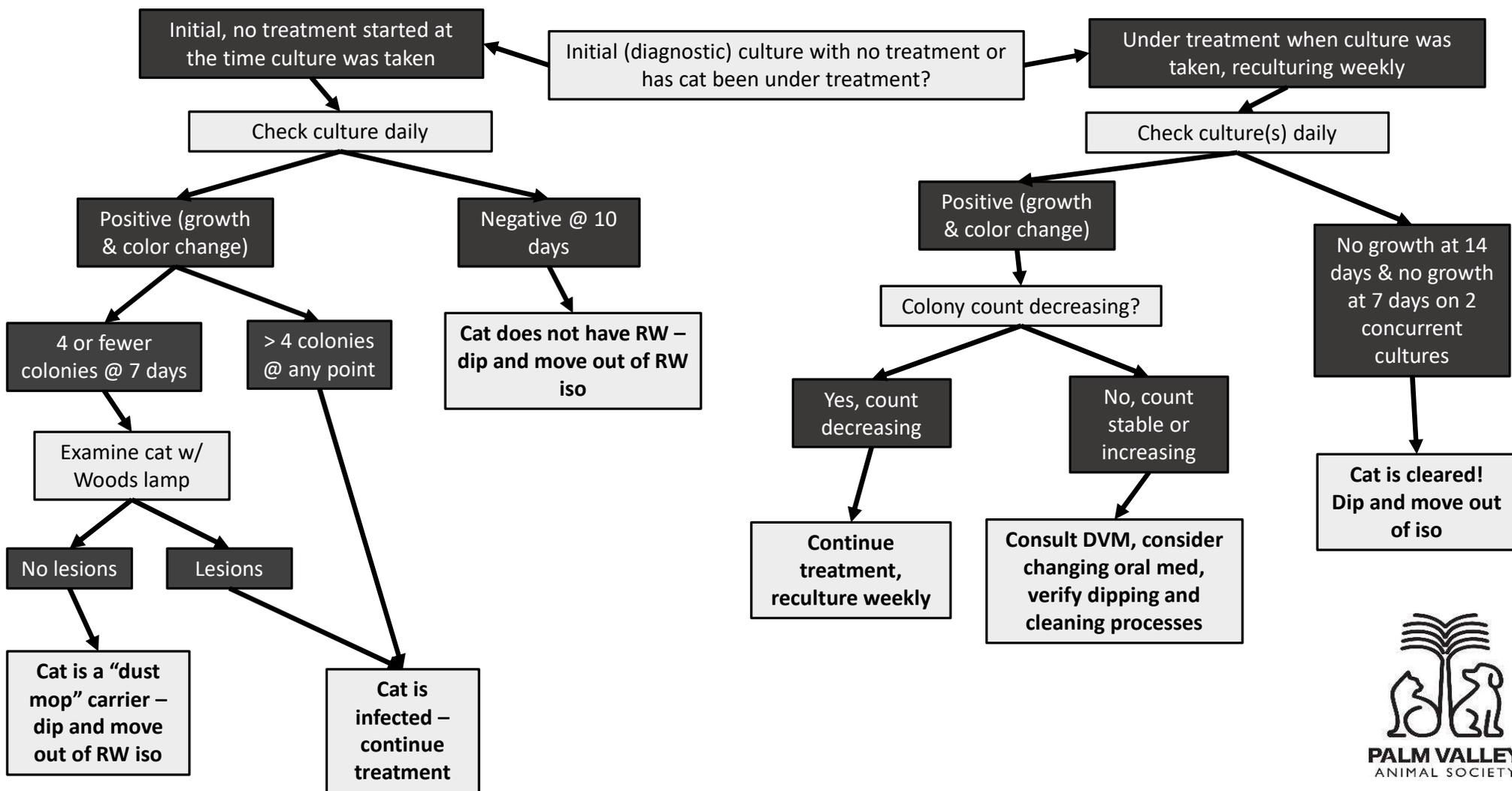
Terbinafine Weight (lbs)	Tablet (250mg)
1	Use liquid
2	Use liquid
3	1/4 tab
4	1/4 tab
5	1/2 tab
6	1/2 tab
7	1/2 tab
8	3/4 tab
9	3/4 tab
10	3/4 tab
11	3/4 tab
12	1 tab
13	1 tab
14	1 tab
15	1 tab

Terbinafine 250mg tablets

Itraconazole (Weight lbs)	Dose (mls)
1	0.2
2	0.5
3	0.7
4	0.9
5	1.1
6	1.4
7	1.6
8	1.8
9	2.0
10	2.3
11	2.5
12	2.7
13	3.0
14	3.2
15	3.4

Itrafungol 10mg/ml

Ringworm DTM Flowchart



Sample: Ringworm In-house Fungal Culture Protocol

Summary: Fungal cultures are performed in-house when possible and provide more information regarding infection status than PCR testing. Some animals are not actively infected and are simply a fomite carrier; DTM with pathogen scoring can distinguish “dust mop” animals from infected ones.

Operational Procedure: Shelter medical staff will collect initial DTM culture and repeat weekly to monitor treatment on infected animals.

Procedures:

Plating and interpreting a DTM culture:

1. Make sure culture medium is at room temperature when inoculated. Use plates, not slants.
2. Apply toothbrush to the medium **evenly** across the entire plate while holding the plate upside down.
3. Place DTM upside-down in an incubator at 80-85 degrees F.
4. Read DTM daily, noting growth and color change. Record number of colonies (if applicable) when growth is significant.
5. Considered negative test if no growth after **10 days** on **initial** DTM.
6. For positive growth, a pathogen score should be recorded:
 - a. P1: 4 or fewer colonies on the plate
 - b. P2: 5-9 colonies on the plate
 - c. P3: 10 or more colonies on the plate
7. P score interpretation and follow-up at 7 days
 - a. P1: Examine with wood’s lamp
 - i. “Dust mop”: if no lesions, dip and clear from isolation.
 - ii. Incubator: will have subtle lesions; check face, ears, paws carefully
 - b. P2: Continue isolation and treatment.
 - c. P3: Continue isolation and treatment.
8. See below for clearing animals undergoing treatment.
9. If there is a need for faster results, submit a Ringworm PCR (Idexx code 3565) using the toothbrush method, as outlined above.

Serial Fungal Cultures

1. Colony counts and pathogen scores should trend down over time, indicating therapeutic progress.
2. DTM should be obtained using the toothbrush collection method, starting after 1-2 weeks of any treatment (including topical, dips, oral, etc.) and repeated weekly.
3. If pathogen scores/colony counts are not decreasing, then consult DVM to troubleshoot (see section below).
4. Start DTM’s on day of lime dip; collect sample **before** lime dip is done.
5. Read DTM daily and record.
6. Positive DTM consists of white fluffy growth AND color change in the medium.

7. Contaminants are common. Contaminant growth that overwhelms the plate is considered negative.
8. The animal is considered cleared/negative when an animal has **one negative DTM grown out to 14 days and the following DTM negative at 7 days**
9. If housing/facilities allow, cats with one negative at 7 days (second culture has just been collected) should be housed separately from cats continuing to test positive.
10. A Ringworm PCR can be used to clear an animal. Because false positives are more common in PCR testing, submit a culture to the lab or collect an in-house culture at same time.

Related documents: *Ringworm Protocol*

Sample protocol: Ringworm Protocol

Summary: Ringworm, is a fungal infection of the skin. It can be spread by contact with an infected animal, its bedding or other fomite. The fungus can also survive in the soil. Ringworm is usually self-limiting, and many animals will recover without treatment, but in the shelter environment, we typically treat to prevent the spread of the infection to other animals or people.

Operational Procedure: The shelter will treat and monitor animals in care with a ringworm diagnosis. Potential adopters will be advised of treatment status and instructed on continuance of treatment and monitoring.

Definitions:

- Ringworm: a fungal infection most typically caused by *Microsporum canis*, *Microsporum gypseum*, or *Trichophyton mentagrophytes*. Clinical signs include circular, crusty areas of hair loss, and possibly diffuse hair loss. It is a zoonotic condition.
- Lime sulfur dip: A topical rinse used to kill ringworm. It needs to be diluted as per manufacturer's instructions. Proper application includes saturating the coat with sprayer and/or towel/sponge, then allowed to dry on the coat.
- DTM: Dermatophyte Test Medium. This is the diagnostic test most commonly used for ringworm and is a fungal culture. The media turns a red color with dermatophyte growth. Contaminants can also be grown.
- Ringworm (Fungal) PCR: Fungal Polymerase Chain Reaction. This lab test is used to determine if the DNA of the fungus causing ringworm is present in the submitted sample.
- Zoonotic: A disease that is transmissible from animals to people. Ringworm is an example.

Procedures:

Initial Diagnostic Testing:

1. Woods lamp screening should be performed on any lesion consistent with ringworm.
2. Consider performing Woods lamp screening before moving an animal to group housing or to foster care.
3. Sample collection for DTM or PCR:
 - a. Samples should be collected in a uniform manner for every DTM.
 - b. For single lesions: Using a sterile toothbrush, brush the entire body (nose to tail) 15 times, then the lesion 5 times.
 - c. For multiple (or no) lesions: Brush the animal 20 times with whole body strokes.
4. For centers with in-house DTM fungal culture capability, refer to ***Ringworm In-house Fungal Culture Protocol***.

5. If there is a need for faster results or for centers that do not have DTM capability, submit a Ringworm PCR (Idexx code 3565).
 - a. If positive PCR, continue with treatment.
 - b. If negative PCR, discontinue treatment – not considered infected.

Topical Treatment:

1. Start twice weekly lime dips after obtaining initial sample. Lime-sulfur should be used at **8 ounces to the gallon**.
2. Safe to use on pregnant and nursing animals and neonates > 2 weeks old.
 - a. Wipe nursing mom's teats after topical treatment, and keep juveniles warm with a heating lamp or warming blocks if necessary
3. Topical therapy is needed to treat the hairs. Systemic therapy (outlined below) will kill spores in the hair follicle but will not kill spores on the hair coat.
4. Continue twice weekly lime dipping until cleared.

Systemic Treatment:

1. Start treatment as soon as positive PCR or DTM is determined or if high suspicions (wood's lamp positive) while waiting on confirmation.
2. The average treatment time is 6 weeks.
3. Continue twice weekly lime sulfur dips during this time.
4. For animals 4 weeks of age or older, start terbinafine (an anti-fungal) 20-30mg/kg once daily, until the animal is cleared.
 - a. Cat dosing schedule, using 250mg tablets +/- suspension:
 - i. Kittens <2kg or any cat if tablets unavailable: liquid suspension at 30mg/kg (calculate exact dose)
 - ii. Cats 2.0-2.8 kg receive one-quarter of a tablet (62.5 mg) per dose.
 - iii. Cats weighing 2.8–5.5 kg receive one-half a tablet (125 mg) per dose.
 - iv. Cats >5.5 kg receive one tablet (250 mg) per dose
 - b. Dogs: calculate dose at 30-40mg/kg once daily (may administer liquid or tablets)
5. Itraconazole is an alternative option (at vet's discretion) and can be considered in cases where terbinafine is ineffective or not well-tolerated.
 - a. Itraconazole 5mg/kg PO SID, pulse dosing – one week on, one week off for 6 weeks.
 - b. Use a commercially available product, **not compounded** itraconazole.

Follow-up Diagnostic Testing

1. A Ringworm PCR can be used to clear an animal. Because false positives are more common in PCR testing, submit a culture at same time.
2. There should be a high suspicion that the infection has been cleared.

- a. Animal is rechecked by staff every 2-3 weeks, if in foster care
- b. PCR is performed when lesions are resolved and new hair growth visible and no new lesions.

Refractory Cases:

1. Verify environmental decontamination (deep cleaning at least once weekly).
2. Verify appropriate lime dipping procedure.
3. Verify appropriate medication dose, particularly with growing animals.
4. Treatment plan to be determined by veterinarian. Consider changing to itraconazole from terbinafine.

Housing:

1. These animals would ideally be housed separately from all others and isolated, including in foster homes.
2. Precautions for ringworm animals:
 - a. Wear protective clothing when working with affected animals (long sleeved gown, gloves, shoe covers or boots used only for that purpose). Discard or launder protective clothing daily.
 - b. Work with non-infected rooms/areas first
 - c. Bedding and toys should be changed or cleaned daily whenever possible
 - d. Use designated cleaning tools (poop scoops, scrub brushes, swiffers).
3. No sleepovers or outings
4. Ringworm positive dogs/puppies may not go to play groups or common areas, should not be introduced to other animals. They may be walked away from other dogs or on roads (safely) with limited dog travel if vaccine status allows. Run mates will also be restricted as above and treated as necessary.

Sanitation:

1. Fungal spores do not “live” in the environment and do not multiply. The purpose of cleaning is to mechanically remove spores so that cultures are not confounded by environmental contamination.
2. The most important part of decontamination is the mechanical removal of debris followed by washing and disinfection.
3. Wash all bedding/towels in bleach and hot water. Do separately from other area laundry. **Do not overload washer.**
4. Clean all dishes separately from other area’s dishes.
 - a. Simple hot water and dish soap with thorough washing/rinsing is adequate; dishwasher cleaning is preferred.
5. Room cleaning (daily)
 - a. Remove all organic debris using a damp mop, swiffer or vacuum. Discard vacuum bag or empty into trash bag (preferably outside) and discard after use. This includes floors, walls, countertops, windowsills, and carriers.

- b. Do not sweep with a broom.
 - c. Spot clean floors and non-porous surfaces as needed with Rescue at 1:16 concentration. Rinsing is not necessary.
 - d. Ensure floors and surfaces stay wet with Rescue for a contact time of 5 minutes.
6. Deep cleaning (1-2x weekly)
- a. Entire room should be deep cleaned 1-2 times per week.
 - b. Perform deep cleaning the same day as lime dipping.
7. Litter boxes:
- a. Change daily
 - b. After removing organic debris, spray with Rescue at 1:16 concentration and let soak for 5 minutes.

Fostering:

1. Foster homes should be disinfected using the same procedures with Rescue at 1:16 concentration.
2. Fosters will be sent home with diluted Rescue.

Adoption:

1. Ringworm animals can be adopted with adopter disclosure, including zoonotic risk.
2. Ringworm animals cannot go on adoption events, nor should their run mates, unless an exception is made by management.

Spay/neuter:

1. Ringworm animals can be spayed or neutered as long as the animal is otherwise healthy and lesions do not involve the surgical site.
2. They will be the last planned surgery of the day.
3. If being spay/neutered while undergoing treatment, lime sulfur dip should be performed the day before procedure
4. Contact the clinic ahead of time to notify of ringworm status to ensure appropriate housing and biosecurity measures.

Related documents: *Ringworm In-house Fungal Culture Protocol*

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Diagnosis and treatment of dermatophytosis in dogs and cats. Clinical Consensus Guidelines of the World Association for Veterinary Dermatology. Karen A. Moriello, Kimberly Coyner, Susan Paterson and Bernard Mignon. *Vet Dermatol* 2017; 28: 266–e68

Dermatophytosis - Our Current Understanding. Chumkee Aziz, DVM, DABVP (Shelter Medicine Practice). ABVP 2019 Proceedings.

<https://www.vin.com/doc/?id=9242795>

Million Cat Challenge: Fighting Fungus with Facts. Laura Mullen, SFSPCA.

https://www.youtube.com/watch?v=MwD_zuNTCww

Speaker Contact Information:

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Recommended Resources:

Feline Ringworm Infections in Shelters, by the University of Florida Maddie's Shelter Medicine Program
<https://sheltermedicine.vetmed.ufl.edu/wordpress/files/2021/05/Feline-Ringworm-Infections-in-Shelters.2021-1.pdf>

Ringworm Guidebook, by the University of Wisconsin Shelter Medicine Program
<https://www.uwsheltermedicine.com/library/guidebooks/ringworm>

Ringworm (Dermatophytosis), by UC Davis Koret Shelter Medicine Program
<https://www.sheltermedicine.com/library/resources/?r=ringworm-dermatophytosis>

DVM360 Shelter Snapshot: Evidence-based answers to your dermatophytosis questions, by Lena DeTar, DVM, DACVPM, DABVP
<https://www.dvm360.com/view/shelter-snapshot-evidence-based-answers-your-dermatophytosis-questions>

Clinician's Brief: Dermatophytosis, by Karen Moriello, DVM, DACVD
<https://www.cliniciansbrief.com/article/dermatophytosis>

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