

Research

## Identification of Clinical Signs, Prevalence, and Risk Factors of Sporotrichosis in Pet Cats in Denpasar City

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### ABSTRACT

Sporotrichosis is a subcutaneous and systemic mycotic infection affecting humans and animals. It is caused by a pathogenic dimorphic fungus of the genus *Sporothrix*. This study aimed to identify the clinical signs, prevalence, and risk factors of sporotrichosis in pet cats in Denpasar city. The sample of this study was the skin surface of cats, with a total sample of 101 cats. This study was conducted from November 2024 to January 2025. The examination method was carried out in four ways: physical examination, acetate tape preparation, and impression smear. The collection of skin surface samples was then examined by cytological techniques (Diff-Quik Staining). The results of this study showed that the clinical signs of one sporotrichosis-positive female cat included pruritus with a score of 4/10 in the head, face, and ear areas; the texture of the skin surface was rather rough and dry; there were crusts in the area between the right and left eyes; there was a lot of squama on most of her body's skin; and there was purulent discharge in both nostrils. The prevalence of sporotrichosis in pet cats in Denpasar city was 1%. Statistical analysis showed that factors such as sex, age, breed, husbandry, presence or absence of skin wounds, bathing frequency, and sterilization status were not risk factors for sporotrichosis.

**Keywords:** sporotrichosis, clinical signs, prevalence, risk factors, cat

### ABSTRAK

Sporotrikosis adalah infeksi mikotik subkutan dan sistemik yang menyerang manusia dan hewan. Penyakit ini disebabkan oleh jamur dimorfik patogen dari genus *Sporothrix*. Penelitian ini bertujuan untuk mengidentifikasi gejala klinis, prevalensi, dan faktor risiko dari sporotrikosis pada kucing peliharaan di Kota Denpasar. Sampel dari penelitian ini diambil dari permukaan kulit kucing, dengan total sampel sebanyak 101 ekor kucing. Penelitian ini dilakukan mulai dari bulan November 2024 hingga Januari 2025. Metode pemeriksaan dilakukan melalui empat cara yaitu pemeriksaan fisik, preparasi pita asetat, dan usapan imersi. Pengambilan sampel permukaan kulit kemudian diperiksa dengan teknik sitologi (Pewarnaan Diff-Quik). Hasil penelitian menunjukkan bahwa terdapat gejala klinis pada satu kucing betina yang positif sporotrichosis yang meliputi pruritus dengan skor 4/10 di area kepala, wajah, dan telinga; tekstur permukaan kulit agak kasar dan kering; terdapat krusta di area antara mata kanan dan kiri; banyak skuama pada sebagian besar kulit tubuhnya; dan terdapat leleran purulen di kedua lubang hidung. Prevalensi sporotrichosis pada kucing peliharaan di Kota Denpasar adalah 1%. Analisis statistik menunjukkan bahwa faktor-faktor seperti jenis kelamin, usia, ras, pemeliharaan, ada atau tidaknya luka kulit, frekuensi mandi, dan status sterilisasi tidak menjadi faktor risiko sporotrikosis.

**Kata kunci:** sporotrikosis, tanda klinis, prevalensi, faktor risiko, kucing

## INTRODUCTION

Sporotrichosis is a subcutaneous and systemic mycotic infection affecting humans and animals. It is caused by pathogenic dimorphic fungi of the genus *Sporothrix*, which are widely present in soil and plant debris (Yingchanakiat et al., 2023). Previous research by Montenegro et al. (2014) in São Paulo, Brazil, from 2011 to 2014, reported a prevalence rate of sporotrichosis in cats of 58% from 329 total samples studied.

The incidence of feline sporotrichosis in Bali has been reported in several case reports (Lutviana et al., 2023; Hartaputera et al., 2024). Feline sporotrichosis was reported with clinical signs of dandruff throughout the body, infecting a long-haired Persian cat (Lutviana et al., 2023). In another report, mild sporotrichosis was reported in a domestic cat, characterized by itching and clinical signs of circular alopecia, accompanied by hyperpigmentation and nodules (Hartaputera et al., 2024).

Sporotrichosis in cats has different clinical signs and symptoms, depending on the form of the disease. The cutaneous form consists of multiple ulcers, crusts, nodules, and abscesses that can be seen on the head, limbs, and base of the tail. In the cutaneous-lymphatic form, multifocally scattered papules, nodules, or abscesses are seen. The most severe, the disseminated form, may affect internal organs, such as the liver and lungs (Llroret et al., 2013; Montenegro et al., 2014; Rossow et al., 2020; Han and Kano, 2021; Martinez-Herrera et al., 2021; Lutviana et al., 2023).

Sporotrichosis often causes open sores on the skin of cats (Gremião et al., 2021). These sores usually start with small nodules and develop into ulcerations, and they are very unpleasant to look at. Sporotrichosis can sometimes spread from the skin to deeper tissues and even to internal organs, which can lead to more severe systemic infections. If not treated promptly, it can be life-threatening to the cat (Gremião et al., 2021). *Sporothrix brasiliensis* is associated with animal infection and zoonotic transmission through the scratches and bites of infected domestic and feral cats (Santos et al., 2024). In addition, transmission through sneezing from infected cats has also been reported in a 2022 study in Brazil (Bastos et al., 2022).

*Sporothrix* spreads through decaying plant material in the form of mycelium (conidia and hyphae), which is readily available to cats due to their biological and behavioral traits. The fungus is associated with epizootic outbreaks in dogs, cats, and rats. Feline sporotrichosis can be transmitted to

humans through scratches, bites, or contact with wound exudates, which allows the entry of yeast-like cells into host tissues (Gaviria et al., 2023).

Given the documented cases and the significant public health risk associated with this zoonosis, information or comprehensive reports related to sporotrichosis are still very limited in Bali, especially in Denpasar City. This preliminary research was conducted to obtain basic information about sporotrichosis in Denpasar City.

## MATERIALS AND METHODS

### Research Location and Time

Sample collection and examination were carried out at the Veterinary Internal Medicine Laboratory and the Teaching Animal Hospital of the Faculty of Veterinary Medicine, Udayana University. This study was conducted from November 2024 to January 2025.

### Ethical Approval and Research Object

Ethical approval was obtained from the Animal Ethics Commission of the Faculty of Veterinary Medicine, Udayana University Denpasar, under number B/244/UN14.2.9/PT.01.04/2024 on November 22, 2024. The subjects of this study were cats in Denpasar City, with a total of 101 cats examined. The sample used for microscopic diagnosis was the surface of the cat's skin.

### Data Collection and Sampling Method

The simple random sampling method was employed for data collection. This technique ensures that each member of the population has an equal chance of selection, thereby aiming to obtain a sample that is representative of the population, allowing the analysis results to be generalized (Rahayu, 2022). The Identification of risk factors was conducted through interviews with animal owners using a structured questionnaire.

Examinations were conducted on cats in Denpasar City using three techniques: physical examination, acetate tape preparation, and impression smear. Acetate tape preparation and impression smear techniques are commonly used to detect fungi, especially in skin or tissue samples. Sample collection examinations were performed using the cytology method (Diff-Quik Staining).

### Physical Examination

Physical examination includes inspection, palpation, body odor characterization, and body

temperature measurement. The sample cat was observed for behaviors such as scratching, biting, or rubbing the surface of its body, and it was examined for skin problems. Palpation is performed to assess lesion consistency, thickness, skin elasticity, and the presence or absence of pain associated with the disease (Lukiswanto and Yuniarti, 2013).

#### Acetate Tape Preparation

This method was used to collect samples from dry lesions. The process involves preparing a clear tape, approximately 5 cm x 2 cm. The tape was placed directly onto the visible skin lesion and pressed firmly. Following removal, the tape was mounted onto a clean object glass (Sampaio *et al.*, 2016).

#### Impression Smear

A collection of skin surface samples from wet lesions was performed using the impression smear method. In this procedure, a clean object glass was gently touched to the wet skin lesion surface. After touching for 1-2 seconds, the object glass is immediately removed and air-dried (Khatun *et al.*, 2012).

#### Diff-Quik Staining

The staining process used a Diff-Quik Staining technique. Methanol, eosin, and methylene blue solutions were prepared in separate glass staining jars. The preparation was fixed using methanol for 15 seconds, then dipped in eosin and methylene blue each 5-10 times for 2-3 seconds per dip, the excess liquid was absorbed using a tissue. Flushing was performed using slow-running water until no visible paint stains remained on the preparation, which was then air-dried (Hanggara, 2023). The preparations were examined under a microscope at magnifications ranging from 40× to 1000×. Immersion oil was used at 400× and 1000× magnification to enhance visualization. Samples were considered positive if *Sporothrix* fungi were identified.

#### Data Analysis

The prevalence data obtained were analyzed descriptively and quantitatively. The parameters of this study used the prevalence formula of Budiharta and Suardana (2007), that is:

$$\text{Prevalence} = \frac{\text{Number of Infected}}{\text{Total Number of Examined}} \times 100\%$$

Using Microsoft Excel, field data were tabulated into a table showing the presence or absence of *Sporothrix* fungal infection in cats in Denpasar City.

Risk factors were analyzed using the Chi-Square Test with the International Business Machines Statistical Program for Social Science (IBM SPSS) Statistics version 26 for Windows software and the results were interpreted.

## RESULTS

#### Prevalence and Identification of Clinical Signs

From the results of the examination of 101 cat samples in Denpasar City, it was confirmed that one sample was positive for sporotrichosis through Diff Quik technique cytological examination. This result established a sporotrichosis prevalence of 1% (1/101) among the cat population studied in Denpasar City, with the remaining 100 cats testing negative.

Samples were taken using the acetate tape preparation method, then stained and observed under a microscope. The examination results showed the presence of an oval-shaped agent (Figure 1). This morphology is consistent with the characteristics of *Sporothrix* sp. Yeast, which typically presents as cigar-shaped, oval, or round, with a round pink nucleus surrounded by unstained cytoplasm (Pereira *et al.*, 2011).

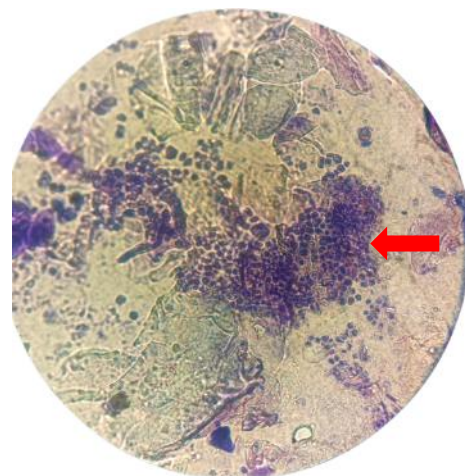


Figure 1. Cytological examination showed the presence of *Sporothrix* sp. agent (red arrow) under 1000× magnification

The results of the physical examination showed that the cat showed pruritus symptoms with a score of 4/10, indicating an increased frequency of scratching, licking, or biting the body (Coatesworth, 2019; Horne *et al.*, 2020), particularly focused on the head, face, and ear areas. The cat's skin surface texture was observed to be slightly rough and dry. Lesions included the presence of crusts in the area between the right and left eyes and extensive squama (dandruff) over most of the body skin (Figure 2).



Figure 2. Appearance of lesions in cats, showing the presence of crusts (A) and squama (B)

Other visible clinical signs included oozing from both nostrils, identified as a yellow-green purulent discharge (Figure 3), suggesting a concurrent disturbance in the respiratory tract.



Figure 3. A sporotrichosis-positive cat is seen to have greenish-yellow purulent discharge from both nostrils (red arrow)

### Risk Factors

The results of the study of seven risk factor parameters studied, namely sex, age, breed, husbandry method, presence or absence of wounds on the skin, frequency of bathing, and sterilization status, were statistically analyzed using SPSS software with the Chi-Square test. The results of the statistical analysis showed no correlation ( $P > 0.05$ ) or association between any of the seven parameters and the occurrence of sporotrichosis. A summary of the results of these statistical tests is presented systematically in Table 1.

### DISCUSSION

The single case of sporotrichosis identified in this study is a five-month-old female domestic (local) cat named Cinta with a white and grey coat and a body weight of 0.7 kg. The cat's appetite and drinking behavior are normal. The owner reported that the cat is kept both in a cage and allowed to roam freely at times. The cat has never received vaccinations or deworming treatment, and it has not been sterilized (ovariohysterectomy).

Clinical signs observed in the sporotrichosis-positive cat in this study include pruritus, crusts, rough and dry skin texture, numerous scales (squama) across most parts of the body, and purulent nasal discharge from both nostrils. According to Thomson et al. (2023), the most observed clinical signs are erosions, ulcers, and fistulas with serous or purulent bloody exudate, particularly located on the head, face, neck, and distal extremities. Lutviana et al.

Table 1. Prevalence of Sporotrichosis in Pet Cats in Denpasar City Based on Risk Factors

Risk Factor Parameters		Sample Total	Results		Prevalence (%)	p-value
			Positive	Negative		
Sex	Male	70	0	70	0	0,131
	Female	31	1	30	3,2	
Age	0-12 month (young)	74	1	73	1,3	0,544
	>13 month (adults)	27	0	27	0	
Breed	Domestic (local)	88	1	87	1,1	0,699
	Mix	13	0	13	0	
Rearing Method	Sometimes caged sometimes roam freely	65	1	64	1,5	0,455
	Always released	36	0	36	0	
Presence or Absence of Wounds on the Skin	Present	27	1	26	3,7	0,088
	Absent	74	0	74	0	
Bathing Frequency	Does not bathe	31	0	31	0	0,504
	1-2 times a month	70	1	69	1,4	
Sterilization Status	Done	2	0	2	0	0,886
	Not yet	99	1	98	1	

(2023) reported clinical signs of sporotrichosis such as dandruff covering the entire body, numerous scales on the skin and hair, alopecia, and crusts on the left cervical lateral region and dorsal areas. Hartaputera *et al.* (2024) identified other clinical signs, including circular alopecia with hyperpigmentation and nodules on the dorsal region, abdomen, and cranial extremities (left and right). Hyperpigmentation was present in some alopecic spots, with a pruritus score of 3/10. Maharani *et al.* (2020) described clinical signs of sporotrichosis in a Persian cat, including hair loss, alopecia in the nasal area, ears, back, and extremities, as well as the appearance of papular or nodular lesions. Over time, these lesions enlarged and eventually ruptured, forming large ulcerative wounds. Additionally, the alopecic areas appeared scaly and were surrounded by microabscesses.

The varying clinical signs observed may be influenced by several factors, including the clinical forms of sporotrichosis, which consist of three types: cutaneous, cutaneolymphatic, and disseminated infections. These three forms can present with different clinical manifestations; therefore, the clinical form of sporotrichosis can affect the variety of clinical signs that appear in infected cats (Lutviana *et al.*, 2023; Hartaputera *et al.*, 2024). The clinical manifestations of sporotrichosis are diverse. The main clinical presentation occurs on the skin and typically appears as either a fixed cutaneous or lymphocutaneous form (Uenotsuchi *et al.*, 2006).

Based on the observed clinical signs, the clinical form of sporotrichosis in this study is cutaneous sporotrichosis. According to Lloret *et al.* (2013), clinical signs associated with the cutaneous form include nodules with ulceration, crusts, abscesses, or cellulitis on the head, limbs, and base of the tail. However, in this study, the cat confirmed positive for sporotrichosis did not exhibit skin lesions such as nodules, ulcerations, abscesses, or cellulitis. The determination of this clinical form is also supported by case reports from Makri *et al.* (2020), who reported similar clinical signs, such as bilateral serosanguinous nasal discharge; from Lutviana *et al.* (2023), who observed scaling on the skin and fur, and from Lloret *et al.* (2013), who noted that crusting is one of the clinical signs of the cutaneous form. Other factors that may influence the appearance of symptoms and clinical signs include the virulence of the *Sporothrix* species, the cat's immunological status, and its behavior and habits (Lloret *et al.*, 2013).

Based on the explanations and comparisons from various sources, it can be confirmed that the type of infection found in the positive case of this study is the cutaneous form. This classification is supported by

the absence of any signs of systemic dissemination, such as chain-like lymphadenopathy, which is characteristic of the cutaneolymphatic form, or multiple lesions involving internal organs, such as the liver or lungs, which are indicative of disseminated infections. Therefore, it can be concluded that the case identified in this study represents the cutaneous form of sporotrichosis.

The calculated prevalence of sporotrichosis in pet cats in Denpasar City is 1% of the total sample of 101 cats examined. This prevalence is lower compared to the findings of Montenegro *et al.* (2014), who reported a prevalence in São Paulo, Brazil, from 2011 to 2014 of 58% out of 329 domestic cat samples. A report by Morgado *et al.* (2022), cited in Thomson *et al.* (2023), stated that the highest prevalence of animal sporotrichosis is found in South America (81%), followed by Asia and Europe. These varying research results are influenced by differences in geographical conditions, climate, husbandry practices, nutritional and health status of cats, and sampling and analytical methods (Wiweka, 2020). According to Morgado *et al.* (2022), the differences in prevalence rates are attributed to the presence of highly virulent pathogenic species, which are more frequently found in South America, especially in Brazil, than in species found in Asia. This aligns with the current study, where Indonesia, particularly Denpasar City, as part of Asia, shows a lower prevalence than Brazil. Additionally, the social and economic factors of a region also influence prevalence rates. Limited access to healthcare services and preventive measures in certain areas of South America contributes to the higher prevalence of infection (Morgado *et al.*, 2022).

Based on this study, risk factors such as sex, age, breed, rearing method, presence or absence of skin wounds, bathing frequency, and sterilization status showed no statistically significant correlation ( $P > 0.05$ ) with sporotrichosis in pet cats in Denpasar City. This finding differs from a study by Duangkaew *et al.* (2019), which reported that one of the risk factors for sporotrichosis is male cats that roam outdoors and acquire wounds through scratches or bites contaminated during fights. A possible explanation for the absence of sporotrichosis-positive male cats in this study is that these male cats may not frequently roam outside the home environment and are less likely to engage in fights or contact with sources of infection, thus reducing their risk of infection.

A study conducted by Han and Kano (2021) indicated that sporotrichosis commonly occurs in both young and adult cats, suggesting that age is a risk factor for this infection. However, this study found otherwise, as age was not identified as a risk factor.



This discrepancy is possibly due to variations in the level of exposure to *Sporothrix* fungi among the studied cats. Although young and old cats are generally considered vulnerable, individual immune responses vary. Some cats may possess stronger or more effective immune systems, enabling them to combat the infection without exhibiting clear clinical signs.

According to available research, there is no strong evidence to suggest that certain cat breeds are more susceptible to sporotrichosis infection and thus considered a risk factor. A study by Macêdo-Sales et al. (2018) in Rio de Janeiro, Brazil, found that most infected cats were of unidentified or non-pedigree breeds (93.8%), while only a small percentage were Siamese (4.2%), Persian (1.5%), and Himalayan (0.3%) breeds. Meanwhile, another study by Rossi et al. (2013) reported that sporotrichosis was more frequently found in mixed-breed cats, particularly males.

A study conducted by Thomson et al. (2023) reported that cats living or roaming outdoors, particularly unneutered male cats, have a higher risk of being infected with sporotrichosis. Additionally, a case study by Hennessee et al. (2024) described two domestic cats with free access to the outdoors (indoor-outdoor) that were infected with sporotrichosis. One of these cats even transmitted the infection to a veterinary technician through a puncture wound sustained during handling. This highlights the risk associated with cats that have outdoor access and the potential for zoonotic transmission. In contrast to these findings, this study did not identify the rearing method as a risk factor. However, the cat confirmed positive for sporotrichosis in this study was sometimes caged and sometimes allowed to roam freely. This suggests a possible connection to findings from previous studies, which stated that cats with outdoor access are more susceptible to sporotrichosis infection. Although some cats may roam or live freely outdoors, they may not have been exposed to enough *Sporothrix* to trigger an infection or produce clinical signs. Environmental factors, such as the presence of contaminated soil or organic material may contribute to the differing results of this study.

A study by Schubach et al. (2004) investigated the epidemiology of sporotrichosis in cats and found that infection most likely occurs when *Sporothrix* fungi enter the body through wounds caused by bites or scratches from infected cats. Furthermore, another study by Schubach et al. (2005) revealed that during a sporotrichosis outbreak in Rio de Janeiro, most human cases had a history of contact with infected cats, primarily through bites or scratches. These findings indicate that skin wounds resulting from interactions

with infected cats may increase the risk of transmission. However, in this study, the presence of skin wounds was not considered a risk factor. This may be because most of the cats observed did not show clear or identifiable wounds, and thus no significant relationship with sporotrichosis was found. In contrast, in other studies, the cat populations may have exhibited higher levels of aggression and fighting, making skin wounds more common and easier to associate with infection risk. Additionally, some bite or scratch wounds may have been very small or healed quickly before they could be detected in this study.

Currently, there is no scientific evidence indicating that bathing frequency is a risk factor in the transmission of sporotrichosis in cats. However, a study conducted by Piorunek et al. (2024) revealed that poor animal care is one of the risk factors for fungal infections. When related to bathing frequency, this should theoretically correlate; however, in this study, bathing frequency was not statistically correlated ( $P > 0.05$ ) with sporotrichosis.

A study by Boechat et al. (2018) analyzed 47 cats infected with sporotrichosis and found that 59.6% of them had not been sterilized. Although the study did not explicitly state that sterilization status is a risk factor, the high proportion of unsterilized cats among the infected group suggests a potential link between sterilization and susceptibility to infection. In contrast, in this study, sterilization status was not identified as a risk factor for sporotrichosis. This may be due to the fact that the unsterilized cats in this study rarely went outdoors or had limited interactions with other cats. Although unsterilized, these cats likely had a lower risk of infection.

The fungal culture examination is considered the gold standard for identifying *Sporothrix* species, as it allows for specific confirmation of the diagnosis through characteristic colony growth and microscopic morphological verification. However, there were several considerations for not performing fungal culture in this study, including limitations in facilities, time, and available materials and equipment. The Diff-Quik staining method was chosen because it provides faster results, thereby supporting early clinical diagnosis. Furthermore, cytological examination using Diff-Quik staining can detect the characteristic morphology of *Sporothrix* at the genus level, although it cannot confirm the species. Therefore, fungal culture was not included in the methodological design but may be considered for future studies focusing on species confirmation and the correlation between culture and cytology findings.

The use of cytology as the primary reference method in this study was intended to evaluate its

detection capability rather than to establish a definitive diagnosis of *Sporothrix* infection. Thus, cytology was used to determine positive samples because it directly demonstrates the presence of fungal elements within tissue or exudate, which is relevant to the focus of this research.

The number of positive sporotrichosis cases found in this study also influenced the results of the risk factor analysis. The low number of samples with positive results limited the ability to detect a statistically significant relationship between risk factor parameters and the incidence of sporotrichosis. In other words, the limited sample size in the positive case group may have reduced the sensitivity of the analysis, making it difficult to optimally identify any true associations in this study.

The positive incidence rate of 1% observed in this study indicates a low prevalence; however, this result cannot be fully generalized as a definitive reflection of the cat population in Denpasar. Several methodological and technical factors may have influenced this low figure, including the diagnostic method used, the sampling approach, environmental variations, and the immune status of the host.

This study has limitations that need to be considered, particularly regarding the methodology used. In this study, fungal cultures were not incubated using an incubator with the addition of cycloheximide to the agar medium. Cycloheximide functions as a fungicide as well as a protein synthesis inhibitor (Lawana *et al.*, 2014). In addition, cycloheximide is used in various media to isolate pathogenic fungi by inhibiting certain non-pathogenic fungi that resemble saprophytic fungi and yeasts (Ali *et al.*, 2015).

"The authors declare that there is no conflict of interest with any parties involved in this research."

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