

FELINE SPOROTRICHOSIS: AN EXPANDING YET STILL NEGLECTED ZONOSIS IN BRAZIL

Esporotricose felina: uma zoonose em expansão, mas ainda negligenciada no Brasil

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Abstract

Sporotrichosis is a zoonosis of major importance due to the global expansion of its occurrence, the identification of new pathogenic species, and changes in the disease's epidemiology. However, the lack of mandatory notification for diagnosed cases hinders an accurate understanding of the disease burden, thereby complicating the implementation of preventive and awareness measures for professionals and the population. The present review aims to update knowledge on the progression and distribution of sporotrichosis in the country to emphasize the need for actions related to prevention, control, and care. The data are essential to understand the dynamics of sporotrichosis and fundamental for promoting public health policies and guiding actions for professionals and the general public. This review highlights the impacts of zoonotic sporotrichosis, which is rapidly

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expanding in Brazil, emphasizing the importance of coordinated actions involving public authorities, public health agencies, and the population to prevent the spread of this zoonosis. In particular, it underscores the need to implement mandatory case reporting nationwide, as the available official data do not accurately reflect the true prevalence of sporotrichosis in Brazil.

Keywords: Zoonosis. Pathogenic fungi. *Sporothrix*. Felines.

Resumo

A esporotricose é uma zoonose de grande importância devido ao aumento de áreas de ocorrência global, descrição de novas espécies patogênicas e mudanças na epidemiologia da doença, ao mesmo tempo em que a exigência da notificação de casos diagnosticados não é obrigatória, o que dificulta conhecer a carga real da doença e a implantação de medidas preventivas e a conscientização de profissionais e da população. A presente revisão atualiza o conhecimento sobre a progressão e distribuição da esporotricose no País. Os dados levantados são essenciais para compreender a dinâmica da esporotricose e fundamentais para promover políticas de saúde pública e nortear as ações de profissionais e da população em geral. Esta revisão aponta os impactos da esporotricose zoonótica em franca expansão no Brasil, reforçando a importância de ações necessárias envolvendo, de forma integrada, autoridades públicas, agências de saúde pública e a população para prevenir a disseminação dessa zoonose. Particularmente, destaca a necessidade de se implantar a notificação obrigatória de casos no País, visto que os dados oficiais disponíveis não refletem a realidade da presença da esporotricose no Brasil.

Palavras-chave: Zoonose. Fungos patogênicos. *Sporothrix*. Felinos.

Introduction

General characteristics of sporotrichosis

Sporotrichosis is a cosmopolitan mycosis but is endemic mainly in regions with warm and humid climates, such as tropical and subtropical areas. It is a zoonotic fungal disease caused by fungi of the genus *Sporothrix*, characterized by a nodular subcutaneous mycosis in the acute phase, which may progress to a gummatous ulcerative form. It can affect the skin, subcutaneous tissue, lymphatic system, muscular fasciae, cartilage, and bones (Chakrabarti *et al.*, 2015). Several clinical forms of sporotrichosis have been described; however, the skin is the primary organ affected, with lymphocutaneous and fixed cutaneous forms observed in most cases (Zancoppe-Oliveira *et al.*, 2015; Orofino-Costa *et al.*, 2017). Nevertheless, atypical clinical manifestations have also been reported, including systemic forms involving bones and joints, lungs, and the central nervous system, as well as mucosal and immunoreactive presentations (Gutierrez-Galhardo *et al.*, 2005; Orofino-Costa *et al.*, 2017; Arinelli *et al.*, 2020).

Fungi of the genus *Sporothrix* are adapted to soil and decomposing organic matter, where the filamentous form of the fungus is found (Ramírez-Soto *et al.*, 2018). Sporotrichosis is transmitted through traumatic inoculation of *Sporothrix* propagules via skin injuries (Orofino-Costa *et al.*, 2017), typically during activities involving contact with contaminated soil and organic material. An alternative transmission route is associated with scratches or bites during animal fights and through contact between humans and infected dogs and cats (Rodrigues; De Hoog; Camargo, 2016; Rossow *et al.*, 2020).

Although dogs and cats are most frequently affected, horses, donkeys, and mules were reported as susceptible to the disease in Brazil between the 1940s and 1960s, a period when draft animals were commonly used in the daily routine of rural workers (Larsson, 2011).

The genus *Sporothrix* comprises a group of thermodimorphic pathogens (Rodrigues; De Hoog; Camargo, 2016). *Sporothrix schenckii* was the first species described as responsible for sporotrichosis

cases (Schenck, 1898); however, the application of molecular biology techniques, particularly those used in fungal taxonomy studies, has demonstrated that *S. schenckii* is actually a complex of phylogenetically related species. Currently, the *S. schenckii* complex includes clinically relevant species such as *S. brasiliensis*, *S. globosa*, and *S. mexicana*, which can be distinguished by genetic mutations (Marimon *et al.*, 2006; Marimon *et al.*, 2007; Zhou *et al.*, 2014; Oliveira *et al.*, 2014). Among these, *S. brasiliensis* is associated with atypical and more severe clinical manifestations (Almeida-Paes *et al.*, 2014).

Epidemiological data

Sporotrichosis occurs worldwide, with hyperendemic areas reported in Brazil, China, and South Africa (Zhou *et al.*, 2014; Zhang *et al.*, 2015). Reports of its occurrence date back to 1989 in countries of North America, such as the United States and Mexico, Europe—including France, Portugal, Russia, and other European countries—Asia, including Japan and India, as well as South America (Sidrim; Rocha, 2004). Atypically, a recent study (Barnacle *et al.*, 2023) described the first three reported cases of *S. brasiliensis* infection transmitted from cats to humans outside Brazil, specifically in the United Kingdom. These cases were likely acquired from a domestic cat that had lived in southeastern Brazil three years prior to being taken to the UK, where transmission occurred. This finding suggests that *S. brasiliensis* may remain dormant for many years and has significant implications for global public health.

To better understand the distribution and diversity of *Sporothrix spp.*, Morgado *et al.* (2024) conducted a systematic review of studies on animal and human sporotrichosis and/or environmental isolation of the fungus published between 2007 and 2023. The authors analyzed the global distribution of environmental *Sporothrix spp.* isolates or causative agents of infection in humans and animals, identified through polyphasic taxonomy, as well as the proportion of isolates deposited in culture collections worldwide. Samples originated from South America, North America, Central America, Asia, Europe, and Africa. South America accounted for the highest number of sporotrichosis isolates, followed by Asia, North America, Africa, and Europe, whereas Central America and Oceania reported the lowest number of cases. The results indicated that *S. globosa*, *S. schenckii*, and *S. brasiliensis* were the most frequently identified species.

S. brasiliensis is prevalent in South America, particularly in Brazil, which reports the highest number of feline sporotrichosis cases worldwide, and is associated with transmission from cat to human, cat to cat, and cat to dog (Gremião *et al.*, 2017). Since 1986, occurrences of *S. brasiliensis* in humans, animals, and the environment have been reported in Argentina, with a notable recent increase in cases (Etchecopaz *et al.*, 2020). The zoonotic sporotrichosis caused by *S. brasiliensis* in Argentina is considered alarming (Etchecopaz *et al.*, 2021), as it indicates a potential expansion of the fungus across borders into other regions of Latin America. Despite regulations implemented for pet travel, insufficient control over road transportation may contribute to the spread of sporotrichosis within Brazil and may pose a risk of dissemination beyond its borders (Ministério da Agricultura, Pecuária e Abastecimento, 2017).

In Brazil, the first reported case of zoonotic sporotrichosis (cat-to-human transmission) occurred in 1955 (Rodrigues *et al.*, 2020). Cat-transmitted sporotrichosis has emerged as a zoonotic epidemic and a public health threat in Brazil since the 1990s, initially in the state of Rio de Janeiro (Rodrigues *et al.*, 2022), and is almost exclusively associated with *Sporothrix brasiliensis*, the most virulent species (Barros *et al.*, 2004). Sporotrichosis has been associated with hospitalizations and deaths throughout Brazil, with a particular prominence in Rio de Janeiro (Falcão *et al.*, 2019).

Brazil has experienced a marked geographic expansion of sporotrichosis, largely associated with social determinants (Gremião *et al.*, 2020). A notable finding is the correlation between higher case numbers and regions with lower per capita income. The socioeconomic dimension of the disease is linked to poor sanitation and limited access to safe drinking water (Alzuguir *et al.*, 2019). Sociocultural

aspects are also relevant, as a higher prevalence among women has been observed, likely related to their greater involvement in domestic activities, including animal care (Alvarez *et al.*, 2022).

Recent literature on sporotrichosis includes a substantial number of studies addressing different aspects of the disease and highlights the concern of research institutions regarding its increasing emergence. In a recent study, Santos *et al.* (2024) described the emergence and spread of sporotrichosis in Brazil, the epicenter of the current epidemic in South America, and suggested that the ongoing epidemic caused by *S. brasiliensis* in the country represents multiple independent emergence events, followed by animal-to-animal and animal-to-human transmission within and across Brazilian states. These reports illustrate how *S. brasiliensis* can emerge and spread within a country. Molecular studies covering data from the last decade (Spruijtenburg *et al.*, 2023), using both traditional genotyping methods and advanced technologies, suggest that *S. brasiliensis* emerged independently in at least seven different regions of Brazil: Rio de Janeiro, Ceará, the Federal District, Rio Grande do Sul, Minas Gerais, Paraná, and São Paulo.

Sporotrichosis and compulsory notification

According to Rabello *et al.* (2022), cases of human sporotrichosis have been reported in all Brazilian states and in the Federal District, except for Roraima. In recent decades, an alarming increase in cases has been reported in the southern and southeastern regions of Brazil, particularly in the state of Rio de Janeiro (Barros *et al.*, 2001; Pereira *et al.*, 2014; Almeida-Paes *et al.*, 2024), followed by Rio Grande do Sul (Michelson *et al.*, 2019; Zamboni *et al.*, 2022; Moraes *et al.*, 2023), Paraná (Cogniali *et al.*, 2023), and São Paulo (Veasey *et al.*, 2022). A recent study (Oliveira *et al.*, 2024) described a high number of sporotrichosis cases in cats (2016–2021) in the metropolitan region of Recife, leading to significant zoonotic transmission and a high prevalence of *S. brasiliensis* as the etiological agent. Sporotrichosis has also been detected in other northeastern states (Figueira *et al.*, 2010; Silva *et al.*, 2021; França *et al.*, 2022; Aguiar *et al.*, 2023; Angelo *et al.*, 2023; Pires *et al.*, 2024) and in other regions of the country, such as the Central-West (Fernandes *et al.*, 2004). There are already reports indicating that *S. brasiliensis* is currently circulating in the metropolitan area of Goiânia, in the state of Goiás, causing sporotrichosis in free-roaming infected cats in that region (Ferreira *et al.*, 2024).

According to the Epidemiological Bulletin of the Brazilian Ministry of Health (Brasil, 2023a), among the prevention and control activities carried out in 2022, 56.8% of the actions reported by the 287 Zoonosis Surveillance Units (ZSU) interviewed nationwide were related to sporotrichosis. Furthermore, when ZSU coordinators were asked about the main diseases routinely reported, sporotrichosis accounted for 40.7% of responses, surpassing a nationally notifiable disease, visceral leishmaniasis (13.9%). These data underscore the importance of health surveillance units in recording zoonotic diseases and conditions that shape the epidemiological landscape, as well as their role in surveillance through case monitoring to support decision-making and the formulation of public health policies.

In a Technical Note dated May 25, 2023, the Brazilian Ministry of Health (Brasil, 2023b), in view of the marked expansion of sporotrichosis as a zoonotic disease, published a report issuing recommendations to states and municipalities regarding animal sporotrichosis surveillance in Brazil.

Despite the concerning expansion of sporotrichosis, notification of the disease is mandatory in only a few Brazilian states and municipalities, which hampers an accurate assessment of its true burden nationwide.

Rio de Janeiro was the first Brazilian state to include sporotrichosis on the list of notifiable diseases, in 2013 (SES Resolution No. 674/13). Subsequently, other states implemented mandatory notification: Paraíba in 2018 (CIB/SES Resolution No. 88/2020); Mato Grosso do Sul in 2020 (CIB/SES Resolution No. 88/2020); and Amazonas in 2021 (Ordinary Law No. 5,411/2021). In 2022, Paraná issued SESA Resolution No. 93/2022 regulating notification, and in 2023 two states established

mandatory notification—Pernambuco (Ordinary Bill No. 872/2023) and Bahia (State Ordinance No. 274/2023). More recently, Rio Grande do Norte made notification mandatory through Bill No. 95/2024. Finally, in 2024, in Rio Grande do Sul, the State Center for Health Surveillance issued Technical Note No. 3/2024, providing epidemiological surveillance guidelines for Human Sporotrichosis as a State-Notifiable Condition and guidance for Animal Sporotrichosis surveillance.

In some states, individual municipalities have recognized the importance of the disease and established mandatory notification. This is the case in Guarulhos (SP), through Ordinance No. 064/2016-SS, of the Municipal Health Secretariat of the city of São Paulo (SP), through Ordinance No. 470/2020 of the Municipal Health Secretariat (SMS); and, more recently, Belo Horizonte (MG), through Municipal Ordinance No. 11/2024. Although the state of Bahia established mandatory reporting in 2023, the city of Salvador already had Municipal Ordinance No. 191/2018, requiring notification.

Current knowledge on feline sporotrichosis and required actions

Since the emergence of sporotrichosis, and in the context of the significant growth of zoonotic sporotrichosis, progress has been made, including increased visibility and knowledge of the disease within the medical community, expansion of research networks in this field, and greater engagement by governmental authorities and funding agencies (Almeida-Paes *et al.*, 2024). However, despite these advances, substantial challenges remain in containing the spread of the disease, which constitutes a major public health issue requiring coordinated action across all sectors of public health systems.

Effective control of the epidemic requires robust public policies implemented in collaboration with the health sector and the general population, adopting a One Health approach (Schechtman *et al.*, 2021; Rabello *et al.*, 2022) to promote comprehensive and effective solutions to challenges such as the sporotrichosis epidemic. These measures include the development of rapid and accurate diagnostic tests and new antifungal drugs, particularly for the treatment of extracutaneous manifestations of sporotrichosis (Almeida-Paes *et al.*, 2024). Schechtman *et al.* (2021) reported diagnostic delays, with several patients receiving care only after months of disease progression. Delayed initiation of treatment leads to an increase in secondary infections and may result in more severe sequelae due to prolonged disease duration.

Regarding felines, broader preventive and management measures should be disseminated among health professionals and the general population. Neutering and early treatment of cats can reduce transmission among animals and from animals to humans. In addition, educational initiatives to promote responsible pet ownership and the use of personal protective equipment could contribute to preventing zoonotic transmission. A particularly challenging issue in reducing sporotrichosis is the management of infected cats. Of the 2,926 human sporotrichosis cases reported by the Oswaldo Cruz Institute in which the outcome of the infected cat was recorded in medical records, only 568 (19.4%) were appropriately managed—either treated by their owners, referred to animal welfare organizations for treatment, or euthanized and cremated. The remainder were simply abandoned or died without proper cremation (Almeida-Paes *et al.*, 2024).

Beyond these aspects, broader inclusion of sporotrichosis on the list of neglected diseases by governmental health authorities would bring greater visibility to this continuously expanding epidemic and enable increased allocation of resources to large-scale scientific studies aimed at containing disease spread (Schechtman *et al.*, 2021).

Conclusion

The extensive recent literature has shown that sporotrichosis has gained increasing prominence due to the emergence of new endemic areas, the identification of new pathogenic species, changes in epidemiological patterns, the occurrence of outbreaks, and the rising number of cases. Taken together, these factors provided the rationale for the present review.

The data analyzed indicate an urgent need for heightened attention from health professionals and veterinarians, as well as for informing and raising awareness among the general population about the risks associated with the disease in order to promote preventive measures. Nationwide data collection through mandatory reporting and strengthened epidemiological surveillance is essential to understand the dynamics of the disease and is critical for engaging the institutions responsible for implementing effective public health policies.

A comprehensive disease control program is required, involving coordinated actions by public authorities, private veterinary services, public health agencies, and citizens to prevent the spread of this zoonosis. This review particularly highlights the need to implement mandatory reporting of cases throughout the country, as available official data do not accurately reflect the true extent of sporotrichosis in Brazil. &

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