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Chapter 4

Fungi, Animals , Environment and Human Health

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Abstract

Fungi are abundant in the environment. Many fungi cause different human infections. Animals like dogs, cat and bamboo rat play decisive roles in propagating and spreading fungal infections. Many birds also harbour fungi in their fecal matter. *Cryptococcus* spp. which can be recovered very commonly from the fecal matter in pigeon faeces and *Histoplasma* spp. and in chicken faeces are examples. These things should be regarded as very important from the viewpoint of one health.

Keywords: Fungi, Animals, Birds.

Introduction

Fungal infections are increasingly becoming common. Multidrug resistant and azole-resistant fungi are also becoming very very common due to poor knowledge of fungi and widespread use of antifungal drugs. Many fungi thrive well in skin and fur of animals, and also in soil and water. Mostly some yeasts, molds and dimorphic fungi are able to withstand the harsh environmental conditions and also colonize animals. Then, they infect man by direct contact or via aerosols.

There is a complex interplay between fungi, the environment and animals. Studying this interaction is very important from the viewpoint of one health. Many fungi have animal reservoirs or animals may play a definitive role in transmitting infections to man. For example, Lobomycosis caused by *Lacazia loboi* can spread to man from Atlantic bottlenose dolphins.

Among the fungi infecting skin, *Microsporum canis* can spread to man and cause ringworm. Fungi like *Histoplasma* are found in bat guano very frequently, since the guano has a high Nitrogen content.

Thus, it is evident that both the environment and animals play crucial roles in survival and persistence of fngi. Fungi are by nature very hardy. Thus they survive well in faecal matter and fur of some animals. The dimorphic fungal pathogen *Talaromyces marneffei*, previously called *Penicillium marneffei*, is closely associated with the Chinese bamboo rat, *Rhizomys sinensis*. The fungus was first isolated from the bamboo rat in Vietnam in 1956. Infection by *Talaromyces marneffei* is especially common in some areas like Vietnam, Thailand, North-East India (particularly the state of Manipur) and Southern China. In places like Chiang Mai province of Thailand, it is the third most common opportunistic infection in HIV positive patients, after TB and Cryptococcosis. This fungus can be cultured from the internal organs of 4 species of rodents, and has also been recovered from soil samples. Human practices like agriculture and deforestation in areas inhabited by this rodent makes one susceptible to infection by these rodents. Human infection occurs almost always via the inhalation of aerosolized conidia that are released from contaminated soil during activities like farming, construction, digging, foraging for bamboo shoots, or just living in close proximity to the habitat of infected rats. The rats *Rhizomys pruinosus*, *R. sinensis*, and *R. sumatrensis* are reservoir hosts of the fungi.

Role of birds

Many birds like to live in and around human habitats due to easy availability of food and shelter. Birds like pigeons can harbor the true yeast pathogen *Cryptococcus neoformans* in their stool. This is because pigeon stool is very rich in Creatinine and *C. neoformans* can assimilate creatinine very well. Some experimental work has shown that the alimentary tract of pigeons may be colonized by *C. neoformans* and that viable microorganisms may be excreted in guano for many weeks . Other findings also suggest that pigeon droppings are able to enrich the soil and help the already-existing *C. neoformans* grow, because guano possibly contains a variety of chemical compounds, like creatinine and phosphates. If the pigeon stool is rich in phosphate, it favours growth of small-capsule morphotypes of *C. neoformans*, which do not cause meningitis commonly but have a propensity of causing bloodstream infections.

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The image below shows a common pigeon *(Columbia livia)*.

Figure 1: Pigeon (image:- author)

Apart from pigeons, faecal matter of hens *(Gallus gallus)* is abundant in *Histoplasma capsulatum*. This is because chicken droppings are rich in organic matter which the fungus utilizes to grow and thrive. Bat secretions can also harbor this fungal pathogen. From these sources, the fungi disseminate to air and infect man via aerosols. Since bats primarily abound caves and old buildings (havelis) in hot and humid locales, in India, human Histoplasmosis is most commonly seen along the Ganga river basin.

Role of cats and dogs in propagating fungal infections

Microsporum canis is known to cause about 98% cases of feline ringworm and about 70% of cases of dog ringworm. In cats, the fungal carriage is asymptomatic, while in dogs, symptoms and signs of infection are observed. Other animals can also spread *M. canis*, like goats, donkeys, foxes, jaguars, cattle and bats. It can survive in the environment for about 18 months. This facilitates its propagation. This mold pathogen emits yellow-green fluorescence in hair under UV light. Macroconidia of *M. canis* have echinulate walls that may facilitate their adhesion to animal skin or fur and subsequent spread to man.

Cats can also spread Sporotrichosis in man. The etiological agent is *Sporothrix schenckii*. Many people get infected with *S. brasiliensis* through contact with infected cats in Brazil in South America. Infections occurring due to *S. brasiliensis* usually tend to be more severe than infections with other *Sporothrix* species.

The image below illustrates the macroconidia of *Microsporum canis*.

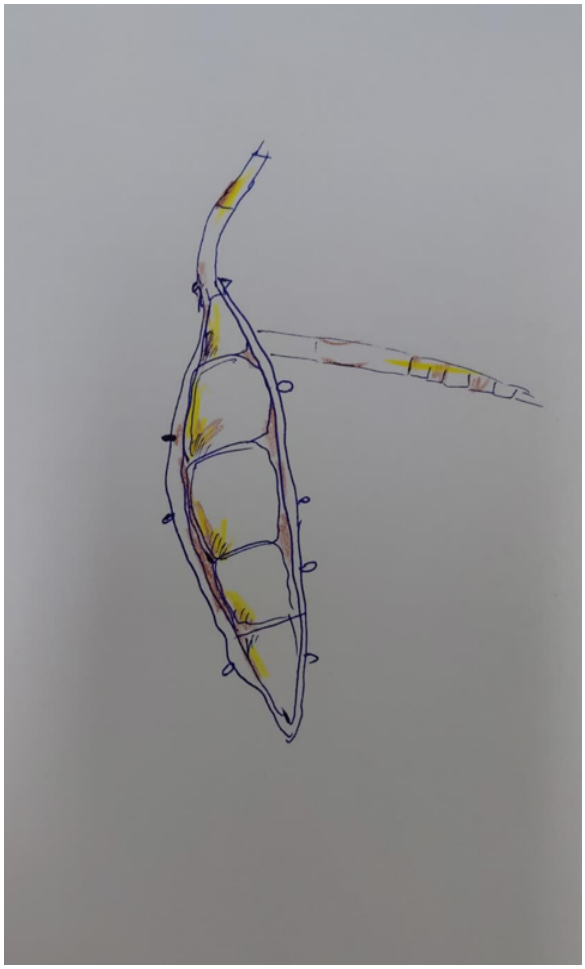

Figure 2: Echinulate macroconidia of *Microsporum canis* (Image:- hand drawn by author)

Role of bats in spreading fungal infections

Bats harbour the fungus *Histoplasma capsulatum* in their guano. When air currents disturb the guano, the fungi are dispersed in air. Bat guano has nitrogenous compounds, which when combined with humidity, lead to good growth of the fungus in the guano. *H..capsulatum* has been isolated commonly from the bat *Artibeus hirsutus* or Hairy fruit-eating bat only found in Ecuador and Peru, and *Artibeus fimbriatus* seen in Brazil.

Another important human *Histoplasma* spp., H*istoplasma duboisii*, has been isolated in Nigeria from *Nycteris hispida* (hairy slit faced bat with long ears) as well as *Tadarida pumila* (little free-tailed bat).

Role of other animals in spreading fungi

Trichophyton erinacei (Onygenales, Arthrodermataceae) is a zoophilic dermatophyte which can infect mammals, especially hedgehogs. People handling hedgehogs or in close proximity with hedgehogs can acquire infection due to *T. erinacei*. Papules, erythema, pustules and scaly plaques may develop. The most common locations are the hands and the head.

It has already been told earlier that dolphins , especially Atlantic bottlenose dolphins are important for spreading Lobomycosis caused by *Lacazia loboi* (now named *Paracoccidioides lobogeorgii*) . Infections caused by the fungus *Lacazia loboi* first came to light in 1931, reported by Jorge de Oliveira Lobo in a person with granulomatous skin lesions in Pernambuco, Brazil. Early histopathological and serological studies have found morphological resemblance and cross-reactive antigens with *Paracoccidioides brasiliensis*. In 1971, veterinarians who were working with dolphins in Florida, The USA, reported granulomatous skin lesions seen in a dolphin, which were similar to that in human lacaziosis. It possibly causes skin disease in dolphins also, and such disease is now known as paracoccidioidomycosis ceti . The etiological agent of Paracoccidiomycos ceti may be different from human lobomycosis. Based on histopathological studies, *L. loboi* was initially believed to be also the etiologic agent behind cutaneous disease in dolphins. Ever since, cutaneous granulomas have been reported in different dolphins around the coast of Asia, Europe, and North and South America. In Portuguese, ‘lobo’ is the name of a wild animal. It should be noted here that apart from direct contact with dolphins, contact with water and aquatic vegetation inhabited by dolphins is also enough to cause the infection.

Fungi that are pathogenic and found in the environment but have no animal reservoir

Rhinosporidium seeberi is a fungal pathogen that is found in the water of ponds near foothills. It cannot be cultured in vitro or can be cultured with much difficulty. The fungus cannot live without moist surfaces, and hence is found in ponds and affects mucosalike ear, nose and pharynx. The factors that promote the growth and survival of this fungus in pond water are humidity, rainfall, low pH of water of pond

in Indian and Sri Lanka, and less Sodium and chloride content. This fungal pathogen causes bulging, polypoid lesions in the nose, ear, eyes and vagina, among other sites. It generally presents to the doctor as strawberry like bleeding polyp in the nose and in severe cases, as disseminated infection. Human practices like washing pet cattle in pond water and also bathing in pond is common in the indian subcontinent but rare in Western countries. This can explain why cases are more common in the Indian subcontinent.

Role of environment in fungal colonization and persistence

The Eucalyptus tree bark harbours the yeast *Cryptococcus neoformans*. It also harbours the Cryptococcus species that infects healthy people, *C. gatti*. However it teleomorph or sexual stage is seen in the tree bark *(Filobasidiella neoformans)*. Eucalyptus bark contains a lot of inositol which the fungus can assimilate and grow. This yeast causes meningitis in humans, predominantly in people with HIV infection with low CD4 T cell count, less than 200 per microlitre. *Talaromyces marneffei* can be cultured from the internal organs of four species of rodents , and has also been retreived from soil specimens. The dermatophytic mold *Microsporum gypseum*, now called *Nannizzia gypsea*, also thrives very well in soil. It feeds on organic matter and exists in soil as saprophyte. Infections caused by the *N. gypsea* complex (including *N. fulva* and *N. incurvata*) are comparatively rare, comprising about 1% of all dermatophytic infections. The prevalence among all dermatophyte infections in man ranges from <1% in Korea to 6.8% in Italy. Humans, typically gardeners or farmers, are mostly prone to get infected, through direct contact with contaminated soil.
Sporotrichosis. As told earlier, can spread to man via cats. However, the more common route is via contact with plant matter and thorns. Rose and rose thorn are especially prone to get colonized by *Sporothrix* spp. Rose thorns can easily penetrate skin and introduce the fungi to skin and subcutaneous tissue of man. The mold is seen on rose thorns, hay, twigs, sphagnum moss and soil. The infection is thus more common among gardeners, nursery workers, and farmers who have to work with roses, hay, moss and soil. Hence it is an occupational hazard.

The mold *Penicillium* spp. should also be discussed here. This mold prefers soils rich in organic matter in the cool and temperate climatic zones. They produce conidia that disperse from soil into air and cause many ailments. One example is the sick building syndrome that occurs due to dissemination of spores of *Penicillium* spp. in closed air space of a room. Apart from *Penicillium* spp., *Aspergillus* spp. can survive in soil very well, and is additionally thermotolerant and thrive in xeric or dry conditions. Aspergillus parasiticus and A. flavus can produce Aflatoxin. The molds gain entry into growing plants and crops via soil , aided by air current and rain splash. Plants like cotton, maize and peas are preferred by *Aspergillus* spp. In producing mycotoxins. Aflatoxin production can be inhibited by *Bacillus subtilis* if it is present on the plant or in the soil. The genus *Fusarium* is also widely distributed in soil and is made up of more than 300 phylogenetically distinct species. This genus includes many species of plant pathogens, which are able to cause diseases of almost all economically important plants. Farmers and gardeners who have regular contact with plant matter also tend to have infections due to *Fusarium* spp. , especially keratitis due to *Fusarium* spp. Hence it is an occupational hazard.

Damp environment after hydrological disasters like floods favours growth and survival of molds called dermatophytes in skin and in between fingers. The humid environment favours survival. Thus ringworm infections caused by dermatophytes are very common after floods.

Construction sites generally have a high load of *Aspergillus fumigatus* and *Aspergillus flavus*. If renovations are going on in old houses, the conidia disperse very easily in ambient air due to masonry work and enter the susceptible hosts by aerial route.

The table below summarizes the animals from which one may acquire fungal infections.

Animals	The fungi they spread	Infection or lesions in man
Dogs	Dermatophytes , especially *Microsporum canis*	Aggressive ringworm lesions in skin
Cats	Dermatophytes, *Sporothrix* spp.	Ringworm, sporotrichosis
Hedgehogs	Dermatophytes, especially *Trichophyton erinacei*	ringworm
Pigeons	*Cryptococcus neoformans* via faeces	Lung infection, bloodstream infection, meningitis
Hens	*Histoplasma capsulatum* via faeces	Adrenal and mucosal involvement
Bamboo rat	*Talaromyces marneffei*	Opportunistic infection after HIV infection with low CD4 count

Future directions and one health perspectives

Thus, it is quite clear now that both animals and environment, or any one of them, play pivotal roles in persistence and propagation of infection by fungi. Fungal spores and conidia are hardy and survive in soil for a long time whereby they remain viable as well as infective. Hence, susceptible individuals should avoid these risk factors. For example, immunosuppressed people should beware of Eucalyptus tree bark and pigeon excreta. Today there is not enough knowledge regarding the role of environment and animals in spreading fungal infections. More awareness needs to be generated in these aspects. One should, thus, always look at the interaction between fungi, animals and environment from one health viewpoint. These things are important from the angle of public health as well as occupational health.

Conclusion

Thus, animals, as well as soil, vegetation and water, play definite roles in growing and spreading fungal infections. Knowledge regarding these things is absolutely crucial for management and prevention of these infections and is important from public health viewpoint, too. Infections like Fusariosis and Sporotrichosis are actually occupational hazards, too, in specific occupations. These are topics of importance for future.

References

[1] Talaromyces marneffei. Available from:- https://www.sciencedirect.com/topics/pharmacology-toxicology-and-pharmaceutical-science/talaromyces-marneffei. Last accessed 22.07.26.

[2] Irere H, Dangarembizi R, Mukaremera L and Dambuza IM (2026) The emergence of neuroinvasive Cryptococcus: why eucalyptus-rich regions, especially in Africa, may be facing greater risk. Front. Cell. Infect. Microbiol. 15:1727496. doi: 10.3389/fcimb.2025.1727496.

[3] Kusnaedi DB. Impact of Floods Causing Skin Diseases. https://www.emc.id/en/care-plus/impact-of-floods-causing-skin-diseases. Last accessed 22.7.26.

[4] Marfatia HK, Kirtane MV. Management of rhinosporidiosis newer concept. India J Otolaryngol Head Neck Surg. 1997;49:73–4. doi: 10.1007/BF02991723.

[5] Esakkiammal M, Rajakumari DVS. Pigeon Droppings as a Cryptococcus Reservoir: A Review. UP J Zool 2025;46(6):169-177. Article no.UPJOZ.4644.

[6] Grishkan I. Soil as a Source of Fungi Pathogenic for Public Health. Encyclopedia. 2024; 4(3):1163-1172. https://doi.org/10.3390/encyclopedia4030075 .

[7] Microsporum canis. Available from:- https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/microsporum-canis. Last accessed 22.07.26.

[8] Vilela, R., Mendoza, L. Paracoccidioidomycosis ceti (Lacaziosis/Lobomycosis) in Dolphins. In: Seyedmousavi, S., de Hoog, G., Guillot, J., Verweij, P. (eds) Emerging and Epizootic Fungal Infections in Animals. Springer, Cham.2018 https://doi.org/10.1007/978-3-319-72093-7_9