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Keratinophilic fungi from warm, moist, cattle - house of Bilaspur Central - India

Abstract

Soil is a well known source that harbors a wide variety of microorganisms. The current study briefly explains the isolation and identification of keratinophilic fungi, which is responsible for the degradation of most abundant and highly stable animal protein keratin. Soil is the home of several such fungi which are not even noticed from various unexplored habitats. During the course of study approximately 18 different fungal species were isolated and identified. The Vanbreuseghem's hair bait techniques were used for the isolation of fungi. The present study includes important fungi like *Aspergillus*, *Chrysosporium*, *Microsporum*, *Trichopyhton*, etc isolated from cattle house located in and around the Bilaspur town of Chhattisgarh state in Central - India.

Keywords: *Aspergillus, Chrysosporium, Microsporum, Trichopyhton*

Research Article

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Introduction

The Soil supports a range of microorganisms and is one of the most complex microbial habitats, allowing the fungi to sustain their entire life cycle. Soil is a cosmopolitan habitat for majority of microbial population that can be explored to find out more specific fungal flora.[1] The soils rich in keratinous material were found to more conducive for keratinophilic fungi[2–11] where this group of fungi usually grow abundently and reproduce. The fungi's nourishment is provided by the keratin substances in skin, hair, nail, feather, horn, hooves, beak etc. The fungi use the keratinous material as carbon source either living or dead.[12,13] Within the potential keratinolytic specificity, some of fungi of this group are potential pathogens to human beings and animals.

Keratinophilic fungi are widely distributed and are responsible for causing dermal infection in man and animal groups.[14] This is one of the most special homogenous groups of fungi which are regarded as potent dermatophytes causing cutaneous infections.[15] In general, the qualitative and quantitative composition of these fungi can be multifunctional and serve as bio-indicators of environmental pollutants. It means that the composition not only include the presence of keratin remnants but also fecal contaminants in the environment and respond to the changes in environmental conditions.[13,14]

The distribution of keratiniphilic fungi is influenced by the amount of available keratin wastes which are usually found in dumping yards, animal house, poultry and veterinary farms. However, their number is restricted because these are mostly confined to habitats rich in keratin wastes.[15] Since the habitat of birds (bird's nest, poultry farm) and animal house with different keratin waste set of predominating species to the possibility of fungal growth and to obtain growth indices of keratin degrading species, therefore in present investigation the cattle forms / yards and houses with variable keratin waste seems worthwhile to find out fungal growth indices under any condition. Although a number of keratinophilic fungi from zoo and other cattle farms have been isolated by different workers,[16–18] but the amount of available literature to support the claim is less.

In cattle house plenty of keratin waste found as an important source promoting growth and contamination by keratinophilic fungi contamination of keratinophilc fungi. Therefore occurrence of keratinophilc fungi in animal house is quite obvious.

The hot and humid climate, with a temperature 22-30°C in wet season and the acidic pH of the soils in the state seems to be potentially interesting to study the distribution of these fungi.

The prevalence of dermatophytes may vary according to the geographical locations, for the susceptibility of dermatophytosis that also relies on the seasonal conditions and the fungal constituents, under which susceptible animals or human beings are exposed.

In general dermatophytes are mostly found in temperate conditions however the hot and humid climate, with a temperature 22 - 35°C, the acidic pH of the soils, seems to be more conducive in wet season rather than dry and hot summer season of low-land area in Chhattisgarh state. Furthermore the distribution of keratinophilic fungi found that *Trichphyon ajelloi* is commonly found in colder climates but found sporadic in hot climates,[19] where dry hot conditions hindering the fungal germination. Moreover they exclaimed that the fungus is to be more often found associated with acidic soils than with alkaline soils.

Several studies have demonstrated the ability of the fungi to invade keratinized living tissue of the body including skin, hair, nails etc.[11,13,19,20] The dermatophytic fungi are classified in to three ecologically groups,

i. Geophiles, which are primarily inhabit the soil

ii. Zoophiles are essentially animal pathogens and

iii. Anthrophiles restricted to man, which very rarely infect animals.

Evidently, the occurrence of keratinophilic fungi is mainly influenced by keratin waste, but the survival and occurrence of these fungi also affected and controlled by the ecological habitats.[10] Several studies on epidemiology of human dermatophytosis in India confirm the prevalence of fungi in rural areas. However, the prevalence and

distribution of keratinophilic fungi in many other parts of India is yet to be investigated.

In fact, the studies conducted on keratinophilic fungi directly or indirectly correspond to coetaneous infections. The incidence of *Microsporum*, *Trichophyton*, with large numbers of other fungi may predict the possibility of infection in farmers and tribal people in contact with domestic animal. Instead of general awareness on hygienic conditions of rural people, no efforts were made to study the mycoflora of the state with particular interest on different cattle houses, farm yards. Therefore, present investigation has been carried out for detection of keratinophilic fungi in soil of four different cattle houses and cattle yards to create awareness against unhygienic conditions leading to coetaneous infections.

Materials and methods

Soil samples were collected from different cattle sheds i.e. such as the state government veterinary farm, Zoo-Kanan Pendari, Dahiyan of domestic or wild animal, and many private cattle houses, in and around the municipal area of Bilaspur. The site is often reserved for domestic animals (cow, sheep, goat, etc.) or preferred by wild animals (baisen) locally called Dahiyan. The soil samples were recovered from the superficial layer of soil (not exceeding 5 cm in depth). In every sample sterile spatula was used for sample collection. These samples were brought to the lab in sterilized polythene bags. Ten Petri plates with baited soil were used for every soil sampling areas and were incubated at 28°C.

Results and discussions

During present investigation the keratin material collected from different cattle houses yielded 18 keratinophilic fungi (Table 1). The *Chrysporium inidcum*, *C. tropicum*, were found to be the most common isolates in cattle farm soil samples. The *Microsporum gypseum* a well known geophilic dermatophyte was also one of the most frequently isolated species from the soil. In addition to this some of the isolates of saprophytic molds, belonging to the species of *Aspergillus*, *Acremonium*, *Alternaria*, *Fusarium* and *Malbranchea aurantiaca* grew on the hair-baits used in soil samples. The predominant keratinophilic fungi reported in most of the samples include *Chrysosporium spp* (*C. indicum*, *C. tropicum* and the dermatophytes *M. gypseum*). In addition, zoophilic dermatophytic fungus (*T. mentagrophytes*) was also isolated from the soil samples.

The *Aspergillus* and *Chrysosporium* were commonly found in soils of cattle house. The Chrysosporium indicum has been considered as the most abundant keratinophilic species in some soil survey in India.[10,21,22] These fungi exhibits keratinophylic tendency and were found in abundance in alkaline soil. However, the present study revealed the abundant prevalence of *C. tropicum* species probably due to acidic soil type. *Microsporum gypseum* was most common species among dermatophytes found in soil samples of domestic animal habitats (21), Plate: 3, 4, 5 & 6 followed by pathogenic *T. mentagrophytes*.

The other closely related non-dermaophytes keatinophilic species of fungi commonly found are (in decreasing order) *Aspergillus*, *Acremonium*, *Alternaria*, *Fusarium*, *Geotrichum*, *penicillium Scytalidium*. Their occurrence varies according to the geographical area. The study demonstrates that dermatophytes are responsible for infections of the toe-nails in human beings. The fungi usually use the keratin of dead animals or hairs, feathers, and skin,[23] that have been shed in the vicinity of cattle houses. That is why the cattle breeders and veterinarians occasionally suffer from dermatosis caused by *Trichophyton*, which causes skin inflammation and scalp lesions. The fungus is transmitted from stray dogs, and its infections are very often known to be higher in rural areas and tribal masses. The occurrence of *Scytalidium* species in abundance was significant because it is rarely isolated from temperate regions. This in turn enhances the possibility of dermal infection in working groups.

Table 1 Keratinophilic fungi from soils of different cattle farm /yards and houses

No.	Name of the Fungi	1	2	3	4	5	%
1	*Aspergillius fumigatus*	1	2	-	2	3	8
2	*A. flavus*	2	1	1	-	1	5
3	*A. niger*	1	1	1	1	-	4
4	*A.Terreus*	1	2	1	2	1	7
5	*Acremonium sp.*	1	1	-	1	1	4
6	*Alternaria sp.*	+	2	-	1	2	5
7	*Chrysosporium indicum*	1	2	1	2	2	8
8	*Chrysosporium tropicum*	1	3	1	3	2	10
9	*Curvularia lunata*	1	1	-	1	1	4
10	*Fusarium oxysporium*	1	2	1	1	3	8
11	*Humicola insolense*	1	1	-	1	-	3
12	*Microsporum gypseum*	1	3	1	3	2	10
13	*Malbracehea aurantiaca*	1	1	-	-	1	3
14	*Penicillium sp.*	1	2	1	1	-	5
15	*Paecilomyces variotii*	1	1	1	-	-	3
16	*Trichophyton rubrum*	-	1	1	1	1	4
17	*T. mentagrophyte*	1	2	1	1	1	6
18	*Scytalidium sp.*	1	2	-	-	2	5
	Total	17	30	11	21	23	102

Cattle Farm / yards and houses 1, The state Govt. veterinary farm; 2, Zoo Kanan pendari; 3, Private cattle house; 4, Dahiyan of domestic animal; 5, Dahiyan of wild animal

During the course of study, classification of different cattle house as per specificity of keratinophilic fungi, was difficult because of their occurrence and distribution which relies on the amount of keratin waste and the number of cattles in the house / farm and the population animals in zoo and other places where animal (herbivores) live in

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collective groups. The soil samples collected from the zoo showed The number of keratinophilic fungi isolates collected from zoo soil samples were same as that of the number of isolates obtained from the state government veterinary farm house center. It is to be noted that the occurrence of keratinophilic fungi is not confined to cattle farms but are found in many other habitats. This may be due to the wide occurrence of spores of keratinophilic fungi and their distribution through air, water and domestic animals.

The richness of soil with a sufficient amount of organic content in natural habitats of zoo, dahiyan seems to be more important for the occurrence of keratinophilic fungi. Because, the above defined protected or unprotected areas explain availability of various types of keratin substances; such as hair, horn, nails, feathers, for survival and sporulation of the fungi.[24] The number of private cattle farms nearby Bilaspur town also showed a considerable number of keratinophilic fungi, which differs in amount of keratin waste as per the number of cattles in the house. The farmers keep domestic animal in houses which have not been exposed to sunshine and this promotes fungal growth.

It has been noted that keratinophilic fungi isolates not only occur in cattle farms, but are found in most of the habitats that have been investigated (3,10,11,) in Bilaspur division. *Micosporum* and *Trichphyton verrucosum* species are usually found in pet dogs' goats, sheeps, and horses.[25] Hence, it is quite obvious that houses can also serve as a habitat that promotes the fungal growth and the infection can spread from the pet animals to humans. Moreover, infective prop gules (spores and conidia) of pathogenic geophilic dermatophytes originating from saprobic sources, are transmitted directly or indirectly by the combined effect of warm and humid environment of Chhattisgarh.

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Conflict of interest

The authors declare there is no conflict of interest.

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