International Journal of Advance and Applied Research
www.ijaar.co.in
ISSN – 2347-7075 Impact Factor – 7.328
Peer Reviewed Bi-Monthly
Vol.9 No.5 May – June 2022

BIODIVERSITY OF KERATINOPHILIC FUNGAL FLORA IN KANPUR ZOOLOGICAL PARK, KANPUR, INDIA

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Abstract
Keratinophilic fungi are highly specialized, keratin degrading ecological group. They live in natural environment, mostly in the keratin rich debris of dead animals in the soil. These fungi cause infection of skin, hair and scalp etc. We investigated the biodiversity of keratinophilic fungal flora in 90 soil samples collected from different indoor animal habitats of Kanpur zoo. Out of 90 samples, positive 76 samples yielded 12 genera and 23 species. Genus Chrysosporium were the most dominating fungus represented by 6 species of which Chrysosporium keratinophilum was the most common species on the basis of occurrence. Microsporum gypseum was the next dominating genus. The frequency of Chrysosporium keratinophilum was positively correlated with the content of humus, nitrogen, phosphorus and $Caco_3$ in the soil.

Keywords: *keratinophilic fungi, soil, Kanpur zoo, Chrysosporium*

Introduction: Keratinophilic fungi and related dermatophytes are the special group of fungi which have ability to degrade keratinous substance. Keratinophilic fungi have affinity to attack, colonize and nourish on keratin-rich non living material such as skin, scales, hairs, nails, feathers, horns etc .The fungi which degrade substrate completely are termed as Keratinolytic (Kushwaha and Gupta 2008). These are highly specialized fungi which are potentially pathogenic to man and animals. These include genera –*Chrysosporium, Trichophyton, Epidermophyton,*and *Microsporum.* Keratinophilic fungi degrade the keratinase substrate in soil considered as a saprophyte. Keratinophilic fungi are ecologically important that balance one of the most abundant and highly stable animal proteins on earth- keratin (Sharma and Rajak, 2002). Keratinophilic fungi are present in the environment with variable distribution patterns and depend on different factors such as presence of human and animals. Keratinophilic fungi act as a bio – indicators of environmental waste pollution. The indicators provide the level of environmental contamination and allow analyzing and evaluating the risk of infectious diseases resulting from contamination. Keratinophilic fungi and dermatophytes have been reported to cause infection of skin, hair and scalp, etc. Keratinophilic fungi is distributed worldwide, reports indicate the presence of these fungi in different soil habitats from different countries such as Egypt, Spain, Iran, Australia, India, Kuwait, Malaysia etc). In general, the habitats mapped out and reported to be rich in these fungi are the soils from densely populated areas, public gardens, play grounds, cattle farms, poultry farms and other places occupied by animals and decomposed organic matter (Mercantini et. al; 1989, Ali- Shataye, 1989, Al- Musallam, 1990, Soon, 1991, Kaul and Sumbali, 1999). The frequency of occurrence of dermatophytes in soils affected by genomic and climatic factors and is also influenced by the frequency of the animals visiting these localities. Seasonal occurrence of these fungi is connected with the climatic effects. The geographical distribution of keratinophilic fungi in soil samples depend a large number of factors such as – site of collection, climatic and edaphic factors of that area, organic material, pH and moisture content of soil (Bhadauria and Sharma, 2001; Gupta and Garg 1991; Kaul and Sumbali, 1998).

Material and Methods:

Collection of soil samples: A total of 90 soil samples were collected from different animal habitats (Aviary, Serpentarium, Rabbit habitat, Guinea pig habitat, Nocturnal house) of Kanpur Zoological Park. The samples were collected from the superficial layer of the soil collected in

sterile polythene bags brought to the laboratory and stored at room temperature.

Isolation, Purification and Identification: Keratinophilic fungi were isolated by Vanbreuseghem hair bait technique. Soil were placed in sterile petridishes and moistened with sterile water and baited with sterile human hairs. The petridishes were incubated at room temperature and examined after one week. After observing the growth, isolates were cultured on SDA medium at 28 ± 2^0 c for up to one week. When fungal colony is seen it is transferred to other dishes for purification. Then isolates were examined and identified on the basis of morphological characters and microscopic characters.

Assessment of frequency distribution based on morphological criteria:

Percentage Distribution –

Also called as frequency distribution, is the total frequency equated to one hundred and the individual class frequencies expressed in proportion to that figure.

$$\text{Percent Distribution (\%)} = \frac{\text{Total number of individual species occurred}}{\text{Total number of samples examined}} \times 100$$

Result:

Data incorporated in table 1 shows the prevalence and distribution of keratinophilic fungal flora of Kanpur zoo. Total of 170 isolates belonging to 12 genera and 23 species were reported in present investigation. . *Chrysosporium* species are widely distributed in aviary section. It was the most common genus recorded, being represented by six species, of which *Chrysosporium keratinophilum* (26.67%) was the most common species on the basis of occurrence, while *Microsporum gypseum* (24.44%) was next most frequent species isolated. In our present study, maximum varieties of keratinophilic fungi were isolated from rabbit habitat and guinea pig habitat. These habitats are rich in keratin debris. C. keratinophilum were found to be most common keratinophilic fungi, isolated from aviary section in large number while M. gypseum occurs mostly from serpentarium. In this study occurrence of keratinophilic fungi in Kanpur Zoological Park reveals that there is more risk of infection to visitors and animals. Therefore, zoo serves as a natural reservoir of keratinophilic fungi which have pathogenic potential to man and animals.

Species diversity of keratinophilic fungi: Twelve genera namely –*Alternaria* (1 sp.), *Aspergillus* (3 sp.), *Bipolaris* (1 sp.), *Chrysosporium* (6 sp.), *Cladosporium* (1 sp.), *Epidermophyton* (1 sp.), *Fusarium* (2 sp.), *Geomyces* (1 sp.), *Microsporum* (3 sp.), *Malbranchea* (1 sp.), *Penicillium* (1 sp.), *Trichophyton* (2 sp.) Were isolated from the soils of Kanpur Zoological Park.

Table 1 Keratinophilic fungal flora of Kanpur zoo

Sources of soil samples	Aviary	Rabbit Habitat	Guinea pig Habitat	Nocturn-al House	Serpentarium	Total	% distribution
Isolated Fungus	2	3	-	2	1	8	8.88
Alternaria	-	-	2	-	1	3	3.33
alternata	-	3	-	1	-	4	4.44
Aspergillus	-	2	-	1	4	7	7.78
oryzae	-	-	2	-	-	2	2.22
Aspergillus	9	4	4	4	3	24	26.6
flavus	5	3	3	3	-	14	15.5
Aspergillus	-	1	2	-	1	4	4.44
niger	4	4	1	2	1	12	13.33
Bipolaris	3	2	2	1	1	9	10
sp.	2	-	1	1	-	4	4.44
C.keratino							
philum	1	1	2	1	1	6	6.67
C.	-	1	2	2	-	5	5.56
merdarium	1	1	1	2	-	5	5.56
C.georgii	-	-	-	1	2	3	3.33
C.tropicum	1	-	-	2	-	3	3.33

C.queensla	2	3	3	1	-	9	10
ndicum	3	3	5	2	9	22	24.44
C.carmacel	-	1	1	-	3	5	5.56
li	2	1	1	1	-	5	5.56
Cladosspor	2	1	1	-	2	6	6.67
ium	-	-	2	-	-	2	2.22
sphaerospe	-	2	-	-	-	2	2.22
mum							
E. floccossum							
Fusarium solani							
Fusarium oxysporum							
Geomyces pannorum							
M. nannum							
M. gypseum							
M. fulvum							
Malbranch ea sp.							
P. citrinum							
T. equinnum							
T. kanei							

Discussion:

In this study occurrence of keratinophilic fungi in Kanpur Zoological Park reveals that there is more risk of infection to visitors and animals. Therefore, zoo serve as a natural reservoir of keratinophilic fungi which have pathogenic potential to man and animals. However no more data have been found on the occurrence of these fungi in Kanpur Zoo so, our aim is to explore these pathogenic fungi and highlights the factors favoring their growth. The majority of dermatophytes can live saprophytically and every keratinophilic fungi can be considered as a potential pathogen (Rippon, 1982). Open play grounds and public parks are often invaded by many animals such as cows, bullocks, birds, dogs, pigs, cats, and rats. These visitors leave organic residue which probably contaminate the soil with propagules of fungal pathogen. Indoor animal habitats viz. farm houses and zoos, and also harbour pathogenic Keratinophilic fungi by Dominck and Majchronic (1970). Therefore soil can become a potential source of infection for humans and animals. (Mantovani, 1978, Filipello,1986). The frequency of occurrence of dermatophytes in soil is affected by genomic and climatic factors and is also influenced by the frequency of the animals visiting these localities.

Acknowledgement- The authors are thankful to Dr. Archana Srivastava, Head, Botany Department, D.G.P.G. College Kanpur for providing facilities.

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