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A Survey of Keratinophilic Fungal (Dermatotophytic) Infections in Balaghat City Specially Moti Talab Area

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Abstract: ***Some keratinophilic fungi are a potential pathogen of warm-blooded animals and cause superficial cutaneous infections (dermatophytoses) of keratinized tissues (skin, hair and nails). Climatic conditions of Balaghat (sub-tropical zone, south-east of M.P., Bharat) heavy rained-1440mm, high-tempretured 30°C-45°C are favorable for fungal growth and infection. In our survey of Balaghat city Specially Moti Talab area 143 patient's skin, nail and hair samples are collected from visiting the hospitals, schools and other localities. Out of 143 samples, 105 persons have keratinophilic fungal infections. As per overall human patient sampling, ~73.43 % of the population recorded to be positive for keratinophilic fungi.***

Keywords: keratinophilic fungi, Balaghat, patient

1. Introduction

Keratinophilic fungi are colonizing various keratinous substrates and degrade them. Keratinophilic fungi are present cosmopolitan, specifically in keratin (most stable animal proteins) containing atmosphere including the human and animal presence (Sharma and Rajak, 2003). Many of them are a potential pathogen of warm-blooded animals. These pathogenic forms of these fungi are known as "dermatophytes" which have adapted themselves to animal and human parasitism during evolution and cause superficial cutaneous infections (dermatophytoses) of keratinized tissues (skin, hair and nails) of humans and animals. Based on host specificity dermatophytes are classified into three ecological groups, namely *geophiles* (soil), *anthropophiles* (man) and *zoophiles* (animals). (Lakshmipathy and Kannabiran 2010). It thought that dermatophytes were initially saprophytic and lived in the soil, but due to increasing interactions with animals, they gradually evolved a parasitic lifestyle (Gugnani 2000, Ellabib and Khalifa 2001, Deshmukh and Verekar 2006, Patel *et al*. 2010, Madhavi *et al*. 2011). The infections caused by dermatophytes are known as "*Tinea*" or "ring-worm" (due to the characteristic ringed lesions) (Gugnani 2000, Simpanya 2000, Laxmipathy and Kannabiran 2010, Deshmukh and Verekar 2006, Kačinová *et al*. 2013, Lavanya 2013).

Climatic conditions of Balaghat (sub-tropical zone, south-east of M.P., Bharat) heavy rained-1440mm, high-tempretured 30°C-45°C are favorable for fungal growth and infection. At this type of condition the study of keratinophilic fungal infections in Balaghat is very important in taxonomic and pathological point of view. Previous studies on the epidemiology of human non-dermatophytosis in Balaghat (Singh and Barde, 1990) showed that it was prevalent in this area especially in rural site.

2. Materials and Methods

Collection of samples from the skin: The affected area is swabbed with 70% alcohol and the active edge of lesion scraped with a flame sterilized blunt scalpel. The scrapings are collected from the margins of the lesion without injuring the skin surface.

From the scalp: The same procedure is followed as for scrapings, in addition a few affected hairs are also epilated and collected with a pair of flame-sterilized tweezers. Care it taken in collecting the basal portion of the hair as the fungus usually found in this area.

From the nails: The affected nails are swabbed with 70% alcohol after which the nails are scrapped deeply enough to obtain recently invaded nail tissue. The samples collected in paper sachets for transportation to the laboratory. The specimens are process by microscopy and culture. (Madhavi *et al*, 2011). Samples are brought to the laboratory and used immediately or stored overnight at 4ºC.

Sample collected from the patients were grown on the SDA medium subjected to potassium-hydroxide (KOH) wet preparation at various concentrations (10%, 20% and 40%) based on the type of clinical specimen for the present fungal species. We are use of Sabouraud's dextrose agar (SDA) and Potato dextrose agar (PDA) regularly used to isolate soil and skin, nail and scalp fungal species (Hasseine,2005). During the study, Dermatophyte test medium (DTM) is also used as and when required for better isolation of fungi. Also, whenever the biochemical test performed the growth of isolates always received from SDA medium (Madhavi *et al.*, 2011).

3. Results

143 patient's skin, nail and hair samples are collected from visiting the hospitals, schools and other localities. As per

growth on Sabouraud's dextrose agar, it has been observed that tested 60 skin samples registered positive for Keratinophilic fungi with 48 samples; then nail with (n= 23) tested positive with 12 samples and scalp (n= 60) recorded positive with 45 (samples). As per the study, it has recorded that patients recorded to be high % positive for keratinophilic fungi.

As recorded human skin samples observed positive for keratinophilic fungi up to 80% (48 out of 60); nail found to positive with 50% prevalence (12 out of 23) and from scalp about 75% prevalence recorded (45 out of 60). As per overall human patient sampling, ~73.43 % of the population recorded to be positive for keratinophilic fungi and compared to that of soil with marginally high percentage closing towards 80% as given in Table 1.

Table 1: Percent prevalence of the keratinophilic fungi in human registered in Balaghat region

Samples type	No. of samples examined	No. of positive samples	%age of positive samples
Skin	60	48	80%
Nail	23	12	52%
Scalp	60	45	75%
Total	143	105	~ 73.43%

Some photographs of keratinophilic fungal infections

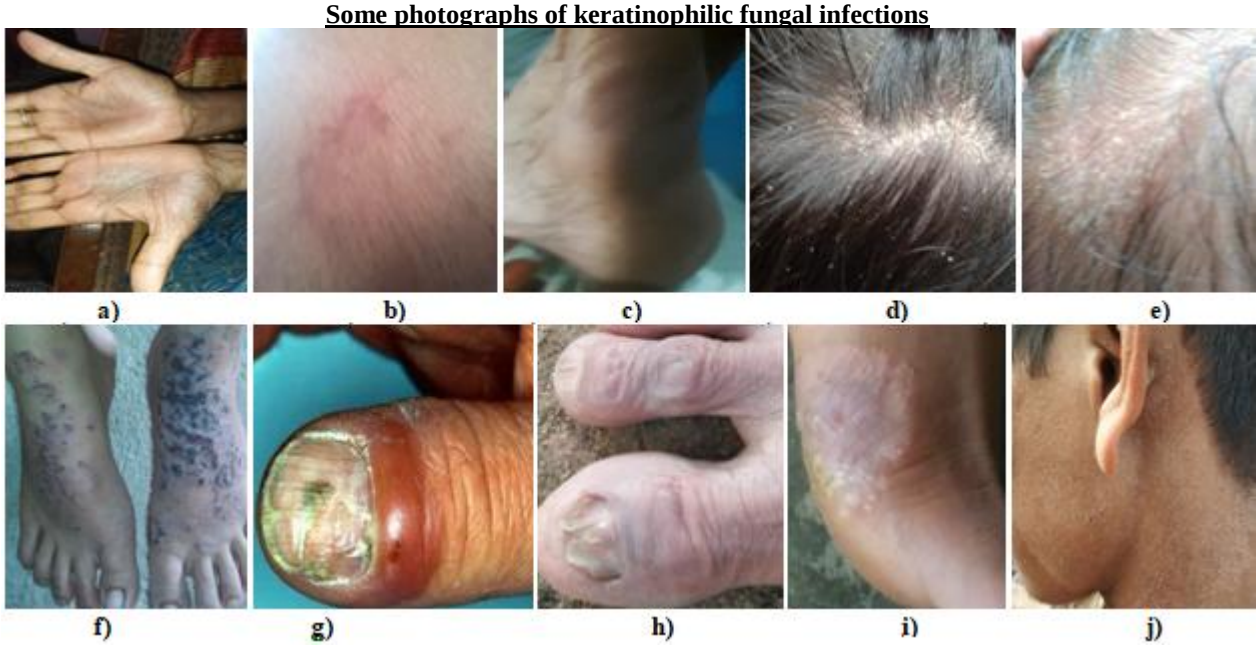

Figure (a - j): Different types of keratinophilic fungal infections

Identification of Keratinophilic fungi and % prevalence

It has observed that per cent prevalence of keratinophilic fungi in patients recorded to be less than 25% and up to 1.90%. Here given fungi recorded in prevalence up to 20% as given below :- *Aspergillus fumigatus* (20%), *Alternaria sp.* (8.57%), *Candida sp.* (18.09%), *Chaetomium sp.* (6.66%), *Chrysosporium indicum* (10.47%), *Chrysosphorum tropicum* (15.32%), *Curvularia lunata* (10.47%), *Epidermophyton floccosum* (4.76%), *Eupenicillum sp.* (2.85%), *Fusarium oxysporum* (14.28%), *Hendersonul torlodiea* (5.71%), *Humicola sp.* (3.80%), *Microascus sp.* (11.42 %), *Microsporum gypsum* (19.04%), *Phoma sp* (2.85%), *Paecilomyces sp.* (1.90%), *Phialophora sp.* (3.80%), *Penicillum sp* (16.19%), *Scopulariopsis sp* (6.66%), *Trichoderma harzianum* (16.19%), *Trichophyton tonsurans* (14.28%), and *Trichophyton tettestre* (17.14%) as given in Table 4. Only a few keratinophilic fungi recorded in 21% - 25% abundance in patients and identified as *Aspergillus flavus* (23.08%), *A. niger* (21.09%), *Rhizopus solenifer* (21%), and *Trichophyton rubrum* (24.76%) as given in Table 2.

Table 2: Identification of the keratinophilic fungi isolated from the human in Balaghat region reported in percent prevalence

S. No.	Name of species	Positive samples	Total samples	%	frequency
1.	Aspergillus flavus	25	**105**	23.08	17.48
2.	A. fumigates	21	**105**	20	14.68
3.	A. niger	23	**105**	21.09	16.08
4.	Alternaria sp.	09	**105**	8.57	6.29
5.	Candida sp.	19	**105**	18.09	13.28
6.	Chaetomium sp.	07	**105**	6.66	4.89
7.	Chrysosporium indicum	11	**105**	10.47	7.69
8.	Chrysospoum tropicum	16	**105**	15.32	11.18
9.	Curvularia lunata	11	**105**	10.47	7.69
10.	Epidermophyton floccosum	05	**105**	4.76	3.49
11.	Eupenicillium sp.	03	**105**	2.85	2.09
12.	Fusarium oxysporum	15	**105**	14.28	10.48
13.	Hendersonul toruloidea	06	**105**	5.71	4.19
14.	Humicola sp.	04	**105**	3.80	2.79
15.	Microascus sp.	12	**105**	11.42	8.39
16.	Microsporum gypsum	20	**105**	19.04	13.98
17.	Phoma sp.	03	**105**	2.85	2.09
18.	Paecilomyces sp.	02	**105**	1.90	1.39
19.	Phialophora sp.	04	**105**	3.80	2.79
20.	Penicillium sp.	17	**105**	16.19	11.88
21.	Rhizopus stolenifer	22	**105**	20.95	15.38

22.	Scopulariopsis sp.	07	**105**	6.66	4.89
23.	Trichoderma harzianum	17	**105**	16.19	11.88
24.	Trichophyton rubrum	26	**105**	24.76	18.18
25.	Trichophyton tonsurans	15	**105**	14.28	10.48
26.	Trichophyton tettestre	18	**105**	17.14	12.58

Biochemical tests

In the present study total 25 fungi present in patient with keratinophilic ability has been tested further at a biochemical level with Amylase, Urease, Keratinase, protease and DTM test. In an amylase test, ability to utilize starch by expressing amylase enzyme confirmed by the majority of species as in table 6. Similar results recorded for Ureases, Keratinase, protease and detection of dermatophytes by DTM. Here out of 25 fungi 4 fungi detected positive for DTM test and considered as presumptive dermatophytes as in Table 3.

Table 3: Biochemical tests for Keratinophilic fungi isolated from patients of Balaghat

	Isolates	Amylase test	Urease test	Keratinase test	Protease test	Dtm test
1.	*Aspergillus niger*	+	_	_	+	_
2.	*A. flavus*	+	+	_	+	_
3.	*A. fumigatus*	+	_	_	_	_
4.	*Alternaria sp.*	+	_	_	_	_
5.	*Candida sp.,*	+	+	_	_	_
6.	*Chaetomium sp.*	_	+	+	+	_
7.	*Chrysosporium indicum*	_	+	+	_	_
8.	*Chrysosporium tropicum*	_	+	+	_	_
9.	*Curvularia lunata*	+	_	_	_	_
10.	*Epidermatophyton floccosum*	_	+	+	_	+
11.	*Eupenicillium sp.*	+	_	+	+	_
12.	*Fusarium oxysporum*	_	+	_	_	_
13.	*Hendersonul sp.*	+	_	+	_	_
14.	*Humicola sp.*	+	_	+	+	_
15.	*Microascus sp.*	+	_	+	+	_
16.	*Microsporum gypseum*	_	+	+	_	+
17.	*Paecilomyces sp.*	+	+	+	_	_
18.	*Penicillium sp.*	+	+	+	_	_
19.	*Phialophora sp.*	_	_	+	+	_
20.	*Phoma sp.*	+	_	+	+	_
21.	*Rhizopus stolonifer*	+	_	+	+	_
22.	*Trichoderma harzianum*	+	_	+	+	_
23.	*T. rubrum*	_	_	+	+	+
24.	*T. tettestre*	_	+	+	+	+
25.	*T. tonsurans*	_	+	+	+	+
+ Positive; - negative test						

4. Conclusion

Here 143 human samples (skin, nails and scalps) have been collected out of them 105 positive for keratinophilic fungal infections. Here skin samples recorded 80% positive incidences for keratinophilic fungi. Nail for 52%, scalps for 75% and overall 73% human samples recorded for the presence of keratinophilic fungi.

In the latter approach, as we understood the natural spreading ability of the fungi in the environment and tend to be pathogenic to human, it is vital to control its infection once human gets infected by those.

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