CHAPTER I

INTRODUCTION

Dermatophytes are a group of filamentous fungi that have the ability to infect the keratinized tissues of the skin, hair and nails. They belong to the anamorphic genera which are classified, based on the conidial morphology and accessory structures – *Trichophyton*, *Microsporum* and *Epidermophyton*. The real founder of medical mycology is the Hungarian physician, David Gruby (1843) (Weitzman and Summerbell, 1995) who did his research in Paris, described dermatophytosis from a patient infected with tinea capitis and identified the etiologic agent as *Microsporum audouinii*. Dermatophytes initially colonize the keratin tissues and inflammation is caused by the host response to the pathogen. Infections are mostly restricted to outer layer of the epidermis because of the inability to invade the deeper tissues of a healthy individual. Occasionally they invade the subcutaneous tissues and induce kerion development. They live on moist surface of the skin and household items like towel, clothing, bedding etc. They have keratinophilic and keratinolytic activity (Simpanya, 2000). It digests the keratin *in-vitro*, by utilizing it as a growth substrate and also invades the keratinized tissues of the host (*in-vivo*). They manifest as variety of clinical types, collectively known as dermatophytosis and popularly termed as ringworm or tinea. Poor hygienic conditions, over population and high humid weather are the risk factors of dermatophytosis.

Dermatophytes are classified, based on the primary habitat as geophilic (live in the soil), zoophilic (live on an animal host) and anthropophilic (live exclusively on humans). Infection is transmitted by direct contact with the infected human or animal or by direct or indirect contact with the contaminated fomites.
Dermatophytes cause different clinical types based on the anatomic site of infection such as tinea capitis (scalp), tinea faciei (face), tinea barbae (beard), tinea corporis (arms, legs, especially on glabrous skin), tinea manuum (hands and palm), tinea unguium (fingernails and toenails), tinea cruris (groin), tinea pedis (feet). The clinical severity is related to the species and strain of the fungus, the inoculum size, the anatomical site involved and the immune response of the host.

Keratinase, proteinase, lipase are the significant virulence factors of dermatophytes. The colonization of dermatophytes is often restricted to the dead keratinized tissue, developing mild or severe inflammatory reactions. Humoral and cell mediated immunity respond to this infection and also prevent the fungal invasion into deep tissues. The antifungal drugs administered to treat dermatophytosis are orally active triazoles, allylamines and hydroxypyridones (Weitzman and Summerbell, 1995).

**Need and importance of the study**

Superficial fungal infections have a major impact on cosmetic health, affecting more than 20-25% of the global population (Havlickova et al., 2008). Dermatophytes are the most repeatedly isolated organisms worldwide. They belong to a small category but globally over USD $500,000,000 per year is spent for the production of antifungals against dermatophytosis (Gräser et al., 2008). The significance of the present study is listed below.

i. Basically, culture is the gold standard method but it is time-consuming, as it requires 14 - 21 days for its isolation and identification of species directly from the clinical specimens. Conventional procedures are either slow or lack
enough sensitivity and specificity. They may not detect all true positives. Strain typing by phenotypic methods is practically difficult since the dermatophytes on sub-culture show morphological variations among isolates. Therefore to overcome certain limitations molecular typing methods are useful in rapid detection, identification of dermatophytes and strain variations. Moreover, the genotypic identification is more stable and precise when compared to the phenotypic methods.

ii. Although many molecular based analyses on dermatophytes were developed earlier, yet there is always a change in the taxonomy and difficulty in naming of the pathogenic species. Scientific queries on the strain differentiation are yet to be solved.

iii. Re-infection is often related to dermatophytosis whether it occurs with the same dermatophyte species, a variant, or a different species producing similar type of lesions.

iv. Anti-fungal drugs that are targeted against a dermatophyte species would obviously be effective against others as well. Thus, clinical treatment may not vary with the species, but speciation is necessary for epidemiological concerns.

v. Although infection by a dermatophyte is not an emergency, identification of dermatophyte species is essential to rule out lesions simulating dermatophytosis and hence start the appropriate treatment at the earliest.

vi. Knowledge about the epidemiology plays a vital role in infection control and community health management. Epidemiological profile of dermatophytes may differ due to certain factors like climatic conditions, environmental and socio-economic category and most eminently due to tourism.
vii. Dermatophytes produce certain enzymes like keratinase, proteinase, phospholipase, lipase etc., which may play a major role in the pathogenicity of the host tissues. These enzymes act as virulence factors of dermatophytes. The association of the virulence enzymes and the host tissue *in-vitro* helps in understanding the host-pathogen interaction.

There is a dearth in the study on virulence enzymes and information on identification of dermatophytes directly from clinical specimens by molecular methods from the Indian subcontinent. Moreover, there are no data, where the molecular strain typing has ever been evaluated in India.

With all the epidemiological characterization and enzyme productivity of dermatophytes by conventional and molecular methods could probably be significant in highlighting the species distribution and the virulence enzymes in relation to dermatophytes.