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First mycological investigation of dermatophytosis in camels due to *Trichophyton verrucosum* in Ethiopia

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Dermatophytosis is a highly contagious cutaneous mycosis of global significance. This paper delineates the spontaneously occurring *Trichophyton verrucosum* infection in two young camels. Both the animals had discrete, nearly circular, raised, grey white, crusty lesions, about 2 cm in diameter on the skin of face and neck. The skin scrapings in 10 % potassium hydroxide solution under light microscope revealed thin, septate hyphae, and arthrospores morphologically simulating to dermatophytes. Cultural examination of clinical material on Sabouraud dextrose agar with chloramphenicol and actidione yielded pure growth of dermatophyte. The detailed morphological characteristic of the dermatophyte was studied in Narayan stain. The topical application of 2% solution of tincture iodine on the individual lesion after the removal of crust was effective in treating the camels. The source of infection to camels was probably the diseased cattle. It is emphasized that ringworm should be considered in the differential diagnosis of infectious dermatitis in camel. As far as could be ascertained, this appears to be the first record of ringworm due to *Trichophyton verrucosum* in young dromedaries from Ethiopia. Further studies are warranted to elucidate the role of this zoophilic dermatophyte in ringworm of humans as well as in other species of animals in the country.

Key words: Camel, Dermatophyte, Ethiopia, Narayan stain, public health, *Trichophyton verrucosum*

INTRODUCTION

Livestock plays a pivotal role in the livelihood of people in poor resource countries. Africa is a large continent with a great diversity of mammal, avian, and plant species. This continent hosts 80 % of the world population of dromedary (16.5 million) of which 63% are attributed to East Africa (Wilson, 1998). Ethiopia is one of the largest camel populated countries in the world, as it possesses over one million camels. The country ranks third in Africa next to Somali and Sudan, and fourth in the

world (Hadush *et al*, 2013). The arid and semiarid climatic conditions of the eastern and southern parts of the country, namely Afar, Somali and Borena are suitable for camel production. In these areas of Ethiopia, camel (*Camelus dromedary*) is an important livestock species in the pastoral economy because it serves an important source of milk, meat, and draft power (Teka, 1991).

Like other animals, camel also suffer from bacterial, viral, fungal, and parasitic diseases, which can result into high morbidity and mortality (Pal and Mehrotra, 1984; Pal and Chandel, 1989; Wernery

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and Kaaden, 2002; Pal, 2007a; Hadush *et al*, 2013). Among several mycoses, dermatophytosis (ringworm, tinea) is one of the most frequently occurring highly infectious cutaneous fungal diseases of animals and humans (Pal, 2007b; Seebacher *et al*, 2008; Nweze, 2011; Dave *et al*, 2014). It is estimated that 20% of the world population is affected with dermatophytosis (Pal, 2005). Dermatophytosis can occur in sporadic as well as in epidemic form, and has a great public health and economic significance (Pal and Thapa, 1993; Dalis *et al*, 2014; Dave *et al*, 2014). The transmission of dermatophytosis involves direct contact with a symptomatic or asymptomatic host or indirect contact with contaminated fomites besides contact with soil (Pal, 2007b; Dave *et al*, 2014). Disease is caused by dermatophytes, which are aerobic, non-acid fast, non-motile, filamentous fungi, and attack the keratinized tissues of the body such as hair, skin, nail, etc. (Pal, 2007b). They grow best in warm and humid environments and are, therefore, more common in tropical and subtropical areas of the world (CFSPH, 2013). Dermatophytes are classified into three genera, namely *Epidermophyton*, *Microsporum*, and *Trichophyton*. The disease in camel is mainly caused by *Trichophyton verrucosum* (Kuttin *et al*, 1986; Fadlemula *et al*, 1994; Pal and Lee, 2000; Ghoke *et al*, 2006), but rarely other dermatophytes, such as *T. langeronii*, *T. mentagrophytes*, *T. sarkisovii*, *Microsporum canis*, and *M. gypseum* are also isolated from dromedary (Kuttin *et al*, 1986; CFSPH, 2013). The extensive search of literature on internet failed to reveal any information on *Trichophyton verrucosum* infection in camels from Ethiopia. Hence, the present communication delineates the first mycologically confirmed cases of ringworm due to *T. verrucosum* in two young camels from Ethiopia.

MATERIALS AND METHODS

The skin scrapings with hairs from the ringworm type lesions of two young camels of both sex, aged 1 year and 1.5 year from Matehara area of Ethiopia submitted to the Microbiology Laboratory constituted the material for this investigation. The affected skin of both the camels was first decontaminated with 70 % ethyl alcohol, and then lesions were scraped from the border/margin of the active lesion with blunt end of sterilized scalpel on a clean piece of paper, and put into a dry and clean paper envelope. A portion of the specimen was treated

in a solution of 10 % potassium hydroxide (KOH), and examined under light microscope for ectoparasite, fungi, and algae. The material was also inoculated onto duplicate slants of Sabouraud dextrose agar with chloramphenicol, and actidione, and incubated for 4 to 6 weeks at 25°C and 37°C. The inoculated media were observed at intervals for the growth of dermatophytic fungi. The detailed microscopic morphology of the culture was made in "Narayan stain", which contained 4.0 ml of glycerin, 6.0 ml of dimethyl sulfoxide (DMSO) and 0.5 ml of 3 % aqueous solution of methylene blue (Pal, 2004). The isolates were identified by studying the macro and micro morphological characteristics as per the description given by Baxter and Rush-Munro (1980) and Pal (2007b). The animal owner was advised to apply 2 % solution of tincture iodine with cotton swab on the lesions after the removal of crusts in a container having some strong antiseptic. As the crust is highly infectious, the animal owner was directed to properly dispose of the crust either by burning or burial to prevent the spread of infection in the environment. Due to long distance of camel owner, it was not possible to undertake mycological evaluation of the drug.

RESULTS AND DISCUSSION

On clinical examination, the both camels (one male aged 1 year, and other female aged 1.5 year) showed two discrete, raised, thick, round, grayish-white, crusty lesions on the skin of face and neck region. The microscopic examination of specimens in 10 % KOH failed to indicate any evidence of ectoparasite, yeast, and algae, but showed hyaline, thin, slender, branched hyphae morphologically resembling to dermatophyte. On Sabouraud medium, the colonies grew as small, heaped, grayish white with no pigment on reverse side, after three weeks of incubation. The isolates in Narayan stain revealed hyaline, antler like, branching hyphae with chains of chlamydo spores. Based on the gross colonial and microscopic morphology, the isolates were confirmed as *Trichophyton verrucosum*. The topical application of 2 % tincture iodine solution showed clinical response after 10 days but the owner was advised to continue the treatment up to three weeks to get complete recovery. The owner narrated that the drug did not exhibit any side effects on animals.

Dermatophytosis is an important cutaneous fungal disease of global distribution as reported from over

145 countries of the world (Pal, 2007b). In the present case, the diagnosis of ringworm in camels was established by direct microscopical demonstration of dermatophyte by potassium hydroxide technique, and its cultural isolation in pure growth on Sabouraud medium. This observation goes parallel with the results of other investigators who used the similar criterion to confirm an unequivocal diagnosis of dermatophytosis in humans and animals (Pal and Thapa, 1993; Pal and Dave, 2006; Nweze, 2011; Dave and Pal, 2014; Jain *et al.*, 2014). Cattle is considered the natural host of *Trichophyton verrucosum* (Pal and Thapa, 1993), though this dermatophyte has been isolated from the cutaneous lesions of humans, buffalo, camel, cat, deer, goat, horse, pig, and sheep (Pal, 1987; Pal and Thapa, 1993; Pal *et al.*, 1995; Pal and Lee, 2000; Nweze, 2011; Jain *et al.*, 2014). In the present study, no attempt was made to establish the source of infection. However, the camel owner narrated that both camels would have probably acquired the infection from diseased cattle, which had similar type of skin lesions. Hence, the role of this zoophilic dermatophyte should be further studied in other animal species. It is pertinent to mention that isolation and identification of dermatophyte to species level is highly imperative for epidemiological point of view (Pal and Dave, 2005).

A plethora of topical and systemic antifungal drugs are available for the treatment of ringworm both in humans and animals (Pal, 2007b; Dave *et al.*, 2014). As antifungal drugs such as clotrimazole, econazole, fluconazole, miconazole, ketoconazole, luliconazole, seritonazole, and terbinafine are very expensive, it may be difficult to the livestock owners to purchase these medicines for treating their animals. The clinical efficacy of 2 % solution of tincture iodine in the treatment of ringworm cases in several species of animals has been reported by Pal (2007b). The drug was found safe, as no side effects were reported by the owners of the animals. Therefore, the topical application of 2 % tincture iodine solution is recommended for the management of animal dermatophytosis (when the lesions are few in numbers), especially in poor resource countries.

The public health implications of animal dermatophytes have been reported by several workers from many countries of the world (Pal and Matsusaka, 1991; Pal and Lee, 2000; Pal and Dave, 2006; Pal, 2007b; Nweze, 2011; Pal *et al.*, 2013; Pal and

Dave, 2014). Hence, it is emphasized that an early diagnosis and prompt therapy of animal is highly imperative to prevent the further transmission of infection to humans or other susceptible animals. As all zoophilic dermatophytes are communicable to humans, it is advised that the persons who are dealing with diseased animals must take necessary precautions to avoid the infection (Dave *et al.*, 2014).

Sexual compatibility studies in dermatophytes are important to determine the prevalence of mating types from epidemiological point of view (Pal, 2007b). However, no facility was available in the department to undertake *in vitro* sexual reproduction in dermatophytes. Pal (1986) when working at the Institute of Tropical Medicine, Antwerp, Belgium modified his sunflower seed medium to study the genetic crossing experiment in *Cryptococcus neoformans*. Later, the same medium was tested to study the sexual compatibility of dermatophytes in order to know the prevalence of mating type (Pal *et al.*, 1991). It is, therefore, recommended that modified sunflower seed medium should be employed in mycology laboratory to study the mating types in dermatophytes.

CONCLUSION

The clinical presentation, direct microscopy, cultural isolation, and clinical response established an unequivocal diagnosis of ringworm infection in two dromedary due to *T. verrucosum*. The disease should be differentiated from scabies dermatophilosis, contagious ecthyma, and camel pox. The etiologic significance of other dermatophytes should be studied in dermatological disorders of camel and other animals. The detailed morphological studies of dermatophytes and also other fungi can be undertaken in "Narayan" stain. Topical application of 2 % solution of tincture iodine is very effective in the treatment of ringworm in animals, and therefore, its wider use in the management of disease, particularly in poor resource countries is suggested. Modified sunflower seed medium can be successfully employed to study *in vitro* sexual compatibility in dermatophytes to know the prevalence of mating types. It is recommended that potassium hydroxide technique can be used as an important screening test in rural based veterinary hospitals with no facility for mycological cultural isolation for presumptive diagnosis of dermatophytosis, which will help the veterinarian to

institute the antifungal therapy to prevent the further spread of infection to other susceptible animals and humans.

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