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PRIMARILY HUMAN PATHOGENIC FUNGI CAUSING DERMATOPHYTOSIS IN CAMEL

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ABSTRACT

In our earlier reports on camel dermal mycoses we have described about *Candida albicans*; Alternaria alternata. In this paper fungi reported to be causing primarily human infections viz. *Epidermophyton floccosum* and *Scopulariopsis brevicaulis* are described. Both of these fungi were found to cause skin infections in camel, and infected many animals of that particular herds. This condition was particularly observed due to high rainfall, leading to high humidity in the environment along with diurnal temperature variations.

Key words: Camel, epidermophyton, scopulariopsis, skin

Rajasthan state is characterised with tropical climatic conditions and the unique species camel is the most suitable mammal for uses in extreme climatic conditions (Wilson, 1984; Yagil, 1985). The skin infections causing contagious skin necrosis, dermatitis, wounds, abscesses or similar lesions are a constant problem in camel. These infections are chronic and difficult to treat medically because of unknown etiology. Though the diseases are not always fatal but an indirect great economical loss is incurred due to reduction in the working efficiency of the animals. At many occasions the skin lesions spread rapidly over the body surface and it becomes difficult to manage these lesions. In practice antibiotic therapy does not work satisfactorily. Most of the pathogenic fungi grow best in warm and humid environments; therefore rainy season coupled with temperature of the desert is most conducive. Some of the primarily human pathogenic fungi like *Epidermophyton floccosum* and *Scopulariopsis brevicaulis* caused infection in the individual herds and infected many animals of that particular herd. These infections occurred after heavy rains in the year 2010, leading to high humidity in the environment.

Materials and Methods

Monsoon season in the year 2010 witnessed an average high rainfall compared to previous years and whole of the Rajasthan state received 114 per cent rainfall of its normal rainfall, leading to high humidity in the environment along with diurnal temperature variations and most of the sandy soils of the desert were covered with the vegetation. During this season incidence of camel diseases was high and the major one was upper respiratory tract infection. Besides this incidence of skin infections was particularly observed to be high and peculiar skin infections were investigated in two camel herds.

Herd i (Camel herd at Charanwala, Bajju, Bikaner): In this herd skin infection were observed with fast spreading peculiar lesions as if hairs were burnt with fire leaving behind ash deposit over the skin.

Herd ii (Camel herd at Khetari, Jhunjhunu): In this herd several hyperkeratotic nodules were detected on the back and belly of the animals.

These camels were observed for the type of lesions, number and age of the affected animals. Relevant manage mental practices adopted by the farmers were recorded. All the relevant samples and photography of the lesions where thought necessary were collected.

Collection of samples: In affected camels with clear skin lesions, ointments or other local applications present were first removed with an alcohol wipe. Then using a blunt scalpel lesions were firmly scraped, particularly at the advancing border. If multiple lesions were present then the most recent were chosen for scrapings. These samples were collected in sterile vials meant for sterile collection of clinical samples. Then these samples were transferred to the laboratory in thermocol box packed with brine packs.

Direct microscopic examination: It was performed by placing the scrapings on a glass slide with two or three drops of 20 per cent potassium hydroxide and placing a cover slip over it. The sample

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was warmed for five minutes over a flame and was then carefully examined microscopically for the presence of hyphae and/or arthroconidia.

Cultural examination: Samples were first mixed with Sabouraud's dextrose chloramphenicol broth and were incubated for up to 24 hours. Then these samples were inoculated onto Sabouraud's dextrose chloramphenicol agar plate and were incubated at 28°C for 3- 4 weeks. These plates were examined daily for the growth of the fungi. The resultant growth was examined for the colony morphology. Microscopic examination was carried out using either lacto phenol cotton blue or calcofluor white stains using wet mount method (Halley and Standard, 1973). Fungal species were identified (de Hoog *et al,* 2000; Sutton *et al,* 1998; Weitzman and Summerbell, 1995).

Results and Discussion

1. Lesions of the disease

Herd i: Lesions were fast spreading and peculiar as if hairs were burnt with fire leaving behind ash deposit over the skin. Lesions were observed through out the body. All ages of the camel were affected but calves were more severely affected. The general dryness of the skin coat was more pronounced in such cases. During development of the lesions necrosis follows alopecia. It caused itching, uneasiness and resulted in weakness and debility of the animals (Fig 1-2).

Herd ii: Several hyperkeratotic nodules were detected which were generalised in distribution but occurred particularly on the abdomen. Lesions were observed more under the hairy portion of the skin. Cutting the hairs revealed more clear visibility of the lesions. After about 15 days there occurred incrustation of the nodules, which gave appearance of patchy skin necrosis. These lesions measured up to 5 cm in diameter (Fig 6, 7).

2. Number and age of the affected animals

Herd No	No of animals examined	Total no of animals infected	No of animals affected as per age		
			Upto 1 yr	1-2 yr	>2-18 yr
Herd i	50	16	10	0	6
Herd ii	147	40	21	9	10

Young calves were affected more in number as well as in the severity of the lesions

3. Causative fungi

Herd i: *Epidermophyton floccosum* grew moderately rapidly and became mature within 10 days following incubation at 28°C. The colour of the colonies was brownish yellow to olive gray or khaki from the front and orange to brown with an occasional yellow border from the reverse. Surface was flat and grainy initially and became radically grooved and velvety by aging (Fig 3, 4). Microscopically septate, hyaline hyphae, thin walled macroconidia, 3- 5 celled, smooth and clavate shaped with rounded ends, single or in clusters (Fig 5). Chlamydoconidium like cells, as well as arthroconidia, are common in older cultures.

Herd ii: *Scopulariopsis brevicaulis* grew moderately rapidly and were granular to powdery. Front colour was white initially and became light brown or buff tan in time. Reverse colour is usually tan with brownish centre (Fig 8, 9). Microscopically septate hyphae, conidiophores are hyphae-like and simple or branched. Lemon-shaped, roughened conidia with truncated bases produced from the tips of annellidic conidiogenous cells. The annellides were produced singly or in penicillate heads. These were cylindrical and slightly swollen (Fig 10) as has been reported by De-Hoog *et al* (2000) and Sutton *et al* (1998).

4. Management by the camel farmers

Camel farmers adopted certain ethno veterinary practices for the management of these infections.

Herd i: Owner applied sump oil topically after cleaning the lesions on alternate days for 2 week and reported partial recovery after one month.

Herd ii: Owners applied sulphur in mustard (Brassica spp.) oil (1:10), topical application, alternate days for 2 weeks and reported complete recovery after one month.

Man is the primary host of *E. floccosum*. It has been reported from mule, dog and goat (Boro *et al,* 1980). Terreni *et al* (1985) isolated *E. floccosum* from a lesion of dermatophytosis on a dog with hyperadrenocorticism in the United States. The infection is restricted to the nonliving cornified layers of epidermis since the fungus lacks the ability to penetrate the viable tissues of the immunocompetent host (Aman *et al,* 2001; Ogawa *et al,* 1998; Weitzman and Summerbell, 1995). However, invasive infection has been reported in an immunocompromised patient with Behcet's syndrome (Seddon and Thomas, 1997). Terbinafine, itraconazole and ketoconazole are being practised for treatment of *E. floccosum* infections (Degreef and DeDoncker, 1994; Hay, 2000; Van Cutsem, 1983).

Fig 1. Epidermophyton fast spreading lesions with circular patches.

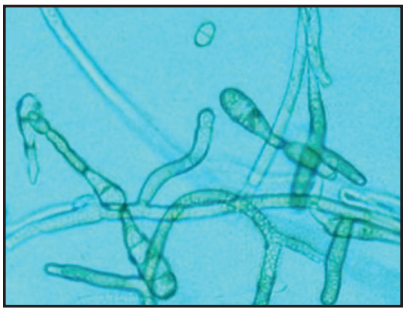

Fig 5. *E.floccosum*; hyphae, macroconidia.

Fig 8. *S. brevicaulis*; colony (10 days front).

Fig 2. Epidermophyton lesions giving just burning appearance.

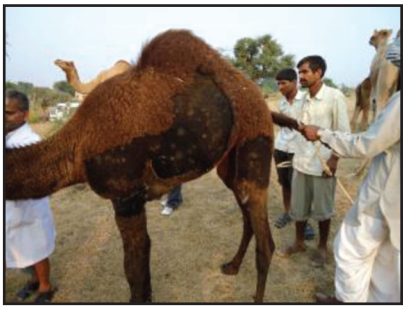

Fig 6. Scopulariopsis hyperkeratotic nodules.

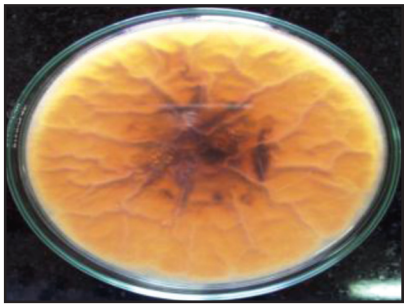

Fig 9. *S. brevicaulis*; colony (10 days reverse)

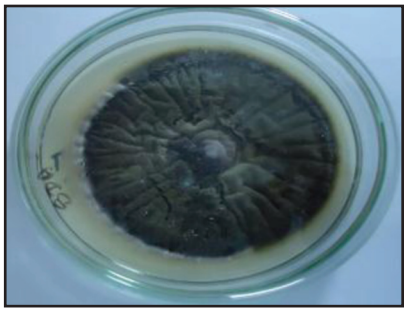

Fig 3. *E. floccosum*; colony (10 days front).

Fig 7. Scopulariopsis lesions as patchy skin necrosis

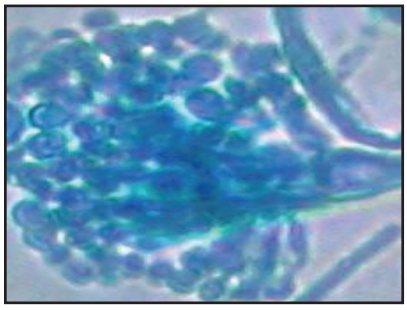

Fig 10. *S. brevicaulis*; annellides in penicillate heads

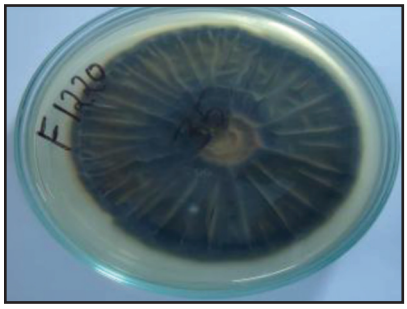

Fig 4. *E. floccosum*; colony (10 days reverse).

S. brevicaulis is basically a fungus causing human infections. Scopulariopsis has been recovered from 53.3 per cent of bovine claw samples (Abdel-Gawad, 1989) and from 1.3 per cent of hair samples (Bagy, 1986). Ogawa *et al* (2008) isolated *S. brevicaulis* from the skin of a 6-month-old Japanese black female calf with hyperkeratotic nodules spread over almost the entire body surface. They first reported the disease caused by *S. brevicaulis* in animals. The fungus has also been isolated from equine hooves (Keller *et al,* 2000), buffalo claws (Abdel-Gawad, 1989), canine hair (Bagy, 1986) and duck claws (Abdel-Gawad and Moharram, 1989).

In human, various cutaneous lesions reported include subcutaneous granulomas on the cheek (Bruynzeel and Starink, 1998) and forearm (Sellier *et al,* 2000); ulcerative granulomatous cheilitis (Creus *et al,* 1994); neutrophilic follicular inflammation on the legs (Cox and Irving, 1993) and dermal spongiosis on the sole (Ginarte *et al,* 1996). This fungus do causes onychomycosis (Tosti *et al,* 1996; Romano *et al,* 2005) and keratitis (Malecha, 2004). Dhar and Carey (1993) reported the area of the skin lesions in the AIDS patient was much greater than in the other patients. In the herd animals described here, the cutaneous lesions were generalised and thus distinct from the localised ones found in immunocompetent

human patients. In the herd examined, in this particular season almost 90 per cent of the camel population suffered with respiratory problem with mucopurulent nasal discharge, anorexia etc. The etiology of this disease is still unclear but thought to be immunosuppressive disease for camels. This infection was species specific to camels. Other apparent clinical abnormalities observed in the herd under investigation were pica in 20 animals, mastitis in 14 animals and weakness in 33 animals. The major clinical findings were anorexia and emaciation, which shows camels may have undergone an immunosuppressive stage, which might have increased its susceptibility to the fungal dermatitis.

Some of the authors have suggested that *S. brevicaulis* is resistant *in vitro* to amphotericin B, flucytosine and azole compounds (Aguilar *et al,* 1999; Johnson *et al,* 1999). Because of its resistance, invasive infections due to *S. brevicaulis* are unlikely to respond to particular antifungal treatment and other therapeutic approaches should be considered (e.g., combined therapy and immunotherapy), particularly in immunosuppressed patients with disseminated mycoses (Estrella *et al,* 2003).

Although both these fungal species have been described as primarily human pathogens, it was observed that camel handlers who remain mostly with camel herds were not found to have skin lesions to be caused by such fungi. Possible reasons for this could be: (1) by constant exposure to such fungi they develop immunity against such fungi; (2) they use mustard oil as hair tonic on the scalp and face after bath and also they use this oil on the skin when so ever the skin is dry, some persons daily use mustard oil on the whole body before taking bath on daily basis. Batra (2003) evaluated mustard oil as health oil in rat model, reported glucosinolate, the pungent principle in mustard oil, to possess anti-bacterial and anti-fungal properties; (3) pearl millet (*Pennisetum glaucum*) is the main cereal crop of the camel inhibiting region, and they use this cereal grain food as main part of their diet. Joshi *et al* (1998) found Pearl millet seeds contain a cysteine protease inhibitor as an anti-fungal protein; (4) they eat raw onion (*Allium* cepa) as part of their food almost daily. *Allium cepa* possesses antibacterial and antifungal properties (Augusti, 1996; Kim, 1997).

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