An outbreak of a mixed infection of *Dermatophilus congoensis* and *Microsporum gypseum* in camels (*Camelus dromedarius*) in Saudi Arabia

C.G. Gitao (1), H. Agab (2) & A.J. Khalifalla (3)

(1) University of Nairobi, Department of Veterinary Pathology and Microbiology, P.O. Box 29053, Nairobi, Kenya
(2) P.O. Box 2373, Qasim, Buraydah, Saudi Arabia
(3) University of Khartoum, Faculty of Science, Department of Microbiology, P.O. Box 32, Khartoum, Sudan

**Summary**

Although both *Dermatophilus congoensis* and *Microsporum gypseum* infections have been reported separately in camels, mixed infection involving both agents has not been reported to date. The authors describe a mixed infection of *D. congoensis* and *M. gypseum* in camels reared on a dairy farm in Saudi Arabia. A total of 131 out of 559 camels (23.4%) were affected. Forty-eight camels less than one year of age had discrete, circumscribed, crusty, hairless lesions, found in particular on the neck and forelegs. Eighty-three camels of varying ages had extensive hair matting with crusty, hairless lesions, especially on the flanks. Camel calves and young camels demonstrated a relatively greater amount of skin lesions. *D. congoensis* and *M. gypseum* were diagnosed by direct microscopy, isolation and histopathology.

**Keywords**


**Introduction**

The Kingdom of Saudi Arabia has a surface area of 2,250,000 km², divided into three main geographical areas: the Asir-Hejaz region along the west coast; the Najd plateau sloping gently from the Asir highlands across the country to the Arabian Gulf; and the Rub' al Khali desert in the south.

Camel dermatophilosis, a skin disease characterised by hair matting and encrustation, has been reported in Kenya (5, 6, 7) and the Sudan (H. Agab, personal communication), both of which are tropical countries. This outbreak is the first to be reported from a country in the Middle East. In Africa, most camels are reared by pastoralists, for whom their milk provides sustenance, especially during the dry season when other animals fail to thrive, or die. In Saudi Arabia, however, camel rearing is one of many agricultural activities which is positively encouraged by the state as a commercial enterprise, where husbandry is of a higher quality. Therefore, it is important to examine the occurrence of camel dermatophilosis in the context of a different management system and ecoclimatic setting.

Different pathogenic dermatophytes have been reported in camels (2, 3, 4, 8, 9). The authors describe the first outbreak of camel dermatophilosis to occur concurrently with infection by a dermatophyte, *Microsporum gypseum*.

**Materials and methods**

**Epidemiology**

The Qasim region is a large farming area in Najd, 300 miles north of Riyadh, the capital of Saudi Arabia. The region is arid, with temperatures ranging from 2°C in the winter to 50°C in the summer. The annual rainfall in the region is 120 mm (1). The topography is that of a dry, rocky desert, with rain in both winter and spring. Most of the area is cultivated, with wheat, barley, dates and citrus fruit grown using underground irrigation. In one privately operated dairy farm, 559 camels...
are reared intensively in pens with no shelter, exposing them to sunlight and rain. Camels were examined once a week for disease from February to May 1997. This was performed by giving each camel a thorough physical examination in a crush. Skin scabs were then examined from four infected adult camels, four infected young camels, three infected camel calves (less than one year of age) with discrete lesions, and three infected camel calves (one year of age) with generalised lesions.

**Bacterial and fungal isolation**

The fourteen skin scabs were emulsified with Ringer's solution and then inoculated on sheep blood agar (SBA) (6% sheep blood agar, nutrient agar and 0.4% sodium chloride), and Sabouraud's dextrose agar (SDA) plates. After incubation for 48 h, *Dermatophilus congolensis* colonies were obtained on the SBA plates, emulsified with Ringer's solution and inoculated into sugar fermentation tubes, gelatin and litmus milk. The catalase test was performed by combining obtained on the SBA plates, emulsified with Ringer's solution and then inoculated on sheep blood agar (SBA) (6% sheep blood agar, nutrient agar and 0.4% sodium chloride), and Sabouraud's dextrose agar (SDA) plates. After incubation for 48 h, *Dermatophilus congolensis* colonies were obtained on the SBA plates, emulsified with Ringer's solution and inoculated into sugar fermentation tubes, gelatin and litmus milk. The catalase test was performed by combining peroxide on a glass slide and observing the evolution of gas. Plate disc antibiotic sensitivity was tested by inoculating the emulsified organism from the nutrient broth onto an SBA plate with a wire loop to obtain confluent growth. Sensitivity discs 6 mm in diameter were placed on each plate, and the zones of growth inhibition measured qualitatively after incubation at 37°C for 72 h. Another set of fourteen skin scabs from the same camels were mixed in 10% potassium hydroxide (KOH) solution for direct microscopic examination. A separate set of fourteen skin scrapings from the same camels were inoculated into SDA slants and incubated at room temperature (23°C-27°C) for fourteen days. Needle-mounts from the colonies were stained with lactophenol cotton blue and examined by oil-immersion microscopy.

**Histopathology**

The biopsy specimens were fixed in 10% formal saline, embedded in wax, cut at 5 μ and stained with haematoxylin and eosin (H&E) and periodic acid-Schiff (PAS) in order to conduct histopathological studies.

**Results**

An infection was found in 131 camels out of 559 (23.4%) (Table I). There were two types of infection, as shown by the two different types of lesions. The first type, found in forty-eight camels less than one year old, was characterised by discrete, well-circumscribed, crusty, hairless lesions 1-2 cm in diameter. The lesions were located primarily on the neck and forelegs, but there were also a few on the shoulders. In the ‘Majheem’ breed, the lesions were especially prominent as their white colour contrasted with the black colour of the skin of the camel (Fig. 1). On removal of the crusts, the skin was almost normal, with no erythema, inflammation or bleeding. The second type of infection was found in 83 camels of varying ages. The infections were diffuse, covering the flanks, legs and the ventral aspects. There was extensive matting of the hair, when the hair was removed, raw, hyperaemic areas became apparent. In many cases, large, brown crusts of variable sizes were present (Fig. 2). Young and growing calves showed a proportionally higher incidence of the disease, with lesions covering 50% or more of the skin.

<table>
<thead>
<tr>
<th>Table I</th>
<th>The lesions in different age groups of camels</th>
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<tbody>
<tr>
<td>Camel groups</td>
<td>Adults (&gt; 4 years)</td>
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<tr>
<td>-----------</td>
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</tr>
<tr>
<td>Number affected</td>
<td>259</td>
</tr>
<tr>
<td>Diffuse lesions</td>
<td>14</td>
</tr>
<tr>
<td>Discrete lesions</td>
<td>14</td>
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<tr>
<td>Percentage affected</td>
<td>5.4</td>
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</table>

One of the observations made during examination of the camels was that no tick had been found on any camel for the previous five months.

Direct 10% KOH examination of the skin scrapings revealed fungal mycelia and arthrospores in the macerated debris and infected hairs, characterised by large-spore (6 to 8 μ) ectothrix arrangement of arthrospores. Mycelia were seen within the hair shaft running parallel to the length of the hair (Fig. 3). A direct Gram's stain was carried out on smears of the scrapings, revealing dense forms of Gram-positive branching filaments with a diameter of approximately 1 μm.

**Isolation processes**

After incubation for 48 h, all the inoculated SBA plates revealed colonies typical of *D. congolensis*. The colonies were white, 1-2 mm in diameter, rough, convex, with a crater-like shape and a 1 mm zone of complete haemolysis. The colonies were firmly attached to the agar. Microscopy revealed a predominance of filamentous forms, but after several passages, coccoid forms and filaments featuring both longitudinal and transverse divisions were present (Fig. 4). The biochemical behaviour was similar to that described by Gitao et al. in 1990 (7). The *D. congolensis* isolate was sensitive to streptomycin (10 μg), ampicillin (25 μg), kanamycin (30 μg), gentamicin (10 μg), sulphamethoxazole (200 μg), chloramphenicol (30 μg). The *D. congolensis* isolate was resistant to co-trimoxazole (25 μg) and tetracycline (25 μg).

The culture on SDA revealed three saprophytes. One was brown, folded and leathery, and microscopy revealed no distinct morphological identification pattern. The second was velvety, green and folded, and was white on the reverse side. Microscopy revealed a large number of sporangiospores. The
third had heavy mycelia growth, with a powdery bluish-green surface and typical 'penicillus' brush on microscopy, and was characterised as a *Penicillium* spp. A dermatophyte was isolated from fourteen samples. The cultures were fast-growing, and had filled slants in four days. The colony was characterised by a dense surface, with a thin white border. The centre was white and fluffy. The reverse was pale to yellow, with a tint of brown in the centre. On ageing, the colony became white and cottony in the centre. Under the microscope, the lactophenol cotton blue mount revealed...
extensive, large, ellipsoidal thin-walled macroconidia with four to five cells (Fig. 5). Histopathology revealed congestion, hyperkeratosis with abundant keratinaceous debris. The epidermis was thickened, and the dermis diffusely infiltrated with polymorphonuclear leucocytes. The characteristics of the dermatophyte, as shown on direct smears, SDA and pathological lesions, confirmed the presence of *M. gypseum*. The keratinised layers were invaded by abundant *D. congolensis* filaments and coccoid forms featuring transverse and longitudinal divisions. Sections stained with PAS revealed abundant mycotic filaments in the epidermis which were mixed with *D. congolensis* (Fig. 6). These clinical, laboratory and pathological findings were used to substantiate the diagnosis of a mixed infection of *D. congolensis* and *M. gypseum*.

**Discussion**

*Dermatophilus congolensis* infection in camels has been reported in Kenya (5, 6, 7) and Sudan (H. Agab, personal communication), both of which are tropical countries. No
occurrence of the condition has been reported in the Middle East. *Microsporum gypseum* infection in camels has been reported previously (2, 9). Other dermatophytes that have been reported in camels include *Trichophyton verrucosum* (4), *Trichophyton schoenleinii* (3) and *Trichophyton* spp. (8). However, no mixed infection involving both *D. congolensis* and a dermatophyte, in this case *M. gypseum*, has been reported to date in camels. In this study, 23.4% of a herd of camels in a dairy farm had a mixed infection of *D. congolensis* and *M. gypseum*. Some animals had discrete, circumscribed lesions, which is characteristic of *M. gypseum* infections (2), while others had confluent crusty lesions with hair matting, which is characteristic of *D. congolensis* infection (5, 7). However, both microorganisms were found in all samples by direct microscopy, isolation and histopathology. This joint infection is probably more common in camels than is documented, but this lack of information may be related to the fact that most camels, especially in Africa, are reared in...
highly inaccessible areas, and receive little veterinary attention.

Young and growing camel calves were the most severely affected. This is consistent with the findings from both Sudan and Kenya (5, 7; H. Agab, personal communication), where *D. congolensis* was the only causative agent.

In tropical countries in Africa, camels are reared in open savannah grasslands or arid desert areas with sparse *Acacia* trees. During the night, they are kept in ‘bomas’, or enclosures made of bushes. In Saudi Arabia, the camels are kept in well-constructed open pens, but the combination of cold winter temperatures and moisture caused by the rain would contribute greatly to the spreading of *D. congolensis*, especially on the flanks and ventral aspects of the camels.

One observation made during examination was the absence of ticks on the camels. This is in contrast to findings in Kenya and Sudan, where the camels had very high tick loads (6; H. Agab, personal communication). In these countries, however, *Amblyomma variegatum* was not among the ticks which infested the camels. It is suspected that, in cattle and other animals, *A. variegatum* is one of the agents involved in the transmission of *D. congolensis* (10). The absence of ticks on the camels in this study is consistent with previous conclusions (5, 6) which suggest that other agents are involved in the pathogenesis of *D. congolensis* in camels.

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**Un foyer d’infection mixte par *Dermatophilus congolensis* et *Microsporum gypseum* chez des dromadaires (*Camelus dromedarius*) en Arabie saoudite**

C.G. Gitao, H. Agab & A.J. Khalifalla

**Résumé**

Dans le passé, les infections par *Dermatophilus congolensis* et par *Microsporum gypseum* étaient signalées chez les dromadaires, mais aucun cas d’infection mixte n’avait été encore constaté. Les auteurs décrivent une infection mixte par *D. congolensis* et *M. gypseum* survenue chez des dromadaires d’un élevage laitier d’Arabie saoudite. En tout, 131 dromadaires sur 559 (23,4%) étaient atteints. Quarante-huit dromadaires de moins d’un an présentaient des lésions discrètes et circonscrites caractérisées par une dépilation et la formation de croûtes, notamment sur le cou et les membres antérieurs. Quarante-trois dromadaires d’âges divers avaient de grandes plaques de poil agglutiné, accompagnées de dépilation et de la formation de croûtes, en particulier sur les flancs. On a observé, chez les jeunes dromadaires, un nombre relativement plus important de lésions de la peau. La présence de *D. congolensis* et de *M. gypseum* a été révélée par microscopie directe, isolement et examen histopathologique.

**Mots-clés**

Brote de infección mixta por *Dermatophilus congolensis* y *Microsporum gypseum* en dromedarios (*Camelus dromedarius*) de Arabia Saudí

C.G. Gitao, H. Agab & A.J. Khalifalla

**Resumen**

Aunque anteriormente se habían comunicado casos de dromedarios infectados tanto por *Dermatophilus congolensis* como por *Microsporum gypseum*, nunca hasta ahora se había informado de una infección mixta en la que estuvieran implicados ambos agentes. Los autores describen una infección mixta por *D. congolensis* y *M. gypseum* en dromedarios de una granja lechera de Arabia Saudí. De un total de 559 dromedarios, resultaron afectados 131 (un 23,4%). Cuarenta y ocho dromedarios de menos de un año de edad presentaban lesiones puntuales y localizadas, con costras y alopecia, situadas sobre todo en la zona del cuello y de las patas delanteras. Ochenta y tres dromedarios de edad variable presentaban un apelmazamiento generalizado del pelaje con formación de lesiones escamosas y alopecias, especialmente en los flancos. Las crías y animales jóvenes exhibían una cantidad relativamente mayor de lesiones cutáneas. El diagnóstico de *D. congolensis* y *M. gypseum* se realizó por técnicas de microscopia directa, aislamiento e histopatología.

**Palabras clave**


**References**


