

A review of Camel Dermatophilosis

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Abstract

Dermatophilosis is a skin disease caused by a bacterium called *Dermatophilus congolensis*. The disease affects many species of domestic and wild animals and occasionally, humans. It is most prevalent in the tropics. The lesions are characterized by an exudative dermatitis with scab formation. The disease causes severe skin matting resulting in hide depreciation, overall decrease in animal productivity and, in severe cases, mortality in susceptible weak animals may be as high as 50% in the absence of treatment.

Although only recently described (Gitao *et al.*, 1990), camel dermatophilosis is recognised as widespread in several camel rearing countries in the tropics. Natural *D. congolensis* infection of camels was first reported in Kenya in semi-arid conditions. Camel dermatophilosis was found to be one of the most serious skin problems faced by camel herders in Butana area of Sudan and in several camel rearing areas in Saudi Arabia where *D. congolensis* and *Microsporium gypseum* infections have both been recorded as mixed infections in a camel dairy farm. Camel calves were more likely to be infected than adults. Lesions began as hair matting and later developed into hard crusts. Fatality ranged from 10 to 30%.

The most effective control measure of this disease was thought to be through control of tick infestations. Several treatment regimes were tried in other animal species but with varying degrees of success. The only

control method of this disease practiced in dromedary camels was the regular washing with 1% potassium aluminium sulphate solution.

The review details some aspects of the clinical picture, epidemiology, chemotherapy and control measures of the disease in camels.

Introduction

Dermatophilosis, a bacterial skin disease caused by the bacterium actinomycete, *Dermatophilus congolensis*, is the most important infectious skin disease of ruminants in the Caribbean Islands (BurrIDGE *et al.*, 1984; Uilenberg *et al.*, 1984; Uilenberg, 1991) and in many West, Central and East African countries (Woldemeskel, 2000; Woldemeskel and Taye, 2002). The disease was first described in Congo by Van Saceghem in 1915. It is considered as one of the main constraints to increased cattle productivity in these African countries and Caribbean Islands (Morrow *et al.*, 1993). The disease affects wild and domestic animal species as well as man. In animals, the disease causes severe skin matting resulting in hide depreciation, overall decrease in animal productivity and, in severe cases; mortality in susceptible animals may be as high as 50% in the absence of treatment (Thoen *et al.*, 1980; Naves *et al.*, 1993). The disease results in gradual loss of condition, impaired reproductive performance, decrease in milk production and marked increase in the somatic cell counts in milk (Yeruham *et al.*, 2000; Chatikobo *et al.*, 2004). Therefore, the disease has great economical importance, especially in the tropics, whereas in temperate countries it affects mainly sheep and horses causing minor economical losses (Martinez, 1993). Severe outbreaks of the disease have long been closely associated with the presence of the tropical bont tick *Amblyomma variegatum* (Barre *et al.*, 1988; Matheron *et al.*, 1989). In man, however, the disease causes nail infection and its clinical spectrum ranges from an

asymptomatic infection to a pustular eruption of the skin (Towersey *et al.*, 1993).

Epidemiology of the disease

There was a lot of debate regarding the role of ticks, particularly *A. Variegatum*, in the epidemiology of animal dermatophilosis. In the Caribbean, seroepidemiological studies using ELISA for screening of sera for the presence of antibodies to *Dermatophilus congolensis* were conducted to clarify the epidemiology of this disease in that region with special attention to the role of *A. variegatum* tick. It was found that seropositive cattle were present in islands not infested by *A. variegatum* and even clinical dermatophilosis was never or rarely seen (Martinez *et al.*, 1993). It was also found that there was no difference in prevalence of seropositive animals between tick-infested and non-infested areas in the islands studied. These findings confirm previous experimental data showing that *A. variegatum* was not necessary for the transmission of *Dermatophilus congolensis*. However, the high concentrations of prostaglandin E2 (between 151 and 377 ng/ml) and prostacyclin (between 124 and 134 ng/ml) found in the saliva of female *A. variegatum* strongly suggested that the tick could favour the development of the lesions through an immunomodulating activity of its saliva (Martinez *et al.*, 1993).

Dermatophilosis was first described in dromedary camels in the Ol-Maisor farm in Laikipia, Kenya (Gitao *et al.*, 1990). The disease was found to be more prevalent in the wet season (21.2%) compared to its prevalence in the dry season (14.5%) and the calves were found to be more susceptible (23.1%) compared to the adults (19%). Clinically the disease in affected camels appeared as hair matting especially on the rump, neck, flanks and lower abdomen with no lesions on the legs. When matted hair is removed, lesions showed hyperaemia with pus exudation.

Lesions may also show hairless brownish crusts with irregular sizes. The disease in camels of the Sudan was discovered in two herds of which 50% to 70% of the animals below two years of age were affected whereas in other 13 herds the prevalence of the disease was lower. Generally, among camels the disease affected mostly growing calves above one year old (34%) compared to adults (8.9%) and the lesions were more severe involving most parts of the body than in the adults. However, very young suckling calves (less than 6 months old) were not affected. In the adults lesions were mostly observed on the hind limbs and abdomen with a morbidity rate of 12.5%. Case fatality rate among infected dromedary calves in the Butana region of Sudan was found to be ranging between 10% to 30% (Gitao *et al.*, 1998a) whereas no mortality was noticed among affected adult camels. This skin disease ranked second, after diarrhea, as the most common disease among growing calves in Butana region of eastern Sudan (Agab, 1993). The disease is more widely spread in camels than originally thought. Again, there is a strong debate about the role of ticks, particularly the bont tick *Amblyomma variegatum*, on the epidemiology of this disease in camels since this tick species was not found in camels among which several other tick species were recovered (Gitao, 1993). In Saudi Arabia, however, a mixed infection of *Dermatophilus congolensis* and *Microsporium gypseum* was described in camels for the first time. In a dromedary herd population of 559 animals, 131 (23.4%) were found to be affected with discrete circumscribed crusty hairless lesions. The disease was also more prevalent among young and growing calves than older ages. *D. congolensis* and *M. gypseum* were diagnosed by direct microscopy, isolation and histopathology (Gitao *et al.*, 1998b). It worths mentioning that during this outbreak in Saudi Arabia, affected camels were not infested with ticks. This observation contrasts the situation in Sudan and Kenya where the affected camel

herds had very high tick loads. This finding is consistent with other conclusions which suggested that agents, other than tick infestation, are involved in the pathogenesis of *D. congolensis* in camels as well as in bovines (Gitao, 1992; Gitao, 1993). Camel pastoralists in Butana region of Sudan regularly complained about this disease problem and enquire about the available preventive and curative measures against the disease.

Treatment and Control

A study of the effect of tick control on the prevalence of dermatophilosis in indigenous cattle was conducted in Ghana (Morrow *et al.*, 1993). It was proved that tick control using the synthetic pyrethroid acaricide and insecticide deltamethrin as a pour-on containing 1% deltamethrin in an oil base ("Spot On"; Pitman Moore Ltd, U.K.) was effective in tick control and, consequently, dermatophilosis prevalence in the studied herd. Moreover, the use of the amidine acaricide, amitraz ("Triatix"; Pitman Moore Ltd, U.K.), was also found effective in tick and dermatophilosis control in Ghana (Morrow *et al.*, 1993). However, it was concluded that the timing of strategic tick and dermatophilosis control was critical to its success.

Currently there are no prospects for a vaccine, and acaricide or antibiotic control is hampered by the development of chemo-resistance (Maillard *et al.*, 1993). Vaccination trials using various methods and routes such as inoculation by several routes of whole bacterial cultures, inactivated or not, and mixed or not with an adjuvant, have all failed. Rearing and breeding resistant breeds of animals is among the best methods for controlling dermatophilosis in animals. However, most of the resistant indigenous cattle breeds are not sufficiently productive to satisfy the desired production objectives in the semi arid rural countries particularly in Africa. Attempts to improve the productivity of local livestock breeds through cross breeding with highly productive exotic

breeds ended with catastrophic results due to dermatophilosis. Strict control of the bont tick, *Amblyomma variegatum*, through dipping of cows in acaricides or dusting of sheep with potassium aluminium sulphate were met with relatively satisfying results.

A trial was conducted to evaluate the efficacy of using 10% formalin administered intravenously at the dosage of 20 ml per 100 kg body weight with and without a combination with long-acting oxytetracycline for the treatment of naturally occurring bovine dermatophilosis in a group of Frisian crossbred cattle in Ghana. The best result was found with using formalin combined with the long-acting oxytetracycline when the affected animals fully recovered after 1.5 treatments compared to the use of long-acting oxytetracycline alone which showed relapse after four months (Aning and Koney, 1996). In Germany when an adult female Bornean orangutan was affected with dermatophilosis, symptoms resolved only transiently after corticosteroid treatment. However, after antibiotic treatment and withdrawal of all corticosteroids, complete recovery of affected animals and return to normal activity patterns was noticed (Brack *et al.*, 1997). The efficacy of Lamstreptocide A and B was studied on nine natural cases of bovine and caprine dermatophilosis employing standard histopathologic and bacteriological methods. The lesions of five of the treated cases dried up and there was marked peeling-off of scabs of a severely affected case exposing erythematous underlying tissue at 3 weeks post application of the product and three mild cases have recovered. An in-vitro sensitivity test of the product revealed a slowing down of growth of *Dermatophilus congolensis* at concentrations in excess of 1% by agar-streak method. There was no inhibition of growth of the bacterium by an agar-impregnated sensitivity method (Isitor *et al.*, 1993). In Australia, a lytic phage with species-specific activity was isolated from wool samples of sheep infected with the

actinomycete *Dermatophilus congolensis*. This isolated phage reduced the cell numbers of *D. congolensis* on infected wool samples in vitro. Thus, the use of this phage as a bio-control agent of dermatophilosis was suggested (Patten *et al.*, 1995). In an outbreak of bovine dermatophilosis in Guadeloupe, when 100% morbidity rate and 45% mortality rate took place, drastic treatments were applied using antibiotics and local disinfection associated with the removal from pastures into covered stables allowed the recovery from the disease (Naves *et al.*, 1993). Very recently, two new triterpenic acids, namely oleanolic and ursolic acids, were isolated for the first time from the alcoholic extract of *Mitracarpus scaber* possessing antimicrobial effects on *Dermatophilus congolensis*. These two triterpenic acids were also active on dermatophilosis in African animals. These acids were quantified in *M. scaber* using a new simple and rapid high performance liquid chromatography method compatible with *M. scaber* detection. There is a great hope that this new development will contribute significantly in the chemotherapy of animal dermatophilosis (Gbaguidi *et al.*, 2005).

Very recently, topical application of povidone-iodine and parental injection of long-acting oxytetracycline revealed 100% and 66.7% cure rates (respectively) in equines (Awad *et al.*, 2008)..

The only control method of this disease practiced in camels (*Camelus dromedarius*) was the regular washing with 1% potassium aluminium sulphate solution (Gitao, 1992). However, this method was not efficient when applied on camels in Saudi Arabia (Agab, unpublished data). In the Llama, on the other hand, it is recommended to use topical antibiotics only or to use disinfectants and/or systemic penicillin or trimethoprim-sulfadiazine for the treatment of dermatophilosis (Rosyehuk, 1989).

Recently, the use of phytotherapy was tried for the treatment of animal dermatophilosis by applying ointments prepared with ethanolic

extracts of leaves of *Senna alata*, *Lantana camara* and *Mitracarpus scaber* as topical treatments on dermatophilosis lesions. It was observed that the lesions healed completely in all the affected animals without recurrence unlike the results observed by using oxytetracycline, terramycin long-acting or procaine-penicillin antibiotics commonly used parenterally for the treatment of dermatophilosis in many African countries (Ali-Emmanuel *et al.*, 2003). These phytotherapies, when applied once a day for 8 – 15 days, provoked the falling off of the crusts after 3 – 4 days of treatments and hair growth was noticed on the treated areas with complete healing without scarring within 3 – 4 weeks after the end of the treatment.

Animal breeders have observed that dermatophilosis susceptibility seems to be determined genetically. Therefore, recently new control methods based on the identification of molecular genetic markers of resistance or susceptibility to dermatophilosis in cattle were developed. A functional candidate gene approach was used to analyze the DNA polymorphisms of targeted genes encoding molecules implicated in known mechanisms of both non-specific and specific immune responses existing in the pathogen/host interface mechanisms. A haplotype marker of susceptibility was found and validated and used for selection and elimination of susceptible animals. This technique resulted in reducing the prevalence rate of dermatophilosis from 0.76% to 0.02% over five years. However, a cross-breeding plan was suggested to study the genetic transmission of the genotypic and phenotypic characters of susceptibility to dermatophilosis and those individuals at highest risk of contracting the disease will be eliminated (Maillard *et al.*, 2002; Maillard *et al.*, 2003). The properties of this system are now under study, including the heterozygote advantage and the frequency dependence theories and their

involvement in the biological mechanisms at the host/pathogen interface (Maillard *et al*, 2003).

Research is still in progress regarding the understanding of the immunological mechanisms involved in the development and the resolution of dermatophilosis at the skin level in order to develop efficient vaccines. Efforts to identify markers correlating with resistance or susceptibility to the disease through analysis of polymorphic systems at the DNA level were on progress. It is highly recommended that all research groups working on dermatophilosis should be better identified with their research priorities and better collaboration with other research groups working on the same field is highly needed to achieve a better and fast advancement of research on this disease.

Recommendations

Despite the high significance of camel dermatophilosis, no direction of collaborative research efforts on this serious disease did exist in the affected countries. Therefore, it is highly justified and thus suggested to call for collaborative efforts and securing enough funds to establish a joined research programme on this disease. The control measures and chemotherapy of the disease in camels need special effort as the disease is widely spreading among camel populations in several camel keeping countries, particularly Sudan and Saudi Arabia. More investigations on the immunology and genetically determined susceptibility or resistance to diseases transmitted or associated with ticks are needed as this could be a promising and sustainable way to control these diseases.

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