

Epizootiology of camel contagious ecthyma in Eastern Sudan

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Key words

Dromedary - Contagious ecthyma virus - Parapoxvirus - Epidemiology - Season - Sudan.

Summary

Free-ranging camels in Butana, Kassala and the Blue Nile areas of the Sudan were surveyed for the occurrence of camel contagious ecthyma (CCE) between 1992 and 1994. Thirty-eight herds were found to be affected with the disease. Clinically the pox-lesions first appeared on the lips of affected animals as small papules and later developed into scabs and fissured crusts. All CCE cases occurred in young camels up to 3 years old and 97.8% of them were in camel calves less than one year old. The mean morbidity and mortality rates in calves less than one year were 60.2 and 8.8%, respectively, while the mean fatality case rate was 13%. The disease had a marked seasonality associated with rainy season and camel skin abrasion caused by eating thorny *Acacia* trees.

■ INTRODUCTION

The parapox virus, responsible for camel contagious ecthyma (CCE), has only recently been identified (1). Formerly it was thought to be a form of camel pox (CP) since clinical symptoms of both diseases were similar (3).

CCE has been reported in Mongolia (4), Kenya (12), Kazakhstan and Turkmenistan (3) and Somalia (10). In the Sudan the disease has been recently reported and is believed to have existed for years under the names *Abu Shalambo* in the Western region (2) and *Al kolate* in the Eastern region (8).

Search of the literature reveals very few information on the epizootiology of CCE. The present work has been undertaken to follow-up CCE outbreaks in order to gain more information on some epizootiological features of this poorly studied camel disease.

■ MATERIALS AND METHODS

Study area

It consists of the Butana plains which lie between the main Nile, the Blue Nile and the Atbara River (Eastern part of Sudan). Areas South and South-West of Kassala as well as East of the Atbara River were also included in the survey (figure 1). Camel herds originating from the Blue Nile area were investigated as well as Central Butana during the rainy seasons. Trees commonly found in the study area consisted of *Acacia mellifera*, *A. nubica* and *A. nilotica* (1). In addition, the Blue Nile has the following species: *A. laeta*, *A. albida* and *A. polyacantha* (6). *Acacia* tree distribution in the Sudan is shown in figure 2.

Study animals

The investigated camel herds belonged to many tribes including Shukriya, Rashaida, Lahawiyin, Bawadra, Musallamiya, Ruffaa, Kawahla and Arakiyin. The camels were of the Arabi and Diaili (pack camels), Annafi and Bishari (riding camels) breeds. Herds were kept under different management and husbandry systems, namely nomadism, semi-nomadism or agropastoralism.

Generally, the Rashaida nomads spend the rainy season (July-October) around Kassala city and in Central Butana. In the dry

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Figure 1: map of the Sudan showing the area of study.

season (November-June), some of them move southward up to Doka area, 350 km South of Kassala, few migrate northward up to Gash Delta and others cross over to the Red Sea coast around Sawakin and Toker (400 km North East of Kassala) to take advantage of range developing as a result of the winter rains (1). The Shukriya, Lahawiyin, Bawadra and Mussalamiya stay in Butana in the rainy season and move during the dry season towards the Atbara River basin. A significant proportion of these tribes as well as some of Rashaida coordinate their movements to coincide with the harvest season (January-March) thus using the crop residues in the rain-fed agricultural schemes of Gedaref area (1). Ruffaa, Kawahla and Arakiyin tribes of the Blue Nile area spend the dry season at rain-fed agricultural schemes in the area and move to the North towards Butana plains in the rainy season to use free range pasture.

The camel population in the study area has been estimated at 750,000, which represents 20% of all Sudan camels (13).

Fifteen camel herds were visited monthly between March 1992 and June 1993 in connection with the French-Sudanese Camel Research Project. The aim of this project was to study the husbandry and production parameters of camels in Butana area (1). During each visit to the study area additional 15 to 20 herds, which were not covered by the above mentioned project, were also investigated. Between July 1993 and December 1994 the study area was visited eight times in response to reports of pox or pox-like disease outbreaks. During the whole period of the study approximately 20,740 camels in 305 herds were surveyed.

Epizootiological investigation

During each field visit the investigated herds were located and data on CCE occurrence were collected. Sick animals were carefully examined for clinical symptoms, site and type of lesions and general animal health. Additional data concerning the age and

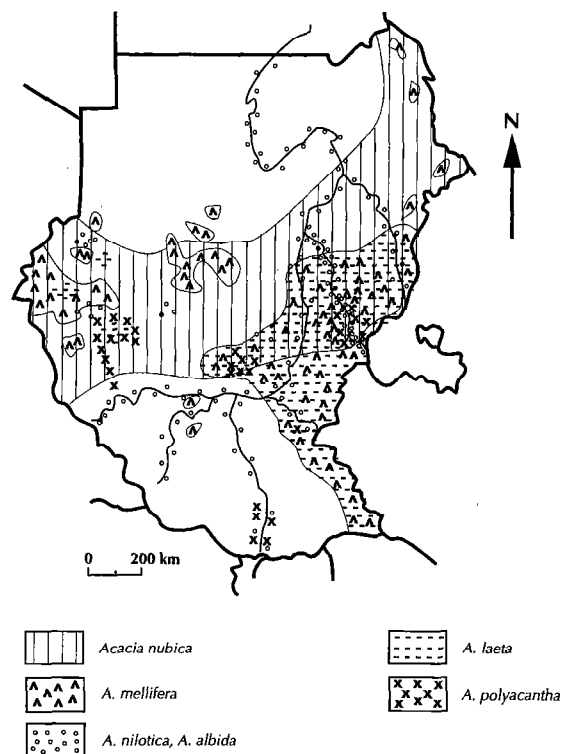


Figure 2: map of the Sudan showing the distribution of some *Acacia* spp. Source: modified from Elamin, Forest Research Institute, Bull. No. 2, 1976.

sex of the affected animals were collected. Herders' accounts of the disease history and progress of symptoms were also obtained. Skin biopsies or scabs were collected from affected animals for laboratory confirmation of preliminary tentative diagnosis.

Laboratory investigation

Ten percent suspensions were prepared from skin biopsies or scabs in phosphate buffered saline (PBS). After light centrifugation one drop of each sample was placed onto a separate carbon-coated grid. After staining with 2% phosphotungstic acid the grids were dried and examined by electron microscopy.

■ RESULTS

CCE clinical features

Initially small nodules appeared on the lips of affected animals followed in most cases with swelling of the face and sometimes the neck (figure 3). Affected animals were ataxic and off-food. Papules and vesicles appeared later and within a few days developed into thick scabs and fissured crusts (figure 4). Lesions occurred sometimes on the face, eyes and nares and in severe cases in the gingiva, dental pad and tongue. Death was probably due to starvation caused by the inability of affected animals to graze or suckle their dams. Healing occurred within 20-30 days in most cases, but sometimes the course of the disease extended up to three months.

Disease incidence

A number of 305 camel herds were surveyed for CCE occurrence. This number represented approximately 3% of the whole camel herds in the study area. Thirty-eight herds were found to be

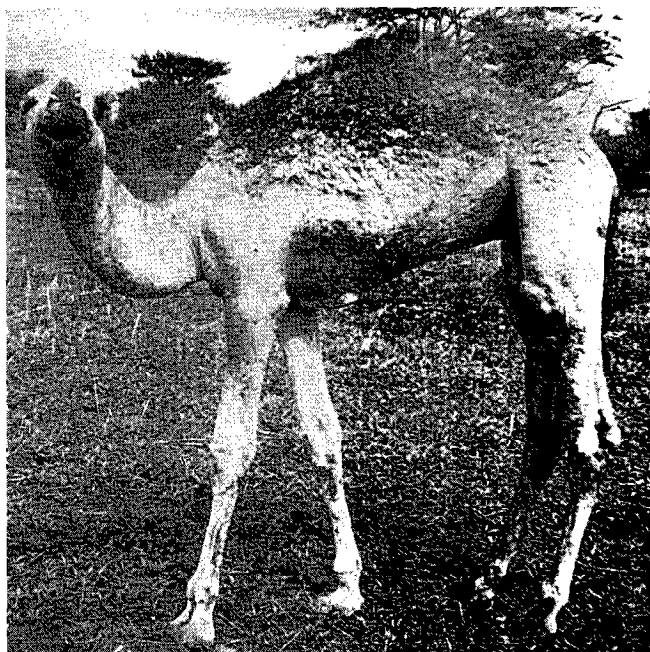


Figure 3: camel contagious ecthyma: acutely affected young camel showing swelling of the head and upper part of the neck.

affected with the disease (herd incidence rate in the sample: 12.5%). The disease was recorded in 35 of these herds (92.1%) during the rainy season (July-October) and only 3 affected herds (7.9%) were recorded in the winter season (November-March), while no disease outbreak was seen in the summer season (April-June).

Table I shows the morbidity and mortality rates and the fatality case rate of camels affected with CCE in Central Butana and Kassala, Southern Butana and the River Atbara, and the Blue Nile areas. The mean morbidity rate in camel calves less than one year old in the three geographical areas was 60.2% and the mean mortality rate was 8.8%, while the mean fatality case rate was 13%.

Age and sex distribution

The age distribution of 280 CCE cases with 34 deaths is shown in table II. All cases occurred in young animals up to 3 years old. Most of the affected animals (70.7%) were in the age group 7-12 months and 27.2% of cases occurred in animals aged 0-6 months. Four animals (1.4%) aged 1-2 years and 2 animals (0.7%) aged 2-3 years accounted for 2% only of the affected animals. The fatality case rate was higher in the age group 0-6 months (21%) than in that 7-12 months (9%).

Sex distribution of CCE 274 cases revealed a male/female ratio of 1/1.2.

■ DISCUSSION

The CCE outbreaks reported in the present study occurred in several camel herds belonging to different tribes and involving different breeds of camels. The observed clinical symptoms of the disease compared well with those described previously (3, 5, 8, 11). The total morbidity rate was found to be 10% while the mean morbidity and mortality rates in the susceptible age group (camel calves less than one year old) were 60.2% and 8.8%, respectively.



Figure 4: camel contagious ecthyma: a close-up view of the affected camel face showing scabby lesions around the lips, nostrils and eyes. Note the lower lip is pendulous.

Although no mention was made of the morbidity and mortality rates in most previous reports on CCE, Munz *et al.* (12) reported no deaths due to the disease, Dashtseren *et al.* (4) reported a mortality of 0.1-0.6% calculated from the total number of young and adults.

Khalafalla *et al.* (8) reported a total mortality rate of 17.5% (34.4% in calves less than one year old) in a CCE outbreak in Butana area of Eastern Sudan in 1991. They attributed the relatively higher mortality rate to the added effects of starvation and lack of food in the season preceding the time of that outbreak. Dashtseren *et al.* (4) attributed deaths caused by CCE in Mongolia to fatigue and exhaustion of affected animals.

Most camels in the study area fed during the dry season on harvest remains (Sorghum stalks) of the rain-fed agricultural schemes. During the rainy season animals fed mainly on free range pasture in Butana plains. However, early in the rainy season (June-July) and due to the spoiling effect of the rains on the Sorghum stalks camels were obliged to leave these schemes and browse *Acacia* trees in the area until adequate green grasses developed in Butana plains. At that time of the year CCE outbreaks occurred. A factor responsible for this seasonality could be lip skin abrasion resulting from eating thorny *Acacia* trees at this time of the year when no other source of food was available. Buchnev *et al.* (3) were of the same opinion when they argued that the thorny plants damaged the lips allowing transmission of the parapox virus. To gain more data on the pattern of CCE outbreaks the study area was revisited during the rainy seasons of the years 1993 and 1994. The disease pattern was similar to that observed in 1992. It seems that CCE constantly appears every year during the rainy season affecting young camel calves in their first autumn season of grazing and also older animals which escaped previous exposure to the virus.

The occurrence of the disease was lower (24%) in the age group 0-6 months than in that of 7-12 months (62.8%). This may be due to the passive transfer of immunity which seems to disappear after 6 months.

In the present study CCE incidence and severity varied depending on the location. The morbidity and mortality rates were relatively high in camels from the Blue Nile area compared to those from Central and Southern Butana, Kassala or the Atbara River (table I). There is no clear explanation to these variations except

Table I

Morbidity and mortality rates in camels affected with camel contagious ecthyma in Eastern Sudan

	Central Butana & Kassala	Southern Butana & River Atbara	Blue Nile	Total
Total num. of herds investigated	145	125	35	305
Num. of herds affected	13	15	10	38
Total num. of animals examined in affected herds	951	1103	842	2896
Total num. of animals affected with CCE (morbidity rate)	73 (7.7%)	102 (9.2%)	105 (12.5%)	280 (10%)
Total num. of camel calves under 1 year old	134	177	144	455
Total num. of camel calves under 1 year old affected with CCE (morbidity rate)	70 (52.2%)	100 (56.5%)	104 (72.2%)	274 (60%)
Num. of dead camel calves under 1 year old (mortality rate)	0 (0)	17 (9.6%)	23 (16%)	40 (8.8%)
Fatality case rate	0	17%	22.1%	14.6%

Herd prevalence of CCE significant depending on the location ; χ^2 with 2 degrees of freedom; $p = 0.006$

Animal prevalence of CCE significant depending on the age (less than one year) ; χ^2 Yates corrected with two degrees of freedom ; $p < 0.0001$

Animal prevalence of CCE significant depending on the age (less than one year) and stratified on the three locations. Mantel Haenszel Summary χ^2 ; $p < 0.0001$
(Assumption: herd structure is similar in the three areas)

Table II

Age distribution of cases and deaths due to camel contagious ecthyma in Eastern Sudan

Age	Num. of cases	Num. of deaths	Case fatality rate
0-6 months	76 (27.2%)	16	21%
7-12 months	198 (70.7%)	18	9%
1-2 years	4 (1.4%)	0	0
2-3 years	2 (0.7%)	0	0
Total	280	34	12.2%

that they could be due to vegetation differences related to changes in the annual rainfall since, for example, Central Butana and Kassala areas are known to contain few *Acacia* trees compared to the Blue Nile area where *Acacia* tree forests are abundant. *Acacia* tree browsing seemed to represent the major predisposing factor to CCE infection. Another possible reason could be stress and exhaustion caused by the long distance between the Blue Nile and Butana plains crossed over in the early rainy season.

Many herders in the study area considered that CCE appears to affect every year young camel calves in their first autumn of grazing between June and September. The causative virus could probably persist in the environment in crust materials shed by affected animals. According to Buchnev *et al.* (3) the CCE virus is extremely resistant to environmental factors. Similarly the orf virus of sheep and goats can survive in dry scabs for months and even for years away from the host (7).

Seasonal movements of camels had a significant role in the spread of CCE in the study area. The authors observed that outbreaks of the disease tended to first appear at the start of the rainy season (June) in the Blue Nile and Southern Butana areas and the infection extended northward coinciding with the annual movements of camels towards Butana plains. However, bearing in mind the meteorological data on the direction of seasonal winds the possible involvement of insect transmission cannot be excluded. This is not unexpected since insects have been suspected or reported to be responsible for transmission of other members of the Poxviridae such as the lumpy skin disease virus (16), sheep pox (9), fowl pox (14), swine pox virus and myxomatosis virus (15). More detailed epizootiological studies involving historical analysis at the animal level are much needed in order to complete the picture.

From the findings of the present study it appears that the major factors associated with increased likelihood of CCE occurrence are: season of the year, camel age, camel movements and location and their association with thorny *Acacia* trees.

Special attention should be directed towards introducing measures to control this disease in the Sudan particularly in the Blue Nile area. In the absence of an effective vaccine against CCE control measures must include quarantine of infected areas, proper disposal of carcasses and all contaminated materials, management of camel movements, as well as provision of extension services to camel herders. Care should be taken to avoid skin abrasions by provision of soft food to young camels when possible.

In conclusion, this poorly studied disease which represents an endemic problem in the Sudan needs to be looked into seriously due to its high contagiousness, significant mortality rate and other economic impact on the growth rate and milk production as a result of calf mortality.

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Résumé

Khalafalla A.I., Mohamed M.E.M. Epizootiologie de l'ecthyma contagieux du dromadaire à l'Est du Soudan

Une enquête sur des dromadaires élevés en liberté dans les régions de Butana, Kassala et Blue Nile au Soudan a été effectuée entre 1992 et 1994 pour évaluer l'incidence de l'ecthyma contagieux du dromadaire (ECD). Trente-huit troupeaux étaient atteints de la maladie. D'un point de vue clinique, des lésions sont d'abord apparues sur les lèvres des animaux atteints sous forme de croûtes ou de croûtes fissurées. Tous les cas d'ECD concernaient les jeunes dromadaires jusqu'à 3 ans d'âge et, pour 97,8 p. 100 d'entre eux, ceux de moins d'un an. Les taux de morbidité et de mortalité moyens chez des jeunes de moins d'un an étaient respectivement de 60,2 et 8,8 p. 100 alors que la létalité moyenne était de 13 p. 100. Cette maladie variait selon la saison, étant associée à la saison des pluies et à la consommation d'acacias épineux causant l'abrasion de la peau.

Mots-clés : Dromadaire - Virus ecthyma contagieux - Parapoxvirus - Epidémiologie - Saison - Soudan.

Resumen

Khalafalla A.I., Mohamed M.E.M. Epidemiología del ecthyma contagioso del dromedario al Este de Sudán

Se llevó a cabo una encuesta sobre los dromedarios criados en libertad en las regiones de Butana, Kassala y el Nilo Azul, en Sudán, entre 1992 y 1994, con el fin de evaluar la incidencia del ecthyma contagioso del dromedario (ECD). Se encontraron treinta y ocho hatos afectados con la enfermedad. Desde un punto de vista clínico, las lesiones aparecieron primero sobre los labios de los animales afectados, bajo forma de costras o de costras fisuradas. Todos los casos de ECD concernieron dromedarios jóvenes, hasta la edad de 3 años, con 97,8% de ellos de menos de un año. Las tasas de morbilidad y de mortalidad medias en los jóvenes de menos de un año fueron respectivamente de 60,2 y de 8,8%, mientras que la letalidad media fue de 13%. La enfermedad varió según la estación y estuvo asociada con la estación lluviosa y la alimentación con acacias espinosas, causando lesiones de la piel.

Palabras clave: Dromedario - Virus ecthyma contagioso - Parapoxvirus - Epidemiología - Estación del año - Sudán.