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An outbreak of suspected tick paralysis in one-humped camels (*Camelus dromedarius*) in the Sudan

MUSA (M.T.), OSMAN (O.M.). Suspicion d'un foyer de paralysie due aux tiques chez le dromadaire (*Camelus dromedarius*) au Soudan. *Revue Elev. Méd. vét. Pays trop.*, 1990, 43 (4) : 505-510

Un foyer de paralysie, probablement due aux tiques, a été découvert sur des dromadaires (*Camelus dromedarius*) dans la région de Darfur, au Soudan, entre les latitudes 11-12° N et les longitudes 24-25° E. Les troupeaux se trouvaient dans des zones infestées de tiques. Dix troupeaux, totalisant 251 animaux d'âges différents, ont été concernés, avec une mortalité de 34,3 p. 100. On a noté les symptômes suivants : incoordination, démarche hésitante et décubitus, suivis soit par la mort, soit par la guérison. Des adultes de *Hyalomma* et des nymphes, et des adultes de *Rhipicephalus* ont été suspectés comme agents responsables de la maladie. Des tiques nourries expérimentalement sur cobaye ont provoqué chez ce dernier une paralysie temporaire. L'éloignement des animaux des zones infestées et le traitement contre les ectoparasites avec du lindane à la concentration de 0,23 p. 100 ont contribué à endiguer la maladie. *Mots clés* : Paralysie - Tique - Dromadaire - *Hyalomma* - *Rhipicephalus* - Soudan.

INTRODUCTION

Tick paralysis is an acute, flaccid, afebrile, ascending motor paralysis of domestic and wild animals including birds and man. It is caused by a neurotoxin generated by ticks. Different species have been found associated with the disease in many parts of the world (6). In camels the disease has been reported by PECK (9). Adult ticks, mainly females, and sometimes nymphs were found responsible for the paralysis and their removal was followed by recovery if heart and respiratory centres were unaffected (10).

In the Sudan, no data are available about this disease. However, nomads are aware of the existence of a paralytic disease in camels attributable to attacks by ticks and it is known as Abu Eggal. This paper describes an outbreak of suspected tick paralysis in camels in the Sudan.

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HISTORY

Before the drought years 1983-1984, camel nomads used to spend the rainy seasons further north in the semi-arid zone. As a result of drought pressures, the traditional movement belts shifted further south. Thus, the outbreak sites were adopted as dry season grazing areas by the camel nomads and other herders.

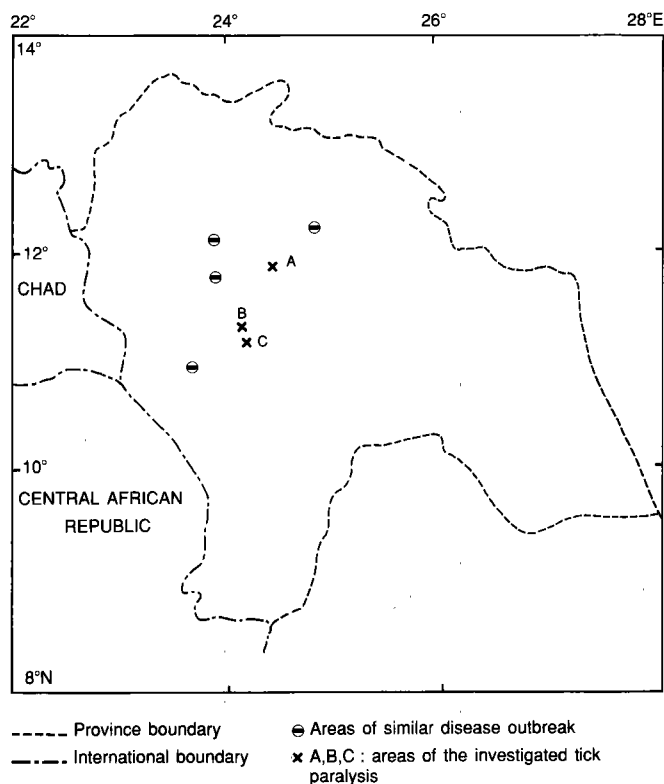
In 1987, because of the poor rains in the north, the camel nomads returned to their usual dry season residences exceptionally earlier (mid-October), shortly after late showers when the tick population had considerably increased. Massive numbers of ticks were seen on leaves and grass blades. They were attached to our clothes during the investigation. Following the entry of camels in infested areas a disease suspected to be tick paralysis occurred. In Somalia, camel owners refer to ticks for explaining such paralysis.

MATERIALS AND METHODS

Three nomadic areas designated as A, B and C were visited in October and November 1987 during an outbreak of suspected tick paralysis among camels in the Southern Darfur Province of the Sudan. Ecology, onset of the disease, clinical and *post mortem* examinations and other relevant epidemiological observations were made to study the disease and the circumstances behind the outbreak (map 1).

Laboratory investigations

Blood in EDTA as well as eight serum samples including one from a recumbent female camel that had aborted and ticks were collected from the paralysed animals in the three areas for laboratory examinations. The blood samples were examined for trypanosomiasis, blood parasites and bacterial infections. Haematocrit centrifugation method was used in the first case, and blood films stained with Giemsa's stain in the latter two. Of the sera, seven were used to inject seven white mice with each 0.5 ml of separate serum samples, for the exclusion of botulism (1). The remaining serum from the animal that had aborted was tested for brucellosis using the Rose Bengal plate and Serum agglutination tests according to MORGAN *et al* (7). Nymphs of ticks were used to feed on two



Map 1 : Areas of tick paralysis outbreaks in Southern Darfur Province, the Sudan.

guinea pigs, three per animal attached to the ear in order to reproduce the disease, while ticks collected from camels were sent in 70 % alcohol to the Central Veterinary Laboratory, Khartoum, for identification. Toxic plants and insecticide poisoning were investigated.

RESULTS

Ecology

The three camel grazing areas, A, B and C, were seasonal stream beds. They were located between latitudes 11-12° N and longitudes 24-25° E. Site A was about 100 km from B, but B and C were only 15 km apart (map 1), and were located along the course of a seasonal stream with a similar vegetation pattern. Though all ecological components were alike, site A had a different vegetation (photo 1 shows the ecology at site B). The annual rain fall of the areas for the last ten years was 300-700 mm.

During years of good rains, floods cover most of the stream beds, while in years of poor rains, water flow is restricted to the main courses of the streams. The soil is used for rain-fed cultivation of cereals or as pasture. The



Photo 1 : Ecology at site B.

type of the soil is a cracking clay providing suitable habitat for ticks. In 1986, rain fall was high (about 600 mm). As a result ecological conditions were improved. But in 1987, which witnessed the outbreak, rain was moderate (about 400 mm), and with hardly no floods.

Site A

Onset of the outbreak

After two days of early entry for pasture in site A, a herd of 40 camels became heavily infested with ticks. Subsequently seven camels, two females and five males, three months to eight years old, showed paralysis which was followed by total recumbency. The symptoms of paralysis which started on the second day after the camels had



Photo 2 : A camel in early stages of tick paralysis. Notice the ascending paralysis. The camel exhibited unsteady gait and incoordination of movements.

entered the site continued to appear daily in other members of the herd in spite of their having ceased to pasture in the site. Within five days it involved another six camels. The body temperatures of two completely recumbent animals were 96.5 and 96.6 °F, while those of two others in earlier stages of paralysis were 99 and 100.2 °F.

Symptoms started by incoordination of movements, unsteady gait (photo 2) followed by recumbency (photo 3), death or gradual recovery. Both sternal and lateral recumbencies were observed in the dying camels.

Of the seven affected camels, one died on the third and one on the fourth day of entry into the site and three died on the sixth day. Different stages of ticks, but mainly immature ones, were present on many parts of the body, above the perineum, under the tail, between hoof clefts, sternum, neck and ears.



Photo 3 : Sternal recumbency in a camel at a later stage of paralysis.

Post mortem findings

One of the camels, which died on the sixth day was examined at *post-mortem* (PM), the principal findings were in the lungs and coronary arteries of the heart indicating respiratory and heart failures. There was congestion of liver and intestinal vessels, ruminal impaction and yellowish discoloration of intestines which could be due to *post-mortem* (PM) changes or absorption of diets during prolonged recumbency.

Sites B and C

The disease similarly started in camels after herds entry in sites B and C. Nine herds entered the areas (five in B and four in C) and grazed for one or three days. In site B, 124 camels showed symptoms and 99 of them died, whereas in site C the number of ill animals was 120 and 40 died. The mortality rates for the sick camels were 79.8 and 33.3 %, respectively, in the two areas. Symptoms were similar to those reported for area A. It is noteworthy that a pregnant recumbent she-camel aborted, and one camel which already showed paralytic symptoms recovered soon after hand removal of ticks from its body. It was also observed that all other herds near A, B and C which were not taken to pasture on the sites, were unaffected.

A total of 15.2 % of the 99 animals in site B died on the third day after their turnout to pasture, 50.5 % on the fourth day and then 15.2, 6.6 and 2 % died each day, respectively, till the seventh day. As a result, the total number of dead animals from the third to the seventh day was 88 camels (88.9 %). There was a lower mortality rate during the subsequent eight days and it represented 11.2 % of the total (11 camels).

Table I summarizes mortality, morbidity and recovery rates in the three outbreak areas. The rates varied from one area to another probably due to the tick chal-

TABLE I Morbidity, death and recovery rates of camels in the three areas A, B and C.

Area	Herd serial no.	Period spent in tick areas (days)	Herd size	Number affected	Number dead	Number recovered	Morbidity rate/100	Death rate/100	Recovery rate/100
A	1	2	40	7	5	2	17.5	12.5	28.6
B	2	3	36	36	35	1	100	97.2	2.8
	3	3	69	67	53	14	97.1	76.8	20.9
	4	3	18	12	8	4	66.7	44.6	33.3
	5	1	40	4	3	1	10	7.5	25
	6	1	60	5	—	5	8.3	0	100
C	7	1	40	20	7	13	50	17.5	65
	8	1	17	11	7	4	64.7	41.2	36.4
	9	2	30	27	17	10	90	56.7	37
	10	1	70	62	9	53	88.6	12.9	85.5
Total	10		420	251	144	107	59.8	34.3	42.6

length in each infested site and length of stay of the camels on the pastures. The values for morbidity, mortality and recovery rates were 59.8, 34.3 and 42.6 %, respectively.

Laboratory results

Blood examinations were negative concerning the diseases investigated such as trypanosomiasis, other blood parasites, pasteurellosis and anthrax. Mice infected with sera survived the challenge excluding botulism. The aborted she-camel was negative for brucellosis so that the abortion could be considered as a secondary manifestation of the tick paralysis. Of the two guinea pigs exposed to nymphal tick feeding, one showed transient paralysis of the hind legs on the fifth day, but recovered when the ticks dropped from the animals. Out of the six nymph ticks used for feeding the guinea pigs, only one was engorged and detached off the paralysed experimental animal without identification.

Identification of ticks

Ticks removed from the pasture were mainly immature stages (larvae plus nymphs) of *Hyalomma* and *Rhipicephalus* spp. Adults collected from camels were *Hyalomma rufipes*, *Rhipicephalus eversti* and *Rhipicephalus turanicus*.

Control

The outbreak completely stopped when the herds left the tick infested areas and when infested camels were topically treated with Lindane (19 % W/W Gamma BHC) at the concentration of 0.23 %.

DISCUSSION

In December of the same year as our investigation, EL TAHIR (2) reported similar cases of paralysis in camels of the Kordofan region, attributable to ticks in areas ecologically and climatologically similar to those described in the case of South Darfur. In eight herds including 1 278 camels, the investigator reported that morbidity and mortality rates were 65.53 and 44.6 %, respectively.

It seems that there were some ecological and host depending factors which might be the cause of this outbreak. The change in the habitats of camels from arid

zones to wooden savannah lands subjected them to conditions and diseases which were less familiar to them. Camels were never known to host the identified ticks, especially their immature stages, apparently for ecological reasons. But due to changes in the sequence of events and the entry of camels in these areas earlier than expected, the animals were subjected to such a high tick challenge that the manifestation of the disease was enhanced.

The ecological factors that favoured the increase in tick population in such areas have been discussed by OSMAN (8). He stated that females of *Hyalomma rufipes* feed during the rainy season and lay eggs in trees or clay cracks. In good rainy years, most eggs and larvae are killed by floods.

The year of the outbreak witnessed no floods and therefore most of the hatched larvae survived in an ecologically favourable environment.

According to SOULSBY (10), tick paralysis is caused by adults or nymphal stages, but immature *Hyalomma rufipes* (a two-host tick) feed and develop on birds and rodents [HOOGSTRAAL (4), and OSMAN (8)]. Therefore, transmission of such a syndrome by *Hyalomma* adults and or *Rhipicephalus* nymphs and adults is highly probable (6). As reported by GOTHE and BEZUIDENHOUT (3), *R. eversti* was found to be responsible for paralysis in sheep, goats and man in South Africa and was also suspected to cause similar problems in Botswana and Zimbabwe. Recently, strains of ticks collected from different areas in South Africa and one from Rwanda were all definitely found to induce paralysis in sheep (3). Because of its ecological adaptability and its widespread distribution in tropical Africa (5), *R. eversti* was speculated to cause many paralytic problems in the region (3). Although the present outbreak was not definitely ascertained to be caused by *R. eversti* alone, this species is thought to be the major factor of the disease, the infesting parasites being mainly immature ones.

As for the host susceptibility, it was observed that the infected camels at site A included both sexes at different ages (three months to eight years old). Likewise, in site B, in herd N° 2 (table 1) out of the 36 camels, 35 of either sex from a few months to over ten years were similarly infected and died (including all the four young ones under six months old). The only survivor animal from that herd was a male adult camel. It is noteworthy that within the recovered animals from all the herds only one young camel under six months was observed. Adult camels also recovered earlier than young ones. These differences could be explained by the host susceptibility and behaviour, and younger camels could be more susceptible than adults. The variation in the incidence among examined herds could be due to the degree of

challenge of the hosts by ticks. There could be some factors which made the ticks generate the neurotoxin especially in that period of the year and under such ecological conditions.

Although the disease symptoms resembled those of plant and insecticide poisonings, these were excluded, because the areas had been used for pasture by the same nomads for the last five years with no occurrence of such symptoms and no presence of poisonous plants were noticed to occur. Insecticides were never used in the outbreak areas or in their vicinity. On the other hand, similar outbreaks occurred in different ecological grazing areas during the rainy season from August to November of the same year. The only common factor between all those areas was the marked increase in the tick population due to lack of floods.

Bacterial and other parasitic diseases were excluded by investigation. The fact that the disease was controlled by avoiding tick infested areas and treating the animals with « Lindane » made it very likely that the disease was due to ticks. Also, the course of the disease conformed well with tick feeding. The decline following the peak of mortality, represents recovery as a result of

drop of ticks from the animals. The deaths which occurred from day 8 to 15, seem to be mostly due to secondary complications following the prolonged recumbency or irreversible effects on the heart and respiratory centres. It is worth mentioning that nomads slaughtered most of the dying animals for their consumption without harm.

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MUSA (M.T.), OSMAN (O.M.). An outbreak of suspected tick paralysis in one-humped camels (*Camelus dromedarius*) in the Sudan. *Revue Élev. Méd. vét. Pays trop.*, 1990, 43 (4) : 505-510

An outbreak of suspected tick paralysis occurred in one-humped camels in Southern Darfur, the Sudan, between latitudes 11-12° N and longitudes 24-25° E, when the camels were herded in tick infested areas. It involved 251 camels of different ages, in ten herds causing 34.3 % mortality. The symptoms were incoordination of movements, unsteady gait and recumbency followed by death or recovery. *Hyalomma* adults and/or *Rhipicephalus* nymphs and adults were incriminated to be the cause of the disease. Transient paralysis in a guinea pig was produced after experimental feeding of ticks. Removal of the camels from the tick infested areas and treatment against the ectoparasites with Lindane at the concentration of 0.23 % contributed to controlling the disease. *Key words* : Tick paralysis - Dromedary - *Hyalomma* - *Rhipicephalus* - Sudan.

MUSA (M.T.), OSMAN (O.M.). Sospecha de un brote de parálisis debida a garrapatas en dromedarios (*Camelus dromedarius*) en Sudán. *Revue Élev. Méd. vét. Pays trop.*, 1990, 43 (4) : 505-510

Un foco de parálisis posiblemente debida a garrapatas fue descubierto en dromedarios (*Camelus dromedarius*) en la region de Darfur, Sudán, entre 11 y 12 ° de latitud norte y 24-25 ° de longitud este. Los hatos se encontraban en zonas infestadas de garrapatas. Diez hatos, con un total de 251 animales de diferentes edades sufrieron la enfermedad, con una mortalidad de 34,3 p. 100. Se observaron los síntomas siguientes : incoordinación, marcha insegura y decúbito, seguidos sea por la muerte, sea por la cura. Se sospechó de adultos de *Hyalomma* y ninfas y de adultos de *Rhipicephalus* como agentes causales de la enfermedad. Garrapatas, alimentadas experimentalmente sobre cobayos, provocaron en estos una parálisis temporal. La lejanía de los animales de zonas infestadas y el tratamiento contra ectoparásitos con lindano, a una concentración de 0,23 p. 100, contribuyeron a disminuir la enfermedad. *Palabras claves* : Parálisis - Garrapata - Dromedario - *Hyalomma* - *Rhipicephalus* - Sudán.

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