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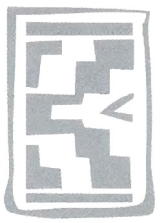

Multifactorial mortality in bongos and other wild ungulates in the north of the Congo Republic

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ABSTRACT

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Wildlife mortality involving bongos, *Tragelaphus eurycerus*, and other ungulates was investigated in the north of the Congo Republic in 1997. Four bongos, one forest buffalo, *Syncerus caffer nanus*, and one domestic sheep were examined and sampled. Although an outbreak of rinderpest had been suspected, it was found that the animals, which had been weakened by an *Elaeophora sagitta* infection and possibly also by adverse climatic conditions, had been exsanguinated and driven to exhaustion by an unusual plague of *Stomoxys omega*.

Keywords: Bongo, *Chrysops* sp., *Elaeophora sagitta*, *Fainia elongata*, forest buffalo, *Glossina brevipalpis*, sheep, *Stomoxys omega*, *Syncerus caffer nanus*, *Tragelaphus eurycerus*

INTRODUCTION

Investigations into wildlife mortalities often are complicated by the remoteness of the area, the impossibility of obtaining fresh specimens and the lack of laboratory facilities in the area. The present study reports the possible causes of mortalities in bongos, *Tragelaphus eurycerus*, and other wild ungulates in the northern Congo Republic near the Sangha River, where the country borders on the Central African Republic (CAR) and Cameroon (Fig. 1).

The only previous reports on bongo mortality, both from East Africa and both by Simon (1962), concerned rinderpest and poisoning by second year growth of *Mimulopsis solmsii*, the setyot vine, which grows in association with bamboo in East African mountain forests and also causes livestock losses.

In view of the ongoing rinderpest epidemic in wild ruminants in East Africa (Kock, Wambua, Mwanzia, Wamwayi, Ndungu, Barrett, Kock & Rossiter 1999) this disease or another serious epizootic was suspected. It was deemed necessary to include in this report details on habitat, biology and ecology of the bongo.

The habitat

The dense lowland forest of the Kabo Forest and Nouabalé-Ndoki National Park contains forest openings or clearings locally called "baïs". Large mammals in search of minerals often excavate holes in the ground in these areas, which fill with water (Fig. 2). Some of these clearings can be quite large (± 1 km^2) and are of uncertain origin. Pools of standing water are created by trenches alongside logging roads, which also provide long stretches of secondary vegetation for browsing (Elkan 1996).

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Bongo antelope

The bongo is a member of the tribe Tragelaphini, and is the largest species of antelope in the African equatorial forest. Adult female bongos weigh 130–200 kg and males 150–220 kg (Ralls 1978). Pelage is light brown to dark chestnut red with 8–13 white vertical stripes on each side and dark and white markings on the head, legs and chest.

Recent surveys have demonstrated that the trinational region of Cameroon, Congo Republic and CAR (Fig. 1) supports some of the highest concentrations of bongos remaining in Central Africa (Elkan 1995; 1996).

Bongos are generally described as an ecotone species, thriving on the forest edge and in areas of past elephant disturbance or timber exploitation (Kingdon 1982; 1997). Investigations have shown that bongos feed predominantly on dicotyledonaceous plants and are classed as browsers, although some grass is taken (Hillman 1986; Elkan 1995). In the northern Congo Republic species of the families Euphorbiaceae and Acanthaceae make up a high percentage of browse where antelope frequently forage along logging roads and visit forest openings for ingestion of soil and water (Elkan 1996).

Ungulate mortalities in the Nouabalé-Ndoki Region

During the period April to May 1997, 18 bongos from a range of age classes and both sexes, five yellow-backed duiker, *Cephalophus sylvicultor*, and two sitatungas, *Tragelaphus spekei*, were found dead or dying by researchers of the Nouabalé-Ndoki Project of the Wildlife Conservation Society (WCS), as well as by safari hunters in the region of the Nouabalé-Ndoki National Park (N-NNP) and the adjacent Kabo Forest Management Unit (FMU), northern Congo Republic.

Reports of the involvement of other species such as bay duikers, *Cephalophus dorsalis*, forest buffaloes, *Syncerus caffer nanus*, and bushpigs, *Potamochoerus porcus*, were also received. During walking and driving surveys no more dead animals were located, although actual mortality numbers are thought to be much higher, given the dense forest habitat and very low frequency with which dead animals are normally encountered.

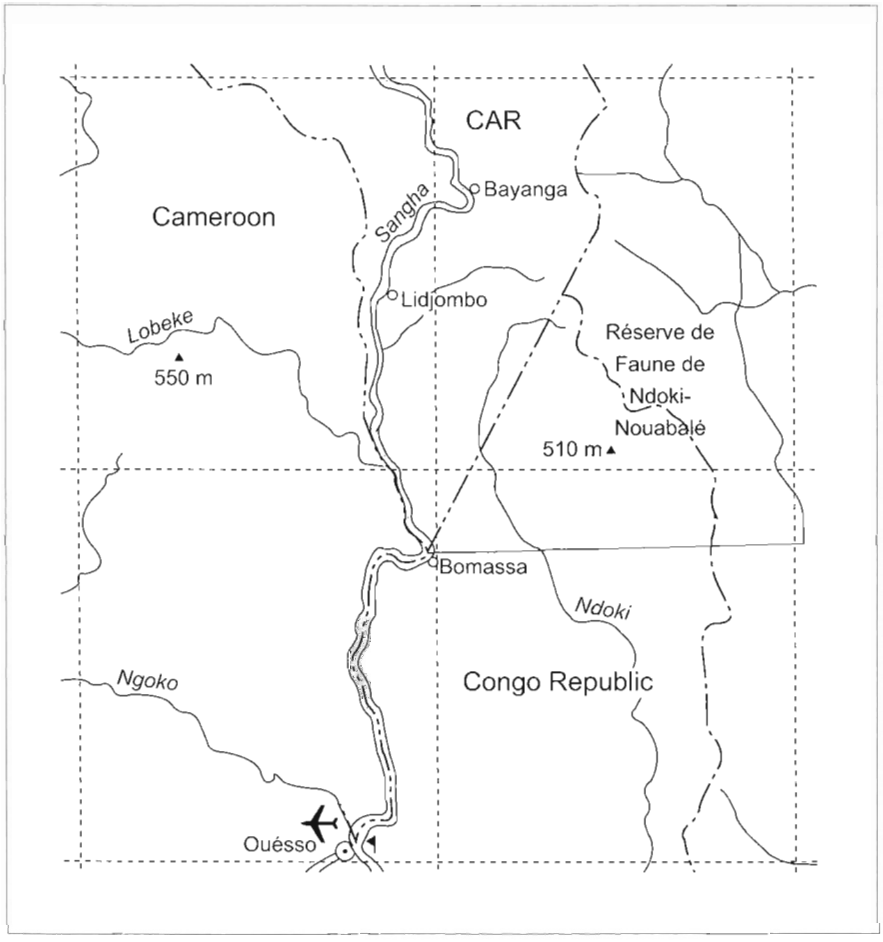

FIG. 1

Map of the area in the northern Congo Republic where the wildlife mortalities occurred

Four seasons are generally described in the northern Congo Republic, namely a dry season from December to March, a short rainy season from April to May, a short dry season from June to August and the rainy season from September to November.

In the Ndoki region rainfall was low during January to March 1997 with a few heavy showers falling at the end of March (N-NNP, unpublished data 1998).

During mid-March a large green-backed non-biting fly increased in vast numbers in the area. This was followed by an equally dramatic increase in *Stomoxys* spp. in early April. The flies occurred in large numbers until the end of May whereafter they decreased rapidly. The bite of the *Stomoxys* spp. was quite painful and caused a high level of discomfort to humans and animals alike.

In the Mombongo research area bongos are generally not seen in the open during daylight hours. However, in April and May bongos were frequently observed on logging roads and in forest openings during the hottest hours of the day. The antelope walked for long stretches along logging roads (>3 km) and were often sighted resting in the open. Many individuals appeared tired and weak in the hind quarters. Large numbers of the *Stomoxys* spp. surrounded and covered nearly all bongos encountered during mid-April to the end of May.

The first dead bongo was found on the bank of the Sangha River, 5 km south of Bomassa on 3 May 1997, and at the time the cause of death was judged to be drowning. During the following week 17 more bongos were either found or reported dead or dying. Estimated causes of death included drowning, being struck by a vehicle, shot by a villager while crop raiding, struck by a villager with a piece of wood, etc. In many of these cases the reports indicated that the animals were exhausted and appeared fearless.

The region in which these mortalities occurred seemed to be confined to the northern Kabo Forest and the N-NNP where flies were observed in large numbers.

However, similar ungulate deaths and high fly numbers were also reported from areas in CAR, 30 km north of Bomassa (C. Bocian, personal communication 1997) and in several areas in the Lobeke region in neighbouring Cameroon (H. Planton, personal communication 1997). Local hunters also expressed surprise and concern over the ungulate mortalities in their areas.

Although no more deaths were reported at the end of May at the time when the actual investigation began, several sick bongos were seen in the area as well as one sick forest buffalo that was observed wallowing for prolonged periods in Wali Baï close to Bomassa camp. An emaciated sheep was found in Bomassa village, but no affected cattle were seen in any of the villages in the area. Subsequently there have been no further reports of wildlife deaths.

Safari hunters later reported hair slip from trophy skins of animals shot during the disease outbreak and submitted several samples from affected treated skins for histopathological examination, but these had become extremely hard and could not be processed.

MATERIALS AND METHODS

On 1 June 1997 the opportunity arose to examine an apparently healthy adult male bongo (specimen B1) shot as a trophy animal near the safari hunting camp. As the animal had already been eviscerated and the viscera disposed of, only the two submandibular lymph nodes were recovered.

Two days later a sick adult male bongo (B2) was shot close to Mombongo. Another sick adult male bongo (B3) was shot on 7 June, approximately 20 km east of the safari hunting camp and another very sick adult male bongo (B4) on 7 June close to the same camp.

On 10 June an emaciated adult West African dwarf sheep ewe (B5) was purchased at Bomassa village and slaughtered at the research camp. Finally, a sick adult male forest buffalo (B6) that had already been observed for a few days was shot on 11 June at Wali Baï, one hour's walk from Bomassa camp.

Necropsies were carried out in the field as soon after death as possible. Blood samples were collected from the heart and allowed to stand at room temperature until coagulated, after which the serum was drained off and kept frozen. Lymph nodes for virus and lungs for bacterial isolation were collected in sterile tubes and also kept frozen. Part of the lymph nodes of B1 and specimens from a wide range of organs and tissues of animals B2-B6 were fixed and stored in 10 % buffered formalin for histopathological examination.

Insects were collected close to the fresh carcases as well as at the camp sites and the entomological specimens were preserved in 60 % ethanol.

Histopathological specimens were routinely wax-embedded, sectioned and stained with haematoxylin-eosin. The lung samples (B2–B6) were cultured on bovine tryptose blood agar in 10 % CO_2 at 37 °C and on MacConkey agar in air at 37 °C. The frozen sera (B2–B6) and lymph nodes (B1–B6) were submitted to the Onderstepoort Institute of Exotic Diseases (OIED). All sera were tested by ELISA for antibodies against foot-and-mouth disease virus strains SAT-1, SAT-2, SAT-3, A, O, and C, and the remaining serum of three samples (B2, B5 and B6) was tested by complement fixation for antibodies to bovine

FIG. 2 Bongo habitat at Wali Baï close to Bomassa camp

FIG. 3 Heart and lung of bongo B2. Note the distended right ventricle of the heart (arrow) as well as the lung lesions: interstitial pneumonia with oedema and emphysema

FIG. 4 Bongo B3, emaciated and with focal loss of hair on its shoulder

pleuropneumonia. In view of the necropsy findings and the results of the histopathological examination, it was decided not to attempt isolation of the rinderpest virus from the frozen lymph nodes. The insect samples were handed to the Entomology Section of the Onderstepoort Veterinary Institute.

RESULTS

Gross pathology

Bongo B2 was emaciated and had severe, diffuse lung oedema and emphysema as well as a dilated right ventricle of the heart (Fig. 3).

Bongo B3 showed focal loss of hair on its shoulder (Fig. 4) and similar lung lesions as B2, but less severe. The right ventricle of the heart was also severely distended.

Bongo B4 had lost a toe on its left fore foot, leaving a festering wound, and was severely emaciated. The right lung was distended and showed the same lesions seen in the two preceding animals, while the left lung collapsed normally. The right ventricle of the heart was also distended.

Both lungs of the sheep (B5) had focal lesions of emphysema and oedema (Fig. 5). The right ventricle of its heart was also distended.

The forest buffalo (B6) was in a reasonable condition, but had the same lung lesions and distended right ventricle of the heart (Fig. 6) as seen in all the other animals.

Histopathology

Lung samples from three of the bongos, the buffalo and the sheep were characterized by diffuse, or focal in the case of the sheep, lobular interstitial pneumonia, mild to severe, with thickening of the alveolar septa due to congestion, accumulation of fibrin and infiltration of neutrophils and eosinophils, sometimes accompanied by alveolar emphysema and oedema and proliferation of alveolar macrophages. Multifocal, or, in the sheep, focally extensive, arteritis and periarteritis was present in all five animals. The arteritis was characterised by fibrinoid necrosis and peri-arteriolar to intramural infiltration of mixed leukocytes, among which eosinophils were the most prominent cell type. In one of the bongos, some of the larger arterioles contained in the lumen easily recognisable nematode parasites (Fig. 7) with a thick eosinophilic hyaline cuticle. No parasites could be identified in the other animals, but arterioles in both the other bongos and the buffalo contained deeply eosinophilic hyaline material that might represent parasitic remnants. Thrombi were evident in arterioles that contained foreign material. In the buffalo, some of the affected arterioles contained granulomas, with large numbers of multinucleate giant cells.

Changes in other organs were mild and unremarkable. They included mild degenerative cardiomyopathy and in the livers mild centrilobular degeneration with dilatation and occasional duplication of central veins, dilation of sinusoids and congestion.

Bacteriology

No mycoplasms were isolated, but only *Arcanobacterium pyogenes* from the lung of bongo B4 and a few colonies of *Pseudomonas aeruginosa* from the lung of bongo B3.

Serology

The sera of the animals B2–B6 tested negative for antibodies to foot-and-mouth disease virus SAT-1, SAT-2, SAT-3, A, O, and C, while the sera B2, B5 and B6 tested negative with the complement fixation test for contagious bovine pleuropneumonia.

Entomology

The biting flies were identified as *Stomoxys omega*, and the large, green-backed, non-biting flies as *Fainia elongata* Bezzi (Calliphoridae: Rhiniini).

In addition, tabanids caught at the safari camp and pointed out as "filaria flies" were *Chrysops* sp.; specimens of *Glossina brevipalpis* had also been caught at Bomassa camp.

DISCUSSION

No lesions possibly attributable to rinderpest were found during any of the postmortem examinations in the field, nor in any of the histopathological specimens. At one stage the possibility of bovine pleuropneumonia was considered because of the lung lesions present in all sick animals that were examined. However, this was also excluded by the unusual range of affected species as well as by the bacteriological and serological results.

Elaeophora sagitta is known to affect tragelaphine antelopes and buffalos (McCulley, Van Niekerk & Basson 1967; Boomker, Horak & De Vos 1989), and the lesions found in this investigation corresponded with those previously described from kudu (Pletcher, Boomker, De Vos & Gardiner 1989). These lesions could have contributed to weakening the condition of the affected animals by interfering with the cardiopulmonary circulation; thereby possibly being responsible for the dilatation and hypertrophy of the right ventricle of the heart.

The single most damaging effect certainly was caused by the unusually large numbers of *S. omega*. A similar incident, caused by *S. calcitrans* in the Ngorongoro Crater in Tanzania, also led to abnormal behaviour of the affected animals (Fosbrooke 1963).

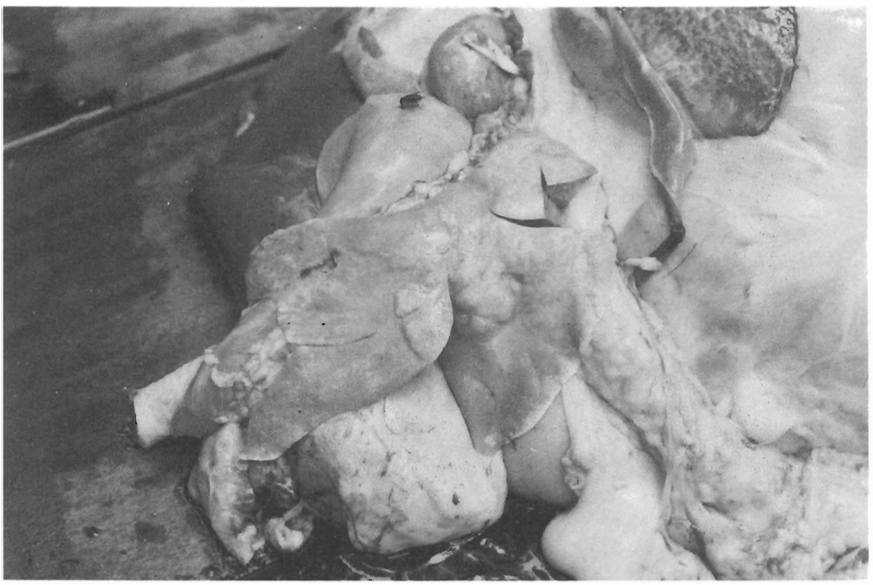

FIG. 5 Emphysematous lesions of in the lung of the village sheep B5

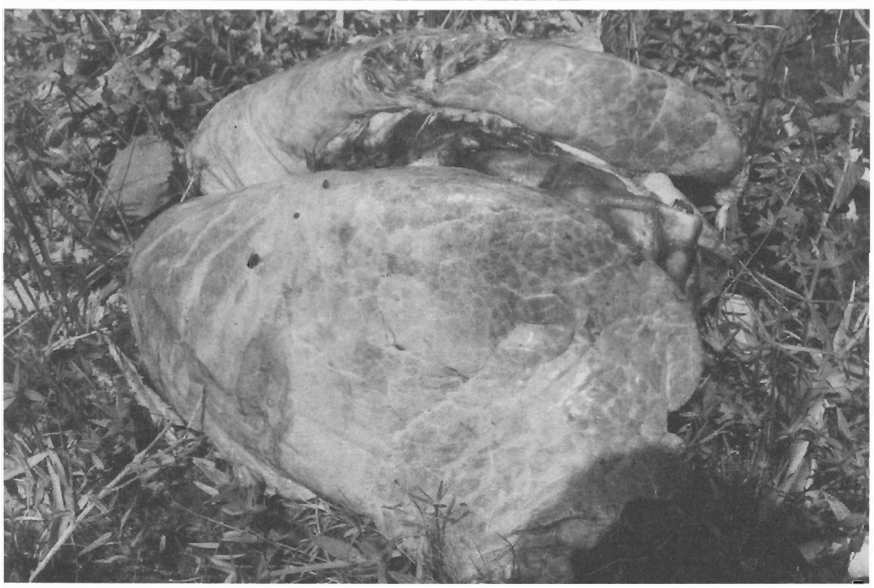

FIG. 6 Lung of forest buffalo B6 with interstitial pneumonia, oedema and emphysema

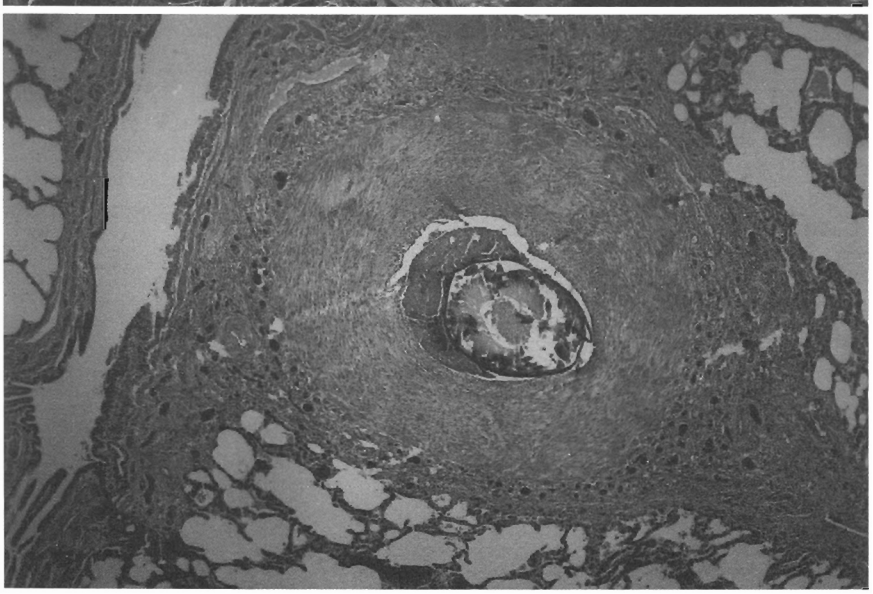

FIG. 7 Cross section of a nematode parasite in the lung arteriole of a bongo with arteritis and peri-arteritis

The abnormal behaviour caused by the presence of *S. omega* might have been increased by the presence of equally large numbers of the non-biting *F. elongata*. Physical exhaustion in addition to exsanguination by the multitude of bites, also described by Fosbrooke (1963), is believed to have been the major contributing cause of the mortalities.

Fosbrooke (1963) also reported hair loss in animals badly affected by the *Stomoxys* plague. Such hair loss was seen on one of the fresh dead animals (B3—Fig. 4) and it is believed that the hair slip later noted on treated trophy skins from the period of the outbreak, was a direct result of excessive numbers of fly bites.

The extreme conditions of the wet and dry seasons of 1997 could have precipitated the development of the large numbers of the two species of flies in the area.

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