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# MYCOBACTERIOSIS IN THE LESSER FLAMINGOS OF LAKE NAKURU, KENYA[1]

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*Abstract:* In 1974, 51 debilitated lesser flamingos *(Phoeniconaias minor)* were easily captured at Lake Nakuru, Kenya. Nineteen (37%) of these had extensive mycobacterial lesions. Two years later it was difficult to locate any debilitated flamingos and no evidence of mycobacterial infection was found. Possible reasons for the high prevalence of mycobacteriosis in the 1974 collection are discussed.

## INTRODUCTION

Lake Nakuru National Park is one of the important feeding areas of the lesser flamingo and, at times, more than one million of the birds are present on the 7 by 11 km lake.[9] The flamingos are a world renowned ornithological tourist attraction of sufficient economic importance to require management-related research.

A wide variety of other birds frequent the lake. The unusually high pH (10.5), high primary productivity,[3,8] and the dense avifauna provide an interesting setting for a disease investigation. Earlier reports had suggested that tuberculosis was a common avian disease in the park, having been reported in lesser flamingos and a fish eagle *(Cuncuma vocifer)* from the lake.[2,3,5] We conducted a four week survey in 1974 and a subsequent single day collection in 1976 to determine the prevalence of mycobacteriosis.

Shortly before the survey in 1974 there was a sudden marked decline in the density of bluegreen algae *(Spirulina* sp.), the major food source of the lesser flamingo, coinciding with a dramatic emigration of flamingos.[8] The remaining birds were forced to feed on less suitable species of algae. Tuite[8] estimated an unusually high mortality among 10,000 flamingos remaining at the lake in July and August, 1974 (420 carcasses were collected in 19 days).

## MATERIALS AND METHODS

In April, 1974, 26 adult and 25 immature debilitated lesser flamingos were captured by foot chase, killed, and examined. Impression smears or sections prepared from formalin-fixed granulomatous lesions were stained by the hematoxylin and eosin and Ziehl-Neelsen acid fast methods. Lowenstein-Jensen medium was inoculated with material from 4 flamingos. In September, 1976 an additional 5 adult flamingos were collected from flocks of birds so dense they were unable to run or fly.

## RESULTS

In 1974 there were many debilitated flamingos at the lake, in 1976 no

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debilitated flamingos were found. In 1974, nineteen (37%) of the flamingos (10 adults and 9 immatures) had extensive granulomatous lesions containing acid-fast bacteria. The lesions varied from massive 6 to 8 cm visceral tubercles in some flamingos to miliary foci of histiocytes in parenchymatous organs in other flamingos. In all cases the generalized distribution of the lesions suggested a hematogenous spread; the route of entry was not clear. Eight of the 19 diseased birds lacked pulmonary involvement. During microscopic examination, prominent aggregates of cells laden with "dust" particles were noted in pulmonary tissue of 10 of the tuberculous flamingos, and 36 of the non-tuberculous flamingos.

Unfortunately all cultures were lost and the isolates were not typed. Population estimates for 1976 are not available; in our opinion the flock was of a similar size (approximately 10,000), and appeared in good health. No fresh carcasses were found and the birds captured were in much better physical condition. No granulomatous lesions were found in the five flamingos examined. The sample was small because of the absence of debilitated flamingos.

## DISCUSSION

Ratcliffe[6] studied data from 3,000 avian post-mortems covering a 20-year interval at the Philadelphia Zoological Garden and concluded that resistence of birds to tuberculosis was influenced by nutritional factors. While the Lake Nakuru data are too fragmentary to establish that the high prevalence of mycobacteriosis in 1974 was related to undernourishment resulting from an algal population crash, this is one possibility.

Human tuberculosis is sometimes considered a disease characteristic of societies where masses of people are herded together under suboptimal sanitary conditions.[7] The dense flamingo population present at Lake Nakuru before the algal crash may have represented the avian equivalent of such an unsanitary situation. It is possible that the healthy flamingos emigrated after the algal crash, leaving behind weakened or diseased flamingos which lacked the energy reserves necessary to leave the lake.

Inhalation of inorganic dust containing free silica injures human lungs and predisposes to the development of pulmonary tuberculosis.[7] Pulmonary dust aggregates were common in the flamingos but there was no evidence of irritation and the tubercle distribution in individual birds did not suggest a pulmonary route of infection.

There are genetic factors which influence the resistence of humans and laboratory mammals to tuberculosis.[7] Wood[10] proposed that similar factors may operate in flamingos based on his observations of the low prevalence of tuberculosis in captive flamingos housed in avicultural flocks where the disease was prevalent.

It is unfortunate that the Lake Nakuru isolates were not serotyped but previous isolations from the Nakuru flock were identified as *Mycobacterium avium* type I by Cooper *et al.*[2] They mention the possibility that the organism was recently introduced as an effect of the ecological changes following the introduction of *Tilapia grahami* in the early 1960's and immigration of fish-eating birds.[1]

The presence of mycobacteriosis in many lesser flamingos and several other avian species from the lake [fish eagle, white pelican *(Pelecanus onocrotalus)*, ruff *(Philomachus pugnax)*, and greater flamingo *(Phoenicopterus ruber)*] prompted Kaliner and Cooper[4] and Sileo (unpubl.) to suggest that the avifauna at Lake Nakuru were an important enzootic focus of avian tuberculosis. Since tuberculosis was a rare disease in domestic

animals in Kenya, transmission from wild birds to domestic livestock apparently did not occur to any great extent; however, any attempts to intensify poultry or animal husbandry in Rift Valley flood plains frequented by flamingos should consider the disease reservoir. Aviculturists should also be aware of the potential dangers of importing Rift Valley water birds.

The Lake Nakuru flamingo flock provides a good opportunity to study the epizootiology of wildlife tuberculosis. Future ecological surveys may elucidate the effect of nutrition and population density on the prevalence of the disease.

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