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# BLOOD PARASITES OF THE NORWEGIAN LEMMING

RICHARD WIGER[1].

*Abstract:* In the Norwegian lemming (*Lemmus lemmus*), it was found that 71% of the animals sampled harbored blood parasites (*Hepatozoon* sp. 23.7%, *Trypanosoma* sp. 7.6%, and *Grahamella* sp. 61.8%) which occurred in all possible combinations. *Babesia* sp. was not found.

## INTRODUCTION

A great amount of literature exists on the blood parasites of rodents throughout the world. However, information on the hematozoa of rodents from the far north are scant, especially in Fennoscandia. This survey was made in connection with a project on the population dynamics of the Norwegian lemming.[2]

## MATERIALS AND METHODS

In the summer and autumn of 1970 there was an abundance (peak year) of small mammals in many parts of Norway. This sample consisted of 131 Norwegian lemmings captured in the alpine zone (1200 m above sea level).

The animals were snap trapped and blood was obtained from the heart. Thin smears were prepared, air dried, fixed in absolute methanol and stained with Giemsa. Smears revealing no parasites after 15 minutes of observation under oil immersion (800X) were considered negative.

## RESULTS

*Grahamella* sp. occurred in 61.8%, *Hepatozoon* sp. in 23.7% and *Trypanasoma* sp. in 7.6% of the animals. The different combinations in which the parasites appeared are presented in Table 1.

The gametocytes of *Hepatozoon* sp. averaged 11.1$\mu$ x 3.7$\mu$, were sausage shaped, slightly curved and occurred in nongranular leukocytes, only 1 per cell (Fig. 1B). Occasionally extracellular gametocytes were found but schizogenous stages were never found.

The average relative number of trypanosomes was 15 per 100 microscope fields (800X) or approximately 7,500/mm$^3$ blood. The trypanosomes' mean length and width were 31.1$\mu$ x 1.8$\mu$. More detailed morphological measurements of these "*lewisi*-like" trypanosomes from *L. lemmus* are presented elsewhere.[7]

## DISCUSSION

The percentage of infected lemmings must be regarded as representing the minimum values, since extremely light infections might have been overlooked.

### Hepatozoon

The chance of discovering the gametocytes of *Hepatozoon* sp. on blood smears is related both to the number and the distribution of leukocytes on the thin blood films. In all smears a greater proportion of leukocytes tends to be found in the tail portion of the smear, especially at the very end. As for the number of leukocytes/mm$^3$, Norwegian lemmings can have as few as 300 but average 2554 /mm$^3$ (unpublished data). Because of this relatively low number, the chance of discovering the gametocytes of *Hepatozoon* sp. in the blood smears is diminished.

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[2] The sample represents a portion of the animals collected by the Norwegian IBP-PT/UM Section at Finse, South Norway.

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TABLE 1. The occurrence of blood parasites in Norwegian lemmings, indicating the combinations in which they occurred. G = **Grahamella** sp. H = **Hepatozoon** sp., T = **Trypanosoma** sp.

| Parasites | No. Positive | % Positive |
|---|---|---|
| Grahamella only | 56 | 42.7 |
| Hepatozoon only | 9 | 6.9 |
| Trypanosoma only | 2 | 1.5 |
| G + H | 18 | 13.7 |
| T + G | 5 | 3.8 |
| T + H | 1 | 0.8 |
| G + H + T | 2 | 1.5 |
| Babesia | 0 | 0 |
| TOTAL INFECTED | 93 | 71.0 |

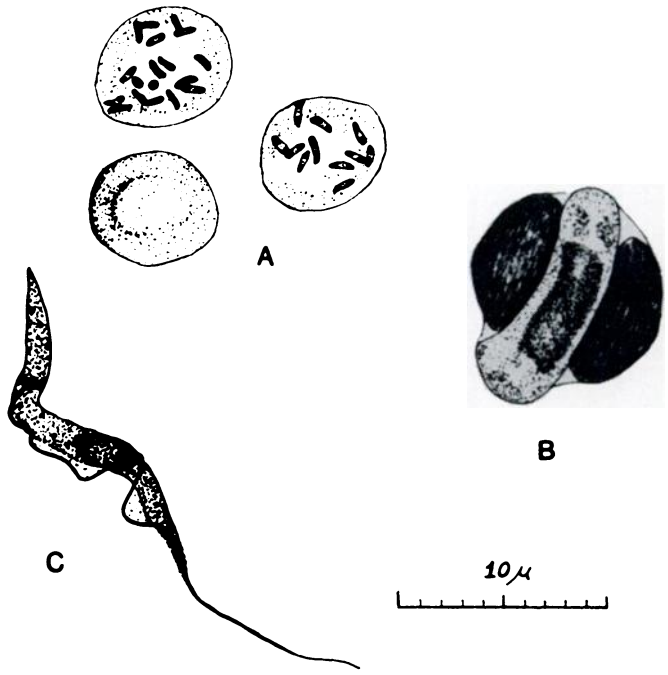



FIGURE 1. Camera-lucida drawings of blood parasites of the Norwegian lemming. A. **Grahamella** sp., B. **Hepatozoon** sp., C. **Trypanosoma** sp.

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Ohbayashi[3] pointed out that when examining liver sections of *Microtus oeconomus* he found that 3 of 15 animals had *Hepatozoon*, whereas the blood smears revealed no infection. Mahnert[4] found that over 50% of *Clethrionomys glareolus* harbored this parasite. *Hepatozoon* has been reported from numerous species of rodents, from both blood smears and sections of other tissues.

#### Grahamella

*Grahamella* sp. was by far the commonest of all parasites enocuntered in the blood of *L. lemmus*, 61.8% of the animals being infected. This infection rate was greater than that generally found for the small rodent species from other investigations.[3]

The average relative number was 14 infected cells per 100 microscope fields (1250X) or ca. 0.1% of the erythrocytes. The parasites were generally rod shaped (1-1.25$\mu$ X 0.25$\mu$) but were also found as more or less pherical bodies (Fig. 1). Short chains of the spherical forms were also observed, as has been reported earlier.[1,4] The number of organisms per cell varied considerably, from two to probably greater than 100 per erythrocyte (so many organisms that they could no longer be separated). The number per cell most often encountered was 12-20 as opposed to 6-8 in *Microtus agrestis* and *M. nivalis*,[4] and 6-14 per erythrocyte in *M. oeconomus*.[2] It appeared that the greater the number of *Grahamella* per infected cell, the smaller and more spherical the individual organisms became.

It was not uncommon to find individuals or groups of rods in the serum, but in most cases this probably represents infected erythrocytes destroyed during preparation of the blood film.

#### Trypanosoma

Trypanosomes from the Norwegian lemming have been described earlier.[7] Morphologically, they are very similar to the trypanosomes of the collared lemming *(Dicrostonyx torquatus)*[6]. As in most "*lewisi*-like" trypanosome infections, the number of organisms in the circulating blood of *L. lemmus* was low, ca. 7,500/mm$^3$. However, the numbers of trypanosomes in the blood of *D. torquatus* ranged from 2,000-58,000, a value considerably higher than that for *L. lemmus*.[6]

Dividing forms were never found in the blood, but short stubby forms have been observed and probably reflect the reproductive phase of the disease. Most individuals, however, were long and slender, and this, coupled with their relatively low number, suggests the final phase of the infection.

It is possible that a higher number of trypanosome infections could have been detected if hemolyzed thick smears were examined in addition to the thin blood films.

#### Babesia

Despite its world wide occurrence the regional geographic distribution of small rodent *Babesia* is not always well documented, a result of both the difficulty in detecting chronic low grade infections and because the intermediate hosts are not cosmopolitan.

Despite the examination of several hundred blood smears, *Babesia* has not been detected in *L. lemmus* even though ticks were taken from some of the animals. However, *Babesia* has been found in *Clethrionomys glareolus* from South Norway (unpublished data). After the initial routine examination, the blood smears of *L. lemmus* with abnormally large spleens were examined again. These re-examinations were negative.

In Alaska experimental inoculation of vole blood *(M. oeconomus)* containing piroplasms into brown lemmings *(L. trimucronatus)* resulted in the majority of the recipients becoming infected.[2] However, natural infections in brown lemmings were not reported.

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