Some vector borne parasites in Swedish reindeer (*Rangifer tarandus tarandus* L).

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Abstract: Some vector borne parasites in Swedish reindeer. A review presented at the Fifth European Regional Meeting of the Society for Vector Ecology, September 2.–6. 1990, Uppsala, Sweden.

The clinical and pathological manifestations as well as some meat hygienic aspects of *Megatrypanum* trypanosomes, *Babesia divergens, Setaria tundrae, Onchocerca tarsicola* and *Lappnema auris* infections in reindeer are reported on.

Key words: Reindeer, vector borne diseases, *Megatrypanum* trypanosomes, *Babesia divergens, Setaria tundrae, Onchocerca tarsicola, Lappnema auris,* parasitology.

Sammanfatting: Vektorburna parasiter hos svensk ren. En översikt presenterad vid «the Fifth European Regional Meeting of the Society for Vector Ecology», September 2.–6. 1990, Uppsala, Sverige.

Kliniska och patologiska manifestationer liksom i viss utsträckning livsmedelshygieniska aspekter diskuteras med avseende på infektioner med *Megatrypanum* trypanosomer, *Babesia divergens, Setaria tundrae, Onchocerca tarsicola* och *Lappnema auris.*

Rangifer, 10 (2): 67—73

Introduction

Reindeer husbandry is a circumpolar industry utilizing forest regions, impediments and barren ground areas for the production of meat and hides.

Today the number of reindeer in Sweden is about 300.000 (adult animals) and around 700.000 in the whole of Scandinavia.

Reindeer are migratory animals. During the long winters they feed mainly on lichens (*Cladinia* spp+ *Alectoria* spp, etc.) During the short snow-free period (May - October) they eat a variety of plants.

During warmer periods, without frost, there is a mass appearence of insects; mosquitos (*Culicidae*), gnats, blackflies, and others of the *Simuliidae*, and different types of horseflies (*Tabanidae*). These insects can follow the reindeer like clouds and make life a nightmare for man and animal. As female mosquitos and horseflies need blood in order to produce mature and viable eggs all kinds of mammals are attacked.

Kadnikov, V. V. (1989) reports on reindeer as exposed to hourly attacks from about 8.000 mosquitoes, 240 biting flies med 24 Oestridae flies.

Also small flies, *Haematobia* spp, during certain hot years may appear as dense swarms attacking and sucking blood from the growing velvet-coverd antlers. (Skjenneberg & Slagsvold 1968).

Vector borne diseases found in reindeer

Trypanosomes

From North American and European Cervidae both salivarian and stercorarian trypanosomes

Plate 1. *Megatrypanum* trypanosome from reindeer (Photo: Seth Bornstein).

have been reported (Kingston 1981, Kingston & Nikander 1985, Dirie et al 1990). In Swedish reindeer (*Rangifer tarandus*) and moose (*Alces alces*) *Megatrypanum* trypanosomes have been reported (Dirie et al 1990). It was found that trypanosomes from Swedish moose were morphologically and biochemically (isoenzyme pattern) similar to American isolates from reindeer, mule deer (*Odocoileus heimonus*), moose and elk (*Cervus canadensis*) while isoenzyme patterns of isolates from Swedish reindeer were considerably different. Hence the *Megatrypanum* trypanosomes of Swedish reindeer may represent a different species (Dirie et al to be published). (Plate 1).

The infection rate appears to be highest during summer (Kingston 1981, Kingston & Nikander 1985) and low during colder periods (Dirie et al 1990), apparently because of the seasonal occurrence of the vectors (Kingston et al 1982, Dirie et al 1990).

Most trypanosome species of the subgenus (*Megatrypanum*) produce low parasitaemias in the mammalian host and therefore are rarely found by direct examination of bloodsmears (Dirie et al 1990), which may explain the earlier ignorance at the presence of these parasites in Swedish reindeer.

The vectors of the trypanosomes of Cervidae are largely unknown, but tabanids have been incriminated (Davies & Clark 1974, Kingston 1981, Böse et al 1987). Keds (*Hippoboscidae*) of sheep and goat have been implicated in the transmission of trypanosomes (Kingston 1981). When tabanid flies (*Tabanus bromius* and *Haematopota pluvialis*) caught near Swedish cattle were dissected, their guts were found to harbour *Megatrypanum* trypanosomes, a form of *Trypanosoma theileri*, identical to the trypanosomes found in cattle (Dirie et al 1990).

Transplacental transmission of trypanosomes to the fetus of Cervidae is known to occur both naturally and experimentally, but nothing is known about their role in abortions or other pathological conditions (Kingston 1981).

No pathological lesions or signs of clinical disease had yet been described in connection with *Trypanosoma* infections in reindeer or other cervidae.

Babesiosis

Babesiosis has long since been found to occur in reindeer (Kertzelli 1909, Chambers 1921, Nilsson et al 1965), and the disease is reported during summer and autumn mainly from the low lying tundras and the taiga region in eastern North Siberia (Chambers 1921, Yakimoff & Kolmakoff 1929, Nikolaevskii 1968). It remains uncertain whether the organism found in Siberian reindeer is identical with *Babesia divergens* or not (Nilsson et al 1965). (Plate 2).

No disease suggestive of babesiosis is known to have occurred in Swedish with *Babesia divergens* (Nilsson et al 1965, Christensson 1990). The natural distribution of reindeer in Sweden, however, does not coincide with the areas where bovine babesiosis is enzootic and, in addition, *Ixodes ricinus*, the main vector of the parasite, has never been recovered from Swedish

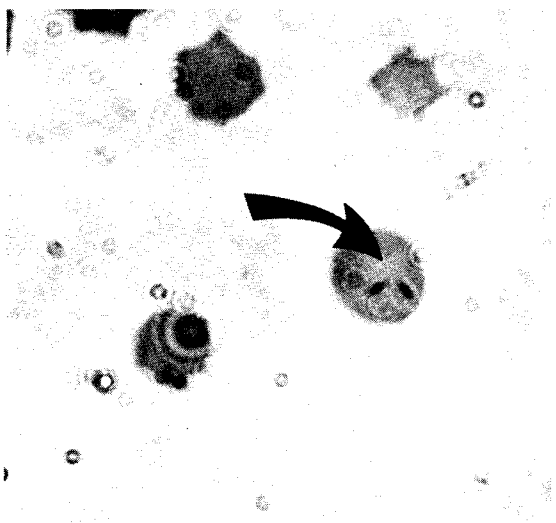

Plate 2. *Babesia divergens* in red blood corpuscule (arrow) (Photo: Dan Christensson).

reindeer (Nilsson et al 1965). Hence, in Sweden, reindeer kept in zoological gardens in the enzootic area are the only ones at risk. *Babesia capreoli* has been found in roe deer in Sweden. Infection may lead to the death of animals producing similar necropsy findings as in bovines (Christensson & Järplid 1979).

In reindeer the clinical signs are similar to those of bovines; fever, which in the terminal stage turns into a subnormal temperature, anorexia, rumen indigestion, anemia, haemoglobinuria, jaundice and diarrhoea, the later followed by constipation and dehydration (Nikolaevskii 1968, Nilsson et al 1965).

Necropsy, as in cattle, reveals anemia, jaundice, a marked spodogenous enlargement of the spleen, dark and swollen kidneys with haemosiderin deposits, thick bile and dark brown-red urin (Nikolaevskii 1968, Nilsson et al 1965, Christensson 1989).

Setaria tundrae

Setaria tundrae, a filarial nematode, occurs primarily free in the peritoneal cavity of reindeer. (Rajewsky 1929, Yeh 1959) but may sometimes also be found in the pleural cavity and pericardial sac (Rehbinder et al 1975). Its presence in the serous cavities is usually asymptomatic and not producing any marked pathological lesions except focal areas of mild chronic peritonitis. Infestations may, however, especially in woodland reindeer, be heavy, exceeding more than 1000 preadult and 100 adult worms in the abdominal cavity.

When the worms die they may produce a very marked inflammatory granulomatous reaction, the severity being correlated with the magnitude of infestation. Dead worms are then found encapsulated, often calcified, in granulomas on the serosal surfaces. (Rehbinder et al 1975). (Plate 3).

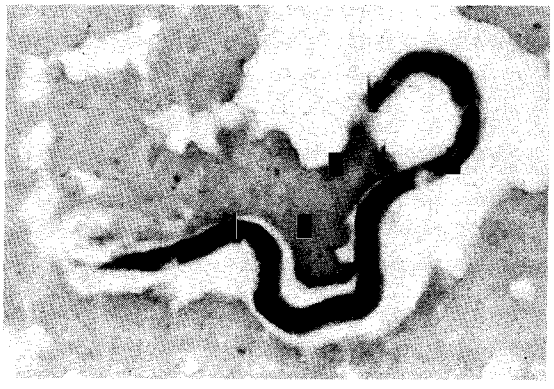

Plate 4. Microfilaria of *Setaria tundrae* in reindeer blood (Photo: Claes Rehbinder).

The major importance of infestations of this worm generally concerns matters of meat hygiene. Some *Setaria* spp are known to invade the central nervous system (Nelson 1966, Dau and Barrett 1981). No central nervous signs have been connected with the presence of *Setaria tundrae* in Swedish reindeer, and the presence of the worm in the central nervous system of Swedish reindeer has never been recorded.

The microfilariae are found in the blood (Plate 4) and the vectors are considered to be mosquitoes (*Anopheles, Aedes,* and *Culex* spp): The lifecycles of *Setaria* spp are incompletely understood. The microfilariae infect the bloodsucking mosquitos, in which they develop into an infec-

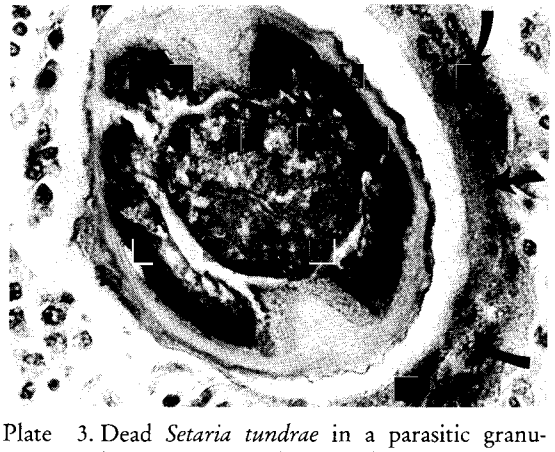

Plate 3. Dead *Setaria tundrae* in a parasitic granuloma. Note the large multinucleated giant cells (arrows) (Photo: Claes Rehbinder).

Plate 5. Liver from reindeer. Note multiple grey foci, caused by *Onchocerca tarsicola,* on the surface and cut surface (Photo: Claes Rehbinder).

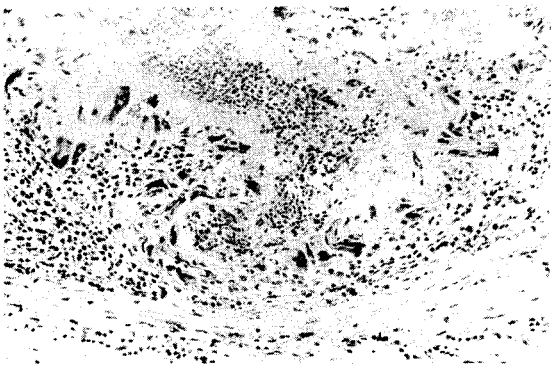

Plate 6. Duct and granulomatous tissue, caused by *Onchocerca tarsicola*, with giant cells in the heart muscle of reindeer (Photo: Claes Rehbinder).

tious stage. The larvae leave the mosquitoes when the latter ingest a blood meal. The pathway used from the site of cutaneous penetration to the site of maturation is incompletely known (Dau and Barrett 1981).

Onchocerciasis

Onchocerca tarsicola (Bain et al 1979) is a very common parasite in woodland reindeer (Rehbinder et al 1975, Rehbinder et al 1979). Adult and old animals are the ones mainly infested. (Bylund et al 1981). The predilection sites are tissues surrounding the tendons of the tibio-tarsal and radio-carpal joints where the adult worms are found entwined and curled in swellings or nodules formed by connective tissue.

At autumn slaughter in most Swedish woodland reindeer greyish-yellow, firm foci of necrosis are found, mainly in livers (Plate 6) but also in kidneys and sometimes in myocardium and subperitoneal and subcutaneous tissues. Histological investigations reveal that these foci or nodules are ducts or granulomas containing both preadult (Plate 7) and adult worms. (Plate 8). Mostly these parasites are dead. All these foci also have proved to be infected with *Corynebacterium* spp in pure culture (Rehbinder et al 1975).

Heavy infestations, which is almost solely the case in woodland reindeer, constitute a serious meat hygienic problem and numerous livers and kidneys have to be discarded at slaughter.

The heavy infestations of *O. tarsicola* seem to have first appeared in the end of the 1960's and since then have become more and more extensive. Bain & Schultz-Key (1974) were the first to describe *O. tarsicola*, their description being from red deer (*Cervus elaphus*) where the parasite is usually found on the tendons distal to the carpal and tarsal joints. The frequent appearance in aberrant locations in reindeer resembles what is commonly observed in «transfuga» parasites (Bain et al 1979). In 1962 some red deer crossed the mountain barrier from Norway to Sweden and were found dead in the forest near Vittangi, a woodland reindeer herding area (Nordkvist 1980). It is possible that they carried the parasite with them as the disease was earlier completely unknown, which in turn is an indication that reindeer may not be the primary host of *O. tarsicola.*

Schultz and Wenk (1979) identified the vectors of *O. tarsicola* and found the lifecycle of this species to be completed through two simuliids, *Prosimulium nigripes* and *Odagmia ornato.* They are booth represented in the forest region

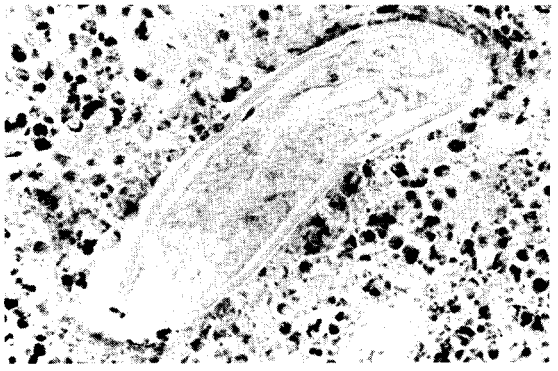

Plate 7. Preadult nematode in a granuloma in the kidney of reindeer (Photo: Claes Rehbinder).

Plate 8. Adult female *Onchocerca tarsicola* in a granuloma in the liver of reindeer (Photo: Claes Rehbinder).

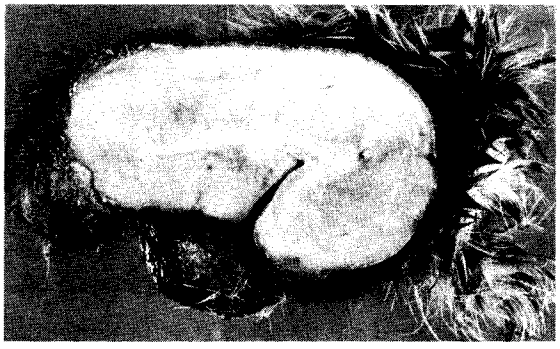

Plate 9. Large nodular granulomas, caused by *Lappnema auris*, in the ear of reindeer (Photo: Sven Nikander).

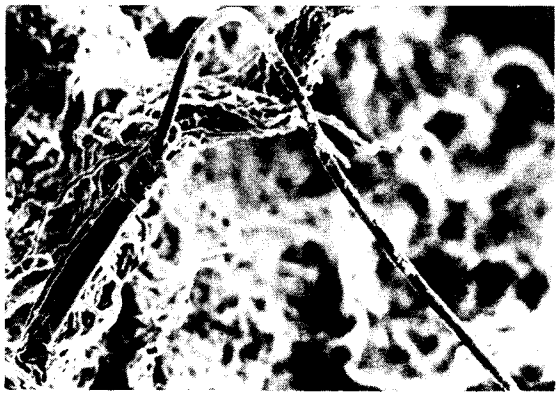

Plate 10. Scanning micrograph of female *Lappnema auris* in a capillary of the ear (Photo: Sven Nikander).

of North Scandinavia. Their lifespan is restricted to around one month during summer and there is only one generation of the adult insects per summer. For their development the larvae need a mean temperature of 10–15°C (Bylund et al 1981), which may explain the low infestation rate of mountain reindeer living in a cooler climate.

The microfilariae are distributed in the small lymph vessels of the skin in a definite pattern which corresponds with the biting habits of the insect vector. (Schultz-Key et al 1975).

In Sweden, moose have also been found to be infested by onchocercids. (Rehbinder and Holmberg 1981, Roneus et al 1984). The species found in moose is *O. alces* (Bain and Rehbinder 1986).

Lappnema auris

Lappnema auris is a small nematode (5–6 mm long and 20–25 μm wide) inducing large nodu-

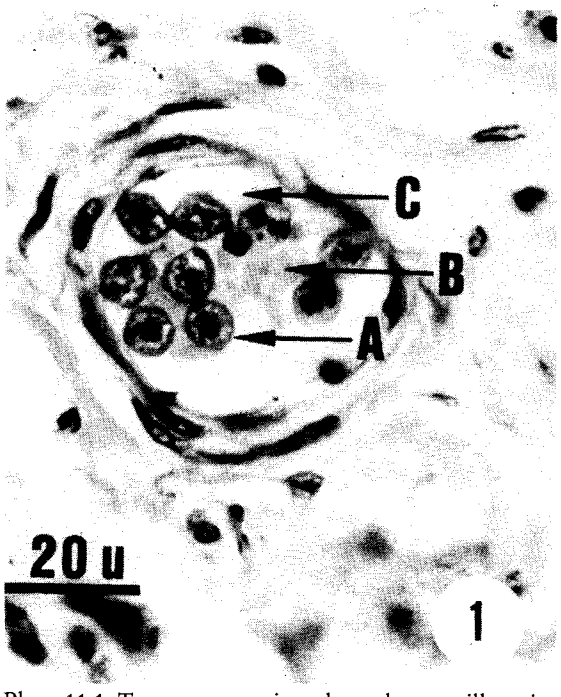

Plate 11:1. Transverse section through a capillary in granulomatous tissue. In the lumen (C) there are 9 larvae of *Lappnema auris* (A) and bloodcells (B) (Photo: Sven Nikander).

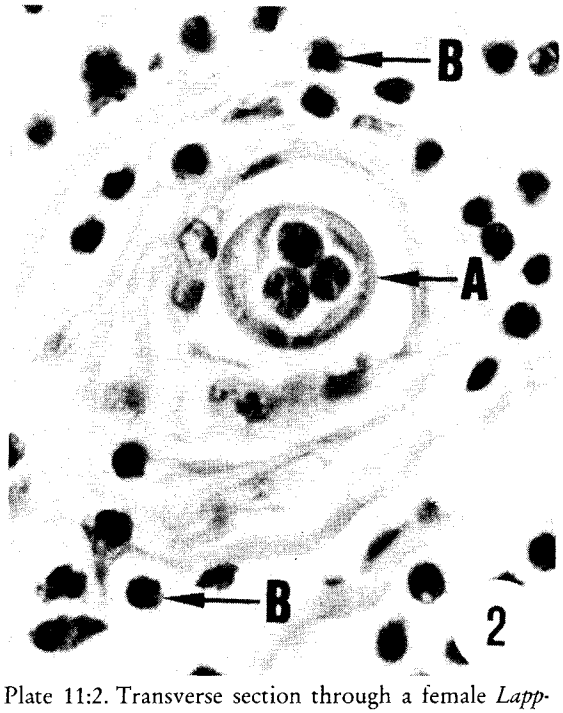

Plate 11:2. Transverse section through a female *Lappnema auris* (A) in a capillary. Note the infiltration by eosinophilic neutrophils (B) in the surrounding tissue (Photo: Sven Nikander).

les on the ears (Plate 9) and sometimes in the eyelids of reindeer. The parasite occurs in the subcutaneous capillaries of the ear (Plate 10). The females are viviparous and the larvae are almost 2 mm long and 10 μm wide. (Plate 11) (Bain and Nikander 1982).

The parasite has been found in woodland reindeer in northern Finland but may most likely be found also in woodland reindeer in Sweden. The vector is unknown, but tabanids have been suggested (Bain and Nikander 1982).

Vector borne diseases recorded in Sweden but not found in reindeer

Tick borne encephalitis

Tick borne encephalitis (TBE) has a known endemic zone in south-eastern Sweden. A high percentage of moose in that area have neutralizing antibodies to TBE-virus. Very probably the virus is of low pathogenicity to moose as many animals seem to survive the infection (Svedmyr et al 1965). As mentioned before, the main vector (*Ixodes ricinus*) has never been recovered from Swedish reindeer (Nilsson et al 1965), nor has TBE been ever recorded in Swedish reindeer.

Tularemia

Tularemia is a zoonotic bacterial disease, affecting animals and man, caused by *Francisella tularensis.*

Tularensis is transmitted among animal populations by insects such as mosquitoes, flies and ticks. The organism is also readily transmitted in aquatic environments by rodents or other animals that die and contaminate the water.

Man may become infected by handling infected carcasses, drinking contaminated water, by eating improperly cooked meat, by inhaling airborne organisms or by being bitten by animals infected or with contaminated mouthparts from eating an infected animal (Morton 1961).

Although the disease occurs especially in the woodland areas (Rehbinder and Karlsson 1979) neither reindeer nor moose develop any clinical signs of disease although both species produce antibodies (Borg 1975).

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