PERSISTENT VIRAL INFECTIONS IN SEMI-DOMESTICATED REINDEER (RANGIFER TARANDUS TARANDUS) IN FINNMARK COUNTY, NORWAY: CLUES FOR ANIMAL HUSBANDRY AND HEALTH?

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1. Persistent infections caused by Alphaherpesviruses
The virus family Herpesviridae includes nearly two hundred virus species or variants obtained from hosts as diverse as molluscs, fish, birds or mammals. The genome of the virion is protected by an icosahedral nucleocapsid of 100 to 110nm, surrounded by a proteinaceous layer which in turn is surrounded by the envelope. This envelope is, in turn, surrounded by several different glycoproteins of which glycoprotein B (gB), C (gC) and D (gD) are the most abundant, bringing the total size of the virion particle to 120 to 300nm. These glycoproteins play a decisive role in the interaction between the virus and the host cell during attachment, penetration and maturation and have been widely used as antigens for diagnostic purposes. Genetic studies have proven that several herpesvirus species are closely related and that genetic recombination and serological cross-infections are possible (Thiery et al., 2006). In general, virus transmission requires close contact, via mucosal contact (coitus, licking etc.). From the 3 subfamilies existing, the Alphaherpesvirinae contains most of the viruses infecting ruminants like Bovine Herpesvirus 1 (BoHV-1) which is associated with two major syndromes, the infectious bovine rhinotracheitis (IBR) and the infectious pustular vulvovaginitis (IPV). Virus from the subfamily Alphaherpesvirinae, genus varicellovirus has been isolated from reindeer in Finland (Ek-Kommonen et al., 1986) and Sweden (Rockborn et al. 1990) constituting a new virus species named Cervid Herpesvirus type 2 (CeHV-2) also abbreviated as RanHV-1.

2. The situation in Finnmark
Finnmark County in northern Norway is the biggest reindeer herding area in Norway with a total area of 56 682 km² and a total of 168 599 animals in
2004/2005 (Hætta, 2006). Reindeer mortality rates in Finnmark are difficult to calculate because reindeer are semi-domesticated and are held in a semi-nomadic herding system but is estimated to be as high as 9% in adults and 15% in marked calves (2004/2005), and may ascend to 36% in unmarked calves. Predation accounts for approximately 85% of the losses. Other known mortality factors such as transport stress or shooting accounts or approximately 5%. Persistent viral infections, such as alphaherpesvirus and pestivirus are believed to exist in Finnmark, given the serosurveys carried out in the past and might partially explain the remaining 10% mortality. These infections could have an impact on reproduction (abortion) and calf survival. In the early 1960s there were two outbreaks of IPV in Norway but since then no other outbreaks were reported until 1993 when some animals of a single herd were found to be seropositive (Nyberg et al., 2006). Since 1994 Norway is free from IBR/IPV. Nonetheless a surveillance program is still ongoing. There are no control programs or ongoing studies regarding such infections in wild animals. The existence of CeHV-2 or other alphaherpesviruses in wildlife would be of extreme epidemiological importance as cross-species infections are known to exist (Thiery et al., 2006). Serological studies by Lillehaug et al., in 2003, found seroprevalences of 29% in wild reindeer, 3% in roe deer and 0.5% in red deer. In semi-domesticated reindeer, in Finnmark, previous studies found seroprevalences of 30% (Stuen et al., 1993) and 10% (Tryland et al., 2005).

3. The serosurvey

To assess the present alphaherpesvirus serological status in reindeer in Finnmark a large screening was designed. Three different serological commercial kits based on either an indirect Enzyme Linked Immuno Sorbent Assay (ELISA) or a gB blocking ELISA technique were tested and compared (Das Neves et al. 2006) and a gB blocking ELISA was chosen for the screening. A total of 3300 animals were sampled from 2003 to 2006 at slaughterhouses in Karasjok, Kautokeino, Varangerbotn and Šuośšjävri as well as from live animals in district 16C and 16A. Serum samples from 3032 animals were used for the present analysis. Reindeer sera was tested using gB BLOCKING LST™ KIT from Laboratoire Service International, France and manufacturers protocol was followed. A competition percentage was calculated based on optical density measurements. Samples were considered positive when the competition percentage was above 50%. Results are presented in detail for each sampled district in figure 4. An overall seroprevalence of 49% was found in this serosurvey with very similar results between eastern (43%) and western (54%) Finnmark even though between districts seroprevalences varied from 8% to 91%. Regarding gender, a seroprevalence of 47% was found in males and 54% in females but this difference was statistically non-significant. Age was found to be statistically correlated with seroprevalence, calves having a much lower
seroprevalence (7%) than adults (80%). The age effect on seroprevalence was to be expected for an infection which is persistent and establishes itself throughout the animal’s life.

![Map of serological results](image)

*Figure 4 – Serological results displayed for each reindeer husbandry district. Bars and values represent the seroprevalence of antibodies against alphaherpesvirus for the respective district. The age distribution of animals is different between districts and the seroprevalence for each district, may therefore, not be directly comparable with each other.*

Weight, time of sampling and district animal density data was also statistically analyzed. Carcass weight was positively correlated with seroprevalence since an increase of weight is correlated to age and the seroprevalence of persistent viral infections is expected to increase with age. An increase in district animal density was also found to be positively correlated with seroprevalence in adult animals though this could not be validated for calves.

### 4. Clues for animal health

The high seroprevalences found in this serosurvey seem to indicate the presence of alphaherpesvirus in the reindeer population of Finnmark. Even though no clinical symptoms that could be addressed to a herpesvirus infection have, so far, been identified, it should be noted that, given its specific latency mechanism, the virus might remain latent in the trigeminal nerve ganglion of the animals for years without expressing itself. Because alphaherpesvirus has been found to cause abortion in cattle this possibility should be addressed for reindeer as well. Several factors like stress, starvation, and extreme low temperatures are known to trigger the reactivation of the virus. These factors are present in Finnmark in
smaller or larger scale and the virus may be reactivated causing abortions which is not easy to detect on mountains pastures. Furthermore alphaherpesvirus serological cross-reactions between cattle, reindeer, deer and caprines have been widely studied and the similarity between cattle and reindeer gB glycoprotein genes was found to be of approximately 84% (Ros et al., 2002). The chance of cross infections between the reindeer and the Norwegian IBR free cattle population remains a situation to be evaluated. The better comprehension of persistent alphaherpesvirus infections in the reindeer population will surely not only improve husbandry methods which implies better economical results but might also shed some light on the IBR ongoing control campaign in cattle. If the reindeer alphaherpesvirus is transmissible to cattle, the reindeer may act as a reservoir species, which could be taken into consideration with regard to the control program for cattle.

5. References


