



Review

Cervid herpesvirus 2 infection in reindeer: A review

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ABSTRACT

Herpesviruses of the genus *Varicellovirus* are known to infect and cause disease in a variety of ruminant species, but the impact of cervid herpesvirus 2 (CvHV2) in reindeer (*Rangifer tarandus*) is mostly unknown. Reindeer is a circum-polar species with a total estimated number of more than 5 million animals. Mortality may reach high values, as in northern Norway, especially in calves (37%; 2005–2006), and disease can potentially account for some of this mortality. CvHV2 has been isolated during a natural outbreak of infectious keratoconjunctivitis, indicating an etiological link. Serological screening has shown that CvHV2 infection is prevalent in Northern Norway and experimental infection studies have demonstrated that viremia, latency and vertical transmission occur for CvHV2. The present review aims at summarizing current knowledge on the epidemiology, pathogenesis and molecular virology of CvHV2.

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1. Introduction

1.1. The agent

The genus *Varicellovirus* (Order *Herpesvirales*, Family *Herpesviridae*, Subfamily *Alphaherpesvirinae*) includes several viruses causing disease in ruminants. As infections can easily be transmitted in animal populations with high densities and may have substantial economic consequences, they have been targeted by eradication campaigns (Ackermann and Engels, 2006). Bovine herpesvirus 1 (BoHV1) is the best characterized ruminant alphaherpesvirus. It is associated with diseases of the respiratory and genital tracts (infectious bovine rhinotracheitis, infectious pustular vulvovaginitis and pustular balanoposthitis), abortion and meningoencephalitis (Muylkens et al., 2007).

Several alphaherpesviruses that are antigenically related to BoHV1 have been isolated from ruminant species where they can cause different types of disease as shown in Table 1.

Control campaigns for BoHV1 aiming at its eradication in cattle lead to studies evaluating the possibility of cross-infections, e.g. wild animals serving as BoHV1 reservoirs. Serological cross-reactions in cattle infected with other alphaherpesviruses could hinder the efficiency of BoHV1

control and eradication. Many ruminant species are susceptible to BoHV1 both in natural infections and experimental studies (Thiry et al., 2008). In reindeer, infection with BoHV1 was asymptomatic with very low viral excretion titres, did not induce neutralizing antibodies and could not be reactivated experimentally (Thiry et al., 2001).

A mild rhinitis was observed in cattle after experimental inoculation of CvHV2 and the virus could be isolated up to nine days after infection. However cohabitation of cattle with infected reindeer failed to produce cross-infections, which might indicate that the risk of natural transmission is low (Ek-Kommonen et al., 1986; Nettleton et al., 1988b; Thiry et al., 2001).

Despite limited information about the impact of CvHV2 on reindeer health, serological data indicate that CvHV2 is present throughout the Arctic in most reindeer subspecies.

1.2. The host

Reindeer (*Rangifer tarandus*, Linnaeus 1758), is a mammal belonging to the order *Artiodactyla* [Owen, 1841], family *Cervidae* [Goldfuss 1820], subfamily *Capreolinae* [Brookes, 1828]. Nine main subspecies, of which seven are still existent, are recognised (Government, 2009; IUCN, 2007; Koubek and Zima, 1999;

Table 1

Ruminant alphaherpesviruses in the genus *Varicellovirus* responsible for different diseases in ruminant species.

Virus	Natural host	Disease	Geographic distribution	References
BoHV1	Bovine (<i>Bos taurus</i>)	Infectious bovine rhinotracheitis, pustular vulvovaginitis and balanoposthitis	Europe, America, Asia and Oceania	Engels and Ackermann (1996); Madin et al. (1956); McKercher et al. (1957); Thiry et al. (2006)
BoHV5	Bovine (<i>Bos taurus</i>)	Bovine encephalitis	Europe, America, Oceania	Bagust and Clark (1972); Del Médico Zajac et al. (2009); French (1962); Johnston et al. (1962)
BuHV1	Water buffalo (<i>Bubalus bubalis</i>)	No clinical disease	Europe, Australia	De Carlo et al. (2004); St. George and Philpott (1972)
CpHV1	Goat (<i>Capra aegagrus</i>)	Vulvovaginitis, abortion, neonatal systemic infection, conjunctivitis	Europe, America, Australia	Berrios et al. (1975); Keuser et al. (2002); Saito et al. (1974)
CvHV1	Red deer (<i>Cervus elaphus</i>)	Ocular syndrome	Europe	Inglis et al. (1983)
CvHV2	Reindeer (<i>Rangifer tarandus</i>)	Ocular syndrome, lesions of the mouth mucosa, possibly involved in abortion	Europe	Das Neves et al. (2009a); Das Neves et al. (2009b); Ek-Kommonen et al. (1986); Tryland et al. (2009)
ElkHV1	Elk (<i>Cervus elaphus nelsoni</i>)	No clinical disease	America	Deregt et al. (2000)

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