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*Expanded abstract*

# A serological, retrospective study in reindeer on five different viruses

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Serological investigations on different cervidae have indicated the presence of several viruses common in domestic ruminants (Thorsen *et al.*, 1977; Lawman *et al.*, 1978; Elazhary *et al.*, 1981; Dieterich, 1981, Kocan *et al.*, 1986, Diaz *et al.*, 1988, Kokles *et al.*, 1988, Liebermann *et al.*, 1989). In addition viruses known to be present in domestic ruminants or related with such have been isolated from cervidae (Romváry, 1965; Nettleton *et al.*, 1980; Boros *et al.*, 1985; Nettleton *et al.*, 1986; Rockborn *et al.*, 1990). Pathological lesions have only at few instances been connected with the isolation of a virus (Romváry, 1965; Diaz *et al.*, 1988; Weber *et al.*, 1982; Rockborn *et al.*, 1990) although mucosal disease like and other lesions have been reported (Richards *et al.*, 1956; Feinstein *et al.*, 1987, Diaz, 1988; Steen *et al.*, 1989).

In the present study a serological retrospective investigation was carried out in semidomesticated reindeer on five different viruses. Serum samples were obtained from two woodland (Västra Kikkijaure and Ängeså) and two mountain herds (Tännäs and umbyn). The samples emanated from the years 73, -74, -75, -77 and -82. Altogether 50 randomly selected clinically healthy animals were tested (Table 1). The animals from Tännäs were kept at the National Veterinary Institute, Stockholm, close to domestic ruminants. Investigations were performed by screening for antibodies against parainfluenza-3 virus (PI-3), bovine herpesvirus type 1 (BHV-1) which cross-reacts with reindeer herpes isolates (Rockborn *et al.*, 1990), bovine viral diarrhoea virus (BVDV) and mammalian reovirus types 1 ans 2. Antibody screening was performed by using the standard ELISA tests of our institute.

Antibody titres against PI-3 were found in all herds and in more than half of the investigated animals (54 %). Titers against BHV-1 were found in 14 animals (28 %) from three herds and against BVDV in three animals (6 %) from two herds (Table 1). All animals were seronegative against the two reoviruses.

The results obtained were in accordance with earlier reports (Elazhary, 1981; Dieterich, 1981; Rehbinder *et al.*, 1985). The keeping of reindeer close to domestic ruminants seems not to have affected the results).

Antibodies against reovirus types 1 and 2 were not found in this study but have been reported from fallow deer (*Dama dama*), red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*) and sika deer (*Cervus nippon*) (Lawman *et al.*, 1978).

It seems evident that reindeer, as well as other deer, may be exposed to and infected with viruses without showing signs of clinical diseases (Thorsen *et al.*, 1977; Rockborn *et al.*, 1990) but under certain circumstances at least some of these viruses may produce disease or

Table 1. Antibody titres in reindeer from four different herds.

| Herd | PI-3 | | | | BHV-1 | | | BVD | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1:10[a] | 1:10[b] | 1:50[b] | 1:250[b] | 1:10[a] | 1:10[b] | 1:50[b] | 1:10[a] | 1:10[b] | 1:50[b] |
| Västra Kikkijaure[w] 73-07 | 8 | 1 | 2 | 1 | 6 | 5 | 1 | 11 | – | 1 |
| Tännäs*[m] 74-02 | 2 | 1 | 6 | 1 | 9 | 1 | – | 10 | – | – |
| Umbyn[m] 75-04 | 2 | 5 | 1 | – | 4 | 1 | 3 | 6 | 2 | – |
| Umbyn[m] 77-02 | 5 | 4 | 1 | – | 7 | 2 | 1 | 10 | – | – |
| Ängesån[w] 82-06 | 6 | 4 | – | – | 10 | – | – | 10 | – | – |
| Total | 23 | 15 | 10 | 2 | 36 | 9 | 5 | 47 | 2 | 1 |

[a]= not significant titre
[b]= significant titres
[w]= Woodland herd
[m]= mountain herd
*= animals kept at the National Veterinary Institute, Stockholm

contribute to disease outbreaks of a multifactorial genesis (Rockborn *et al.*, 1990).

In Table 2 are listed some known relations between the investigated agents and some maladies of a multifactorial genesis common in domestic ruminants and possibly present in reindeer.

The connection between herpesvirus infection and outbreaks of necrobacillosis in reindeer (Fig. 1) is stated by Rockborn *et al.*, (1990). Rehbinder and Nordkvist (1983), however, pointed out that anything that causes abrasions or other injuries to the oral mucosa may contribute to outbreaks of necrobacillosis. In this

Table 2. Possible (?) or known (+) relations, in reindeer, between the investigated agents and some maladies of a multifactorial genesis (virus, bacteria, stress, etc.).

| Malady / Virus infection | Necro-bacillosis | Pasteu-rellosis (pneumonia) | Keratitis | Abortions | Perinatal mortality | Cataract |
|---|---|---|---|---|---|---|
| Herpesvirus | + | ? | ? | ? | ? | ? |
| BVD-virus | ? | ? | – | ? | ? | ? |
| PI-3-virus | – | ? | – | – | ? | – |

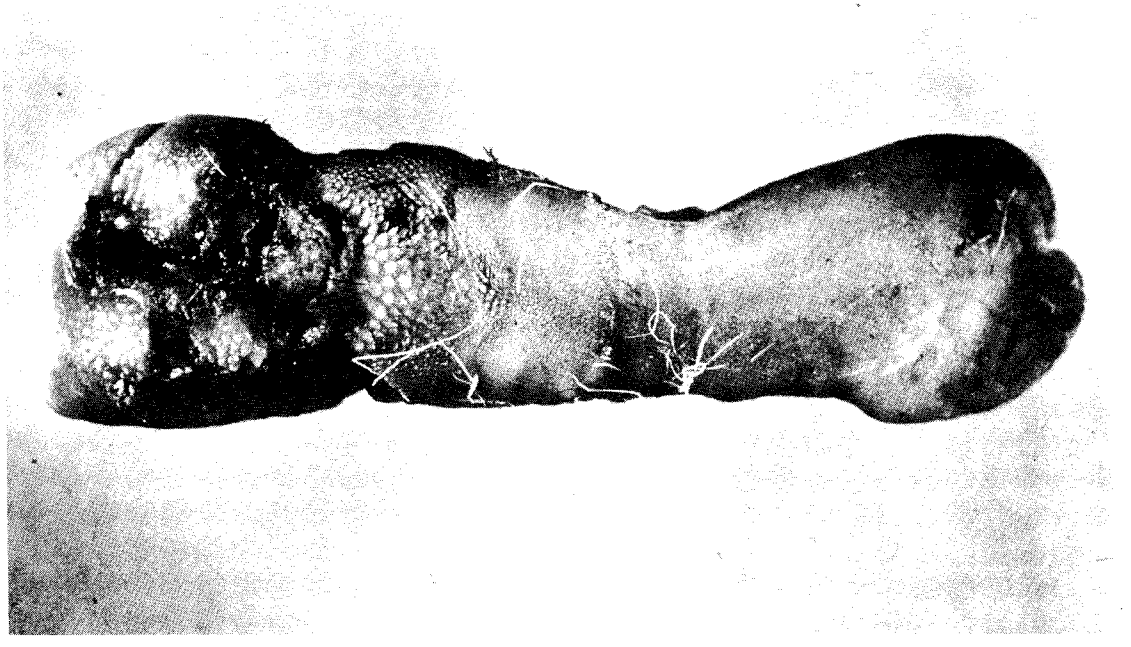

Fig. 1. Tongue from reindeer which suffered from oral necrobacillosis.

respect also BVDV can be regarded as a possible primary causative agent of necrobacillosis in reindeer.

In reindeer severe outbreaks of pasteurellosis have been reported (Magnusson, 1913; Brandt, 1914; Skjenneberg, 1957; Nordkvist and Karlsson, 1962; Kummeneje, 1976). Predisposing factors such as environmental stress, parasites and viral infections have been considered. In this context neither PI-3, herpesvirus nor BVDV may be eliminated as parameters of a multifactorical genesis (Jubb *et al.*, 1985).

Keratitis in reindeer is also a disease of multifactorical genesis and mainly caused by different management factors, such as stress, dust, corneal abrasions etc. (Rehbinder, 1977). In farmed deer herpesvirus of Cervidae type 1 (CHV-1) is known to be involved in outbreaks of ocular disease (Nettleton *et al.*, 1986) and thus the possibility that herpes virus plays a role in outbreaks of ocular disease in reindeer can not be excluded.

Both BHV-1 and BVD viruses are well known as causative agents in abortions and perinatal mortality in cattle (Jubb *et al.*, 1985), but the role of herpesvirus and BVDV in abortions in reindeer is unkown. In addition, in reindeer, abortions are considered to take place under stressfull situations (Skjenneberg and Slagsvold, 1968; Rehbinder, 1975) and thus again a multifactorical genesis can not be ruled out.

Cataracts (Fig. 2) may occur in cattle as a result of BVDV and BHV-1 infections (Williams and Gelatt, 1981a; William and Gelatt, 1981b). Cataracts are infrequently seen in reindeer (Fig. 2) and the etiology is unknown.

Still several questions are unanswered in this context such as; what is the significance of PI-3, BHV-1 and BVDV in the herds examined? Are reindeer capable of transmitting these agents to domestic ruminants either by direct contact or via blood feeding insects? Transmission of BVDV by blood feeding flies has been reported (Tarry *et al.*, 1991) and reindeer are exposed to heavy attacks from mosquitos and biting flies (Kadnikov, 1989).

Are reindeer acting as reservoirs for these viral agents? Are reindeer capable of transmitting these agents to other cervidae? Are the serologically detected viral agents identical with viruses of domestic ruminants or are they only cross-reacting strains such as the reindeer herpesvirus type 1 strain which crossreacts with bovine herpes virus type 1 (IBR) and probably does not infect cattle (Ek-Kommonen *et al.*, 1982)?

Fig. 2. Cataract in reindeer.

Conclusions: The present observations indicate that PI-3, BHV-1 and BVDV cause natural infections in reindeer herds in Sweden. Viral infections may play an important role inducing various disease complexes. The significance of these viruses is, however, not yet understood. Hence, further investigations, e.g. virus isolation attempts and transmission experiments ought to be undertaken in order to clarify the role and significance of these viruses in disease outbreaks in reideer.

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