PARAPOXVIRUS INFECTION IN DEER : A NEW DISEASE?

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INTRODUCTION

In New Zealand parapoxvirus infections are very common in sheep, goats (scabby mouth, contagious ecthyma, contagious pustular dermatitis, orf) and cattle (pseudocowpox, papular stomatitis). Infections have also been reported in man (orf, milkers nodule), chamois and thar.

Reports from other countries have indicated orf virus may produce lesions in a number of deer species, both experimentally (Lance *et al*, 1983; Zarnke *et al*, 1983) and naturally (Kummeneje and Krogsrud, 1979). The infections, however, appear to be both rare and benign in nature.

No poxvirus infections of deer had been diagnosed in New Zealand by the Animal Health Laboratories before November, 1985, in spite of the increasing numbers of deer that have been farmed over the last 15 years. Since reports of the deer poxvirus infections were released to the media in January a deer farmer has contacted us to let us know that outbreaks of a scabby mouth-like disease did occur on two deer farms in the Taupo area during the summers of 1977-8 and 1978-9. Several farm workers on one property subsequently developed skin lesions. These properties were described as "rough" with a lot of cut native bush and little improved pasture. Young hinds were affected with scabby lesions around the mouths, noses and along both flanks. No samples from these outbreaks were ever sent to the laboratory for confirmation to my knowledge.

THE NEW ZEALAND OUTBREAKS

Epidemiology

Outbreaks of parapoxvirus infection in deer have been confirmed on seven farms to date. The farms are widely separated (Table 1) apart from the two Rotorua properties which were 1 km apart. Only one farm is in the South Island. The outbreaks occurred between late November 1985 and March 1986.

Morbidity rates were up to 100% (Table 1) while deaths occurred on two farms with the mortality rate reaching 38% on the South Island property. Multifactorial disease was suspected on this latter property but, to date, other causative factors have not been identified.

TABLE 1 : A SUMMARY OF THE OUTBREAKS OF PARAPOXVIRUS INFECTION IN DEER

Farm	County	Date of Outbreak	Age of Affected Deer	Sex	Breed	No at Risk	No Affected	No Dead
1	Waitomo	231185	2 yr	M	Red	350	300	
2	Opotiki	171285	1-4 wk	M & F	Wapiti X Red and Red		4	2
3	Rotorua	241285	2 yr	M & F	Red	120	12	
4	Rotorua	130186	Mixed	M & F	Red	39	39	
5	Mackenzie	150186	Mixed	F	Red	55	55	21
6	Inglewood	110386	Mixed	F	Red	23	20	
7	Whakatane	120386	2 yr	F	Red	70	1	

Sheep and/or goats were used to variable degrees on all properties for pasture management. Cattle were also present on most of the farms. Scabby mouth in sheep had been recognised previously on four of the farms and vaccination was practised on three of them.

Only red deer (*Cervus elaphus*) were affected except on one farm where wapiti-red deer hybrids were also involved. On two farms recently captured deer were affected.

Thistles were reported as being abundant on four farms while two had patches of blackberry and barberry. Swampy areas were a feature on two farms. Wet, humid, weather at the time of the outbreaks was mentioned in reports on all the farms in the Bay of Plenty/Rotorua area.

Gross Lesions

The lesions seen varied in severity and distribution between farms and were influenced by the age and sex of the infected deer. They consisted of multiple scabby lesions being both focal (3-10 mm diameter) and diffuse.

Removal of the scabs left a red raw surface or revealed pus in the cases where secondary bacterial infection was evident. Lesions were variable present on the mouth (5 farms), face (4 farms), velvet (3 farms), ears (2 farms) oral cavity (2 farms), eyelids, neck, legs, body and perineum (all on 1 farm). The lesions seen on each farm are described in more detail elsewhere (Horner *et al*, 1986).

LABORATORY FINDINGS

Histology

Fixed skin lesions were received from four farms. In all cases there was a proliferative viral dermatitis consistent with poxvirus infection. Eosinophilic intracytoplasmic inclusions were detected in epidermal cells in two of these cases.

Bacteriology

Where secondary infection was evident *Staphylococcus aureus* was a frequent isolate (3 cases). *Dermatophilus spp.* was present in smear preparations from two cases.

Electron Microscopy

In all cases scab material was examined under the electron microscope after negative staining and virus particles morphologically resembling parapoxvirus were seen. The approximate size of the particles was 250 x 160 nm.

Restriction endonuclease analysis

The viral DNA from two deer parapoxviruses was compared to that of orf virus by DNA fingerprinting using four different endonucleases. The detailed results are reported elsewhere (Horner *et al*, 1986) but the fragment bands of the two deer viruses was identical, whereas those derived from orf virus were clearly different. The pattern of fragment bands also appeared to be different from those published for papular stomatitis and milkers nodule viruses in other countries (Gassmann *et al*, 1985).

Virus Isolation

Two of the deer parapoxviruses were inoculated onto bovine embryonic lung cell cultures. After up to 14 passages in these cells at 32°C and 37°C no evidence of viral growth could be demonstrated.

Lamb Inoculations

Five lambs were inoculated intradermally with three isolates of deer parapoxvirus. After ten days all lambs were challenged with a scabby mouth vaccine (Mannings). Unfortunately mild scabby mouth lesions were present in four of the six lambs used, at the time of inoculation with the deer virus, so this may have influenced the results obtained.

Minimal dermal reactions were only seen in one of the lambs (Table 2) with deer virus whereas two showed some reaction to the vaccine virus. No relationship between the reactions and the viruses involved was demonstrated.

Further experimental infections will be needed to test for *in vivo* immunological relationships between deer parapoxvirus and orf virus and to ascertain the susceptibility of different species to the deer virus.

TABLE 2 : THE RESULTS OF EXPERIMENTAL INOCULATION OF LAMBS WITH DEER PARAPOXVIRUS

Lamb	Inoculum	Natural SM	Reaction to DPV	Reaction to SMV
1	DPV-0744	-	-	-
2	DPV-0744	+	-	-
3	Control	+	-	+
4	DPV-3091	+	+	-
5	DPV-3091	-	-	-
6	DPV-3140	+	-	+

Key: + = lesion present
- = lesion not detected
SM = scabby mouth
SMV = scabby mouth vaccine
DPV = deer parapoxvirus

DISCUSSION

Outbreaks of infection due to a parapoxvirus occurred on seven New Zealand deer farms. This is the first occasion that such outbreaks have been diagnosed in deer in this country and no reports of a disease resembling this could be found on a literature search.

Although the lesions varied in severity and distribution between the outbreaks generally morbidity rates were high and mortality rates low. The disease was more severe where lesions were extensive and secondary bacterial infections had occurred. Mortalities occurred on two properties, but, on the most severely affected farm other unidentified factors were believed to have contributed to the deaths.

The widespread lesions on velvet seen on three farms caused considerable alarm in the velvet export industry. However, with present meat inspection procedures and the heat treatment used to dry velvet before export, it seems unlikely any infected material would be exported. Considerable financial losses can occur for individual farmers as the affected velvet cannot be marketed. On the farm which had over 300 stags affected the loss was estimated at $24,500.

When the initial outbreaks occurred it was believed orf virus was involved and had "spilled over" from the sheep or goats present on the farms. However, using DNA fingerprinting, it was shown the deer parapoxvirus is quite distinct from orf virus and thus could be a virus with a primary host specificity for deer. The DNA from the two deer viruses analysed had identical fragment patterns in spite of the fact that one came from a Rotorua farm and the other from the South Island property. This further suggests that these viruses are specific for deer rather than being parapoxviruses of some other species. Trace backs conducted on the farms revealed no common source of stock or movement of stock between farms.

It is possible this virus circulates at a low incidence rate in feral deer and the combination of increased stocking densities due to deer farming and favourable climatic conditions contributed to the outbreaks. If the epidemiology of the disease in deer is similar to that of other parapoxvirus infections then it has the potential to become widespread in farmed deer.

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REFERENCES

Gassmann, U.; Wyler, R.; Wittek, R. (1985): Analysis of parapoxvirus genomes. Arch. Virol. *83*:17-31.

Horner, G.W.; Robinson, A.J.; Hunter, R.; Cox, B.T.; Smith, R. (1986): Parapoxvirus infections in New Zealand Red Deer (*Cervus elaphus*). N.Z.vet.J. Manuscript submitted.

Kummeneje, K.; Krogsrud, J. (1979): Contagious ecthyma (orf) in reindeer (*Rangifer tarandus*). Vet.Rec. *105*:60-1.

Lance, W.R.; Hibler, C.P.; De Martini, J. (1983): Experimental contagious ecthyma in mule deer, white tailed deer, pronghorn and wapiti. J.Wildl.Dis. *19*:165-9.

Zarnke, R.L.; Dieterich, R.A.; Neiland, K.A.; Ranglack, G. (1983): Serological and experimental investigations of contagious ecthyma in Alaska (USA). J.Wildl.Dis. *19*:170-4.