

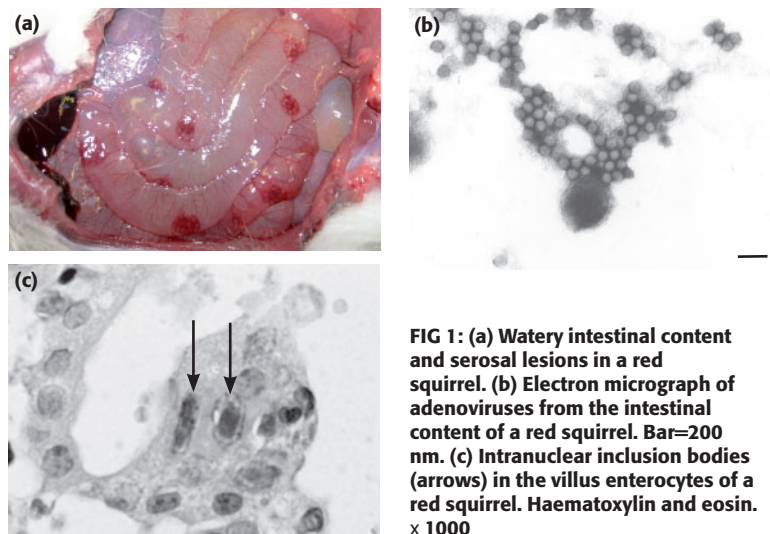
## Enteric adenovirus infection in a red squirrel (*Sciurus vulgaris*)

SIR, – There is increasing evidence that squirrel pox disease is the principal cause of the rapid decline of the red squirrel (*Sciurus vulgaris*) in England (Rushton and others 2006). However, relatively little is known about other infectious agents that may adversely affect this endangered species. Prospective investigations of squirrel pox and other diseases of the red squirrel are now supported by DEFRA through an extension of the Veterinary Laboratories Agency (VLA) diseases of wildlife scheme. The findings of one recent fatal outbreak are presented here.

Two male red squirrels were submitted to VLA – Penrith for examination in February 2006. They had been found dead, two days apart, in a north Cumbrian farm garden in which a feeding station provisioned with nuts was used by at least five squirrels. Antecedent clinical signs had not been observed.

The first squirrel was considered on the basis of developmental characteristics to be an adult and was in normal body condition. No external abnormalities were noted, in particular pox-like skin lesions or faecal staining around the perineum. At postmortem examination, scant ingesta were present in the stomach and the intestines were distended with opaque watery content. Visible through the serosal surfaces of both the small and large intestines were scattered 2 to 3 mm diameter disc-shaped hyperaemic areas (Fig 1a). The intestinal mucosa was mildly congested. No other gross abnormalities were noted in the viscera and brain. Neither parasitic worm eggs nor coccidial oocysts were detected in wet smears of intestinal content. Culture of the intestine on 10 per cent sheep blood agar produced a mixed growth of coliform organisms. Adenovirus particles were detected in the intestinal content by electron microscopy at VLA – Weybridge (Fig 1b).

The second carcass, which was also considered to be an adult, had been frozen before postmortem examination.



**FIG 1: (a) Watery intestinal content and serosal lesions in a red squirrel. (b) Electron micrograph of adenoviruses from the intestinal content of a red squirrel. Bar=200 nm. (c) Intranuclear inclusion bodies (arrows) in the villus enterocytes of a red squirrel. Haematoxylin and eosin. x 1000**

The stomach contained pale ingesta of unknown identity. Tissue autolysis was much more marked, with the intestines uniformly purple and the catarrhal content bloodstained. Individual serosal lesions if originally present were not discernible. Adenovirus particles were again detected by electron microscopy in intestinal contents.

Blood collected from both carcasses was seronegative for squirrel pox antibody by ELISA at the Moredun Research Institute. Selected tissues were fixed in 10 per cent neutral buffered formalin, processed to paraffin wax and 4 µm thick tissue sections stained with haematoxylin and eosin. Histological examination of the intestine from the fresher animal revealed an acute exfoliating enteropathy associated with some villous atrophy and crypt hyperplasia. Solid amphophilic inclusion bodies were observed in the nuclei of some villus enterocytes (Fig 1c), accompanied by mild, mainly mononuclear, cell infiltrates of the mucosa. Acute lympholysis was seen within the splenic periarteriolar lymphoid tissue. Unfortunately, intestinal sections from the second animal were uninterpretable due to advanced autolysis.

Adenovirus has been detected by the VLA in intestinal contents from red squirrels on several occasions (seven positive samples from 10 tested since February 2006). In those submitted for microscopic examination, however, confounding autolytic disruption of the intestinal mucosa precluded histological detection of suspect viral inclusion bodies. Fortunately, in the present investigation, sufficient detail remained in the fresher carcass to identify likely adenovirus-associated inclusion bodies in enterocytes. Their staining characteristics and intranuclear location in villus enterocytes paralleled enteric adenovirus infection in pigs (Abid 1984). The absence of inclusion bodies in other visceral tissues and brain suggests a viral predilection for the intestine.

The findings in the fresher animal suggest a pathogenic role for adenovirus in the red squirrel rather than transient sub-clinical infection. No other intercurrent condition was identified in either carcass as an alternative cause of death. Further evidence to support this hypothesis will only be obtained by future examination of fresh carcasses suitable for critical histological examination of well preserved intestine.

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### References

- ABID, H. N. (1984) Enteric adenovirus infection in pigs. *California Veterinarian* **38**, 16-18
- RUSHTON, S. P., LURZ, P. W. W., GURNELL, J., NETTLETON, P., BRUEMMER C., SHIRLEY, M. D. F. & SAINSBURY, A. W. (2006) Disease threats posed by alien species: the role of a poxvirus in the decline of the native red squirrel in Britain. *Epidemiology and Infection* **134**, 521-533