

## POX VIRUS INFECTION IN CAPTIVE JUVENILE CAIMANS (*CAIMAN CROCODILUS FUSCUS*) IN SOUTH AFRICA

MARY-LOUISE PENRITH\*, J.W. NESBIT\*\*, and F.W. HUCHZERMAYER\*

### ABSTRACT

Light grey macules developed on the skin and in the mouths of juvenile caimans, (*Caiman crocodilus fuscus*) (n=8), kept in the quarantine section of the reptile park at the National Zoological Gardens, Pretoria, Republic of South Africa. The gross, histopathological and ultrastructural features of the lesions were commensurate with pox virus infection. This outbreak closely resembled the disease described elsewhere in 3 juvenile captive caimans.

**Key words:** Pox virus, caiman, *Caiman crocodilus fuscus*

Penrith M.; Nesbit J.W.; Huchzermeyer F.W. **Pox virus infection in captive juvenile caimans (*Caiman crocodilus fuscus*) in South Africa.** *Journal of the South African Veterinary Association* (1991) 62 No. 3, 137-139 (En.) Department of Pathology, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, 0110 Onderstepoort, Republic of South Africa.

In the class Reptilia, disease caused by pox viruses has only been recorded in crocodilians. Banks<sup>2</sup> described skin lesions in the Arafuran file snake, (*Acrochordus arafurae*), which he suggested resembled caiman pox lesions, but no confirmatory histopathology was done.

Poxlike skin lesions in juvenile captive caimans (*Caiman sclerops*=*Caiman crocodilus fuscus*) were first reported in Florida<sup>6</sup>. The authors stated that similar lesions were considered by veterinarians and importers to be "not uncommon" in caimans, but apparently had not been encountered outside Florida.

An outbreak of poxviral disease in farmed Nile crocodiles, (*Crocodilus niloticus*), in South Africa was described by Horner<sup>1,4</sup>. This is the first report of an outbreak of pox virus infection in captive juvenile caimans (*Caiman crocodilus fuscus*) in South Africa.

The National Zoological Gardens, Pretoria, Republic of South Africa received a consignment of juvenile caimans (of indeterminate age) bred at Pet Farm in

Florida, United States of America, on 16th February 1990. All were placed in the quarantine section of the reptile park, which is an insect-proof enclosure isolated from the remainder of the reptile park, with a separate water supply and drainage system. The water in the pond is derived from the municipal supply and is changed daily. The temperature in the quarantine ward is maintained at approximately 30°C by cable heaters. The

group of 8 that survived the first 6 weeks, developed extensive, light grey, discrete (occasionally coalescent), circular and macular skin lesions 1-3 mm in diameter in May 1990 (Fig. 1). The lesions occurred mainly on the dorsal surface of the head and body as well as the limbs; no lesions were found on the ventral surface. At a post mortem examination performed on a specimen that died on 30th May 1990 as a result of an enteritis, it was noted that similar lesions were present on the palate, tongue, and gingiva. The remaining live animals were examined and found to have similar lesions on the skin and in the oral cavity, but were otherwise healthy, with a good appetite and habitus.

Subsequent to the discovery of the extent of the lesions, artificial sunlight was supplied by means of incandescent and ultraviolet light, and additional cover was supplied to reduce stress and promote basking. Over a 6-week period, a considerable reduction in the number and extent of the lesions was noted in the remaining caimans.

A complete necropsy was undertaken on the caiman that died acutely. Samples of several skin and mucosal lesions as well as from brain, lung, trachea, kidney, liver, heart and gastrointestinal tract tissue were taken from the necropsied caiman in 10% buffered formalin for histopathological investigation. Sections



Fig. 1 Juvenile caiman with round, pale macular lesions on dorsal surface of head, body and on limbs

\*Section of Pathology, Veterinary Research Institute, 0110 Onderstepoort, Republic of South Africa

\*\*Department of Pathology, Faculty of Veterinary Science, University of Pretoria

Fig. 2: Section through skin showing a pox lesion. Intracytoplasmic inclusion bodies are arrowed. HE X 40

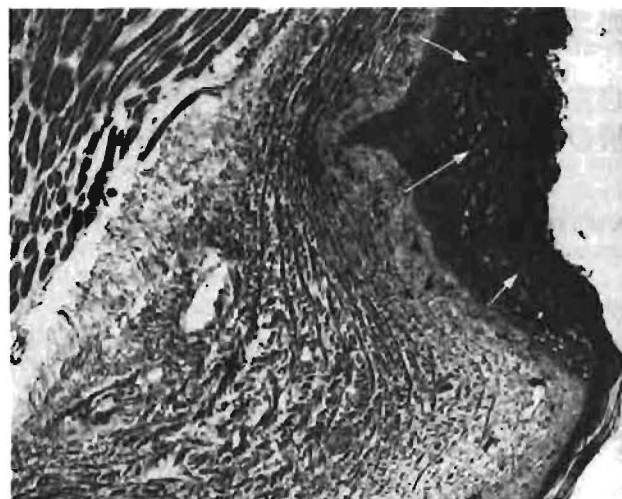


Fig. 3: Section through lesion showing (a) Bollinger bodies and (b) Borrel bodies in cytoplasm of affected cells. HE X 200

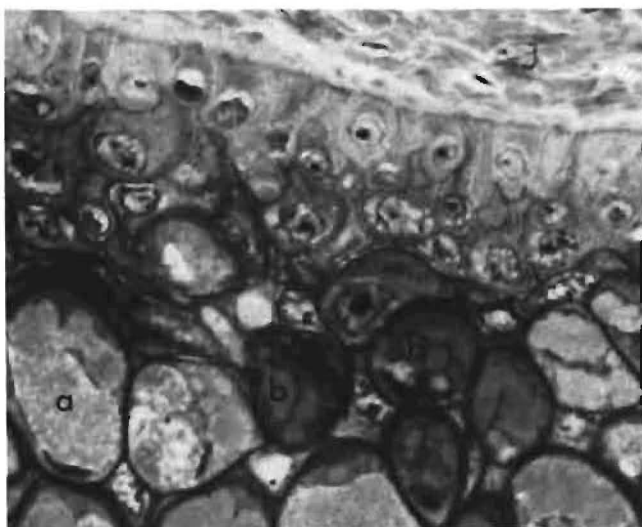


Fig. 5: Nucleocapsid (central dumbbell-shaped body) typical of the pox viruses well delineated in the viral particles. Electron micrograph X 80 000



were routinely prepared and stained with haematoxylin and eosin (HE), the Brown-Hopps modification of Gram's stain and periodic acid-Schiff methods. Selected portions of the skin lesion and adjacent normal tissue were processed for transmission electron microscopy.

Thin sections were stained with toluidine blue for light microscopy. Ultrathin sections were mounted on grids, stained with uranyl acetate and lead citrate and examined in a Jeol JEM1200 EX electron microscope.

Swabs for bacterial and fungal culture were taken from skin and oral lesions of a living specimen. Subsequently, skin scrapings and water samples for viral identification were taken and submitted to appropriate specialists (Veterinary Research Institute, Onderstepoort), but to date attempts to isolate the virus have not been successful.

The most significant macroscopic lesion at necropsy, was an acute severe catarrhal to pseudomembranous (necrotic) enteritis. The stomach contained 3 juvenile mice. The pox lesions were confined to the skin and oral mucosa. No other pathological lesions were present.

Examination of sections of the intestinal tract confirmed the severity of the enteritis, which was attributed to the excessive numbers of Gram negative bacilli associated with the lesion. The epidermis was predominantly involved with the pox lesions (Fig. 2 & 3) which consisted of hyperkeratosis, marked acanthosis, and partial involvement of the stratum basale. The basement membrane was thickened in some of the lesions. Changes included ballooning degeneration and necrosis of the epithelial cells. Affected cells were swollen, with nuclear changes including margination of chromatin, loss of nucleoli, and pyknosis; the pyknotic nuclei often being distorted and compressed. Eosinophilic cytoplasmic inclusions were present in many cells (Fig. 2 & 3). All lesions showed cells with large cytoplasmic inclusions resembling Bollinger bodies (Fig. 3 & 4), and some showed cells with smaller, more deeply eosinophilic inclusions resembling Borrel bodies (Fig. 3). Inflammatory changes in the dermis were minimal, and included oedema and foci of mononuclear cell infiltration.

Inclusion bodies were demonstrated in the epithelial cells by transmission elec-

tron microscopy (Fig. 4). These appeared at lower magnifications as granular areas (Fig. 4). At higher magnification they were seen as light areas containing large numbers of viral particles, as well as more irregular, granular masses. The viral particles (virions) were round to oval and contained a dumbbell-shaped body, the nucleocapsid (Fig. 5).

*Pseudomonas aeruginosa* was isolated from the skin swabs. The macroscopic and microscopic evidence implicated bacterial enteritis as the cause of death of the necropsied caiman. The macroscopic, microscopic and ultramicroscopic features taken in conjunction with the distribution of the skin lesions bear a strong resemblance to previous descriptions of pox virus infection in caimans<sup>5,6</sup>. The virus exhibits a distinct tropism for the epidermis and epithelium of the oral cavity. The dumbbell-shaped nucleocapsid as revealed by electron microscopy provides positive identification of the virus as belonging to the pox virus group<sup>3,6,7</sup>.

The origin of the infection is unknown. However, 3 epidemiological aspects are significant in this outbreak. Firstly, the fact that the caimans originated from Florida in the USA, to which area the infection has hitherto been unique<sup>5,6</sup>; secondly, that the disease occurred in all of the animals shortly after arrival; and thirdly, that the caimans were kept under strict quarantine. These factors suggest that the infection was present in a latent but sub-clinical form and underwent clinical recrudescence under the stress of a changed environment. It is unlikely that infection occurred subsequent to their arrival. Complicating stress factors probably involved lack of sunlight and disturbance due to activities of staff in the isolation unit. Part of the managerial control of skin conditions in farmed Nile crocodiles entails increasing the time the animals spend out of the water, and that they preferably be exposed to direct sunlight. In addition to a presumed development of immunity, the provision of artificial sunlight, additional cover, and large basking surfaces out of the water, resulted in an improvement in the skin condition of the caimans.

Comparison of pox virus infection in caimans and crocodiles reveals a number of distinct differences. While the microscopic and ultrastructural appearance of the lesions is very similar to that of pox

virus infection in the Nile crocodile<sup>4</sup>, the macroscopic appearance and distribution of the lesions is very different. Crocodiles usually develop brown, wart-like lesions mainly on the skin of the head, sides of the mouth and ventral neck, the sides of the body, the belly, and on all four limbs<sup>4</sup>. Lesions may show patterns that suggest association with trauma due to bite wounds. The occurrence of lesions on the skin of the belly is potentially important from an economic viewpoint, this being the most valuable part of the skin. Crocodiles develop pox lesions when kept in overcrowded and unhygienic conditions, while the caimans developed lesions in a very clean and spacious tank. The pattern of the lesions did not indicate any association with trauma in the caimans. Pox lesions have not been noted in any of the Nile crocodiles kept in the collection of the National Zoological Gardens, which are completely separated from the caimans in the quarantine unit.

It therefore seems likely that the caimans became infected with the pox virus before leaving Florida, that a long period of latency is possibly, and that the caiman pox virus is different to the pox virus that affects Nile crocodiles in South Africa, even if it should prove to be transmissible to them.

## ACKNOWLEDGEMENTS

Our grateful thanks are due to Mr W Labuschagne, Mr M J Penrith, Ms C Maree, Ms H Smit, Ms L Limper, Dr M Henton and Ms V K A Käber.

## REFERENCES

1. Anon 1990 Poxvirus in farmed Nile crocs may have economic impact on industry. *Agricultural News* 25 June 1990: 5
2. Banks C B 1989 Management of fully aquatic snakes. *International Zoo Yearbook* 28: 155-163
3. Cheville NF 1975 Cytopathology in viral diseases. In: Melnick J L (ed.) *Monographs in Virology*. Vol 10 S Karger, Basel
4. Horner R F 1988 Poxvirus in farmed Nile crocodiles. *Veterinary Record* 122: 459-462
5. Jacobson E R 1984 Immobilization, blood sampling, necropsy techniques and diseases of crocodilians: a review. *Journal of Zoo Animal Medicine* 15: 38-45
6. Jacobson E R, Popp J A, Shields R P, Gaskin J M 1979 Poxlike skin lesions in captive caimans. *Journal of the American Veterinary Medical Association* 175: 937-940
7. Mayr A, Mahnel H, Munz E 1972 Systematisierung und Differenzierung der Pockenviren. *Zentralblatt für Veterinärmedizin (B)* 19: 69-88