

Mentali 139

Sonderdruck aus
Verhandlungsbericht des 31. Internationalen Symposiums
über die Erkrankungen der Zoo- und Wildtiere
Dortmund 1989



AKADEMIE-VERLAG BERLIN

1989

From the Department of Pathology, National Zoological Park, Smithsonian Institution, Washington, D.C.

PATHOLOGIC SURVEY AND REVIEW OF DISEASES OF CAPTIVE MANED WOLVES
(CHRYSO CYON BRACHYURUS) AND BUSH DOGS (SPEOTHO S VENATICUS)

By R.J. M o n t a l i and K. K e l l y

Introduction

Of the Canidae indigenous to South America, two species, the Bush dog (*Speothos venaticus*) and the Maned Wolf (*Chrysocyon brachyurus*) have been successfully exhibited and propagated at the National Zoological Park in Washington, D.C. and Front Royal, Virginia (BRADY and DITTON, 1979). Considerable contrast is shown between each of these canids. The maned wolf is a large (20 - 23 kg) sleek animal with long legs used for propulsion through the grass and swamp lands it inhabits in parts of Brazil and adjoining countries. The maned wolf is nocturnal and its diet mostly omnivorous, consisting of small mammals, birds, and insects as well as fruit and other vegetation. The bush dog on the other hand is relatively small (5 - 7 kg) with a stocky body and short legs. It is primarily diurnal and inhabits forests and savannahs extending from Panama to northeastern Argentina where packs of up to ten aggressively prey on large rodents. The bush dog is considered semiaquatic and has been observed diving for prey (NOWACK and PARADISO, 1983).

Both of these South American canids are relatively uncommon now in the wild as well as in captivity. The bush dog is currently listed in Appendix 1 of CITES and the maned wolf in Appendix 2, and considered endangered. The ecology, and social structure and behavior of these two species have been well studied and contrasted (KLEIMAN, 1972; BIREN, 1983; DIETZ, 1984). The medical management of maned wolves in captivity and some disease problems of hand raised maned wolves have been previously reported (SCHNEIDER et al., 1979; BUSH, 1980).

The purpose of this paper is to review the diseases based on the pathological findings in bush dogs and maned wolves that died at the National Zoological Park (NZP) and to compare these findings with those reported in the literature.

Materials and Methods

This survey includes summaries of pathologic findings obtained from necropsy records from 46 bush dogs and 22 maned wolves that died at the National Zoological Park in Washington, D.C. and Front Royal, Virginia between 1975 and 1986. During that time all of these animals underwent complete necropsies with systematic dissections. Specimens of heart blood and any lesions were obtained for microbiologic examination; selected tissues were frozen at -70 °C for virologic examination, and representative tissue specimens from all organs were fixed in 10 % buffered formalin, embedded routinely in paraffin and sectioned 4 - 6 μ and stained with hematoxylin and eosin. Selected special stains were performed including PAS and Gomori's methenamine silver for fungi, Brown and Brenn and Brown and Hopps stains for bacteria, and Warthin-Starry silver stain for leptospirae. Special procedures for serosurveys and virologic methods have been previously published, (MANN et al., 1980; JANSSEN et al., 1982; MONTALI et al., 1983). Reports and pathologic materials were also obtained from other zoos to which animals had been loaned. Data from all the animals that died were categorized by groups containing perinatal deaths (up to 30 days old), and juvenile and adult deaths for each of the bush dogs and maned wolves (Tables 1 - 4).

Table 1: Summary of pathologic findings in perinatal bush dogs

Perinatal, undetermined	- 0.1, 1 day old, 172 gm - 0.1, 13 days old, 195 gm - 0.1, 1 day old, 210,4 gm
-------------------------	--

Perinatal, hypoxia	- 0.1, 1 day old, 175 gm
Perinatal, inanition	- 0.1, 4,5 days old, 151 gm Remarks: Beta-hemolytic streptococcus cultured from heart blood; no signs of any nursing activity
Perinatal, intra-uterine death/stillborn	- 1.0, fetus, 202 gm Remarks: Removed by cesarean - 0.3, fetus, 190 gm, 202 gm, 197 gm Remarks: Removed by cesarean; probably associated with uterine inertia - Sex unknown, fetus - 0.1, 1 day old Remarks: On loan to another zoo; removed by cesarean
Perinatal, abortion	- 0.1, fetus, 194 gm
Perinatal, pneumonia	- 1.0, 1 day old, 200 gm Remarks: Staphylococcus aureus cultured from the lung; plant material aspirated - 1.0, 3 days old, 141 gm Remarks: Beta-hemolytic streptococcus and Staphylococcus aureus cultured from heart blood - 1.0, 1 day old, 172,4 gm Remarks: Non-hemolytic Streptococcus sp. cultured from lungs; agenesis of the left kidney
Perinatal, trauma	- 1.0, 1 day old, 188 gm Remarks: Parent induced - 1.0, 1 day old, 292 gm Remarks: Parent induced - 0.1, 5 days old, 114 gm Remarks: Beta-hemolytic streptococcus and Staphylococcus aureus cultured from liver and heart blood - Sex unknown, 1 hour old Remarks: Killed by juveniles; parental cannibalism - Sex unknown, 1 day old Remarks: No carcass, parental cannibalism
Perinatal, trauma	- 1.0, 4 days old, 116 gm - 1.0, 1 day old, 181,8 gm Remarks: Parental cannibalism - Sex unknown, several hours old Remarks: Parental cannibalism - 1.0, 1 day old, 156,6 gm
Perinatal, congenital	- 0.1, 1 day old, 145 gm Remarks: Cleft palate

Table 2: Summary of pathologic findings in juvenile and adult bush dogs

Infectious, viral, canine parvovirus	- 1.0, 18 weeks old - 1.0, 5 months old, 3 kg Remarks: E. coli and Morganella sp. also cultured from heart blood - 1.0, 6 months old, 5,74 kg Remarks: Necrotizing enteritis with bacterial invasion. E. coli also cultured from peritoneal fluid - 1.0, 6 months old, 5,32 kg Remarks: E. coli also cultured from abdominal fluid - 1.0, 6 months old, 6,14 kg Remarks: CPV confirmed by HI. Pseudomonas fluorescens also isolated from liver; filamentous bacilli (Fusobacterium necrophorus) evident in the liver lesions and mesenteric lymph nodes - 0.1, 5 months old, 2,78 kg - 0.1, 6 months old, 4,96 kg Remarks: E. coli also cultured from the liver - 0.1, 6 months old, 5,745 kg
--------------------------------------	---

Infectious, bacterial, leptospirosis	<ul style="list-style-type: none"> - 0.1, 7 months old, 3,45 kg Remarks: Parvovirus positive by HI and HA. Campylobacter sp. was cultured antemortem - 0.1, 3 years old, 5,43 kg Remarks: E. coli also cultured from the spleen - 1.0, 9 months old, 6,76 kg - 0.1, 2 years, 10 months old, 7,73 kg
Urinary, nephritis/nephrosis	<ul style="list-style-type: none"> - 1.0, 20 months old Remarks: On loan to another zoo; renal changes led to uremia - 0.1, 6 years, 11 months old, 5,79 kg Remarks: Interstitial nephritis, euthanized - 1.0, 8 years old, 5,7 kg Remarks: Immune complex type glomerulonephritis - 0.1, 3 years old, 6,96 kg Remarks: Pyelonephritis. Hypotensive shock associated with gram negative sepsis
Parasitism, ectoparasite	<ul style="list-style-type: none"> - 0.1, 3 years, 4 months old, 7,34 kg Remarks: Heavy flea infestation
Euthanasia	<ul style="list-style-type: none"> - 1.0, 5 years, 8 months old, 6,92 kg Remarks: Severe lameness - 1.0, 11 years, 27 days old, 7,32 kg Remarks: Advanced disc disease - 0.1, 1 year, 3 months and 14 days old, 6,36 kg - 0.1, 1,5 years old, 5,62 kg

Table 3: Summary of pathologic findings in perinatal maned wolves

Perinatal, not evident	- 1.0, 26 days old, 901,5 gm
Perinatal, stillborn	- 0.2 Remarks: Premature
Perinatal, trauma	<ul style="list-style-type: none"> - 3.0, 1 hour to 1 day old, 386,8 gm Remarks: Inexperienced parents - 0.2, one 2 hours old, one 13 days old. 13 day old pup weighed 366 gm Remarks: 1 hour old pup died as a result of a parental struggle - 0.2 Remarks: Separate litters, parental cannibalism
Perinatal, aspiration	<ul style="list-style-type: none"> - 1.0, 12 days old, 432,0 gm Remarks: Tube feeding accident - 0.1, 15 days old, 590 gm Remarks: Tube feeding accident

Table 4: Summary of pathologic findings in juvenile and adult maned wolves

Infectious, viral, canine distemper	- 1.0, 2 months, 22 days old Remarks: Died while on loan to another zoo. Modified live canine distemper vaccine (Galaxy-4) induced the distemper
Infectious, viral, canine parvovirus	- 1.0, adult Remarks: This wolf was in a chronic healing stage with secondary infection
Urinary, urolithiasis/atrophy	<ul style="list-style-type: none"> - 1.0, 2 years +, 32,2 kg Remarks: Atrophic right kidney = source of cystine calculi obstructing urethra; adrenal adenoma; tracheal <i>Filaroides osleri</i> - 1.0, 5 years old, 28,0 kg Remarks: Cystine renal calculi, thyroiditis and atrophic gastritis. Euthanized, selfmutilation

	<ul style="list-style-type: none"> - 0.1, 12 years old, 27,2 kg Remarks: Cystine calculus, left kidney; atrophic right kidney with nematode remnant; thyroid and adrenal adenoma and pheochromocytoma; gingival hyperplasia - 0.1, 5 years +, 24,8 kg Remarks: Atrophy, right kidney; pheochromocytoma; marked gingival hyperplasia. Euthanized
Urinary, nephrosis	<ul style="list-style-type: none"> - 1.0, 6 months old, 12,5 kg Remarks: Renal tubular necrosis and severe cystitis
Reproductive, pyometra	<ul style="list-style-type: none"> - 0.1, 8 years +, 24,6 kg Remarks: Marked cystic endometrial hyperplasia. Streptococcus was isolated from vaginal tract and cervix antemortem. Malignant pheochromocytoma; adrenal cortical adenoma; ovarian sertoli cell tumor. Euthanized
CNS, hemorrhage	<ul style="list-style-type: none"> - 1.0, 5 years old Remarks: Meningeal hemorrhage pons; extensive myopathy (atrophic) head and neck. Euthanized
Musculoskeletal, fracture	<ul style="list-style-type: none"> - 1.0, 40 days old, 2,2 kg Remarks: Mal-aligned healed femoral fracture; ileosacral subluxation. Euthanized

Results and Discussion

Bush dogs

Patterns in 25 perinatal bush dog deaths studied revealed a variety of unrelated causes mostly associated with failures during the neonatal period (Table 1), as most of the deaths occurred at or within a few days of birth. In some cases there was evidence of parental trauma and cannibalism, or failure of nursing activity on the part of the neonate. Beta-hemolytic streptococcus and Staphylococcus aureus were isolated from three cases which were considered secondary to neonatal stress associated with parental neglect or trauma. Viral or other infectious disease agents were not identified during this perinatal period, and only 2 congenital malformations were found, a cleft palate and an aplastic left kidney, each in 1 day old male bush dogs.

In 21 juvenile and adult bush dogs, most of the significant findings were attributed to infectious diseases and renal conditions (Table 2). The 10 cases of canine parvovirus infections occurred during an outbreak of this disease late in 1979 which also affected maned wolves and crab eating foxes (*Cerdocyon thous*). The disease was highly lethal for the bush dogs and was characterized by anorexia, lethargy, diarrhea and vomiting. The clinical and pathologic findings included extensive hemorrhage and necrosis of the small intestine (Fig. 1) and panleucopenia, and high hemagglutination inhibition (HI) titers to CPV in several bush dogs that survived (MANN et al., 1980). Subsequent outbreaks of CPV in bush dogs in 1981 and 1982 were attributed to vaccine breaks associated with maternal antibody interference with the killed feline origin parvovirus vaccine that was used (JANSEN et al., 1982). Following that, bush dogs pups were isolated from their parents and repeatedly vaccinated to prevent these breaks. Subsequently a modified-live CPV vaccine (Duramune, Fort Dodge Labs, Fort Dodge, Indiana), developed for domestic dogs was used that provided good protection against CPV in bush dog pups without having to isolate litters from the main colony (MONTALI et al., 1987).

Bush dogs in our collection are also vaccinated against canine distemper with a modified-live vaccine that has been attenuated in cultured chicken cells (Fromm D, From Laboratories, Inc., Grafton Wisconsin), since killed CDV vaccines were shown earlier not to elicit adequate immune response in bush dogs, and modified-live vaccines of canine origin were known to induce clinical distemper in some exotic canids (MONTALI et al., 1983; MONTALI et al., 1987).

As noted in table 2, two bush dogs deaths were attributed to leptospirosis based on clinical and histopathological findings of jaundice and renal failure associated with severe subacute interstitial nephritis. Neither bush dog had serological evidence of leptospirosis probably because of its peracute nature and treatment with antibiotics early in the course of the disease. However, wild rats trapped in the vicinity of the bush dog pens had both leptospires in their urine by darkfield examination and titers against *L. icterohemorrhagiae* and *poona* of up to

1:1000. Bush dogs appear to be highly susceptible to acute leptospirosis and should therefore be protected against this disease with polyvalent leptospira bacterins.

The renal conditions observed in 5 bush dogs (Table 2) ranged from interstitial nephritis (possibly leptospirosis-associated but not proven) to staphylococcal pyelonephritis in a 3 year old bush dog that may have been associated with a severe hypothyroid state. Some unusual conditions included the finding of gallstones composed of bilirubin in an approximately 7 year old female bush dog (that also had interstitial nephritis), degenerative disc disease in an 11 year old male bush dog that was euthanized after showing progressive ataxia, and a heavy flea infestation which led to a profound anemia in a 3 1/2 year old female that occurred while on loan to another zoo.

Maned wolf

Causes of mortalities in maned wolves in the perinatal period were evaluated in 12 animals (Table 3). Most deaths occurred in neonates and could not be attributed always to specific causes; several were due to parental trauma or mishaps during tube feeding of cubs being hand raised. There were no specific bacterial or viral disease evident during this time. In the 10 juvenile and adult maned wolves, as with the bush dogs, problems were mainly related to infectious diseases and kidney conditions (Table 4). Canine parvovirus first broke out in the maned wolves in 1979 and was responsible for the death in one of three affected animals. The one maned wolf fatality with CPV died in a chronic healing stage (Fig. 2) of secondary bacterial infection (MAHN et al., 1980). Canine parvovirus was first described in maned wolves in 1978 at the San Antonio Zoo in Texas (FLETCHER et al., 1979) and has also been reported in maned wolves in some European zoos (BIENIEK et al., 1981; SCHAPPUIS and LERNOULD, 1987).

Pathologic findings in the urinary tracts of maned wolves were quite different from those mentioned in the bush dogs. Urinary calculi composed of cystine were found in 3 maned wolves. In a 2 year old male, calculi developed in the right kidney which was atrophied. The calculi obstructed the os penile urethra. A 5 year old male died of complications associated with the surgical removal of renal cystine calculi, and a 5 year old female was euthanized with severe atrophy of the right kidney that also had a large staghorn calculus composed of cystine in the contralateral kidney (Fig. 3). Cause of the calculi formation has been attributed to a renal defect for reabsorption of cystine and dibasic amino acids which has been detected in both captive born and wild-caught maned wolves of approximate equal sexes (BUSH and BOVEE, 1978; BOVEE et al., 1981). The atrophied right kidneys which occurred only in wild-caught maned wolves are attributed to previous infections with the giant kidney worm, *Diocotophyma renala* (MATERA et al., 1968; KUMAR et al., 1972). In the maned wolf with the staghorn calculus a remnant of the worm was found in the dilated pelvis of the atrophied right kidney (Fig. 4), but usually no worm segments remain and sometimes the kidney itself appears to be absent. This has led to the misinterpretation of congenital aplasia or hypoplasia of the right kidney in maned wolves. It is likely that the report of an "aplastic" right kidney in a 12 year old female maned wolf was really due to an earlier involvement with the giant kidney worm (FEEBACK et al., 1986).

The one case of fatal canine distemper infection (Table 4) was induced by modified-live vaccine (canine origin) which developed in 2 of a litter of 3 cubs while on loan to another zoo. (THOMAS-BAKER, 1985). This points out the importance of using only killed or avian-origin modified canine distemper vaccines in exotic canids that are proven to be safe and efficacious for those species as previously mentioned (MONTALI et al., 1983).

Other significant changes in the maned wolves included gingival hyperplasia noted in two animals. This has been observed as a progressive condition initiating in the maxillary gingiva near the parotid duct opening and eventually involving mandibular mucosa (Fig. 5). Lesions progress to bone involvement with periosteal hyperostosis and bone resorption. Most of the maned wolves affected with gingival hyperplasia were wild-caught, and similar osseous lesions of the mandibles were observed in maned wolves collected in the wild by the Smithsonian Natural History Museum (BUSH et al., 1986). The cause of this gingival hyperplasia is not known; one report attributes the mandibular hyperostosis associated

with it to chronic renal failure (FREEBACK et al., 1986) but we have observed this condition in maned wolves that were not in renal failure; the five year old female with marked gingival hyperplasia and mandibular hyperostosis (Table 4) had a BUN of only 29 mg/dl and a creatinine of only 1.3 mg/dl at time of euthanasia.

There appeared to be a trend for adrenal cortical and medullary tumors; of the 3 pheochromocytomas noted (Table 4) one was histologically malignant in a female maned wolf that also had an ovarian sertoli cell tumor. There is little information about tumor incidence in the maned wolf; one report describes an osteogenic sarcoma in a 5 year old male which metastasized widely (MEIER et al., 1982). Other pathologic conditions not observed in our series but reported in the literature include cryptorchidism involving two litters of maned wolves with monorchid male cubs (BURTON and RAMSEY, 1986), a report of *Spirocerca lupi* in a maned wolf (WRANG and WEINGARTNER, 1972), and encephalomalacia associated with intravascular coagulation in 2 maned wolves with heavy flea infestations (PKEET and GAYNOR, 1987).

Summary

Pathologic Survey and Review of Diseases of Captive Maned Wolves (*Chrysocyon brachyurus*) and Bush Dogs (*Speothos venaticus*)

Pathologic analyses of necropsy cases were performed on 46 bush dogs (*Speothos venaticus*) and 22 maned wolves (*Chrysocyon brachyurus*) from The National Zoological Park in Washington D.C. and Front Royal, Virginia. These findings are discussed and compared with findings reported by others in the literature.

Zusammenfassung

Übersicht und Besprechung von pathologischen Befunden bei in Menschenhand gehaltenen Mähnenwölfen (*Chrysocyon brachyurus*) und Waldhunden (*Speothos venaticus*)

Es wird eine Analyse der Sektionsbefunde von 46 Waldhunden und 22 Mähnenwölfen aus dem Nationalen Zoologischen Park in Washington, D.C. und Front Royal, Virginia, vorgenommen. Die Ergebnisse werden diskutiert und mit Befunden aus der Literatur verglichen.

Résumé

Aperçu et discussion de résultats pathologiques chez des loups à crinière (*Chrysocyon brachyurus*) et chez des chiens des buissons (*Speothos venaticus*) gardés par l'homme

Analyse des résultats de dissections effectuées sur 46 chiens des buissons et sur 22 loups à crinière venus du Parc zoologique national de Washington, D.C. et Front Royal, en Virginie. Les résultats obtenus sont discutés et comparés aux résultats présentés dans la littérature.

Резюме

Обзор и обсуждение патологических данных, полученных от гривастых волков (*Chrysocyon brachyurus*) и лесных собак (*Speothos venaticus*)

Обсуждается анализ секционных результатов, полученный при обследовании 46 лесных собак и 22 гривастых волков из национальных парков Вашингтона, Д.С., Фронт Рояля в Виргинии. Результаты обсуждаются в сравнении с литературными данными.

References

- BIBEN, M. (1983): Comparative Ontogeny of Social Behavior in Three South American Canids, The Maned Wolf (*Chrysocyon brachyurus*), Crab-Eating Fox (*Cedocyon thous*) and Bush Dog (*Speothos venaticus*): Implications for Sociality, *Anim. Behav.* **31**, 814 - 826.
- BIENIEK, H.J., ENCKE, W., GRANDRAS, R., and P. VOGT (1981): Parvovirus Infektion beim Mähnenwolf. *Kleintier Prax.* **26**, 291 - 298.

- BOVEE, K.C., BUSH, M., DIETZ, J.M., JEZYK, P., and S. SEGAL (1981): Cystinuria in the Maned Wolf (*Chrysocyon brachyurus*) of South America. *Science* 212, 919 - 920.
- BRADY, C.A., and M.K. DITTON (1979): Management and Breeding of Maned Wolves (*Chrysocyon brachyurus*) at the National Zoological Park, Washington, D.C. In *Internat. Zoo Yearb.* Ed. P.J.S. OLNEY, 171 - 176, Zoological Society of London.
- BURTON, M., and E.C. RAMSAY (1986): Cryptorchidism in Maned Wolves (*Chrysocyon brachyurus*). *J. Zoo. Anim. Med.* 17, 133 - 135.
- BUSH, M. (1980): Medical Management of Maned Wolves (*Chrysocyon brachyurus*). *Ann. Proc. Am. Ass. Zoo. Vet.* 132 - 134.
- BUSH, M., and K.C. BOVEE (1978): Cystinuria in a Maned Wolf. *J. Am. Vet. Med. Ass.* 173, 1159 - 1162.
- BUSH, M., PHILLIPS, L., JANSSEN, D., and R.J. MONTALI (1986): Gingival Hyperplasia in the Maned Wolf (*Chrysocyon brachyurus*). In: *Proceedings of Exotic Animal Dentistry*, Milwaukee Country Zoo, MI 53226.
- DIETZ, J.M. (1984): Ecology and Social Organization of the Maned Wolf (*Chrysocyon brachyurus*). In *Smithsonian Contrib. Zool.* 392, 1 - 51.
- FEEBACK, D.L., JENSEN, J.M., and S.D. KOSANKE (1986): Renal Hyperostotic Osteodystrophy Associated With Unilateral Renal Aplasia in a Captive Maned Wolf (*Chrysocyon brachyurus*). *J. Wildl. Dis.* 22, 595 - 600.
- FLETCHER, K.C., EUGSTER, A.K., SCHMIDT, R.E., and J.B. HUBBARD (1979): Parvovirus Infections in Maned Wolves. *J. Am. Vet. Med. Ass.* 175, 897 - 900.
- JANSSEN, D.L., BARTZ, C.R., BUSH, M., MARCHWICKI, R.H., GRATE, S.J., and R.J. MONTALI (1982): Parvovirus Enteritis in Vaccinated Juvenile Bush Dogs. *J. Am. Vet. Med. Ass.* 181, 1225 - 1227.
- KLEIMAN, D.G. (1972): Social Behavior of the Maned Wolf (*Chrysocyon brachyurus*) and Bush Dogs (*Speothos venaticus*): A Study in Contrast. *J. Mammal.* 53, 791 - 806.
- MANN, P.C., BUSH, N., APPEL, M.J.G., BEEHLER, B.A., and R.J. MONTALI (1980): Canine Parvovirus Infection in South American Canids. *J. Am. Vet. Med. Ass.* 177, 779 - 783.
- MEIER, J.E., APPEL, G., and P.J. KIESSLING (1982): Osteogenic Sarcoma in a Maned Wolf (*Chrysocyon brachyurus*). *J. Zoo. Anim. Med.* 13, 107 - 113.
- MONTALI, R.J., BARTZ, C.R., and M. BUSH (1987): Canine Distemper Virus. In: *Virus Infections of Carnivores* Ed. APPEL, M. 437 - 443. Amsterdam: Elsevier Science Publishers.
- MONTALI, R.J., BARTZ, C.R., and M. BUSH (1987): Parvoviruses. In: *Virus Infections of Carnivores* Ed. APPEL, M. 419 - 427. Amsterdam: Elsevier Science Publishers.
- MONTALI, R.J., BARTZ, C.R., TEARE, J.A., ALLEN, J.T., APPEL, M.J.G., and M. BUSH (1983): Clinical Trials with Canine Distemper Vaccines in Exotic Carnivores. *J. Am. Vet. Med. Ass.* 183, 1163 - 1167.
- NOWACK, R.M., and J.L. PARADISO (1983): In: *Walker's Mammals of the World*, 4th Edit. Baltimore: Johns Hopkins Univ. Press.
- PEET, R.L., and W. GAYNOR (1987): Encephalomalacia in Maned Wolves (*Chrysocyon brachyurus*) Associated With Possible Disseminated Intravascular Coagulation Syndrome. *Aust. Vet. J.* 64, 59.
- FRANGE, H., BERG, W., und A. JACOB (1988): Vergleichende Erhebungen zur Zystinurie bei besonderer Beachtung des Mähnenwolfes. *Verh.ber. Erkr. Zootiere* 30, 243 - 256.
- SCHAPPIUS, G., and J.M. LERNOULD (1987): Infection a parvovirus felin chez le chien de foret (*Speothos venaticus*). *Verh.ber. Erkr. Zootiere* 29, 293 - 297.
- SCHNEIDER, H.E., GEIDEL, B., und P. GEIDEL (1979): Bemerkungen zur künstlichen Aufzucht und zu Erkrankungen von Mähnenwölfen im Zoologischen Garten Dresden. *Verh.ber. Erkr. Zootiere* 21, 315 - 321.

- THOMAS-BAKER, B. (1985): Vaccination-Induced Distemper in Maned Wolves, Vaccination Induced Corneal Opacity in a Maned Wolf. *Proc. Am. Ass. Zoo. Vet.* 53.
- WRANG, H., and E. WEINGARTNER (1972): (*Spirocerca lupi*) Spiruroidea Nematoda in a *Chrysocyon brachyurus*. *Kleintier-Prax.* 17, 45 - 47.

Address of authors: R. J. M o n t a l i, DVM
National Zoological Park
Smithsonian Institution
Washington, D.C. 20008 (USA)

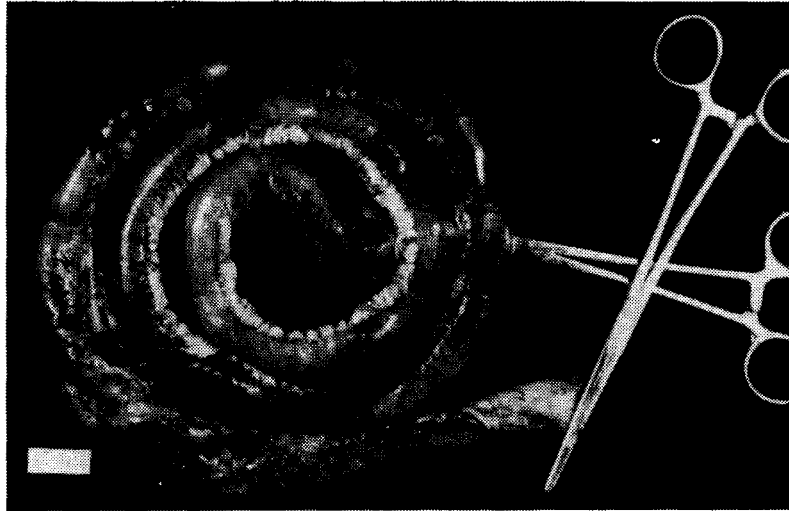


Fig. 1: Gross appearance of a coiled section of the small intestine from a bush dog with canine parvovirus infection (CPV) showing segmental suffusive hemorrhages through the serosal surfaces.



Fig. 2: Histologic appearance of the small intestine from a maned wolf with CPV in the healing stages. Note lack of defined villi and extensive regeneration of crypt epithelium.
H&E, X100.

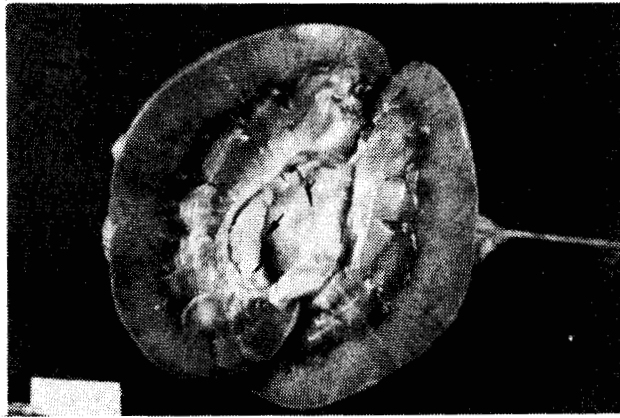


Fig. 3: Bisected left kidney from 12 year old female maned wolf showing large staghorn calculus in the pelvis (arrows) composed of pure cystine.



Fig. 4: Bisected atrophic right kidney from maned wolf in Fig. 3; tubular structure in pelvis was identified as a degenerate segment of the giant kidney worm, Diectophyma renale.



Fig. 5: Maxillary and mandibular gingiva of a dissected maned wolf head shows extensive hyperplasia (arrows).