# Blood Smear from a Wild-Caught Panther Chameleon (*Furcifer pardalis*)

**What Is Your Diagnosis?**

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## Case Presentation

A wild-caught male panther chameleon (*Furcifer pardalis*, previously known as *Chamaleo pardalis*) imported from Madagascar and of unknown age was presented to the Avian and Exotic Animal Clinic of Lafayette with a complaint of anorexia. The chameleon's diet consisted primarily of crickets, which the owner occasionally would dust with calcium supplement. Although physically vigorous, the patient was thin (52 g), exhibited poor coloration (Figure 1A), and had pale oral mucous membranes. Physical examination revealed 4 multifocal, poorly defined small bulges underneath the skin (not shown). Two of the bulges were located behind the left forearm, and the other 2 were located cranial to the right rear limb. As part of the diagnostic workup, heparinized blood samples were collected and used to prepare several air-dried smears and wet preparations. Most blood smears were stained with a rapid Romanowsky stain (Diff-Quik, Dade Diagnostics, Aguada, Puerto Rico). The remaining blood smears were later stained with an automated Romanowsky stain (Hematek, Bayer Diagnostics, Elkhart, Ind) at the Purdue University Veterinary Clinical Pathology Laboratory (Figure 1B). Other laboratory tests (clinical chemistry, PCV, CBC) were not done because of the limited amount of blood available.

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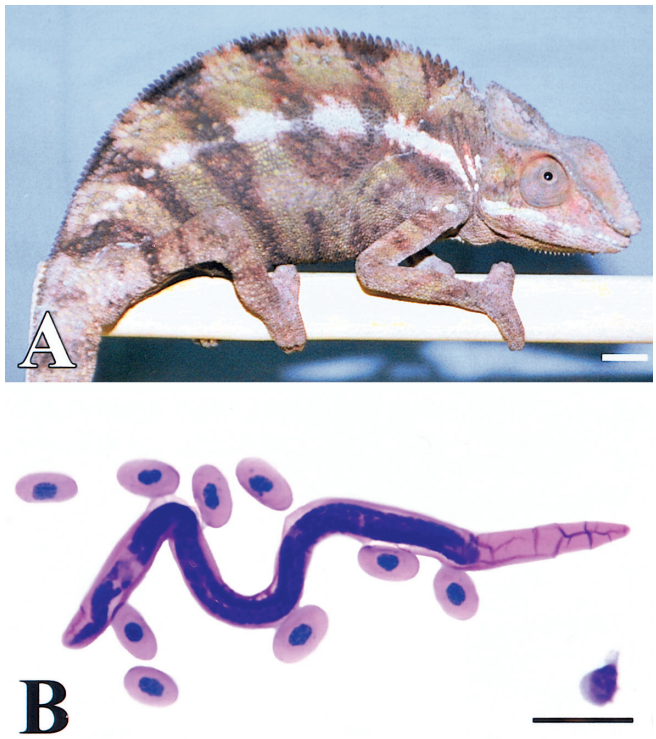


**Figure 1**. Panther chameleon (*Furcifer pardalis*) at the time of presentation (**A**). Note the brownish off-color discoloration of the skin. Bar = 1 cm. (**B**) Blood smear. Wright's, bar = 20 µm.

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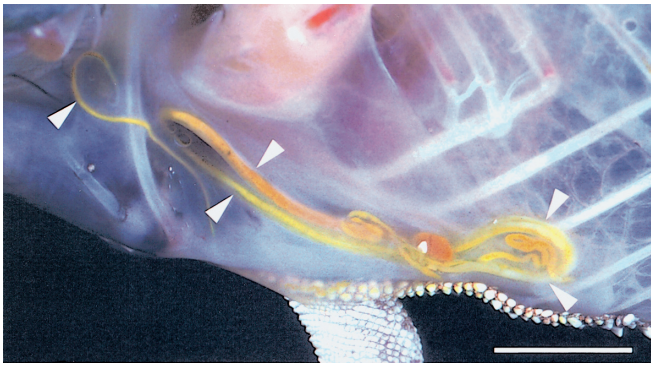

**Figure 2**. Panther chameleon at necropsy, left lateral view. Note the orange-yellow subcutaneous nematodes (white arrowheads) at the left cranioventral aspect of the carcass. The head of the chameleon is not visible and is to the left of the image. The left front limb has been rotated caudodorsally out of the image area to demonstrate the nematodes. The point of the left shoulder is at the top of the image and the right front limb is at the bottom left. Bar = 1 cm.

### Hematologic Interpretation

The hematologic preparations contained numerous sheathed microfilariae (Figure 1B). As measured by the Knott's test, the organisms were 160.7 µm long and 6.9 µm wide, with short, pointed tails and gently tapering anterior ends. A cephalic hook was not present. The loosely fitting sheath had gently tapering ends and completely enclosed the microfilaria. The automated Wright's stain was better than the Diff-Quik stain at demonstrating the sheath. The morphologic characteristics of the microfilaria were most consistent with *Foleyella* sp. Other significant hematologic changes observed in the blood smears and not shown in Figure 1 included a moderate decrease in RBC density with 1.5% polychromasia and an inflammatory leukogram characterized by a left shift in the heterophil series.

### Clinical Follow-up and Pathologic Findings

Surgical dissection of the masses exposed moving subcutaneous nematode parasites. Based on the location of the adult worms and the presence of microfilariae in the blood, the veterinarian suspected infection by a filariid parasite. The worms were removed at the time of the visit and submitted to the Purdue University Veterinary Clinical Parasitology Laboratory for identification. The worms were identified as *Foleyella furcata* based on the morphologic characteristics of the male and female adult worms and the size of the microfilariae.

The chameleon was treated with a single intramuscular (IM) injection of 5 mg/kg levamisole (Levasole, Mallinckrodt Veterinary Inc, Mundelein, Ill, USA) and vitamin B complex and was sent home with instructions for the owner to tube feed with a/d (Hill's Pet Products, Topeka, Kans, USA). During scheduled reexaminations 1 week and 2 weeks after the initial presentation, the chameleon was lethargic, weak, and anorectic. The owner reported seeing another worm moving subcutaneously, but additional worms were not located during the visits. Evaluation of wet blood and blood smear preparations revealed the continued presence of microfilariae during both visits. Additional laboratory tests were not conducted because of the limited amount of blood available. Three weeks after initial presentation, the chameleon returned for a second dose of levamisole (10 mg/kg IM) and was found to be gaining weight (54 g). The owner reported that the chameleon appeared to be feeling better. Microfilariae were readily identified in the blood smear. Nine days later, the chameleon was found dead by the owner and was submitted for necropsy to the Veterinary Clinical Pathology Laboratory.

At necropsy, 2 large female adult worms and 2 small male worms were found in the ventrocranial aspect of the chest (Figure 2). These worms were removed and identified as *F furcata*. Tissue samples from all major organs and lesions were collected and fixed in 10% buffered neutral formalin. Air-dried cytologic preparations of bone marrow, liver, kidney, adrenal glands, spleen, and testes were stained with the same automated Wright's stain described above. All cytologic samples included a variable amount of peripheral blood and numerous microfilariae that were morphologically similar to those described above. Histologically, large numbers of microfilariae were observed within capillaries, blood vessels of various sizes, and the heart chambers. Intact and necrotic fragments of adult worms and microfilariae were found in the soft tissues where the worms were found at necropsy (not shown). Soft tissue edema, moderate fibrosis, and a mild infiltrate of macrophages, small lymphocytes, and heterophils were intimately associated with the worm fragments. Multinucleated giant cells were noted in very low numbers. Other histologic lesions included multifocal ulcerative glossitis with intralesional bacteria and multifocal acute to chronic skeletal muscle necrosis and degeneration with fibrosis in various locations, including the digits, limbs, ribs, muscles near the worms, and muscles of the tongue.

### Discussion

Filarial nematodes affect a variety of domestic and nondomestic animals, including reptiles.[1,2] Members of various genera can be found in reptiles, including *Foleyella*, *Oswaldofilaria*, *Befilaria*, *Conofilaria*, *Conispiculum*, *Piratuba*, *Piratuboides*, *Solafilaria*, *Cardianema*, *Pseudothamugadia*, *Madathamugadia*, *Thamugadia*, *Saurositus*, and

*Macdonaldius*.[1] *Foleyella* species affect chameleons and lacertid lizards.[1] Natural infections are seen primarily in Africa, the Middle East, and Eurasia[2,3]; however, cases have been reported in other parts of the world, probably because of the international pet trade.[4] Chameleons appear to be exclusively infected by *Foleyella*.[1,5-7]

Currently, 4 species of *Foleyella* are known to infect reptiles, and of these *F furcata* and *F brevicauda* are commonly reported in chameleons from Madagascar.[8] Adult *Foleyella* worms may be found in subcutaneous tissues, intermuscular connective tissue, and the body cavity.[2,9] In this affected chameleon, worms were found only in the subcutaneous tissues. After fertilization by the male worm, the adult female releases large numbers of microfilariae into the peripheral blood. Blood-sucking arthropods such as *Culex* and *Aedes* mosquitoes serve as intermediate hosts and transmit the infective larval stages to other reptiles.[3,7,10,11] To be infective, the microfilaria must undergo development within the intermediate host.[12]

Microfilariae belonging to different genera and species can be morphologically differentiated by several methods, including the number of nuclei and their relative positions, absence or presence of a sheath, absence or presence of a cephalic hook, shape of the anterior and posterior ends, and size of the worm.[13] However, definitive identification to species is based on the morphologic characteristics of adult worms.[2] Ultrastructurally, there are differences among the microfilariae[13]; however, ultrastructural descriptions of *Foleyella* have not been published. Ultrastructurally, the microfilariae from this chameleon had the typical general ultrastructural characteristics of other microfilariae (data not shown). Microfilariae of *Foleyella* have a prominent sheath that loosely and completely encloses the body.[2] Sheaths are not unique to *Foleyella* and are also seen in the microfilariae of *Loa*, *Brugia*, and *Pelecitus*, among others.[2,14] However, these other filariids do not affect reptiles.

Most infections caused by *Foleyella* sp, including *F furcata*, are asymptomatic; however, heavy infestations, infection of aberrant hosts, and the anatomic location of the adult worms could produce pathologic changes (thrombosis, edema, necrosis) and clinical signs.[1,4] Immunosuppression or concurrent disease could possibly worsen the clinical signs and lesions.

The affected chameleon had a moderate parasite burden and exhibited clinical signs of anorexia and weight loss. These clinical signs may have been directly related to the infection; however, contributory disease processes may have played an important role. Other lesions were noted at necropsy, and it is unknown whether these lesions were present before the patient was presented to the veterinarian or whether they developed during the course of the infection. The skeletal muscle lesions were acute to chronic in nature, indicating previous and recent or ongoing muscle damage. Various myopathies have been described in reptiles,[15,16] including those caused by nutrient deficiencies (vitamin E/selenium deficiency) and infections. Myopathies caused by excessive sudden exertion and struggling have not been described in reptiles. Since the owner force fed this chameleon, exertional muscle damage due to struggling could have been an important contributing factor. Nutritional deficiencies could not be ruled out. The nutritional requirements (vitamin E/selenium) for chameleons have not been determined; however, most insect-based diets should contain sufficient trace minerals.[17] There is very little information on the vitamin content of insect diets.[17] Levamisole has been associated with myalgias in human patients[18] but has not been associated with myodegeneration, myonecrosis, or other myopathies in animals or people. Long-term glucocorticoid treatment has been linked to myopathies,[19] however, this chameleon received only 1 injection of dexamethasone.

Detection of filariid infections is simple and straightforward using a blood smear prepared with a minimal amount of blood. Definitive identification of the species of filariid requires examination of the adults by a trained parasitologist. We encourage routine peripheral blood examination of sick and first-time reptile patients as part of a complete examination.

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**Key Words**: Chameleon, filariids, *Foleyella furcata*, hematology, microfilaria, myopathy, nematode, parasites, reptile

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**References**

1. Lane TJ, Mader DR. Parasitology. In: Mader DR, ed. *Reptile Medicine and Surgery.* Philadelphia, Pa: WB Saunders; 1996:183-203.
2. Bartlett CM. The reptilian filarioid genus *Foleyella* Seurat, 1917 (Onchocercidae: Dirofilariinae) and its relationship to other dirofilariine genera. *Syst Parasitol.* 1986;9:43-56.
3. Schacher JF, Khalil GM. Development of *Foleyella philistinae* Scacher and Khalil, 1967 (Nematoda: Filarioidea) in *Culex pipens molestus* with notes on pathology in the arthropod. *J Parasitol.* 1968;54:869-878.

4. Thomas CL, Artwohl JE, Pearl RK, Gardiner CH. Swollen eyelid associated with *Foleyella* sp. infection in a chameleon. *J Am Vet Med Assoc.* 1996;209:972-973.

5. Chabaud AG, Brygoo ER. Nematodes parasites de cameleons malgaches. *Ann Parasitol Hum Comp.* 1962;37:569-602.

6. Bain O. Remarques au sujet d'une nouvelle filarie de cameleon malgache proche de *Foleyella brevicauda. Bull Mus Natl Hist Nat 2nd Ser.* 1968;48:802-806.

7. Mancianti F, Magi M, Bicchi F, Salvadori M, Verni F. Filariosis in chameleons (*Chamaleo* sp.) [abstract]. *Parasitologia*. 2000;42:103.

8. Brygoo ER. Contribution a la connaissance de la parasitologie des cameleons malgaches. *Ann Parasitol Hum Comp.* 1963;38: 149-334, 525-739.

9. Bolette DP. *Foleyella candezei* (Onchocercidae: Dirofilariinae) from a Fisher's Chameleon, *Bradypodion fischeri* (Sauria: Chamaeleonidae) with a comment on the synonymy of *F. candezei. J Parasitol.* 1998;84:1034-1035.

10. Obiamiwe BA, Okuzu VI, Oloko OR, Uwake NU. Identification of the microfilarie and infective larvae of *Foleyella agamae* infecting *Agama agama* in Nigeria. *Indian J Anim Res.* 1989;23:7-12.

11. Brygoo ER. Evolution de *Foleyella furcata* (Von Linstow, 1899) chez *Culex fatigans* Wiedemann, 1828. *Arch Inst Pasteur Madag.* 1960;28:129-138.

12. Georgi JR, Georgi ME. Helminths. In: *Parasitology for Veterinarians.* 5th ed. Philadelphia, Pa: WB Saunders; 1990:103-223.

13. McLaren DJ. Ultrastructural studies on microfilariae (Nematoda: Filarioidea). *Parasitology.* 1972;65:317-332.

14. Purnomo S, Dennis DT, Partono F. The microfilaria of *Brugia timori* (Partono et al. 1977 = *Timor microfilaria*, David and Edeson, 1964): morphologic description with comparison to *Brugia malayi* of Indonesia. *J Parasitol.* 1977;63:1001-1006.

15. Fry FL. Common pathologic lesions and disease processes. In: *Biomedical and Surgical Aspects of Captive Reptile Husbandry.* 2nd ed., vol. II. Malabar, Fla: Krieger; 1991:529-619.

16. Fry FL. Nutrition: a practical guide for feeding reptiles. In: *Biomedical and Surgical Aspects of Captive Reptile Husbandry.* 2nd ed., vol. II. Malabar, Fla: Krieger; 1991:41-100.

17. Donoghue S, Langenberg J. Nutrition. In: Mader DR, ed. *Reptile Medicine and Surgery.* Philadelphia, Pa: WB Saunders; 1996:183-203.

18. DeLorenzo L, Stewart JA. Levamisole toxicity. *J Clin Oncol.* 1990; 8:365.

19. Braunstein PW, DeGirolami U. Experimental corticosteroid myopathy. *Acta Neuropathol.* 1981;55:167-172.