

# **Brief Report**

# Lens-Anomalies and Other Ophthalmic Findings in a Group of Closely-Related Angola Lions (*Panthera leo bleyenberghi*)

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After the diagnosis of bilateral, immature, nuclear, and posterior cortical cataracts in one Angola lioness, and because of the possible implications of the cataracts for a breeding program, complete ophthalmic examinations on a group of related adult Angola lions and their offspring were carried out. Five adult lions, ranging in age from 1.5–5.5 years, and five lion cubs were studied clinically. The examination included slit-lamp biomicroscopy, indirect ophthalmoscopy, and photography. The eyes of three of the offspring were submitted for histopathologic examination and examined by light microscopy. The most significant findings were cataracts of various stages, which were observed in four adult lions and one male cub. Mild lenticular abnormalities were noted in the histopathologic examination of the lion cubs' eyes. Additional ophthalmic findings, of lesser clinical consequence, were also noted. This breeding program would benefit from further investigation by animal nutritionists and geneticists, and the animals in this group should undergo periodic ophthalmologic examinations. Zoo Biol 25:433-439, 2006. © 2006 Wiley-Liss, Inc.

#### Keywords: Katanga lion; cataract; eye; nutrition; inheritance; breeding

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#### INTRODUCTION

The Angola lion, or Katanga lion (*Panthera leo bleyenberghi*), is a rare and endangered sub-species of the African lion (*Panthera leo*). It is assumed that the number of free ranging Angola lions is very low. A captivity breeding program of this rare subspecies was created in two German zoos (Halle Zoo and Leipzig Zoo) in 2002.

One lioness was diagnosed with bilateral cataracts in 2003 and underwent phacoemulsification surgery. Because of the possible implications of the cataracts for the breeding program, and because the five lions were related, it was decided to carry out complete ophthalmic examinations of all the lions in the group and their offspring.

## MATERIALS AND METHODS

#### Animals

Five adult lions (ranging in age from 1.5–5.5 years) born in a single European zoo and five of the offspring (lion cubs until 6 months of age) were evaluated clinically. The adult lions Lissa ( $\mathfrak{P}$ ) and Bono ( $\mathfrak{F}$ ) were purchased by the Halle Zoo. Luena ( $\mathfrak{P}$ ), Kimbali ( $\mathfrak{P}$ ), and Matadi ( $\mathfrak{F}$ ) were purchased by the Leipzig Zoo from the Lisbon Zoo. The lions, their gender and their age at time of examination are presented in Table 1. All animals are paternally or maternally related to lion Kurika and lioness PLB004As as shown in the family trees of the lions (Fig. 1).

Bono and Lissa mated three times. The first two litters were not nursed by their mother and died or had to be euthanized. The eyes of three deceased or euthanized lion cubs (5 days of age) were submitted for histopathologic examination. As result of the third mating two female and one male offspring were born in September 2004 (Offspring E–G). This litter is still normally nursed by the mother.

Matadi and Lissa mated once and a single male cub was born in July 2004 (Offspring D). Offspring D was transiently fed with milk-replacer. It is likely that all adults got temporarily milk-replacer as well.

#### **Ophthalmic Examination**

The ten lions underwent a complete ophthalmic examination, including slit-lamp biomicroscopy (SL 14, Kowa Company Ltd, Tokyo, Japan), indirect ophthalmoscopy (Omega 200, Heine, Friedrichshafen, Germany) with 30D- and 20D-lenses,

#### TABLE 1. Ages of the Lions at Time of Examination

Kimbali  $\Im$  (20 months) Lissa  $\Im$  (21, 28, 38 months) Bono  $\eth$  (24 months) Matadi  $\eth$  (40 months) Luena  $\Im$  (66 months) Offspring C  $\eth$  (5 days) Offspring D  $\eth$  (1 month and 6 months) Offspring E  $\Im$  (1 and 3 months) Offspring F  $\Im$  (1 and 3 months) Offspring G  $\eth$  (1 and 3 months)

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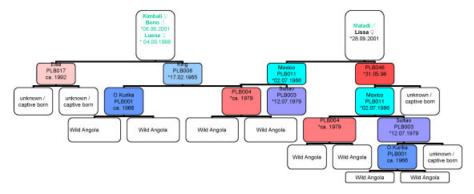


Fig. 1. Family tree of the five adult lions studied in this report. Luena, Kimbali and Bono are siblings. Kimbali and Bono are littermates. Matadi and Lissa are also littermates.

and photography (Genesis, Kowa Company Ltd, Tokyo, Japan). All examinations of the adult lions were conducted under xylazine/ketamine (3 mg/kg xylazine, 3–5 mg/kg ketamine) or medetomidine/ketamine (0.03 mg/kg medetomidine, 2 mg/kg ketamine) intramuscular anesthesia. Cubs were not sedated during the first examination. At the second examination the offspring were sedated with medetomidine/ ketamine (0.04 mg/kg medetomidine, 1 mg/kg ketamine) intramuscular.

## Pathologic Examination

Eyes were fixed intraocularly with 4% formalin (in the vitreous body) and globe immersed in 10 times its volume of 4% formalin and processed routinely for paraffin sections, stained with hematoxylin and eosin (H&E), and examined by light microscopy.

## RESULTS

#### Medical History

Ophthalmic history of the adult animals was unremarkable with one exception. On arrival at the zoo, Kimbali had difficulties adapting to the new environment. This lioness also had epiphora in the left eye.

#### **Results of the Ophthalmic Examination**

Adnexal examination showed absence of the upper lacrimal puncta and nasolacrimal duct obstruction in the left eye of Kimbali, which probably accounted for the epiphora noted in this eye. In Offspring C, persistent vessels of the pupillary membrane were noted in both eyes. The vessels made no contact with the cornea (Fig. 2). In Offspring F, temporary small strands of persistent pupillary membrane (iris-to-iris) were noted in the upper half in both eyes.

Four of five adult lions and one cub showed cataracts of various stages. Bilateral, immature, posterior cortical, and nuclear cataracts were recorded in Kimbali (Fig. 3).



Fig. 2. Offspring C (&, 5 days): persistent vessels of the pupillary membrane.

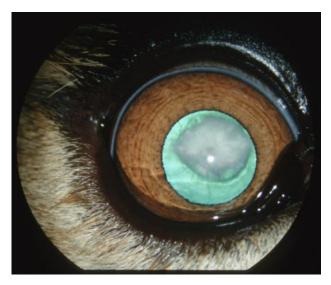


Fig. 3. Kimbali (9, 20 months): nuclear and posterior cortical cataract.

Another lioness (Luena) had some incipient opacities in the lenticular nuclei of both eyes. In both male adult lions, incipient anterior cortical and nuclear cataracts were seen in both eyes. An additional opacity was seen on the anterior lens capsule of Bono's left eye (Fig. 4).

During the examination of Offspring D at 6 months of age, several spots could be seen in the anterior cortex of both lenses (Fig. 5).

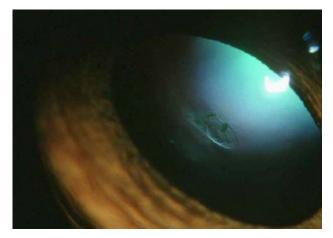


Fig. 4. Bono (&, 24 months): incipient anterior cortical cataract.

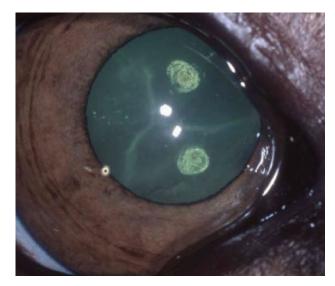


Fig. 5. Offspring D (&, 6 months): incipient anterior cortical cataract.

No lenticular abnormalities were noted in Lissa, nor in Offspring C, E, and F. Indirect ophthalmoscopy showed a typical feline fundus. Mature tapetum in the adults possessed mature, greenish-yellow to greenish-blue tapeta. In Bono and Lissa, a hyper-reflective striated area, medial to the optic disc, was seen in both fundi (Fig. 6).

# **Results of Histopathologic Examination**

In Offspring C, both lenses were of normal size, and only mildly deformed (Fig. 7). Few remnants of blood vessels were found in the pupillary space. Additionally, the left posterior lens capsule showed fine capillaries.

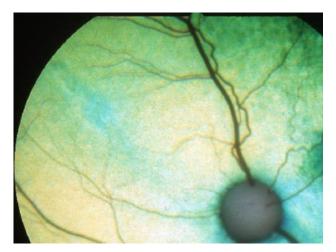


Fig. 6. Bono (&, 24 months): striated hypo-reflective area in the central retina.

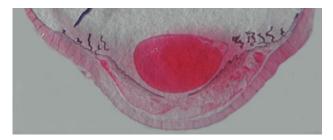


Fig. 7. Left eye of Offspring C ( $\delta$ , 5 days): Microphotograph of the anterior globe with mildly deformed lens and remaining vessels from the pupillary membrane. H/E stain 20x.

# DISCUSSION

The most significant findings were cataracts of various stages and congenital lenticular abnormalities.

Primary and inherited cataracts are rare in domestic cats; in most cases feline cataracts are secondary [Glaze and Gelatt, 1999]. One reported cause of secondary feline cataracts is the use of milk replacements to feed kittens. In one study, kittens fed a milk replacement formula developed diffuse anterior and posterior lens opacification and vacuolation at the posterior Y-sutures [Remillard et al., 1993]. The researchers suggested that the milk replacer contained inadequate levels of arginine [Remillard et al., 1993]. Low levels of dietary histidine have also been implicated in the pathogenesis of cataract formation in kittens [Quam et al., 1987]. It is possible that nutrition plays a similar role in cataractogenesis in captive wildlife felines. In the Leipzig zoo, hand-raised Siberian tiger cubs that were fed a mixture of cow milk and liver mash developed cataracts (Eulenberger, personal communication). It is conceivable that use of milk replacements contributed to the formation of lens opacities in some of the lions we studied (e.g., Offspring D).

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In the domestic cat, it has been shown that most of the nutrition-derived lenticular opacities resorb when the milk replacement is substituted by a balanced growth diet [Remillard et al., 1993]. As congenital cataracts have been described in Persian [Peiffer and Gelatt, 1975], Birman [Schwink, 1986], and Himalayan [Rubin, 1986] kittens as well in domestic Short hair cats [Glaze and Gelatt, 1999], it is conceivable, that the cataracts we noted in Kimbali, Luena, Matadi, and Bono were congenital. It is possible, however, that these cataracts were of late onset. In Offspring D, we documented several opacities at 6 months of age that had not been present at 1 month of age. In view of the kinship of the lions in this study, we cannot rule out the possibility that inbreeding played a significant role in the pathogenesis of the lesions we observed. In this context it should be noted that a possible inherited basis was also discussed in a case of cataracts in another captive wildcat fed milk replacer, a clouded leopard (Neofelis nebulosa), that was diagnosed with bilateral cataracts at age 6 months. The inherited basis was proposed because the cataracts of the leopard were unlike nutritional cataracts reported previously in domestic cats and dogs [Cooley, 2001].

Some of our findings in the retinas of the adult lions have been associated with ocular disease in other species. The hyper-reflective striated area medial to the papilla that was seen in both eyes of Bono and Lissa resemble Stage 3 of taurine deficiency retinopathy described in cats and in captive wildlife felids [Leon et al., 1995; Ofri et al., 1996].

#### CONCLUSIONS

Cataracts of various stages were the most significant findings in the group. Other ophthalmologic findings are incidental results that are comparable with those in domestic animals. This lion-group should undergo periodic ophthalmologic examinations. This breeding program would benefit from further investigation by both animal nutritionists and geneticists.

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