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Abnormal iris coloration in the Campo Flicker, *Colaptes campestris*: pigmentary color production error?

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RESUMO: Coloração anormal de íris no pica-pau-do-campo, *Colaptes campestris*: erro na produção de cor pigmentária?

Apesar do amplo interesse dos pesquisadores em aspectos envolvendo a coloração da plumagem, pouco se sabe acerca dos mecanismos de produção de cor encontrados nas íris das aves. Nesse estudo, apresentamos dados sobre a possível variação na coloração da íris do pica-pau-do-campo, *Colaptes campestris*, assim como, o registro de um indivíduo com uma coloração não usual dos olhos. Análises fotográficas revelaram que não existe variação na coloração da íris entre os sexos. Entretanto, filhotes apresentam uma coloração diferente de indivíduos juvenis e adultos. Adicionalmente, os dados sugerem que o registro encontrado pode ser resultado de alguma falha na produção da coloração pigmentar ao longo do desenvolvimento.

PALAVRAS-CHAVE: coloração do olho, pica-pau, pteridinas, dicromatismo sexual, íris das aves.

KEY-WORDS: eye coloration, woodpecker, pteridines, sexual *dicromatism*, avian iris.

Bird coloration is produced either by chemical pigments or through physical interactions of light with the structure of avian integument and tissues. Studies show that both mechanisms act to produce coloration in the plumage, skin and eyes of many bird species (Prum 2006). However, little research has focused on the mechanisms underlying production and function of the variable coloration found in the avian iris.

Pteridines are the most common of the pigments responsible for eye coloration (Oehme 1969). The widespread distribution of pteridines and purines among avian irises was confirmed by Oliphant (1987), who also suggested that carotenoids were much less commonly the basis for eye coloration in birds. Pteridines are a group of nitrogenous compounds endogenously synthesized from purines. Purines, in turn, are responsible for the bright eye color of many birds, as well as silver eye colors of birds such as starlings (McGraw 2006).

Iris coloration often varies intraspecifically, and this variation is attributed to differences between sexes (Hardy, 1973; Ervin, 1975) and age classes (Trauger 1974; Sweijd and Craig 1991; Rosenfield and Bielefeldt 1997), among other possibilities. Some researchers use these differences in iris coloration during banding studies to classify captured individuals (Yunick 1977; Manuwal 1978), since age and sex may be important attributes in studies of population dynamics and social behavior, for example.

Here, we describe an unusual eye coloration documented for an individual Campo Flicker, *Colaptes*

campestris. Campo Flickers are medium-sized woodpeckers (150 g) with a vast distribution in South America, occurring from the Brazilian Northeast to Argentina. They are easily recognized by their shape and color, with yellow coloration on both sides of the head and neck, with males presenting a red patch on the malar region (Sick 1997).

METHODS

We have been capturing Campo Flickers for three years (2006-2008) in central Brazil as part of a study on reproductive behavior. The study site is at the Fazenda Água Limpa (15°57'S, 47°56'W), property of the University of Brasília. The area of approximately 2000 ha is composed by different vegetation types of Brazilian savanna (Cerrado) and also by altered vegetation due to agricultural usage. However, most of the study is conducted in areas where Campo Flickers are more easily found, composed of open native vegetation with sparse trees and termite mounds.

We capture individuals with mist nets and band them with a combination of three colored bands and a permanent metal band from the Brazilian Bird-banding Agency (CEMAVE). For each individual we collect morphometric data, record eye coloration, and also take a photo. Additionally, during the breeding season we actively search for nests. Whenever found, nests are monitored and the nestlings banded on the 25th day after

hatching, repeating all the procedures carried out with adults. We repeat the same protocol with recaptured individuals. Through the examination of photos we can compare individual eye coloration through time and explore variations linked to sex and age.

RESULTS

We have banded 108 Campo Flickers to date, including 56 adults, three juveniles and 49 nestlings, considering age on the day of the first capture. We recaptured 14 of the nestlings as juveniles or adults and have also monitored the other individuals through the years with binoculars, for other purposes. All juveniles and adults have dark reddish-brown iris coloration (Figure 1), and the sexes are not dichromatic for this trait (Figures 1 and 2). Nestlings present dark-gray eye color (Figure 1) that changes to the juvenile-adult coloration when they are approaching fledging.

On 14 November 2007, we captured a female with a pale iris coloration (Figure 2). No other morphological

or plumage aspect was different in this female relative to other captured individuals. The abnormal iris coloration of this female did not affect mate acquisition and reproduction, for she bred in that year and produced four nestlings, two males and two females. Based on both recapture and monitoring data for these young, we have found that none of them presented the same eye coloration of the mother and no color alterations have been perceived subsequently.

DISCUSSION

Although other studies have shown that individuals of some species change iris coloration as they age and that for other species this coloration is sometimes sexually dichromatic (Ervin 1975; Sweijd and Craig 1991; Rosenfield and Bielefeldt 1997), this is not the case for the Campo Flicker. With the exception of the documented change in nestling eye color close to fledging, we have found no iris color difference in Campo Flickers among age classes or between sexes. Considering that there is no



FIGURE 1: Male Campo Flicker, *Colaptes campestris*, at different ages: nestling, juvenile and adult (left to right). All photos by R.I. Dias.



FIGURE 2: Female Campo Flicker, *Colaptes campestris*, with normal eye coloration (left) and with abnormal eye coloration (right). All photos by R.I. Dias.

natural variation in adult Campo Flickers' iris coloration, we presume that this documented case may have resulted from some ontogenetic problem related with the mechanism of pigmentary color production. A study that evaluated pigments from the stroma of the iris of several bird species revealed that for the Northern Flicker (*Colaptes auratus*), a congeneric species, the iris pigments were primarily pteridines (Oliphant 1977). We speculate that a problem in pteridine synthesis could have caused the observed abnormality.

Some unusual eye colorations are occasionally described in the literature (Prescott 1972; Boano and Jani 2008), however, no obvious explanations have been suggested for these cases, thus preventing conclusions as to whether these colorations are normally found in the species or whether they may result from developmental abnormalities. However, iris coloration is based not only on pigments but also on complex combinations of pigments and other cellular mechanisms of avian integuments (Prum 2006). Explanations for these kinds of abnormalities depend upon further documentation of the phenomenon and studies directed toward uncovering the underlying genetic and developmental contexts of bird iris coloration.

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