

BILL DEFORMATIONS IN FIVE SPECIES OF PARAGUAYAN BIRDS

Deformaciones de pico en cinco especies de aves paraguayas

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ABSTRACT.- Bill deformities in birds are a well-known, but a poorly understood phenomenon, with limited published data from the Neotropics. Bill deformities for five species in five families of Paraguayan birds are reported. These are documented in *Veniliornis spilogaster* (Picidae), *Furnarius rufus* (Furnariidae), *Myiarchus swainsoni* (Tyrannidae), *Thraupis sayaca* (Thraupidae), and *Molothrus bonariensis* (Icteridae). We discuss the importance of reporting bill deformities.

KEYWORDS: malformation, mandible, overgrown.

RESUMEN.- Las deformaciones de pico de ave son un fenómeno bien conocido, pero pobremente entendido, con poca información publicada de casos en el Neotrópico. Reportamos deformaciones de pico en cinco especies de aves paraguayas. Estas son *Veniliornis spilogaster* (Picidae), *Furnarius rufus* (Furnariidae), *Myiarchus swainsoni* (Tyrannidae), *Thraupis sayaca* (Thraupidae) y *Molothrus bonariensis* (Icteridae). Discutimos la importancia de reportar deformaciones de pico.

PALABRAS CLAVE: malformación, mandíbula, sobrecrecimiento.

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INTRODUCTION

Avian bill deformation is a well-known, but poorly understood phenomenon, estimated to affect less than 1% of wild birds (Pomeroy 1962, Craves 1994). Though no quantitative data is available, incidences of bill deformation in captive birds seem to be higher than those in the wild (Fox 1952), so perceived low occurrence may be a result of general rarity in wild conditions, under-reporting of wild cases, or perhaps reflecting low survival rates due to an inability to forage or preen effectively (Pomeroy 1962). However, the plasticity of foraging techniques employed by birds has been adequately demonstrated (Fox 1952, Hinde 1959), and at least some individuals with deformed bills are able to live apparently normal, healthy lives (Michener & Michener 1936, Rintoul 2005).

The relevance of reporting such phenomena in wild birds has been disputed (Parkes 1969), but whilst the mechanics of deformations are largely understood, the pre-

cise underlying causes remain for the most part unclarified. Mutation (Fox 1952, Wu 2004), infection (Gartrell *et al.* 2003, Zylberberg *et al.* 2016, 2018), parasites (Galligan & Kleindorfer 2009), physical injury (Wouterlood 1975), and environmental contaminants (Gochfeld 1972, Ludwig *et al.* 1996, Kuiken *et al.* 1999, Handel *et al.* 2010) have all been proposed as potential factors affecting prevalence within a given population, but it is not always clear which drivers are involved in every given case.

Several cases of bill deformation have been reported in Argentinian birds (Vidoz & Bielsa 1994, Casaux 2004, Marti *et al.* 2008, Juárez *et al.* 2012, Oscar 2012, Bianchini & Arenas 2014, Jones *et al.* 2015, De Maio 2016, Gorosito *et al.* 2016, Quiroga *et al.* 2016, Bianchini & Arenas 2018, Quiroga & Lammertink 2018), Chilean birds (Valdebenito *et al.* 2018) and a small number of Brazilian birds (Vasconcelos & Rodrigues 2006, Ortíz 2011, Rezende 2013, Vitorino & de Oliveira Souza 2013,

de Oliveira Souza *et al.* 2016), but no data have ever been published on bill deformations in Paraguayan birds. Given that bill deformations may potentially provide clues regarding ecosystem and population health, documentation of bill deformities in five species of Paraguayan birds is provided here.

MATERIALS AND METHODS

Records of bill deformations in Paraguayan birds were compiled from field observations by the authors between 2012 and 2018, and examination of the IBIS (Instituto de Bioecología e Investigación Subtropical) collection, housed at Centro IDEAL, Mariscal Estigarribia 321 c/ Tte. Capurro, Pilar, Ñeembucú Department Paraguay during 2017 to 2019.

RESULTS

Bill deformations are reported in six individuals (four wild birds, two museum specimens) of five species of birds, in five different families.

White-spotted Woodpecker *Veniliornis spilogaster* (Picidae)

A female with a laterally diverted, upcurved and elongated lower mandible was photographed at Reserva Limoy, Alto Paraná department on 2 October 2014 by Jon Lehmborg (Fig. 1).

Rufous Hornero *Furnarius rufus* (Furnariidae)

1) Female specimen CE003200 (Acosta Ñu, Cordillera Department; 9 January 1987; Collector Andres Contreras) housed in the IBIS (Instituto de Bioecología e Investigación Subtropical collection, Pilar, Ñeembucú department) has an upper mandible that is elongated 4 mm beyond the lower, and slightly downcurved (Fig. 2). The individual had a mass of 44.3 g when it was collected, well within the normal range for other specimens in the collection (33.4-51.5 g).

2) An adult photographed by SDR on 16 May 2012 at Barrio Loma Pytá, Asunción, showing slightly elongated curved and crossed mandibles (Fig. 3).

Swainson's Flycatcher *Myiarchus swainsoni* (Tyrannidae)

A Paraguayan specimen lacking any collection data or collection number housed in the IBIS collection, Pilar, Ñeembucú department shows an elongated lower mandible (Fig. 4) 17.5% longer than the upper mandible (upper mandible 17 mm, lower mandible 20 mm). Paraguayan specimens with “normal” bills in the same col-



Figure 1. White-spotted Woodpecker *Veniliornis spilogaster* with a laterally divergent, upcurved and elongated lower mandible. Reserva Limoy, Alto Paraná department, Paraguay (Photo Jon Lehmborg).



Figure 2. Rufous Hornero *Furnarius rufus* with elongated and slightly downcurved upper mandible. Specimen CE003200, IBIS collection, Pilar, Ñeembucú department, Paraguay (Photo Paul Smith).



Figure 3. Rufous Hornero *Furnarius rufus* with slightly elongated curved and crossed mandibles. Barrio Loma Pytá, Asunción, Paraguay (Photo Sergio D. Ríos).



Figure 4. Swainson's Flycatcher *Myiarchus swainsoni*, with elongated lower mandible. Specimen lacking data or number from IBIS collection, Pilar, Ñeembucú department, Paraguay (Photo Paul Smith).



Figure 5. Sayaca Tanager *Thraupis sayaca* with crossed and elongated mandibles, and twisted and thickened upper mandible. San Lorenzo, Central department, Paraguay (Photo Rodolfo Ruíz).

lection had the following mean measurements ($n = 11$): culmen length of 17.2 mm (range 16-18 mm); bill length (from gape to tip, taken laterally) 21.8 mm (range 21.0-23.5 mm).

Post-mortem dehydration of cartilage and ligaments can sometimes cause unnatural movement of mobile appendages such as the mandibles. In the case of this specimen, we were unable to conclusively rule out that this may have occurred as no collector's notes are available to confirm the deformation at the time of collection. However, the phenomenon was not observed in over 1,600 other examined specimens collected and prepared by the same team of museologists.

Sayaca Tanager *Thraupis sayaca* (Thraupidae)

An adult bird with crossed and heavily overgrown mandibles showing extensive corneal overgrowth on the distal portion was photographed by RR in San Lorenzo, Central department on 26 September 2016 (Fig. 5). A different bill deformity in this species was reported by de Oliveira *et al.* (2016) from São Paulo, Brazil.

Shiny Cowbird *Molothrus bonariensis* (Icteridae)

An adult male bird with crossed mandibles and a strongly overgrown and somewhat twisted and thickened upper mandible was photographed by LD in Ypané, Central department on 21 July 2018 (Fig. 6). An apparently very similar deformation was reported in this species by Bianchini & Arenas (2018) from Buenos Aires, Argentina.

DISCUSSION

Goodman & Glynn (1988) provided a review of



Figure 6. Male Shiny Cowbird *Molothrus bonariensis* with crossed and elongated mandibles, and twisted and thickened upper mandible. Ypané, Central department, Paraguay (Photo Luís Doldán).

osteological disorders observed in a collection of 1,043 Paraguayan birds, with a frequency rate of 7% showing some kind of disorder, most of which could be attributable to trauma associated with the ecology of the species. However, of the 70 specimens showing osteological disorders, the vast majority affected the axial skeleton, and only one (*Rostrhamus sociabilis*) showed damage to the bill (lower mandible), representing a prevalence rate of just 0.096%.

Bill deformations in Picidae have been previously published for very few species, but despite a presumed dependence on a healthy bill for the highly-specialized foraging mode, it seems that some deformities do not always unduly affect survivorship in this family (Bowles 1908, Whittle 1927, Parkes 1969, Taylor 1973, Bianchini & Arenas 2018). The female *Veniliornis spilogaster* illustrated here (Fig.1) was apparently healthy, showed no sign of unexpected plumage wear, was paired with an apparently normal male and was observed hammering at a dead trunk with the normally-shaped upper mandible.

Lateral diversion and upcurving of the mandibles are rare phenomena and are usually associated with damage to the tip of the upper mandible (Pomeroy 1962). Though it is impossible to ascertain with certainty the cause of the deformation in the Paraguayan individual of *V. spilogaster*, but bill trauma causing divergence of the mandibles may be reasonably speculated as a cause. Elongation of the lower mandible thus occurs because of the disunion of the two mandibular tips (Wouterlood 1975) and continues unimpeded because of the lateral diversion, whilst elongation of the upper mandible is inhibited by the need to hammer at wood when foraging. Typically, elongation of mandibles occurs until there is a breakage (Pomeroy 1962).

An elongated and decurved upper mandible is one of the most frequently observed bill deformities (Pomeroy 1962). In addition to the Rufous Hornero (specimen CE003200) documented here (Fig. 2), another individual of the same species with a similar deformity was also observed at Reserva Limoy, Alto Paraná Department on 2 October 2014 (same date and locality as the woodpecker). The normal mass of the specimen suggests that it was not handicapped by its slight deformity. Such growth can occur when there is a damage to the tip of the lower mandible, resulting in unimpeded growth of the upper mandible.

Reports of bill deformities in Tyrannidae are rare (Bianchini & Arenas 2018), but elongated lower mandibles reported for Willow Flycatcher *Empidonax traillii* in Colorado, USA, similar to the deformity documented here for Swainson's Flycatcher (Fig. 5), represented 0.3% (n = 4/1170) of all birds captured, and 27% of the total bill and eye deformities observed. Abnormality rates in this study

were higher in some populations than others, and though the authors speculated that environmental or genetic factors may be involved it was not possible to conclusively determine the causes (Sogge & Paxton 2000).

Swainson's Flycatcher is a breeding northern migrant to Paraguay (Guyra Paraguay 2005). The specimen is adult, so, if the causes of the deformity were environmental or congenital, it was apparently able to fulfill its caloric requirements to migrate successfully. However, if the deformation was the result of a recent trauma and adversely affected the individual's ability to feed, then it could potentially have had negative effects on its migration capability. Unfortunately no data accompanies this specimen in order to speculate on the health or capabilities of the bird, but the upper mandible is apparently complete and normal, bearing a slightly hooked tip, which may indicate that the deformity is not caused by trauma or alternatively, that the trauma is old enough for the tip of the upper mandible to recover its growth.

The two examples of *Molothrus bonariensis* and *Thraupis sayaca* show dramatic deformities involving crossed mandibles that are exhibiting unimpeded growth. Twisting and thickening of the upper mandible can be seen in both cases and is perhaps related to the pressure caused by the lower mandible at the point of crossing.

Whilst it is tempting to provide traumatic causes as logical explanations for such deformations, in reality much remains to be learned about factors affecting bill deformation in wild birds. Recent evidence has suggested that infections by novel groups of picornaviruses that infect and actively replicate in bill tissue can cause Avian Keratin Disorder (AKD), which results in bill deformations similar to some of those documented here, and that such viruses may be far more widespread than previously known (Zylberberg *et al.* 2016, 2018). Given this potential relationship with viruses, we feel that reporting such occurrences continues to be warranted. This is especially true in South America where the effects of rapid environmental changes are receiving scant attention and potential environmental causes may be being overlooked. We encourage other Neotropical field workers to publish their observations of bill abnormalities to contribute to a better understanding of spatial and temporal occurrence continent wide.

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