SHORT COMMUNICATIONS

ORNITOLOGIA NEOTROPICAL 16: 263–266, 2005

A PARTIAL DOUBLE-LAYERED EGGSHELL IN THE TROPICAL MOCKINGBIRD (*MIMUS GILVUS*)

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Un huevo con cáscara parcialmente doble en una Paraulata Llanera (*Mimus gilvus*).

Key words: Multilayered eggshell, Tropical Mockingbird, *Mimus gilvus*, Trinidad.

During their sojourn in the reproductive tract, avian eggs are vulnerable to stress factors that may be manifested in a variety of structural defects (Romanoff & Romanoff 1949, 1972; Solomon 1997). One such defect is a multilayered eggshell, which occurs extremely rarely in birds and has been reported in the Domesticated Chicken (*Gallus gallus*; Bushnell & Maurer 1914, Romanoff & Romanoff 1949, Solomon 1997), Japanese Quail (*Coturnix japonica*; Jackson & Varricchio 2003), and Herring Gull (*Larus argentatus*; Playle 1975). Here I report a defective egg with a partial double-layered eggshell produced naturally by a Tropical Mockingbird (*Mimus gilvus*).

During the breeding season of 2001, a color-banded, monogamous female mockingbird produced five clutches of eggs between January and June on the campus of Caribbean Union College, Maracas Valley, Trinidad. The first clutch of three eggs was estimated to have been laid on 10 January and hatched on 23 January, but none of the nestlings fledged. A second clutch of three eggs was estimated to have been laid on 15 February and hatched on 1 March, producing two fledglings. A third clutch of unknown quantity was estimated to have been laid on 27 March and hatched on 9 April, yielding two more fledglings. A fourth clutch of four eggs was estimated to have been laid on 3 May and hatched on 16 May, producing at least two fledglings. On 20 June, the female was seen in the same nest as its previous brood, located 5.9 m above the ground on a beam just under the eve of a dormitory. It appeared to be incubating a fifth clutch. When the nest was inspected on 29 June, I found what appeared to be a single, abnormally long egg with a partial eggshell layer superimposed on a complete egg (Fig. 1). No additional eggs or eggshell fragments were found within the nest. Because the egg was cold, desiccated, and obviously abandoned, it was retrieved for further study.

The thin, fragmented edges of the outer shell layer were affixed very tightly to the outer surface of the egg throughout its perimeter. The two eggshell layers could not be

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FIG. 1. Abnormal egg of a Tropical Mockingbird (*Mimus gilvus*) with a partial double-layered eggshell compared with three normal mockingbird eggs taken from an abandoned nest on a different territory.

pulled or twisted apart without breaking the egg. The egg was unusually long, measuring 32.1 mm long and 18.7 mm wide; in comparison, three normal eggs abandoned in a nest on another territory ranged from 25.3–27.4 mm long and 18.3–18.8 mm wide. Both ends appeared to be pointed. The outer layer was normally pigmented, with brown spots on a pale blue background, whereas the inner layer was darker green and more finely speckled. After photographs were taken comparing the abnormal egg with three normal eggs (Fig. 1), the egg was broken manually to inspect its inner surfaces. Desiccated contents of the egg were attached to the fragile surfaces of the inner eggshell layer, which appeared smooth and continuous. This suggests that the outer eggshell was tightly superimposed on one end of the inner eggshell rather than merely overlapping it in the vicinity where the two fragments were joined. The fragmented remains were discarded.

DISCUSSION

Due to their extreme rarity, little is known about the natural history of multilayered avian eggs. Because complete multilayered eggshells may appear normal, presumably they are often overlooked. Partial multilayered eggs are much more easily detected. A partial second layer of thin calcium deposits occurred on a Domesticated Chicken egg (Romanoff & Romanoff 1949) and a patchy third layer occurred on portions of a double-layered Japanese Quail egg (Jackson & Varricchio 2003). Pigmentation of both inner and outer eggshell layers was reported in a chicken egg (Romanoff & Romanoff 1949), a Japanese Quail egg (Jackson & Varricchio 2003), and two Herring Gull eggs (Playle 1975). In the case of the chicken egg, the inner layer was lightly pigmented and the outer, thinner layer was more deeply pigmented (Romanoff & Romanoff 1949), similar to the mockingbird egg. However, the Japanese Quail egg was normally pigmented on the inner layer and lightly pigmented on the outer layer (Jackson & Varricchio 2003). A dead, partially emerged chick was found in one of two double-layered Herring Gull eggs, indicating the chick developed normally but was unable to break completely through the outer layer, of which 70% remained intact (Playle 1975). Scanning electron micrographs have been published for a double-layered Japanese Quail egg in which a detailed ultrastructure analysis was provided (Jackson & Varricchio 2003), and in a double-layered chicken egg (Solomon 1997).

Multilayered eggshells represent one of

several conditions collectively referred to in the ornithological literature as "ovum in ovo" (egg within an egg). In birds, most descriptions of "ovum in ovo" refer to a smaller egg located within a larger egg, in which the eggshells are separated by albumen or yolk (Hargitt 1897, Herrick 1899, Romanoff & Romanoff 1949). Such structural abnormalities are thought to be induced by stress, which can cause reversal of the peristaltic waves of muscular contraction pushing the egg toward the cloaca. The shell of an egg forms within the tubular shell gland after passing through the isthmus. When an egg reverses direction and reenters the isthmus, the process of shell formation begins again, thus creating a multilayered eggshell (Romanoff & Romanoff 1949, Solomon 1997). Normally an egg is laid pointed end first but occasionally an egg rotates about its short axis and is laid blunt end first (Smart 1991). The pointed ends of the mockingbird egg suggest it was rotated about its short axis between periods of eggshell formation, presumably when it reversed direction. An unusually high reproductive output by the female mockingbird may have contributed to the abnormal development of her egg. Her production of five separate clutches within six months was the most that I documented on an average of 12 mockingbird territories monitored annually during a 6-year study.

Much remains to be learned about the causes and consequences of multilayered eggshells. In addition to birds, multilayered eggshells have been reported in a variety of reptiles, in which the condition appears to be more common, including turtles (Ewert *et al.* 1984, Jackson & Varricchio 2003), lizards (Schleich & Kästle 1988), an unspecified crocodilian (Erben *et al.* 1979), and dinosaurs (Erben *et al.* 1979, Jackson & Varricchio 2003). Because the reproductive anatomy differs significantly between reptiles and birds (see references in Jackson & Varricchio 2003), any multilayered eggshells found should be preserved, examined with electron microscopy, and reported in the literature to better understand the comparative reproductive biology of amniote vertebrates.

ACKNOWLEDGMENTS

I thank F. D. Jackson and D. J. Varricchio for reviewing the manuscript, N. McKee for providing a reference, and E. Conroy for processing interlibrary loan requests. My research on the Tropical Mockingbird was partially funded by a grant from the Linnean Society of London.

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Accepted 27 January 2005.