SHORT COMMUNICATIONS

CRANIAL PNEUMATIZATION IN THE INDIAN WEAVER BIRD, *PLOCEUS PHILIPPINUS*

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The pattern of pneumatization of the skull is used extensively to estimate the age of passerine birds (Verheyen 1953; Serventy et al. 1967). The thin translucent cranial roof of nestlings is gradually pneumatized by outgrowths from the tympanic and nasal air sacs (Serventy et al. 1967). During this process the roof of the skull becomes opaque and appears pitted because of the formation of bony trabeculae within the air spaces (Bignon 1889; Verheyen 1953; Bellairs and Jenkin 1960; Harrison 1965). In general, pneumatization of the skull from the single-layered type of most passerines is completed within 4 to 8 months after hatching (Chapin 1917, 1923; Ticehurst 1925; Harrison and Harrison 1949; Verheyen 1953). Possible exception to the 4–8 months period are in the Ploceidae, Certhidae, and perhaps in the Paridae (Chapin 1917, 1949; White 1948). Detailed studies of pneumatization of the skull of birds of known age are those of Nero (1951) on the House Sparrow, *Passer domesticus*, and of Serventy et al. (1967) on the Zebra Finch, *Taeniopygia castanotis*. Verheyen (1953) has described the general pattern of pneumatization in 25 passerine species, using individuals of unknown age. In the House Sparrow the rate of thickening of the cranium seems to proceed at a fairly constant rate (Nero 1951). Different species acquire complete pneumatization at different ages and there is geographic variation also (Grant 1966; McNeil 1967). Some species may never attain the adult skull (White 1948; Chapin 1949; Harrison and Harrison 1949), while others may acquire complete pneumatization quite early in life (Chapin 1949). Diseases and captivity also influence the rate of pneumatization of the skull (Harrison and Harrison 1949).

MATERIAL AND METHODS

The Indian weaver bird, *Ploceus philippinus*, commonly known as Baya, is a small, nonmigratory, sparrow-sized ploceid which breeds during summer months (July–August). It is distributed throughout the Indian union, Pakistan, Ceylon, and Burma (Ali 1964). In nature, males take more than a year to mature, while females become adult during the same year (Saxena and Thapliyal 1966; Thapliyal and Chatterjee 1965; Bageshwar 1969).

During late August and September 1966, large numbers of young birds (about 700–750 birds, with eyes still closed) less than 20 days of age were collected from nests and were hand-fed for about 20 days when they were switched to grains (Paddy, *Oryza sativa*; Kakun, *Setaria italica*). Birds always had plenty of water and food and remained in good condition on this regime. This formed the stock from which birds were taken for this study.

Beginning from September 1966, four young birds from the stock were killed at 10-day intervals up to February 1967 and at monthly intervals thereafter until the following September. Skulls were thoroughly cleaned and dried in the shade. The course of pneumatization was studied with the help of the dried and cleaned skulls. Each skull was examined by holding it against a window and allowing light to illuminate the area of pneumatization, which was then outlined in black water-proof ink (Serventy et al. 1967).

OBSERVATIONS

From the large number of crania studied, 14 have been taken as representative of the course of normal development of pneumatization in captive Baya (fig. 1). These can be used for assessing the age of young birds of this species.

The dark areas (fig. 1) represent the fontanelles; the clear areas indicate the absence of pneumatization; stippled areas, bounded by a fine line, indicate the limit to which pneumatization has advanced; fine lines wholly or partially dividing the cranium represent the sutures which become less discernible after day 50. In some crania there was peculiar hardening and this appeared in the specimen as a bubble-like formation slightly dotted with bone (fig. 1, 40 and 50 days-old crania).

THE NORMAL PROCESS OF PNEUMATIZATION

Young Baya, *Ploceus philippinus*, normally leave the nest 17 or 18 days after hatching (Ambedkar 1964). At this age, although cranial pneumatization may be lacking in some, in the majority the process appears to have begun at the exoccipital region around the foramen magnum and at the extreme anterior end of the frontal bones. With increase in age, pneumatization appears to extend more or less symmetrically from these two areas but probably more rapidly from the posterior region (fig. 1).

Formation of double layer of bone follows the pattern of growth as described by Nero (1951) for the House Sparrow with a difference in timing, namely, the double layer begins about 20 days after hatching and up to 50 days of age is confined largely to lateral extensions of the area posterior to fronto-parietal sutures. After 100 days, two clear windows are frequent, and the latter disappear at 120 days or persist up to 150 days, but are not observed after 5 months of age (fig. 1).

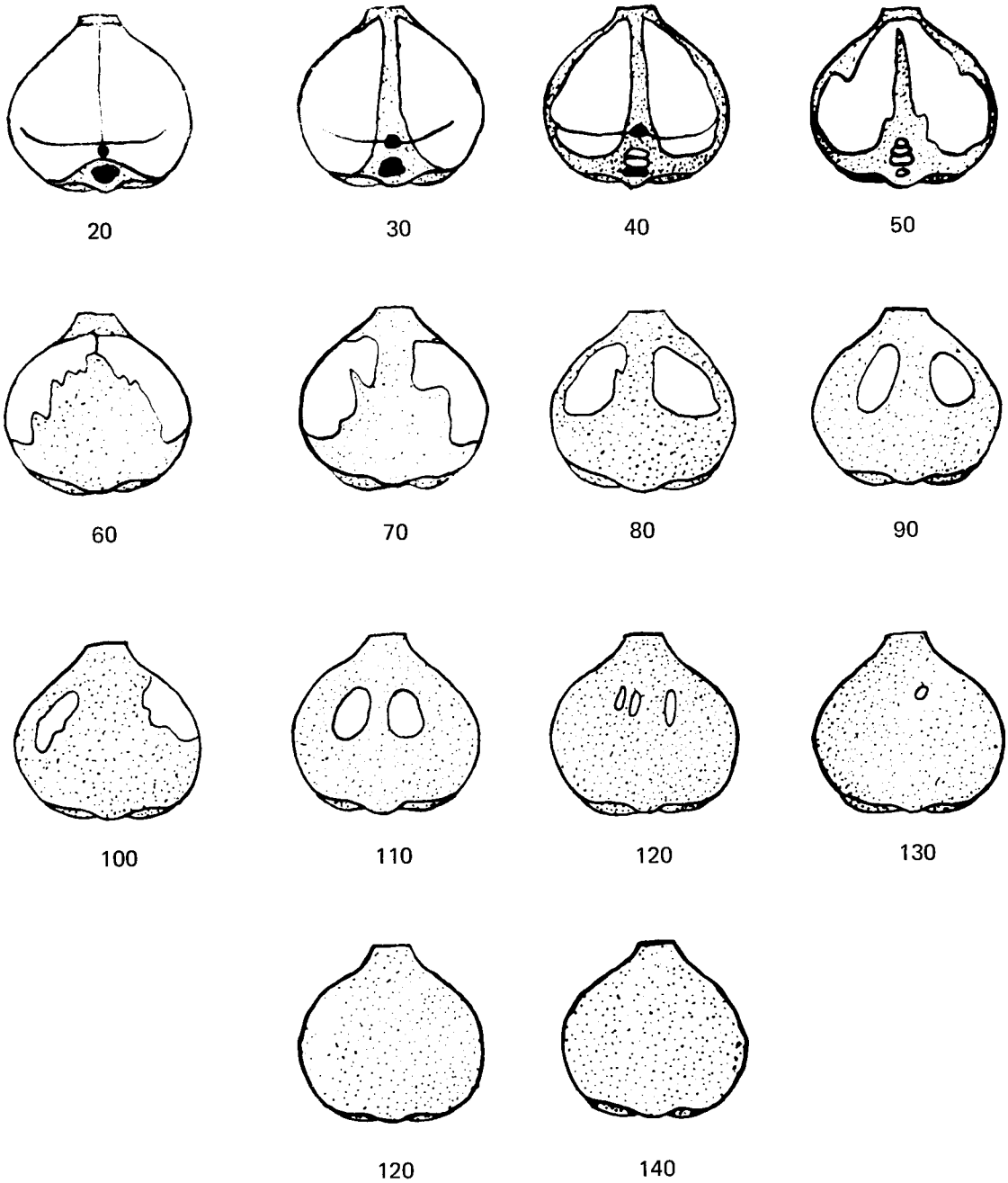

FIGURE 1. Pneumatization of the cranium (dorsal view) in the Baya, *Ploceus philippinus*. The age of the bird in days is given beneath each diagram.

DISCUSSION

Observations show that, in some other passerine birds (Chapin 1917, 1923; Ticehurst 1925; Harrison and Harrison 1949; Nero 1951; Verheyen 1953; Serventy et al. 1967), complete pneumatization of the skull characteristic of the adult occurs while Baya are only a few months old. Contrarily, Harrison and Harrison (1949), White (1948), and Chapin (1949) have shown that in species included in the genera *Anthoscopus*, *Salpornis*, and *Vidua* windows are present even in the skulls of old adult birds. Grant (1966) reported a retarded or arrested development in specimens of *Myiopagis virdicata* that breed while the skull is only partly pneumatized. Similarly, swifts and small sandpipers retain a condition throughout life that suggests an immature condition of the skull (Chapin 1949).

CONCLUSIONS

Pneumatization of the cranium in the nonmigratory Baya begins even before the young has left the nest and is completed when the birds are 120–140 days old. There is no sex difference in the rate or extent of pneumatization of the cranium.

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THE SHELL PIGMENT OF GOLDEN EAGLE EGGS

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The purpose of this note is to characterize the nature of the external pigmentation of the egg of the Golden Eagle (*Aquila chrysaëtos*), based upon our examination of the 16 eggs laid in our home by one of our normal, healthy Golden Eagles. The process of emergence from the cloaca was closely observed in five of these cases. Twice the egg was laid directly into the hand. The producer of the eggs has been isolated from sight and sound of other birds of prey throughout her conscious life. The eggs were laid between November 1964 and April 1971. They appeared normal both internally and externally and exhibited the full range of variability in color characteristic of the species as described by Bent (1961), Reed (1965), Godfrey (1966), and Brown and Amadon (1968).

The 1st, 10th, and 15th eggs were white and unmarked as a small percentage of Golden Eagle eggs normally are (Bent 1961). The shells of eggs 2–9, 11–14, and 16 were superficially splashed with blotches of color more brightly reddish than brown. They were typical of the species. This characteristic coloring matter has been universally assumed to be the secretion of pigment glands. We contend that, on the contrary, it is blood proper from the rupture of blood vessels in the oviduct or cloaca. Glandular pigments have been shown to fade with age (Thomson 1964). Blood is known to darken with age. According to Simpson (1965), blood turns from red to brown within about 24 hr and then darkens slowly. The deposits on extremely old Golden Eagle eggs are very dark (pers. obs.). In the case of Golden Eagle egg shells in the American Museum of Natural History collected before the turn of the century, the coloring matter is dark, approaching black. Blood deposits on 1964–65 Golden Eagle eggs on Featherland carry darker color than when first coagulated and somewhat darker than the deposits on 1969–71 eggs from same bird. Bacterial action will have rendered extremely old deposits hard and no longer the substance they were at the time of laying. Therefore, the origin of the pigment is probably impossible to determine by study of old eggs (pers. comm., E. J. Fennell, A. J. Beaton, and Dr. George Anderson).

Within 60 sec of emergence, the coloring matter on egg no. 13 was spread, smeared by thumb and finger, and stained them. In the case of egg no. 14, the coloring washed off as blood does under a tap flow.

In May 1970, the Official Analyst to the City of Vancouver and to the Attorney General of British Columbia, E. J. Fennell, and his staff applied the Takayama test for blood to several of the typical Golden Eagle eggs in our presence; the reaction was positive. This test for blood is more sophisticated than mere detection of hemoglobin, and is a confirmatory test often used in court cases (Fennell, pers. comm.). This test applied to the typical coloring incorporated into the shell of gull eggs was negative, though substances related to hemoglobin were present.

The 16th egg, typically color-splashed, laid 5 April