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Gross Morphology of Male Sex Organs of Cattle Egret (*Bubulcus Ibis*) During Breeding and Non-Breeding Seasons

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ABSTRACT

Cattle egrets are important stocky herons involved in biocontrol of cattle parasites. The study was aimed at evaluating the gross morphology of the sex organs of male cattle egrets (*Bubulcus ibis*) during breeding and non-breeding seasons. Ten (10) male cattle egrets were sourced from the wild, five (5) each during breeding and non-breeding season. The animals were anaesthetized using ketamine hydrochloride (50mg/kg body weight), thereafter perfused with 10% neutral buffered formalin. The reproductive organs were gently extracted using a pair of scissors and a scalpel blade. Grossly during breeding season, the left testis is relatively slightly longer than the right testis but the right is relatively slightly wider than left. Both testes are whitish in color, varies between elongated to oval shaped, convex at lateral surface but slightly concave medially where it joins the epididymis. The epididymis is brownish, spindle- to fusiform in shape, and is unsegmented. The vas deferens is light grey in color, slightly convoluted, and conspicuous from the point of exit at the epididymis to the point of entry to the cloaca. While, in non-breeding season: the testis appeared creamy pale, shrunken with an oval shape. The vas deferens is faintly obvious from the epididymis but later becomes conspicuous after first twisting as it extends toward the cloaca. The cloaca is similar to those in other avian species, as a single chamber that is connected to the vent as the most external portion of the sex organ. In conclusion, the male reproductive organs of cattle egrets showed great similarities and variations between breeding and non-breeding seasons and across various species of birds.

Keywords: Cattle egret, Gross morphology. Season, Sex organs, Variations.

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Data Availability

Data supporting the findings are available from the corresponding author on reasonable request.

Introduction

Cattle egrets are important stocky heron involve in bio-control of cattle parasites and also feed on insects like grasshopper, maggot and grains (Abou shaky, 2012; John, *et al.*, 2016). They are versatile species that can survive and adapt to different environments and food

sources (Talbi, *et al.*, 2023). Egret are good subject for breeding study as they are abundant, consume easily identifiable prey, and are consumed by rural dwellers as meat (Lie, *et al.*, 2016). Studies has shown that environmental changes have effects in motivating them in their distribution, habitat use, reproductive parameters

and foraging behavior (Arendt, 1988, Sodhi, 1989; Robert, *et al.*, 2000).

The male reproductive structures are highly vascularized with many glands and ducts that promote the formation, storage and ejaculation of sperm for fertilization and to produce important androgens for male development (Mawhinney and Mariotti, 2013). The major male androgen is testosterone which is produced from Leydig cells while inhibin B and Mullerian inhibiting substance (MIS) hormone are produced by the Sertoli cells in the testes. Important hormones that modulate these include follicle-stimulating hormone (FSH) and luteinizing hormone (LH), which are released from the anterior pituitary gland and are regulated by gonadotropin releasing hormone (GnRH) produced by the hypothalamus. Together, these hormones form the hypothalamic-pituitary-gonadal axis that promotes and maintains sexual development and function in the male (Plant and Marshall, 2001).

Male reproductive organs undergo significant changes in morphology annually in many bird species as such classify as one of the most flexible organs in terms of physiology and anatomy among adult vertebrates (Leska, *et al.*, 2012; Islam, *et al.*, 2013), with one organ typically being larger in adulthood than the other (Aire and Ozegebe, 2007). However, some species, such as the tree swallow (*Tachycineta bicolor*) and chicken, have identically sized organs (O'Hearn, 2017).

Materials and Methods

A total number of ten (10) male cattle egrets were divided into five (5) each for breeding and non-breeding season. The cattle egrets were sourced from Zuru town, Kebbi State in North-western Nigeria. The birds were captured by trap with the use of fishing nets around the top branches of tree where the bird nest at night as described by Danmaigoro, *et al.* (2014). The birds were held in plastic cages and were transported to the Gross Anatomy Laboratory of the College of Veterinary Medicine, Federal University of Agriculture Zuru, Kebbi state. Ethical approval was sought from the committee on animal welfare and handling of Ahmadu Bello University Zaria with approval no: (ABUCAUC/2025/004).

Organ harvesting

The birds were weighed and thereafter anesthetized using 50mg/kg body weight of ketamine hydrochloride and subsequently perfused with 10% neutral buffered formalin, placed on ventral recumbency and a ventral midline incision was made, extending from the last rib close to the sternum to the pubic symphysis (vent). The peritoneum was reflected and intestines were displaced to gain access to the testis as described by James and Howard, (2017). The organs were examined *in situ*, photographs were taken and thereafter harvested by gentle dissection and trimmed as described by Geoff, *et al.* (2018).

Results

Macroscopically, the testis in breeding season (May-September) varies between elongated to oval shape, convex on lateral surface, slightly pointed or rounded at cranial and caudal extremity and Concave but slightly depress medially where it joins the epididymis. The testis appears white to slightly creamy and are connected together by epididymis and associating structures and held to the ventral aspect of the vertebral column or coelomic cavity by mesorchium. It is located cranioventral to the kidney and caudal to the heart in the abdominal cavity. The epididymis is grossly inconspicuous on ventral view *in-situ* (plate I) but may be identify on the dorsal view along with the associating tissues (plate II).

The vas deferens is light grey in color, slightly (when not fully filled with spermatozoa) (plate III) or highly convoluted with presence of spermatozoa passing through to the cloaca (plate II). The vas deferens is also highly conspicuous from point of exit at epididymis to the point of entering the cloaca. The left testis is slightly longer than the right testis but the right is slightly wider in width than the left testis (Plate I). The right is also slightly more cranial and lateral than left testis. The epididymis is similar with other avian as a spindle shape unsegmented structure and continues at the caudal limit as vas deferens. The mesorchium is inconspicuous on the ventral view during breeding season (plate I).

Macroscopically, the testis in non-breeding season is also abdominal in location and place cranial to kidney but caudal to lungs and heart. It varied from creamy (January-march) to pale and deep black (November-December) (plate III) during non-breeding season depending on the time of the season. It is small (shrink) and almost rudimentary with somewhat oval shape (plate III). The right testis is slightly cranial and laterally placed than the left testis which is more medially position. The left testis is longer but less-wider in width than the right testis (plate I). During this season, the spermatic cord attaching the two testis is obviously visible (conspicuous) on ventral view *in-situ* (plate I). It is oval and somewhat flabby grossly (plate III). The vas deferens is faintly obvious from the epididymis but later become conspicuous after first twisting as it extends toward the cloaca. The cloaca is somewhat flabby and muscular, highly obvious in non-breeding season than breeding season (plate III),



Figure 1: Image of one of the cattle Egret used for the experimental study



Plate II: dorsal view of male cattle egret reproductive organ during breeding season showing left (A) and right (B) testis, mesorchium (C), epididymis (D), cloaca (E) and kidney tissue with vas deferens and associated structures.

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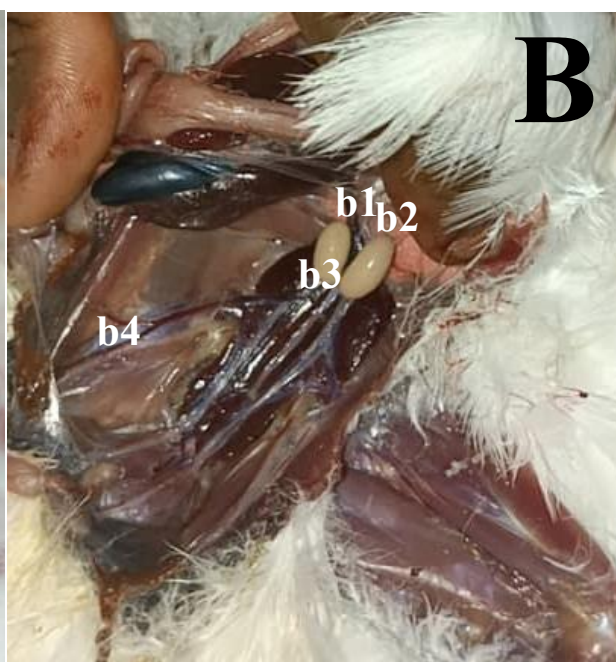
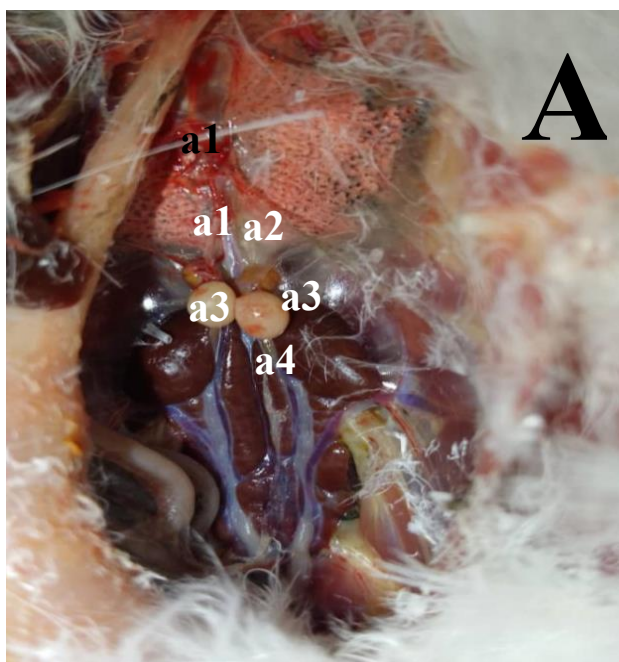


Plate I: Ventral view of male cattle egret reproductive organ during breeding season showing right (a1 and b1) and left (a2 and b2) testis, vas deferens (a3 and b3), cloaca (a4 and b4).

Note: Image A is August-September and Image B is May-June

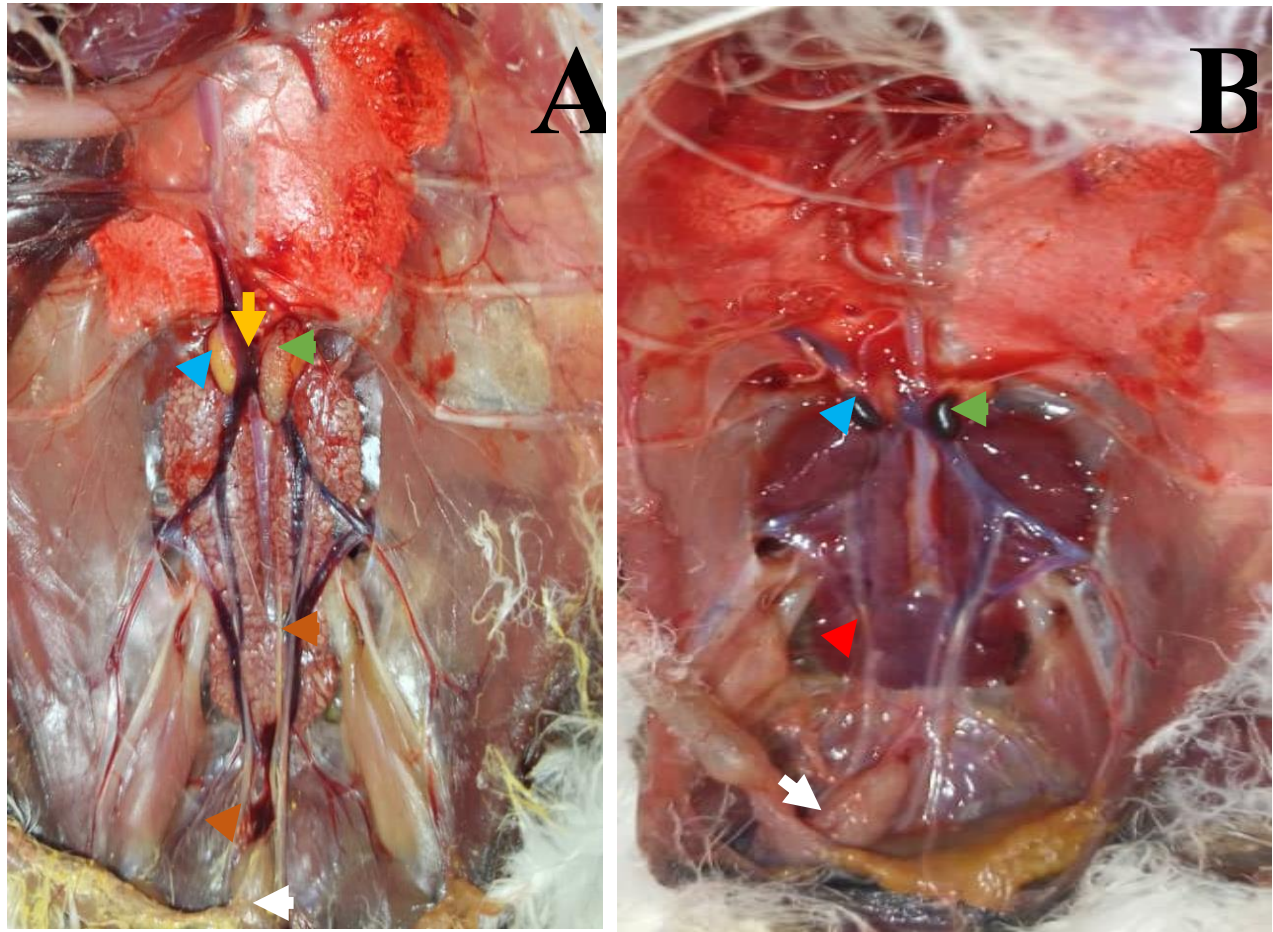


Plate III: Ventral view of male cattle egret reproductive organ during non-breeding season showing left (A and B green arrow) and right (A and B blue arrow) testis, mesorchium (yellow arrow), vas deferens (A and B red arrow), cloaca (A and B white arrow). Note: Image A is January-February while Image B is November-December

Discussion

It has been reported that herons are seasonal breeders with their reproductive cycle coinciding with onset of raining season (Maddock and Baxter, 1991), this findings is similar with our findings with the breeding season lasting May and September which is the onset of raining season while the non-breeding season is between November to February in Northwestern Nigeria Male cattle egrets showed presence of two testis, two epididymis, two vasa deferens and a cloaca but absence of glomus and phallus, this finding is similar with major reproductive tract organ in avian vertebrates but with slight variations (Jorge, *et al.*, 2022). Cattle egrets showed elongated to oval shape testis in breeding season but shrink oval pale to creamy yellow to dark testis in non-breeding season, this is in contrary to the findings of Lita, *et al.*, (2019) who reported a pale color testis in buffalo egret during breeding season, but in agreement with the oval shaped reported during both seasons. Our result on asymmetrical testis with the right more cranial than the left in both seasons and the left relatively longer than the right but the right relatively wider than the left in both seasons, this is in agreement in-terms of asymmetry but contrary in-terms of each half with the findings of Lake, (1981) who reported that birds general have asymmetric testis with the right relatively longer

than left but the left larger the right. It also differs from the report of (Kempnaers, *et al.*, 2002) who reported that tree swallow (*Tachycineta bicolor*) has identical or symmetrical testis. Our findings on relative length and width of each half of the testis are also in agreement with the finding of Jos-dorlan *et al.*, (2022) who also reported that the left testis was relatively longer than the right and the right is relatively wider than the left in yellow feathered broiler. Our result on epididymis of cattle egret is almost inconspicuous on the ventral view thus slightly visible in non-breeding season due to the large gap created as a result of testis shrinkage and more displace distance of the two testicle but visible at the medio-cranial aspect of the dorsal surface in both seasons where it joins the most cranial aspect of the vas-deferens, this findings is similar with the finding of Lita, *et al.*, (2019) who reported that the epididymis is a pair channel that connect the testis with the ductus deferens and is conspicuous only on the dorsal view of the testis in buffalo egret. Our result also showed light grey straight to highly convoluted vas deferens in both seasons. The point of exit from the epididymis is rarely visible on the ventral view, this is in agreement with the report of Althnaian (2021) who reported a grey and highly convoluted vas deferens in Al-ahsa native rooster. Absence of phallus in this species may be due to species

variation, since only 3 percent of birds have retained or presence of a phallus capable of intromission Herrera, *et al.*, (2013)

In conclusion, the observations on shape, size and location of the male reproductive organs of cattle egrets showed great similarities and variations between breeding and non-breeding seasons and across various species of birds. The breeding season shows more visible and larger structures than non-breeding season though this could be due to more feed availability during breeding season that coincide with the farming period and cool temperature than non-breeding season with low grain availability (no farming activity) and high temperature in this region.

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Conflicts of Interest

None declared

Authors' Contributions

A.S.O., M.T.A., S.M.H., and I.J. – Conceptualisation and original draft; M.S.M., A.H.A., and Z.M. – review, correction and final editing; Z.M., B.A. and O.H. – methodology and data collection

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