Eastern Journal of Agricultural and Biological Sciences (EJABS)
ISSN: 2753-3247
Website: https://qabasjournals.com/index.php/ejabs

MACRO AND MICRO ANATOMY OF THE MALE GENITALIA OF THE NIGERIAN LAUGHING DOVE (*Spilopelia senegalensis*)

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ARTICLE INFO

Received: January 2, 2024
Accepted: November 14, 2024
Volume: *4*
Issue: 3

KEYWORDS

Testis, epididymis, laughing dove, efferent ductules, rete testis

ABSTRACT

In the present study, male reproductive tract of the Nigerian laughing dove was studied, where twenty doves were captured from the wild in Funtua village, Katsina State, Nigeria. They were euthanized according to standard ethical practice. The reproductive tract was subsequently harvested and the gross and micro anatomical features were studied. The testis, epididymis and ductus deferens of the birds were dissected and prepared for histological study. Result showed that the male reproductive tract of the Nigerian Laughing dove consist of the testis, tubuli recti, rete testis, efferent ductules, epididymis and the ductus deferens. The testis in this present study was ellipsoidal to bean in shaped. The tunica albuginea was present and epididymis was not divided into head, body and tail. Result also showed that the concentration of spermatozoa varies from low concentration from the rete testis to high concentration towards the ductus deferens. It was therefore concluded the male reproductive organs of the Nigerian Laughing dove like other avian species consist of the testis, extratesticular rete testis, efferent ductules, connecting duct, epididymal duct and ductus deferens.

1. Introduction

The laughing dove (*Spilopelia senegalensis*) is ubiquitous in nature, with black spotted reddish fore-neck which are easily distinguished from other doves. The laughing dove earned its name because of the distinctive coo that sounds just like human laughing (Al-Obaida and Al-Shadeedi 2011).

It has been reported that the Nigerian Laughing dove (NLD) are almost in all the regions of the country (Fagbohun *et al*. 2000), where they spend much time on the ground, feeding on fallen seeds. They also contribute to the rural society as a cheap substitute to animal protein and serve as an alternative source of delicacies in Nigerian villages. This could explain why the NLD is seen at some "Suya" or barbecue spots in Northern Nigeria especially Zaria (Oniye *et al*., 2000, Adang *et al*., 2008).

Young laughing doves, just like other doves reach maturity at six to seven months. They breed well for at least five to six years and will continue to reproduce, but less regularly, into an old age of 10 or less. The laughing dove breeds all year-round year round in Malawi and Turkey, May to November in Zimbabwe, and February to June in Egypt and Tunisia (Biricik and Murat, 1997). This breeding and seasons as described indicates the development of the genital system especially the gonadal size from hatching to sexual maturity. Although studies have been conducted on the hematological biochemical parameters (Olayemi *et al*., 2006) and survey of helminth parasites (Oniye et al., 2000), there is dearth information on the macro and micro anatomy of the reproductive tract of NLD. The aim of this work is to determine the gross and micro anatomical features of the adult male NLD.

2. Methodology

2.1 Study Area

The NLD used for this study were gotten from the wild in Funtua village, Katsina State, Nigeria. All gross studies were done in the Department of Veterinary Anatomy Laboratory, University of Abuja, Nigeria. While the Histologic studies were done in Histology Laboratory at the University of Abuja Teaching Hospital Abuja. The Photomicrographs were taken at the Pathology Laboratory at the National Hospital Abuja.

2.2 Tissue Collection

Five mature and apparently healthy NLD were used in this study, these birds were euthanized using chloroform in a plastic air tight container. Appropriate incision was made to gain access to the visceral organs. The reproductive organs including the testis, epididymis and ductus deferens of the birds were dissected out for gross and histological observations.

2.3 Gross Examination

The entire male genitalia of each bird were carefully exposed and details of the anatomical location, in relation to other structures, color and courses were observed insitu. The genitalia of each bird were separated from its underlying structures. The weight of the testes was taken using a digital weighing balance. The length of these segments was also measured using thread and meter rule (Anaso et al., 2024).

2.4 Histological preparations

The protocol for the histological preparation was a modified method El-Saba and Abdrabou (2013). Immediately after the gross examination, samples from the various segments of the male genitalia were taken and fixed by immersion in 10% formalin solution. For the epididymis, samples were taken from the cranial, mid and caudal regions. Fixed specimens were dehydrated, cleared and embedded in paraffin wax. Sections of 5-6 micrometers thick were obtained and stained with Hematoxylin and Eosin for general tissue structure (Anaso et al., 2023; Anaso et al., 2024).

3. Results and Discussion

Results

Grossly, the testes, epididymis and ductus deferens of the NLD appeared light yellow to cream in color. The testes are symmetrically located and suspended by short sheet of peritoneum between the abdominal aorta, renal artery and kidney (Fig 1). The testes are paired soft structures, bean to ellipsoidal in shape, having a concave medial border and a convex lateral border (Fig 1). The epididymis is interposed between the testes and ductus deferens. Lying caudomedial to the testes, its cranial portion is embedded into the testis whereas the caudal portion continued into the ductus deferens and is narrower. It is thin, spindle shaped and somewhat elongated (Fig 1). The ductus deferens of NLD continues from the caudal aspect of the epididymis, caudomedial to the testes. It runs medially and enters the medioventral aspect of the cloaca at the region of the urodeum (Fig 1). The weight, thickness, and length, of the testis, epididymis and ductus deferens are presented in the table 1.

Histological studies

Upon histological examination, the testis of the NLD was found to be covered by a thin capsule, the tunica albuginea. This tunica albuginea does not send ramification into the testis (Fig 2).

Distributed in the testis of NLD are numerous seminiferous tubules which are mainly circular at the cortex and elongated towards the medulla (Fig 2).

The seminiferous tubules which were divided into the basal and adluminal compartments presented various stages of the spermatogonic series thereby have a stratified epithelium of 5-7 layers (Fig 3). From the basal layer are spermatogonia which are deeply which are deeply stained sandwiched between the lightly stained Sertoli cells. Immediately after this layer are layers of primary spermatocytes in that order. This was followed by a layer to the spermatids varying from 1-2 layers (Fig 3).

Separating the seminiferous tubules are the interstitial space with its interstitial tissue (interstitium). They appeared distinct consisting mainly of connective tissues, distributed in the interstitial tissue are the Leydig cells (Fig 4).

The Tubulu Recti which is the structure connecting the seminiferous tubule to the Rete testis was seen to be embedded in a network of anastomosing channels of fibrous stroma (Fig 5).

The tube, the rete testis connected the Tubuli Recti to the ductus efferentis. It consisted of a plexiform arrangement of channels surrounded by highly vascular collagenous supporting tissue containing myoid cells (Fig 6).

The ductus efferentis presents an epithelium which is pseudostratified columnar epithelium (Fig 7).

The epididymal epithelium was of the pseudostratified columnar type. Matured spermatozoa was seen in the lumen (Fig 8).

Although not easily divided into head, body and tail, the distributions of spermatozoa, in the lumen of the epididymis increases dramatically towards the ductus deferentis (Fig 9a, b and c). Again, the epididymis was embedded in loose connective tissue.

Also embedded in the pool of loose connective tissue, the ductus deferens followed the epididymis and its epithelium being of the pseudostratified type like the epididymis (Fig 10).

The muscular layer was thrown into folds. There was a single layer of inner longitudinal smooth muscle, an extensive circular layer of smooth muscle and a final layer of the external longitudinal smooth muscle (Fig 10).

Doves	TL (mm)	TW (gm)	LE (mm)	DDL (mm)	GLI (mm)	LGS (mm)
1	27.0	0.22	4	34	65	70
2	16.0	0.007	2	32	50	65
3	5.0	0.17	4	45	54	56
4	11.0	0.06	3	37	51	60
5	9.0	0.08	6	50	65	80

Table 1: Table showing testis weight (TW) and testis length (TL), epididymal length (LE), Ductus deferens length (DDL), length of genitalia intact (GLI) and length of genitalia stretched (LGS)

Figure 1: A photograph of the male reproductive tract of NLD
Note the ellipsoidal light yellow to cream colored testis (A), the spindle shaped and somewhat elongated epididymis (B) and the ductus deferens (C) and the kidney (D).

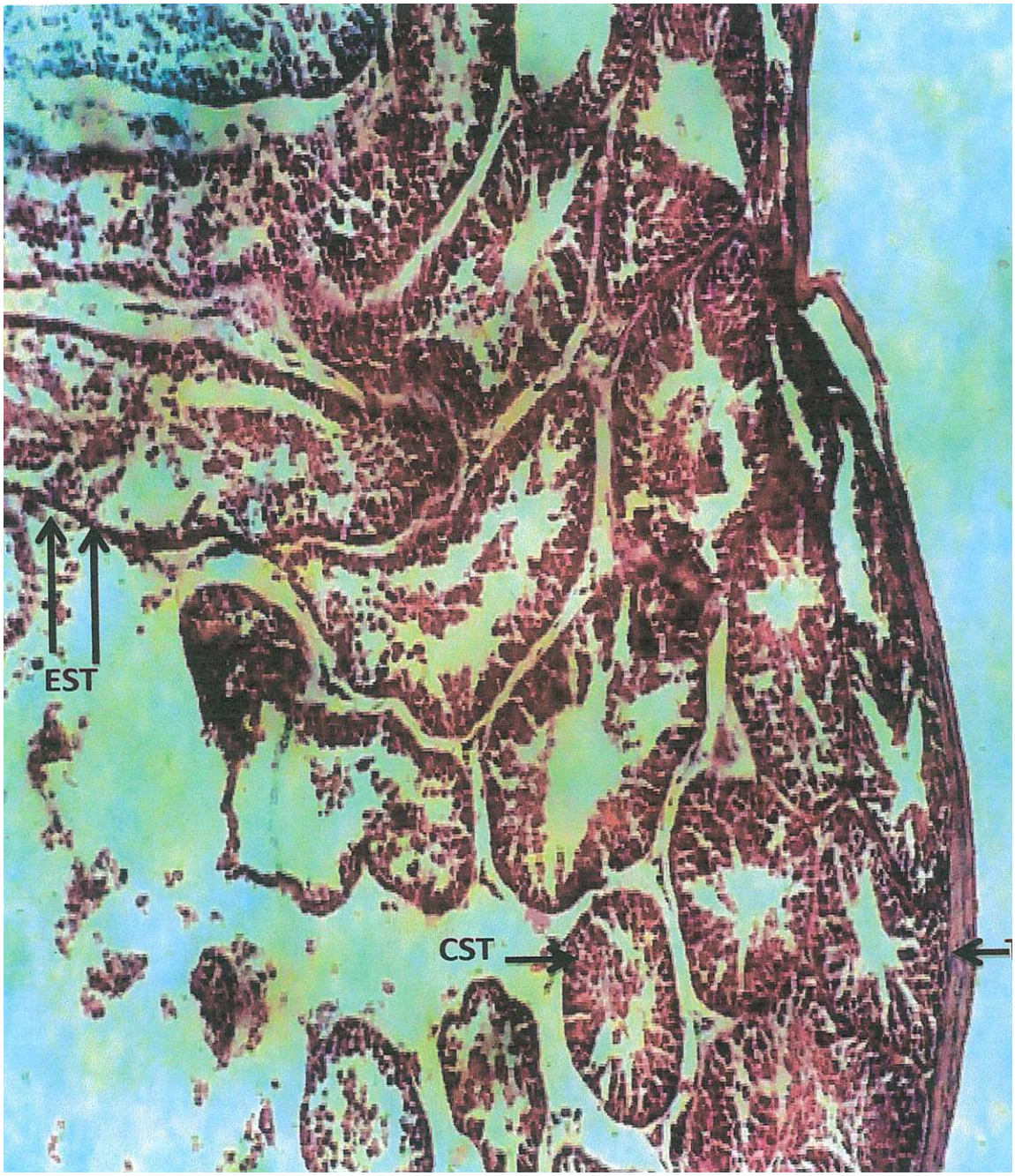

Figure 2: Photomicrograph showing the tunica albuginea (TA) and seminiferous tubules which are circular (CST) at the cortex and elongated (EST).

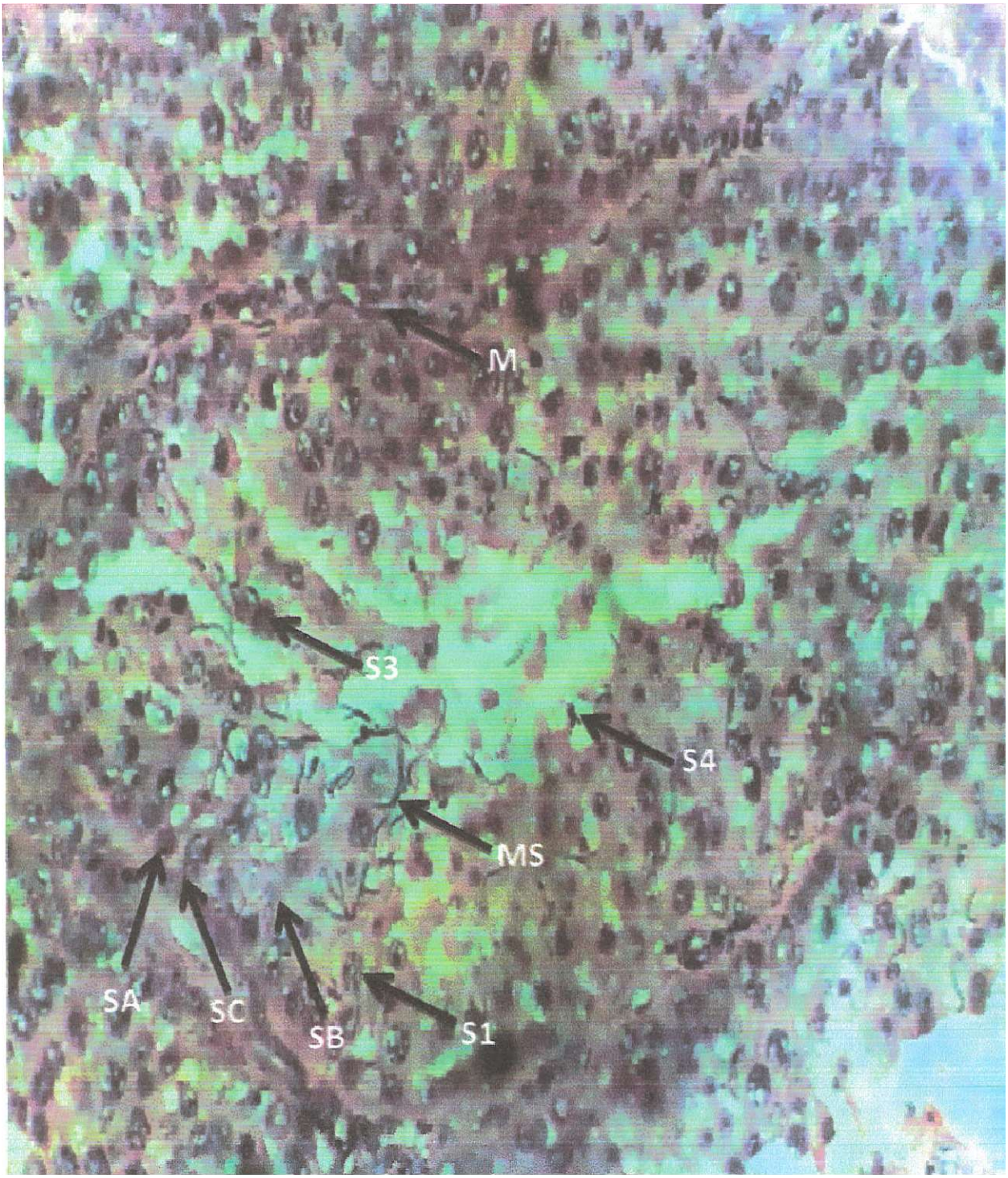

Figure 3: A photomicrograph showing the seminiferous tubules (ST) which presents various stages of spermatogenic series in both the basal and adluminal compartment and also shows the non-spermatogenic cells.
Spermatogonia type-A (SA), Spermatogonia type-B (SB), Sertoli cells (SC), Primary spermatocytes (S1), Spermatids (S3), Matured spermatozoa (MS), Myofibroblast (M), x40 magnification.

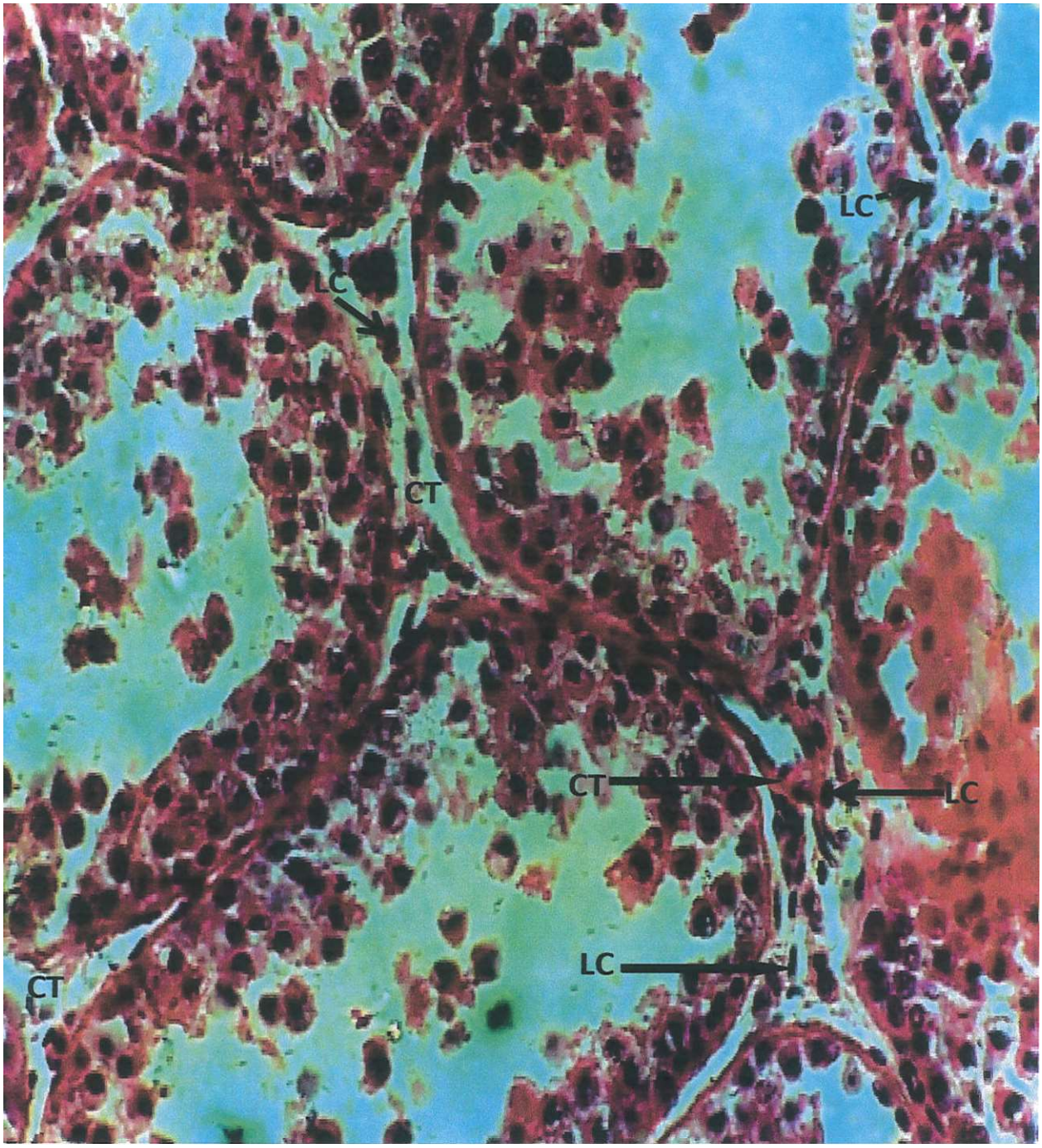

Figure 4: a photomicrograph of seminiferous tubules showing the interstitial tissue, Leydig cells (LC) and connective tissue (CT) which holds the various seminiferous tubules. X40 magnification

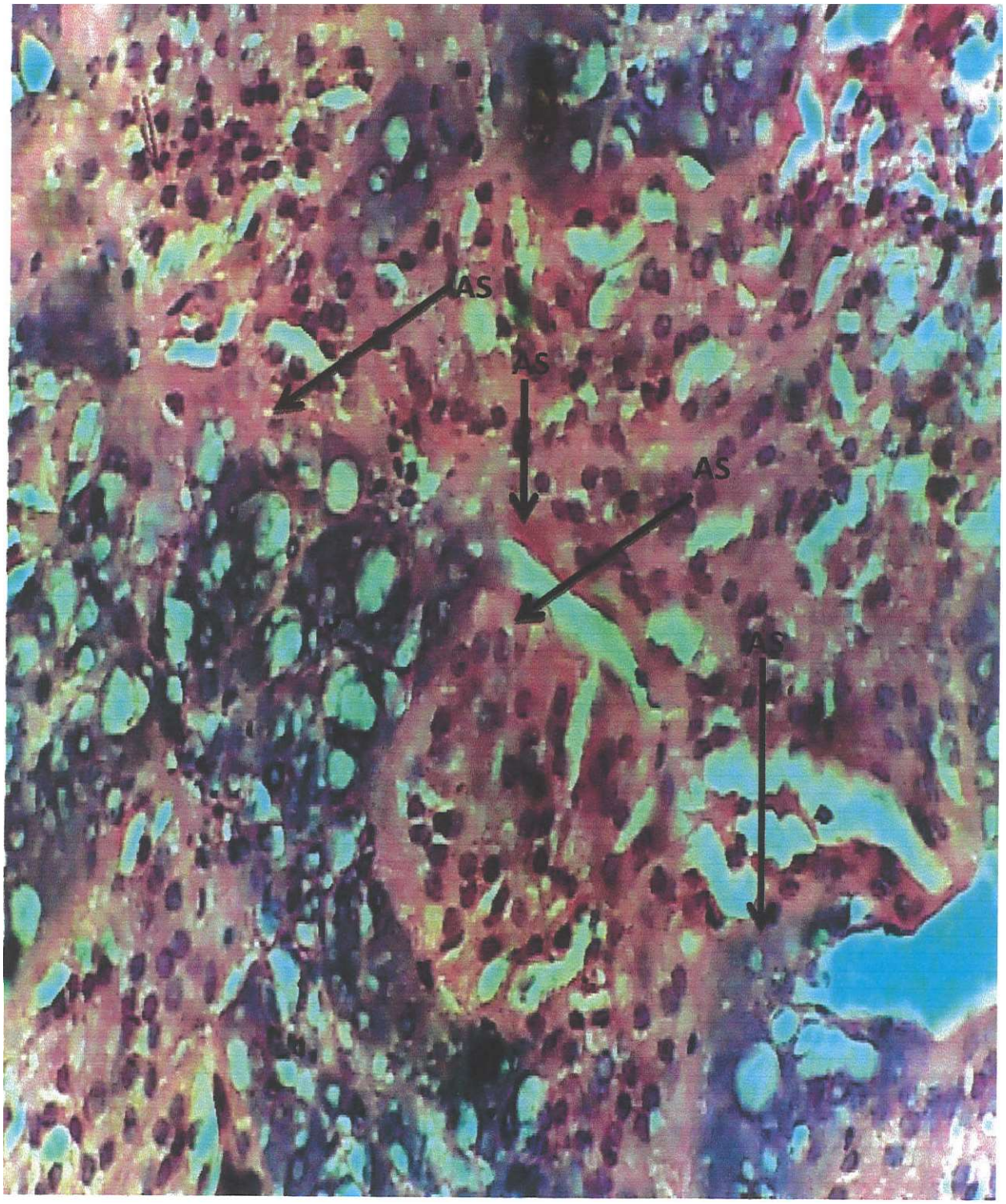

Figure 5: A photomicrograph of the tubuli recti showing network of anastomosing stroma (AS). X40 magnification

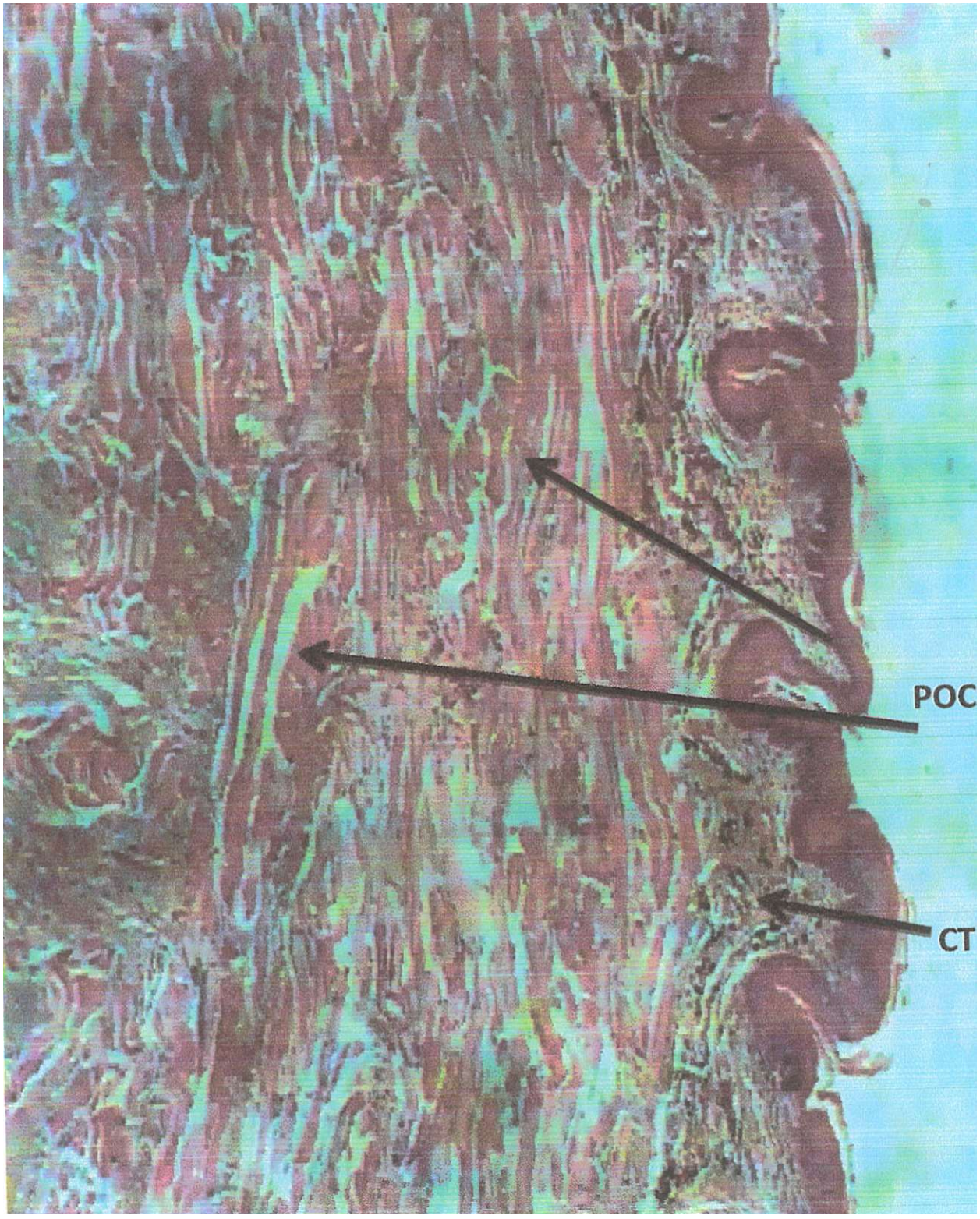

Figure 6: photomicrograph showing a section of the rete testis, notice the plexiform arrangement of channels (POC) and the connective tissues (CT) x 40 magnification

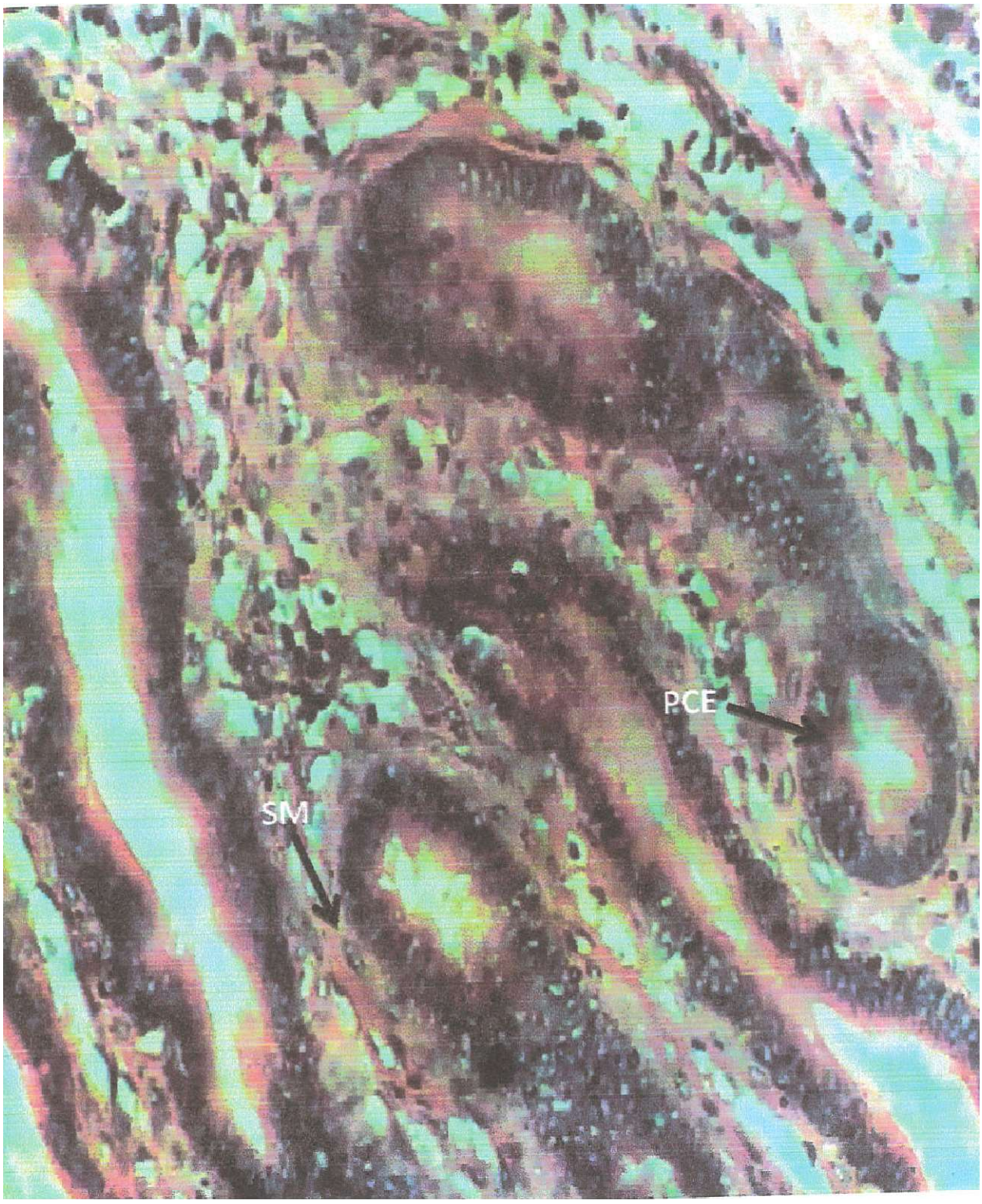

Figure 7: photomicrograph showing a section of the ductus efferentes which shows a pseudostratified tall columnar epithelium (PCE) and a thin band of smooth muscle (SM) surrounding each duct. X40 magnification

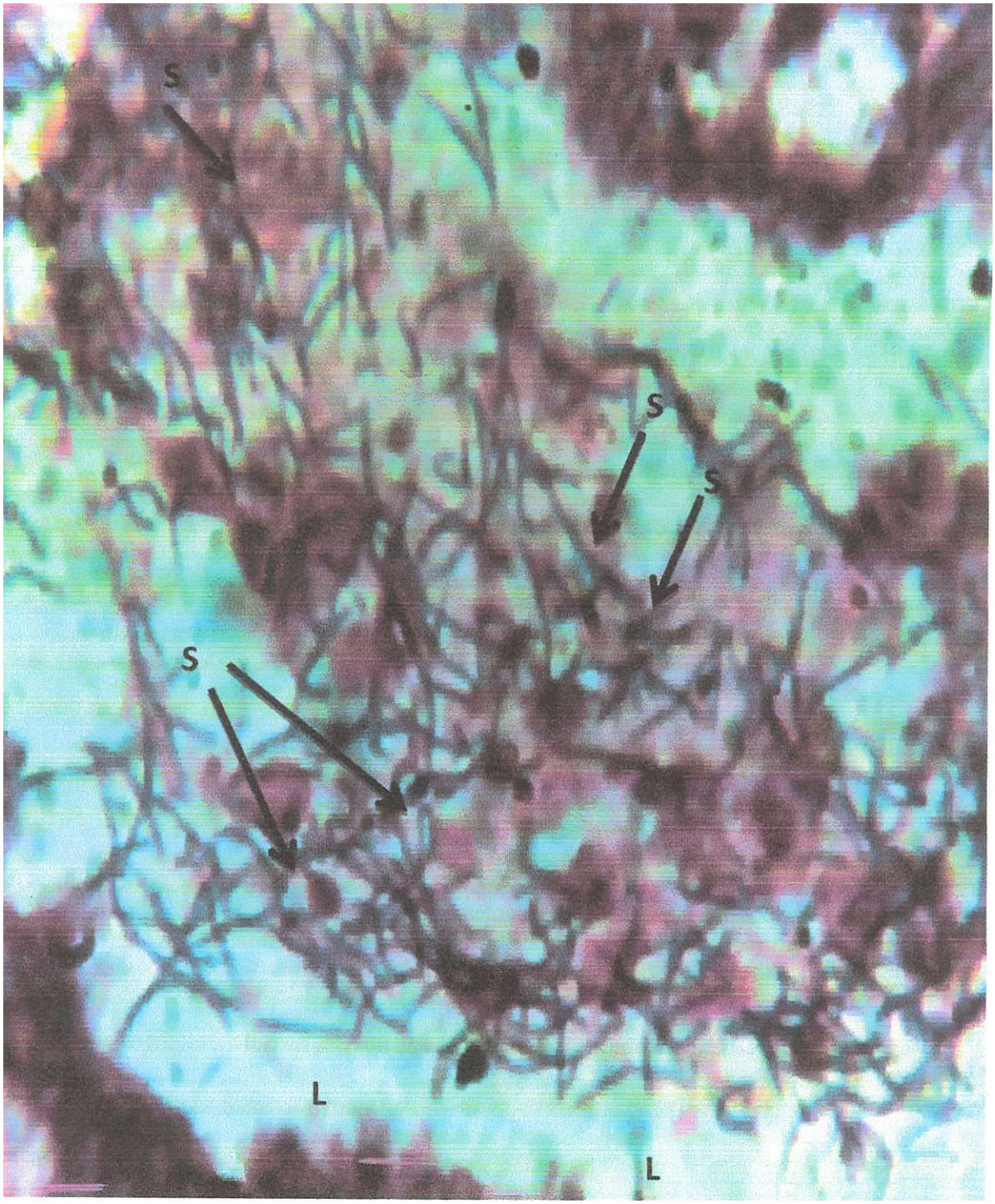

Figure 8: photomicrograph of the epididymis showing matured spermatozoa (S) in the lumen (L) which is pseudo-stratified columnar epithelium. X100 magnification

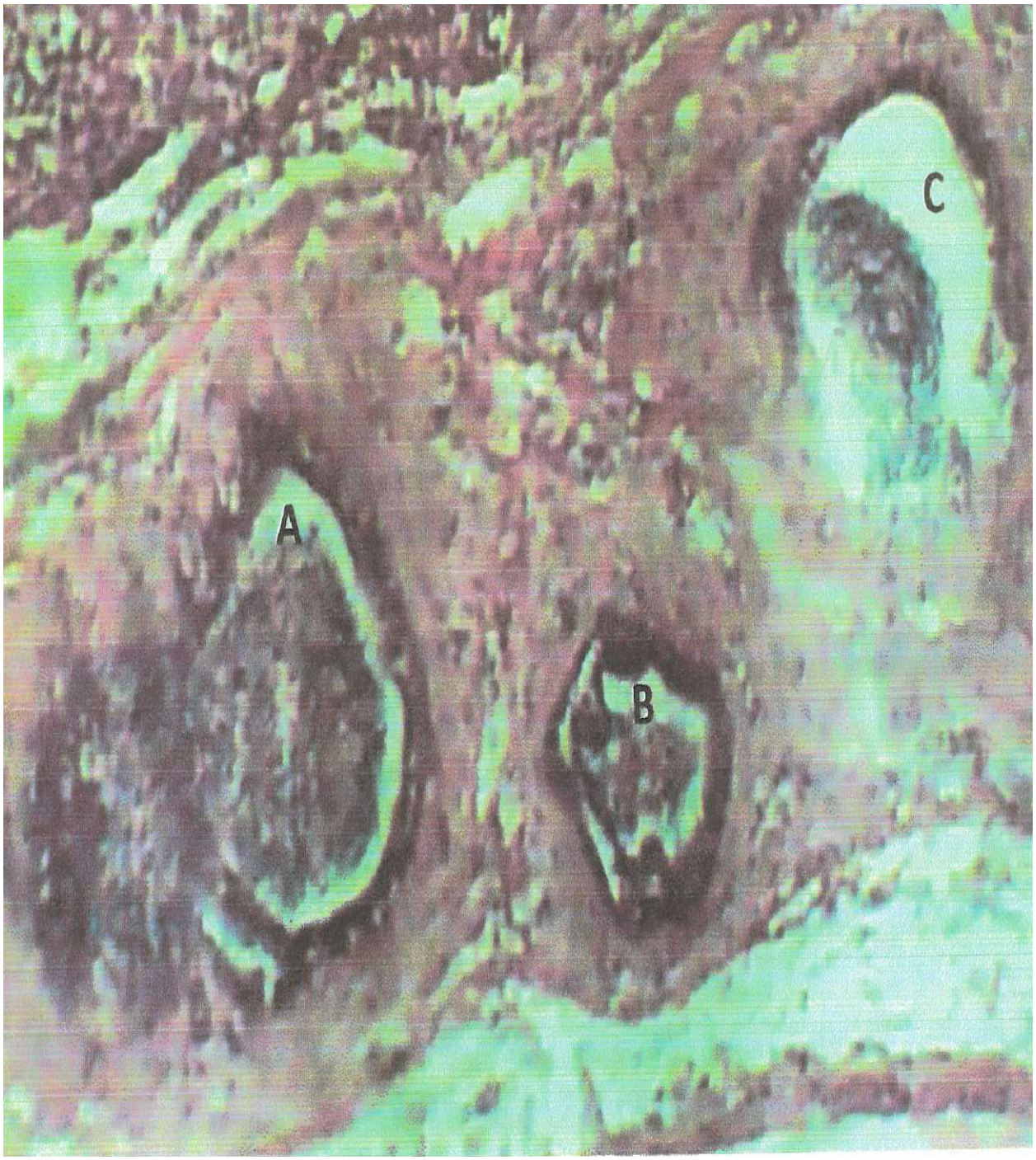

Figure 9: photomicrograph of the epididymis showing the dramatic increase of the spermatozoa in its lumen showing the tail (T), middle part (B) and the cranial part (C) and also showing a loose band of connective tissue. X40 magnification

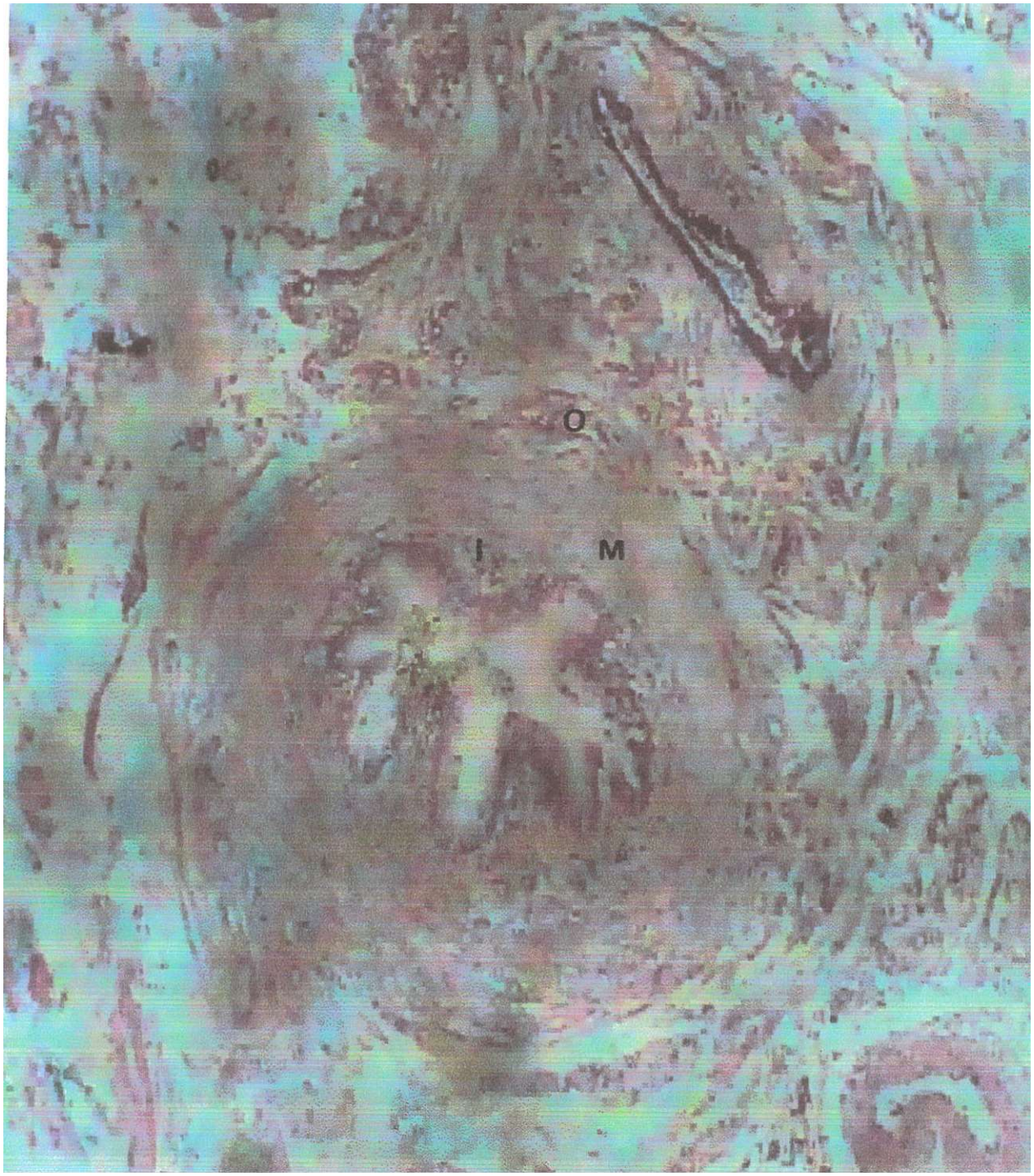

Figure 10: photomicrograph of a section of the ductus deferens showing a pseudostratified columnar epithelium and three distinct muscular layers which are the inner longitudinal smooth layer (I), middle smooth layer (M) and the outer longitudinal smooth layer (O). x40 magnification.

Discussion

This work has shown that the male reproductive tract of the NLD consist of the testis, tubuli recti, rete testis, efferent ductules, epididymis and the ductus deferens. The testis in this present study is ellipsoidal to bean in shape which is in contrast to the oval shaped reported by Razi et al., (2010) I white rooster birds. The left testis in this study is longer and thicker than the right and this collaborates the findings of Mercadante et al., (1983) but however contrast that of Artoni, (1993) who reported the right testis of the adult quail tends to be a little longer and thicker than that of the right Razi et al., (2010) in the white rooster birds. The

tunica albuginea is a solid capsule of dense irregular connective tissue consisting predominantly of collagen fibers, a few elastic fibers and myofibroblasts that meander along the branches of the testicular artery; a network of anastomosing veins constitutes the vascular layer of the tunica albuginea (Meschar, 2010). This study showed that this tunica albuginea is present in NLD and supported the earlier report of Razi et al., (2010) who showed that the tunica albuginea of the Iranian white rooster contained more collagen fibers than smooth muscle cells, which is similar to the ostrich and emu.

In light of Razi et al., (2010), who demonstrated high density of the seminiferous tubules, while, in some cases, the interstitial connective tissue between seminiferous tubules was extensive in white rooster, this research has also shown extensive and dense seminiferous tubules as well as interstitial connective tissues in NLD. They are lined by the stratified spermatogenic epithelium (germinal epithelium), surrounded by the lamina propria and connected at both ends to straight testicular tubules by a specialized terminal segment similar to the works of Mescher, (2010) and Lake, (1975).

The epididymis of the NLD is not divided into head, body and tail collaborating earlier works of Aire (1982) as opposed to that of mammals (Mescher, 2010). However, this work has shown that the concentration of spermatozoa varies from low concentration from the rete testis to high concentration towards the ductus deferens. The epithelium of the epididymis of the NLD was of the pseudostratified columnar type similar to earlier reports of Razi et al., (2010) for white rooster birds.

Furthermore, this work has shown that the caudal aspect of the epididymis continues as the ductus deferens similar to the works of Mescher, (2010) and Sissons and Grossman (1973). The epithelial linning of this ductus deferens is pseudostratified columnar type and collaborate the works of Razi et al., (2010) in white rooster birds. The morphometric data from this study was observed to be smaller than those obtained from the domestic pigeons.

Conclusion

The male reproductive organs of the NLD like other avian species consist of the testis, extratesticular rete testis, efferent ductules, connecting duct, epididymal duct and ductus deferens. The testis is ellipsoidal to bean shaped. This have not been reported in birds.

Funding:. The study has not received any external funding.

Acknowledgments: In this section you can acknowledge any support given which is not covered by the author contribution or funding sections. This may include administrative and technical support, or donations in kind (e.g., materials used for experiments).

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

References

Adang, L.k., Oniye, S.J., Ezealor, A.U., Abdu, P.A., Ajanusi, J.O., and Yoriyo, K.P. (2008). Ectoparasites of the Laughing Dove Streptopelia senegalensis (Linnaeus, 1766) (Aves: Columbidae) in Zaria, Nigeria. Lundiana 9(1): 67-71.

Aire, T.A. (1982). Surface morphology of the ducts of the epididymal region of Darke (Anas platyhynchos) as revealed by scanning and Transmission electron microscopy. J. Anat., 135 (3): 513-520.

Al-Obaidi Faris, A. and Al-Shadeedi Shahrazad, M.J. (2011). Effects of season on serum enzymes activity of Collared dove (Streptopelia decaocto) and Laughing dove (Streptopelia senegalensis). Research opinions in animal and veterinary sciences. 1(3): 130-132.

Anaso EU, Olafadehan OA, Chibuogwu IC, Alagbe JO. Seminal mophology and organ morphometrics of rabbit bucks fed Piliostigma thonningii essential oil supplemented diet. Science Letters 2024; 12(2):70-75. DOI: https://doi.org/10.47262/SL/12.2.132024280

Anaso EU, Olafadehan. OA and Chibuogwu, IC. Semen characteristics of rabbits fed Camel's foot (Piliostigma thonningii) essential oil supplemented diet. Discovery 2023; 59: e36d1037.

Artoni, S.M.B. (1993). Consideracoes sobre a morfologia e a histofisiologia do testiculo da codorna (Cotunix cournix japonica). Botucatu-sao paulo. tese (Doutorado em Anatomia) – Instituto de Biociencias, Universidade Estadual Paulista, Abstact.

Biricik and Murrat (1997). Winterbrut freilebender palmtauben streptopelia senegalensis. Journal fur Ornithology 138 (3); 335-336.

Fagbohun, O.A., Oluwayelu, D.O., Olayemi, F.O. (2000). Serological survey of infectious Bursal virus antibiodies in cattle egrets and Nigerian laughing doves. Afri. J. Biomed. Res.3: 191-192.

Lake, P.E. (1975). The male reproductive tract of fowl. J.Anat., 91:116-129.

Meschar, A.L. (2010). The male reproductive system; Basic histology text and atlas. Mc Graw Hill Medical Publishers. 12th Ed;371-375.

Olayemi, F.O., Ojo, E.O. and Fagbohun, O.A. (2006). Haematological and plasma biochemical parameters of Nigerian laughing dove (Streptopelia senegalensis) and Nigerian duck (Anasplatyr hynchos). Vet. Archiv 76, 145-151.

Oniye, S.J., Audu, P.A., Adebote, D.A., Kwaghe, B.B. Ajanusi, O.J. and Nfor, M.B. (2000). Survey of helminth parasites of the laughing dove Streptopelia senegalensis in Zaria, Nigeria. Afri.J.Nat.Sci. 4: 65-66.

Razi, M., Hassanzadeh, S.H., Najafi, G.R., Feyzi, S., Amin, M., Moshtagion, M. and Janbaz, H. (2010). Histological and anatomical study of the white Rooster of testis, epididymis, and ductus deferens. Int.J.Vet.Res. 4(4):229-236.

Sisson, S. and Grossman J.D. (1953). The anatomy of domestic animals, Volume 2., 5th Ed, W.B. Saunders Company. Philadelphia.