



## Histo-Morphometric Comparative study of the Cecum in Collard Dove (*Frivaldszky*), Ruddy Shelduck (*Pallas*) and Owl (*Otus Scors brucei*) in Iraq

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### Abstract

The morphometric and microscopic study of the cecum in the studied birds (Collard Dove, Ruddy Shelduck and Owl) consists of paired elongated organs that divided into right and left tube this two caeca originated from the lateral walls of the rectum and close to the junction with the ileum. Each tube consisting of three parts: proximal or base, middle or body and distal or apex, the two caeca were blind pouches the mean length of the right cecum is about 33.48mm in Owl, 174.89 mm in Ruddy Shelduck and 29.34 mm in Collard Dove. Whereas, in the left cecum 32.98 mm in Owl, 174.21 mm in Ruddy Shelduck and 29.11 mm in Collard Dove. And the mean weight 0.22gm in Owl, 3.91gm in Ruddy Shelduck and 0.20gm in Collard Dove. The microscopic observation the caecal wall consist of four histological layers (mucosa ,submucosa, muscularis and serosa). The mucousa layer is formed into from the three membranes (simple columnar epithelia, lamina propria and muscularis of mucosa).The mean thickness of this layer in Ruddy Shelduck was (1204 $\mu$ m) whereas, in the Owl was (1008.3  $\mu$ m) and in the Collard Dove was (812 $\mu$ m). The submucosa was a thin layer formed by dense connective tissue and blood vessels and nerves, the mean thickness of this layer in Ruddy Shelduck was (58.3 $\mu$ m) whereas, in the Owl was (62.5  $\mu$ m) and in the Collard Dove was (95.8 $\mu$ m). The muscularis externia composed of smooth muscles different in number layers of birds on this study, the mean thickness of this layer in Ruddy Shelduck was (2195.8 $\mu$ m) while in the Owl was (445.8 $\mu$ m) and in the Collard Dove was (454.1 $\mu$ m). Externally, there is a layer of squamous epithelium under which is a thin layer of loose connective tissue containing a few small elastic fibers. The mean thickness of this tunica in Ruddy Shelduck was (37.5 $\mu$ m) whereas, in the Owl was (33.3 $\mu$ m) and in the Collard Dove was (29.1 $\mu$ m).

### Introduction

There are (8948) living species of birds are assigned to (27) orders. The number of species within an order varies greatly. The largest order is the Passeriformes which

contains (5243) species. The smallest orders are the Struthioniformes which contain one species. The Anseriformes which contains five species, one of them are ducks.The Ruddy, one of the ducks species from the

Anseriformes order, this birds accommodation for water living, and its flesh are very delicious from any water fowl flesh, for this reason become as a hunters target.(King and Mclelland, 1996).

Large intestine of birds consists of a pair of caecum and a straight short intestine called rectum. Caecums in many bird groups are in the form of two right and left closed-base tubes originate of the joined to ileum and cloaca. Shape and size of caecums are very variable. Caecums are long and their colour is dark green, and are easily diagnostable in necropsy. Caecum bends backwards in posterior direction because of being long. Dilated in owl (Barnes and Thomas, 1987). Its length in parrots, swifts and Collard is short.

According to the (Clench & Mathias, 1995) the classification of large intestine which is characterized as long structures that are histologically similar to the small intestines. The mucous membrane is similar to that of the small intestine, with less goblet cell and fewer glands. There is evidence that the caeca play a role in the microbial degradation of some carbohydrates (Jorgensen *et al.*, 1996; Jamroz *et al.*, 2002), absorption of water (Mc Nab, 1973), microbial synthesis of vitamins (Coates *et al.* 1968), cholesterol digestion and absorption (Tortuero *et al.*, 1975), and degradation of nitrogenous compounds (Goldstein, 2005).

### Materials and Methods

A total of 15 birds (5 Collard Dove, 5 Ruddy Shelduck and 5 Owls) aged 1-2 years

### Results

#### Morphological study:

The large intestine started from the caeca, the cecum in the studied birds consists from

were used in this study. The birds were euthanized prior to its dissection with an intravenous injection of sodium pentobarbitone (80 mg/kg for the Owl & Collard Dove and 200 mg/kg for the Ruddy Shelduck) (Mitchell and Smith, 1991). cecum were isolated from birds at the iliocaecal junction and separated from mesenteries and iliocaecal ligaments. And gently straightened on a flat plane. Measured such as length to the collected specimens were conducted in millimeters by using the electronic Vernier scale and the weights were measured in grams by using sensitive digital balance. For histological study three caeca were cut. The specimens were immersed in 10% neutral buffered formalin and Bouin's solution for 2 days, after well fixation the specimens is dehydrated by passing them through a series of ascending ethanol each for two hours (70%, 80%, 90%, 95% and 100%) and then specimens was cleared in xylene for one hour after that embedded in paraffin wax and then the blocks were sectioned serially at 6µm thickness and stained with either one of the following stains(Bancroft and stevens, 2010): Mayer's Hematoxylin and Eosin routine stain for general features identification, Lillies Allochrome for connective tissue and Mcmanus method for glycogen and mucopoly saccharide materials Periodic acid Schiff (PAS) (Luna,L.G.1968). The measurement of length of each layers by ocular micrometer to histometrical analysis.

the paired elongated organs that divided into right and left tube this two caeca originated from the lateral walls of the rectum and close to the junction with the ileum.

Each tube consisting of three parts: proximal or base, middle or body and distal or apex, the caeca was blind pouches placed in dorsocelomic cavity most parts of cecum were covered by ascending and descending part of duodenum and pancreas.

The mean length of the right cecum is about 33.48mm in Owl, 174.89mm in Ruddy Shelduck and 29.34mm in Collard Dove. Whereas, in the left cecum 32.98mm in Owl, 174.21mm in Ruddy Shelduck and 29.11mm in Collard Dove, the right cecum longer than of the left cecum in the studies birds, the cecum in Ruddy Shelduck longer

### Light microscopy

The right and left caecal wall in the studied birds consists of four histological layers (Fig.1, 4, 7) mucosa, submucosa, muscularis and serosa.

#### 1- Mucosa:

This layer is formed from the three sublayers; the epithelium was simple tall columnar epithelia that have goblet cells (Fig. 2, 7 and 10) these epithelia lining the folds of mucosa (Fig.2). In ruddy shelduck the folds characters by large number of goblet cells and the fold appeared long leaf-shaped folds arranged in a zig-zag pattern (Fig. 9, 10), whereas, in owl and collard dove appeared short and blunt( Fig. 2, 5).

The lamina propria formed from the loosely aggregation connective tissue with the presence of mucosal glands was simple branched tubular glands that lining by simple cuboidal epithelia (Fig. 3, 6 and 9) which have simple duct open between the fold and occupy most of the lamina propria between the base of the folds and the

compared with Owl and Collard Dove this according to types of food habits the shelduck is omnivorous whereas, owl is carnivorous and collard dove granivorous. And the mean weight 0.22gm in Owl, 3.91gm in Ruddy Shelduck and 0.20gm in Collard Dove. The cecum of the Ruddy Shelduck and Collard Dove that same in shape that characters by longitudinal tube organ and pointed end whereas, the cecum of owl different in the shape that characterized by longitudinal the distal and middle parts were the proximal part characterized by swollen and pointed end.

muscularis mucosa. The propria containing blood vessels, nerve and lymphocytes, the lamina propria extend inside the circular mucosa folds.

The last layer of the mucosa was formed from smooth muscle fibers called the muscularis mucosa; this separated the mucosa from the submucosa layer.

Muscularis mucosa appeared as circularly arranged smooth muscle bundles interrupted by the presence of mucosal glands in the lamina propria in owl (Fig. 5), whereas, in collard dove appeared thinner layer of circularly arranged smooth muscle fibers separating the mucosa from the underlying submucosa (Fig.3).

Characteristically thick layer of smooth muscle bundles arranged as inner circular and outer longitudinal in ruddy Shelduck (Fig.9). The mean thickness of this tunica in Ruddy Shelduck was 1204 $\mu$ m, whereas, in the Owl was 1008.3  $\mu$ m and in the Collard Dove was 812 $\mu$ m.

## 2- Submucosa:

The submucosa of the cecum in the three birds composed of abundant dense connective tissue containing blood vessels and nerves (Fig. 2, 3, 5 and 9). The mean thickness of this tunica in Ruddy Shelduck was 58.3 $\mu$ m, whereas, in the Owl was 62.5  $\mu$ m and in the Collard Dove was 95.8 $\mu$ m.

## 3- Muscularis Externia:

The muscularis externia composed of a thin, outer longitudinal layer and a thick inner circular layer between this was a narrow connective tissue layer this in Owl and Collard Dove (Fig.2,3 and 5), whereas, in the Ruddy Shelduck this tunica was collected of smooth muscle fibers oriented in three main directions,(Fig.8) the external

layer is longitudinal, the middle layer is circular, and the internal layer was oblique. The mean thickness of this tunica in Ruddy Shelduck was 2195.8 $\mu$ m, whereas, in the Owl was 445.8 $\mu$ m and in the Collard Dove was 454.1 $\mu$ m.

## 4- Serosa

Externally, there is a coated with layer of simple squamous epithelium under which was a thin layer of loose connective tissue containing a few small elastic fibers (Fig. 2, 5 and 8). Blood vessels and nerves. The mean thickness of this tunica in Ruddy Shelduck was 37.5 $\mu$ m, whereas, in the Owl was 33.3 $\mu$ m and in the Collard Dove was 29.1 $\mu$ m.

**Table 1. Gross measurements (Mean  $\pm$  SE) of the cecum in three studied birds.**

Organ	Collard Dove Mean $\pm$ SE	Ruddy Shelduck Mean $\pm$ SE	Owl Mean $\pm$ SE
Right cecum	29.34 $\pm$ 3.013	174.89 $\pm$ 8.104	33.48 $\pm$ 3.762
Left cecum	29.11 $\pm$ 3.401	174.21 $\pm$ 8.269	32.98 $\pm$ 3.114

Different small letters mean significant differences ( $P \leq 0.05$ ) between different birds

**Table 2. Microscopic thicknesses (Mean  $\pm$  SE) of the four layers of the cecum walls measured in the Ruddy Shelduck, Collard Dove and Owl.**

Layers	Collard Dove Mean $\pm$ SE	Ruddy Shelduck Mean $\pm$ SE	Owl Mean $\pm$ SE
Mucosa	812 $\pm$ 15.041	1204 $\pm$ 13.87	1008.3 $\pm$ 76.11
Submucosa	95.8 $\pm$ 8.012	58.3 $\pm$ 4.712	62.4 $\pm$ 4.875
Muscularis Externia	454.1 $\pm$ 12.34	2195.8 $\pm$ 18.390	445.8 $\pm$ 11.043
Serosa	29.1 $\pm$ 3.12	37.5 $\pm$ 3.001	33.3 $\pm$ 3.011

Different small letters mean significant differences ( $P \leq 0.01$ ) between different birds

## Discussion

The cecum was paired that divided to right and left caeca this originated from the lateral walls of the rectum and close to the junction with the ileum this finding concur with Majeed *et al.*, (2009) in the caecum in

broiler chicken and Dyce, K.M. (2010). The mean weight 0.22gm in Owl, 3.91gm in Ruddy Shelduck and 0.20gm in Collard Dove this fallout different to the finding Hirosh *et al.*, (1998), Majeed *et al.*, (2009) in the caecum in broiler chicken and Al-

Zaydy (2011) in the Ceca of Chicken and four histological tunica (mucosa, submucosa, muscularis and serosa) this akin with Majeed *et al.*, (2009) in the caecum of broiler chicken. The epithelium lining the folds and crypts of the caeca consist of a single layer of tall columnar cells this study was supported with the consequence of Kitagawa *et al.*, (1996) on the apical cecal of the chicken. The lamina propria consists of the loosely aggregation connective tissue containing blood vessels, nerve and muscle fibers this finding coincides with the result of Strong *et al.*, (2005) in Gambels quail cecal microanatomy. The muscularis mucosa consists from fibers of smooth muscles this is in agreement with the Ferre *et al.*, (1991) on chicken ceca, this layer are

Goose. The caecal wall consists from the very thick in Ruddy Shelduck this similar to Al-Zaydy (2011) on goose ceca. The submucosa is a thin layer of C.T. the fallout of this work is in accordance with Samuelson (2007) on avian ceca. The muscularis externa composed of a thin, outer longitudinal layer and a thick inner circular layer between the two is a narrow connective tissue layer this finding in Owl and Collard Dove parallel to Tully *et al.*, (2003). The external layer named the serosa that composed from simple squamous epithelia and blood vessels this agree with Samuelson (2007) on avian ceca and Goldstein, D.L. (2005) in the caecum in broiler chicken.

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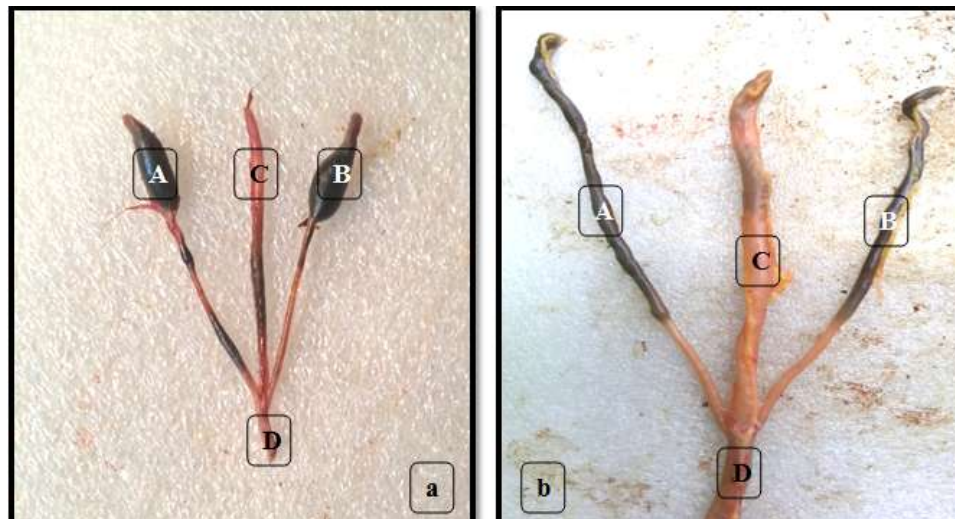
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**Fig. (1): Photograph illustrate segmentation ceca showed right ceca (A), left ceca (B), ileum (C), and Rectum (D), Owl (a) and Ruddy Shelduck (b).**

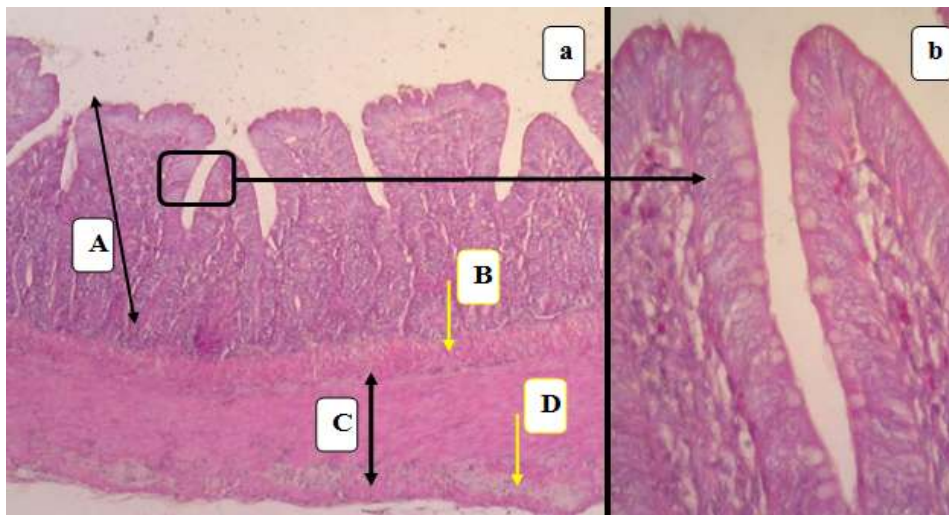


Fig. (2): Cross section of the cecum wall of Collard Dove showed T. mucosa (A), T. Submucosa (B), T. Muscularis (C), and T. serosa (D), H & E, X100 (a) and X400 (b).

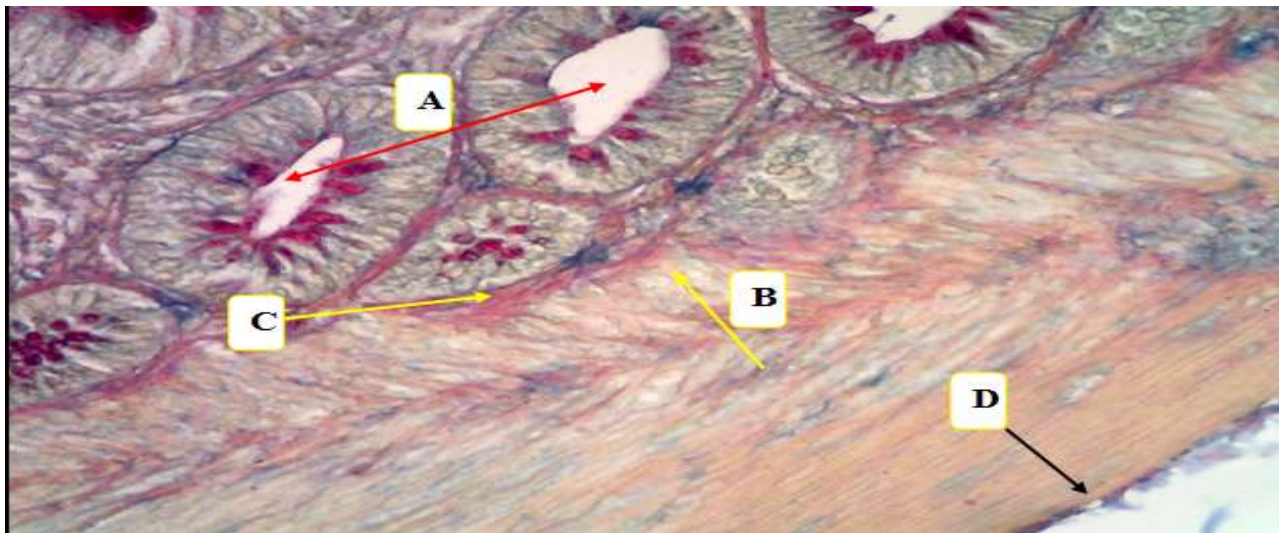


Fig. (3): Cross section of the cecum wall of Collard Dove showed Crypts of Lieberkuhn (A), T. Submucosa (B), Muscularis mucosa (C), and T. serosa (D), Lillies Allochrome, X400

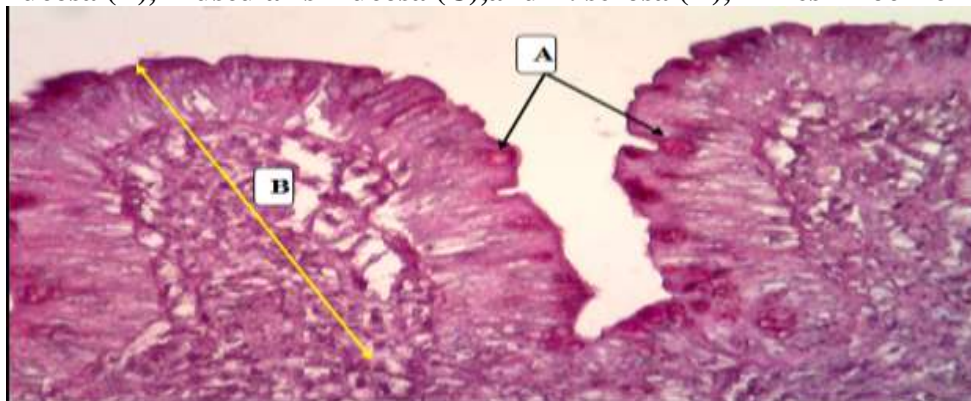


Fig. (4): Cross section of the cecum wall of Collard Dove showed goblet cells (A), Villi (B) PAS X400

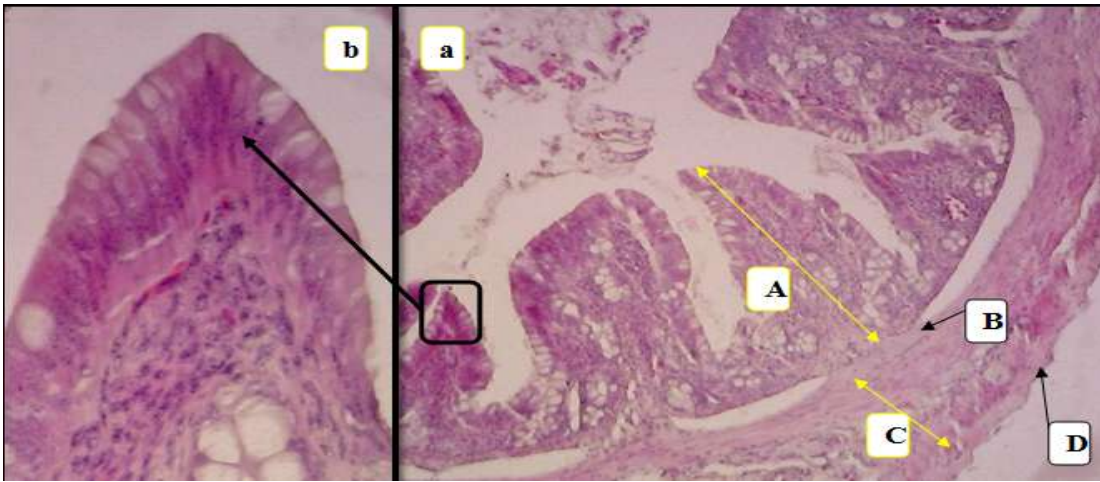


Fig. (5): Cross section of the cecum wall of Owl showed T. mucosa (A), T. Submucosa (B), T. Muscularis (C), and T. serosa (D), H & E, X100 (a) and X 400 (b)

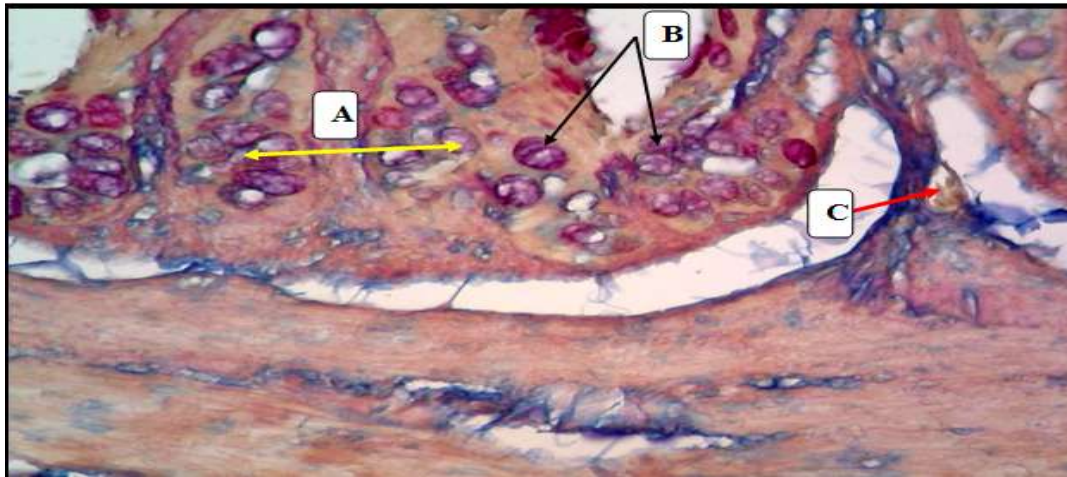


Fig. (6): Cross section of the cecum wall of Owl showed Crypts of Lieberkuhn (A), Goblet cells (B), Artery (C), Lillies Allochrome, X400

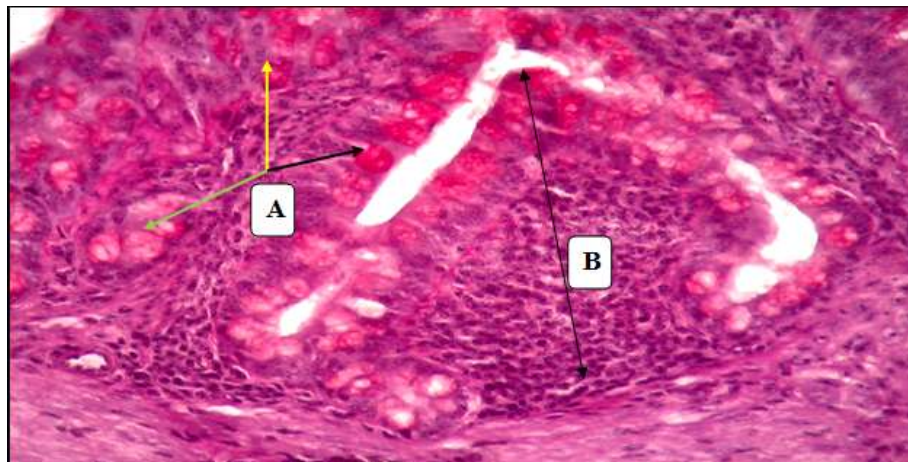


Fig. (7): Cross section of the cecum wall of Owl showed goblet cells (A), Villi (B) PAS X400



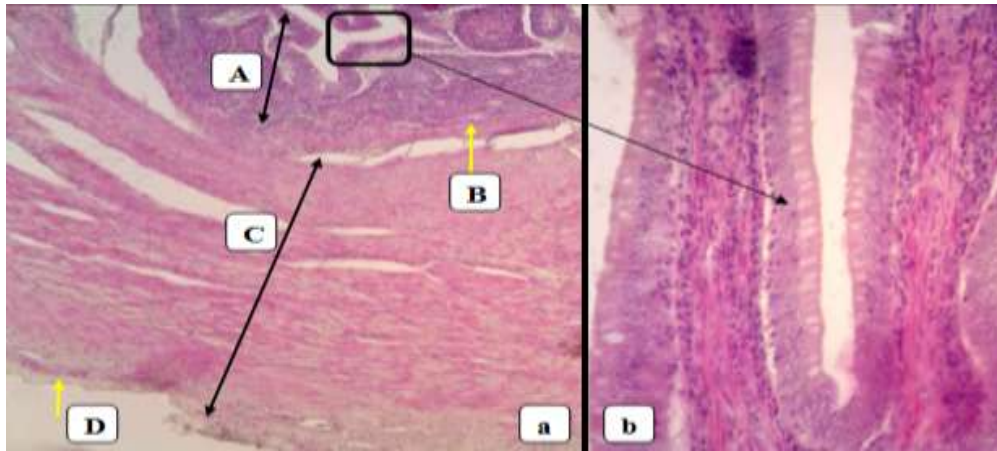


Fig. (8): Cross section of the cecum wall of Ruddy Shelduck showed T. mucosa (A), T. Submucosa (B), T. Muscularis (C), and T. serosa (D), H & E, X100 (a) and X400 (b).

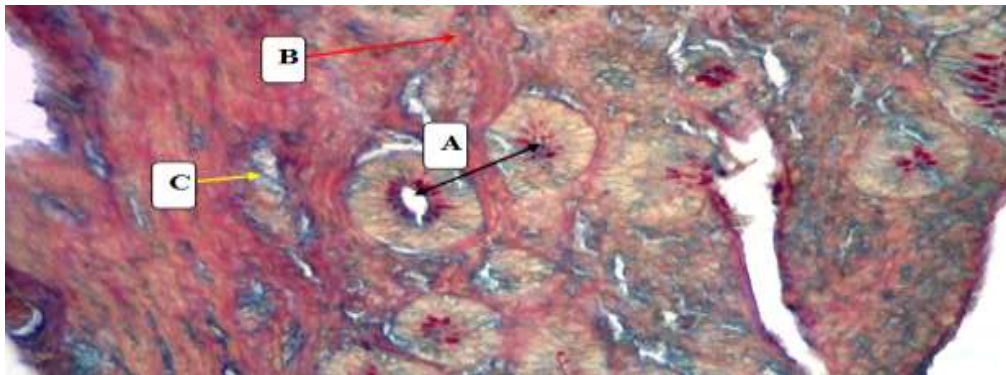


Fig. (9): Cross section of the cecum wall of Ruddy Shelduck showed Crypts of Lieberkuhn (A), muscularis mucosa (B), connective tissue (blue) (C), Lillies Allochrome, X400

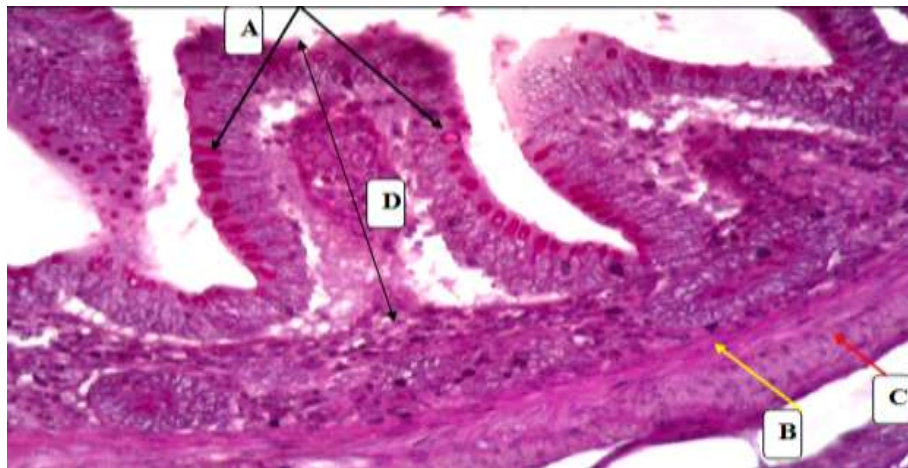


Fig. (10): Cross section of the cecum wall of Ruddy Shelduck showed goblet cells (A), Muscularis mucosa (B), submucosa (C), and Villi (D) PAS, X400

## دراسة نسيجية وشكلانية قياسية مقارنة للاعور لطير البوم والبط الصيني والفاخته في العراق

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## الخلاصة

اظهرت الدراسة المجهرية والشكلية للاعور في طيور الدراسة (البط الصيني، الفاختة والبوم) بأن الاعور يتكون من زوج من الاعضاء المتطاوله والذي ينقسم الى اليمين واليسر والذي ينشأ من الجهتين الجانبية للمستقيم والذي يتصل اماميا مع اللفائفي. يتكون كل عضو من ثلاثة اجزاء (الجزء العلوي، الجزء الوسطي والجزء السفلي) بلغ معدل اطوال الاعور اليمين في طير البوم 33.4 ملم ، 174.89 ملم في البط الصيني و 29.34 ملم في الفاختة بينما كان معدل اطوال الاعور اليسر في البوم 32.98 ملم ، 174.21 ملم في البط الصيني و 29.11 ملم في الفاختة. وكذلك بلغ معدل اوزان الاعور في البوم 0.22 غم، 3.91 غم في البط و 0.20 في الفاختة.

اظهرت الدراسة المجهرية ان جدار الاعور يتكون من اربعة طبقات مختلفة (المخاطية، تحت المخاطية، العضلية و المصلية) تتكون الطبقة المخاطية من ثلاثة طبقات ثانوية بلغ معدل سمك هذه الطبقة مايكرون 1204 في البط، 1008.3 في البوم و 812 مايكرون في الفاختة. تتكون الطبقة تحت المخاطية من النسيج الضام والتي يتخللها الاوعية الدمويه والاعصاب بلغ سمك هذه الطبقة مايكرون 58.3 في البط، مايكرون 62.5 في البوم و 95.8 مايكرون في الفاختة. تتكون الطبقة العضلية من العضلات الملساء والتي تختلف من حيث عدد الطبقات في طيور الدراسة بلغ سمك هذه الطبقة مايكرون 2195.8 في البط، 445.8 مايكرون في البوم و 454.1 مايكرون في الفاختة اما الطبقة الخارجية وهي المصلية والتي تتكون من الضهارة البسيطة مع النسيج الضام والتي بلغ سمكها مايكرون 37.5 في البط، مايكرون 33.3 في البوم و 29.1 مايكرون في الفاختة.