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Original Research Article

Morphological characteristics of the oviduct in Egyptian Balady Duck (*Anas boschas domesticus*) during laying cycle.

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ABSTRACT

The objective of the current study was to present baseline data on the morphology and surface architecture of the oviduct in adult female Balady duck grossly and by using scanning electron microscope (SEM). Fifteen apparently healthy adult female Balady ducks were used which weighted (2-4 kg). Two birds were formalized while the other birds were used in the fresh state for dissection then careful evisceration of the oviduct. For SEM five of the latter were used immediately after immersion in saline. Our data anatomically revealed that infundibulum had funnel and tubular parts, magnum was highly convoluted pale white or creamy color, less convoluted isthmus, dilated uterus and S-shape spiral vagina. The inner wall of the duct contains longitudinal folds in the first four parts while the vagina showed transverse thick folds. color of the mucosa was reddish in infundibulum, magnum and isthmus while greenish brown in color in the uterus and whitish yellow in the vagina. SEM showed primary and secondary folds allover the oviduct which became more thicker in the uterus and carrying tertiary folds in the vagina.

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1. Introduction

The domestic ducks were considered one of the main sources of food and income for people in many parts of the world including Egypt. Native breeds of duck as Domiati duck and Balady (Sudan) ducks belong to the family Anatidae, genus *Anas* (EL Gendy et al., 2016).

The left oviduct is a highly convoluted and muscular organ that constituted the whole female genital tract; It was showed a series of changes during the formation of an egg. The oviduct presents special interest to the commercial egg industry, because any deviation in the oviduct function can directly affect the egg shell quality. The oviduct was either divided into five regions; infundibulum, magnum, isthmus, uterus, and vagina in duck (Chousalkar and Roberts 2008, Mohammadpour et al., 2012, Sari et al., 2014 and Mahmud, et al., 2017) or six regions in hen, where red isthmus or tubular shell gland was added (Solomon, 1991 and Fernandez et al., 2003).

Although there were a lot of research about oviduct in birds, a lack of detailed morphological data relating to the oviduct of Balady duck. The aim of this work was adding a further structural information using the gross anatomy and scanning electron microscope to be used in the anatomical research studies on ducks help the pathologists during necropsy.

2. Materials and methods

The current study was applied on fifteen apparent healthy (n=15) adult female Balady ducks at different stages of lying, weighting (2-4) kg. These birds were purchased from different areas in Beni-Suef governorate, Egypt, then the birds were anesthetized according to EL

Gendy et al., (2016), then slaughtered using the Halal method.

2.1. For anatomy

Two (n=2) female genital tracts were fixed using 10% formalin, another eight (n=8) were examined for topography and morphology in fresh state. The fresh and formalized samples were photographed using Nikon Digital Cam D5100, Thailand, the nomenclature was adopted according to **Nomina Anatomica Avium, (1993).**

2.2. For scanning electron microscope

Five birds (n=5) were used for scanning electron microscope whereas the different parts of oviduct were collected and immersed in normal saline then transported to be processed for examination within 30 minutes after slaughtering.

3. Results

The left oviduct together with the left ovary form the whole female reproductive system in the female Balady duck (fig.1). The oviduct was located on the caudal and dorsal aspect of the abdomen and its size was variable depending on the reproductive activity of the bird. It was much voluminous during laying period, whereas its whole length was recorded to be 33-59cm. The oviduct was related; rostrally, to the ovary, caudally to the cloaca, dorsally to the left kidney, ventrally to the gizzard and the small intestine and it related to the colon from the right side. Fixation of the oviduct was done by two peritoneal folds called dorsal and ventral oviductal ligaments.

Grossly the oviduct could be distinguished into five regions; infundibulum, magnum, isthmus, uterus, and vagina.

Infundibulum

It was the beginning of the oviduct, measured about 4- 8 cm in length and it could be divided obviously into two parts; funnel and tubular (fig.1,F). The former was semitransparent,

located just behind the ovary and received the ovum through an oblique slit-like opening that measured 3-7 cm. The tubular part of infundibulum was increased in thickness caudally, became narrower in lumen, its length was measured about 2.5-3 cm and located at the level of the junction of the two caeci with the intestine.

The mucosa of the inner wall of the infundibulum was reddish in color containing about twelve longitudinal fine folds with wide spaces in between rostrally, these spaces became narrower caudally.

By scanning electron microscope (SEM) the aforementioned folds were appeared thin longitudinal and each carried secondary folds (fig.2). The primary folds continued with that of the magnum without a clear line of demarcation. The cells of the caudal part of infundibulum were few obvious ciliated among non ciliated cells scattered all over the secondary folds.

Magnum

It was the longest thicker pale white or creamy second part of the oviduct which appears more convoluted (fig.1,D). It is attached by dorsal and ventral oviductal ligament. Its average length is 15-25cm.

Its reddish mucosa shows thicker twelve fold originated from its junction with infundibulum having narrow spaces in between and passes caudally to be terminated at the isthmus. A small area free of folds between the magnum and the isthmus was observed.

SEM was revealed that the twelve primary folds were appeared thick and longitudinal carrying secondary folds, no tertiary folds were observed (fig.2). The primary folds were stopped at the junction between magnum and the isthmus. The cells were ciliated, numerous in numbers, and the cilia here appeared thick and short.

Isthmus

It was the third less convoluted part that measured about 7-12 cm in length. It extended from the magnum by numerous series of very small longitudinal folds terminated at the beginning of the uterus. These folds together with the mucosa of the isthmus were reddish in color.

SEM was showed numerous, parallel longitudinal folds that carrying secondary ones while, tertiary folds could not be observed (fig.3). These ridges were stopped at the junction between the isthmus and the uterus. The cells distributed all over the secondary ridges were ciliated and non ciliated.

Uterus or shell gland

It was the most dilated part of the oviduct located between the isthmus and vagina (figs.1,3 &4).. It was measured about 4-9 cm length and its width was increased caudally to reach its maximum (2-3 cm) at its middle. The uterus was related dorsolaterally to the synsacrum, ureters, and caudal part of the left kidney while from the right, it was related to the terminal part of the colon. The interior of the uterus showed a different coloration in the lining mucosa where it was appeared granular with greenish coloration, this may be attributed to the glands of the uterus. Moreover, there were many longitudinal folds that crossed by clear transverse corrugating grooves, while the terminal part became devoid of both folds and grooves to be continued with the vagina.

The uterus by SEM was declared that, there were many primary thick corrugated folds appeared longitudinally. It begins from the isthmus and increased in thickness toward its center, then decrease again to be terminated at the junction between the uterus and vagina (fig.3). Thick short cilia appeared on the cells which were lined the uterus.

Vagina

It was the terminal part of the oviduct, which was more convoluted and spiral forming S-shape with length measured about 3-5cm was lined by whitish yellow mucosa with about ten transverse very thick spiral intermingled folds. Just 1cm before the termination of the vagina these transverse folds of the vagina were disappeared.

(fig.1&4). It was related to the caudal part of the uterus cranially, the cloaca caudally, the terminal part of the left kidney and the ureter dorsally. The inner surface of the vagina SEM of the vagina was asserted that, there were many primary folds appeared longitudinally that carried secondary and tertiary longitudinal folds that lined with heavy ciliated cell (fig.4).

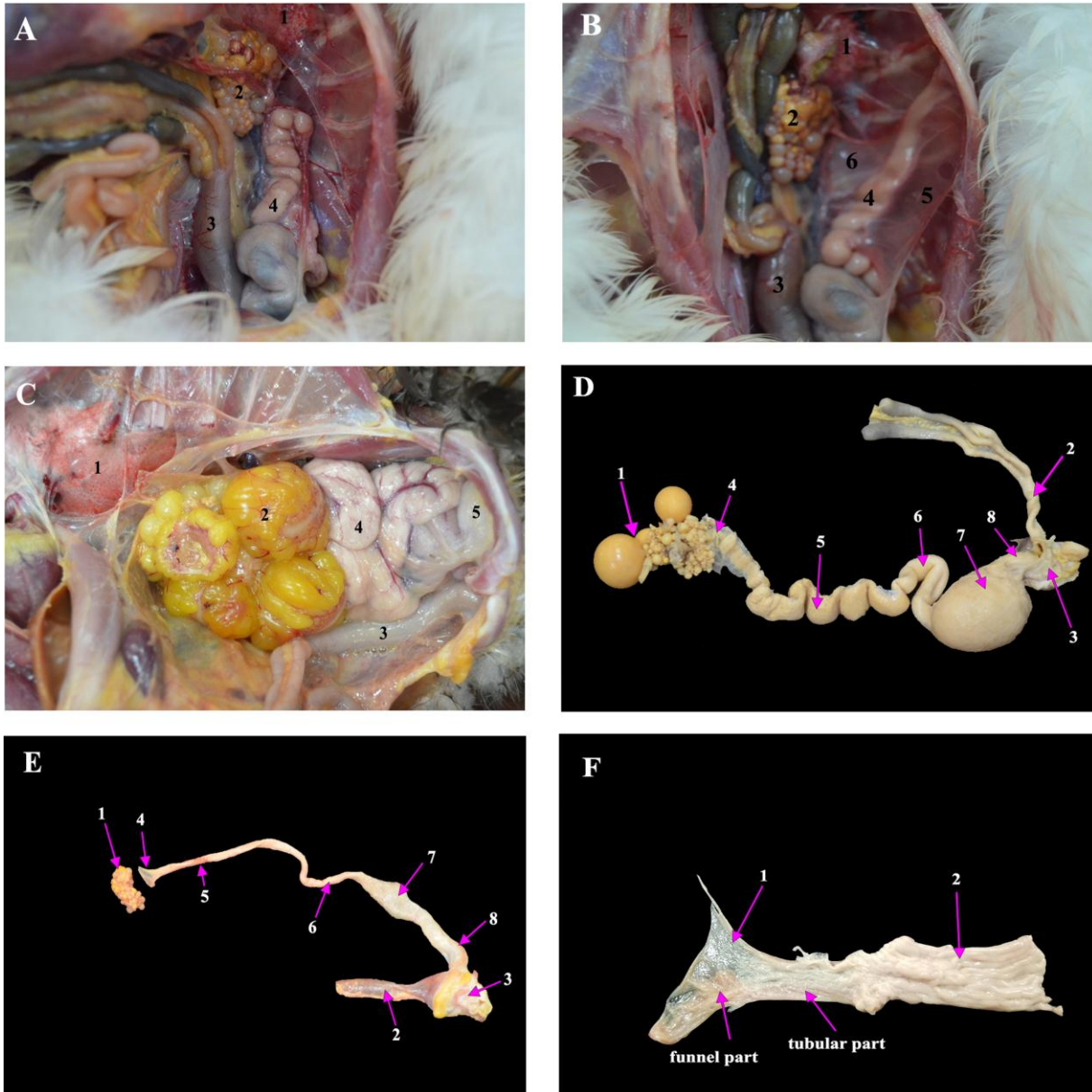


Fig. 1: (A) and (B) photograph showing the topography of oviduct in non laying duck (ventral view), A the size of the duct is reduced; 1. Left lung; 2. Ovary; 3. Colon; 4. Oviduct 5. Dorsal oviductal ligament.6. Ventral oviductal ligament (C) a photograph showing the topography of oviduct in laying duck, the size of the duct is voluminous; 1. Left lung; 2. Ovary; 3. Colon; 4. Oviduct; 5. Cloaca. (D) a photograph showing the parts of oviduct in laying duck (the oviduct was removed outside the abdomen and fixed in formalin) ; 1. Ovary; 2. Colon; 3. Cloaca. 4. Infundibulum; 5. Magnum; 6. Isthmus; 7. Uterus (containing egg) ; 8. Vagina. (E) a photograph showing the parts of oviduct in a non laying duck (the oviduct was removed outside the abdomen); 1. Ovary; 2. Colon; 3. Cloaca. 4. Infundibulum; 5. Magnum; 6. Isthmus; 7. Uterus; 8. Vagina. (F) a photograph showing the inner parts of infundibulum and magnum ; 1. Infundibulum (funnel and tubular parts); 2. Magnum

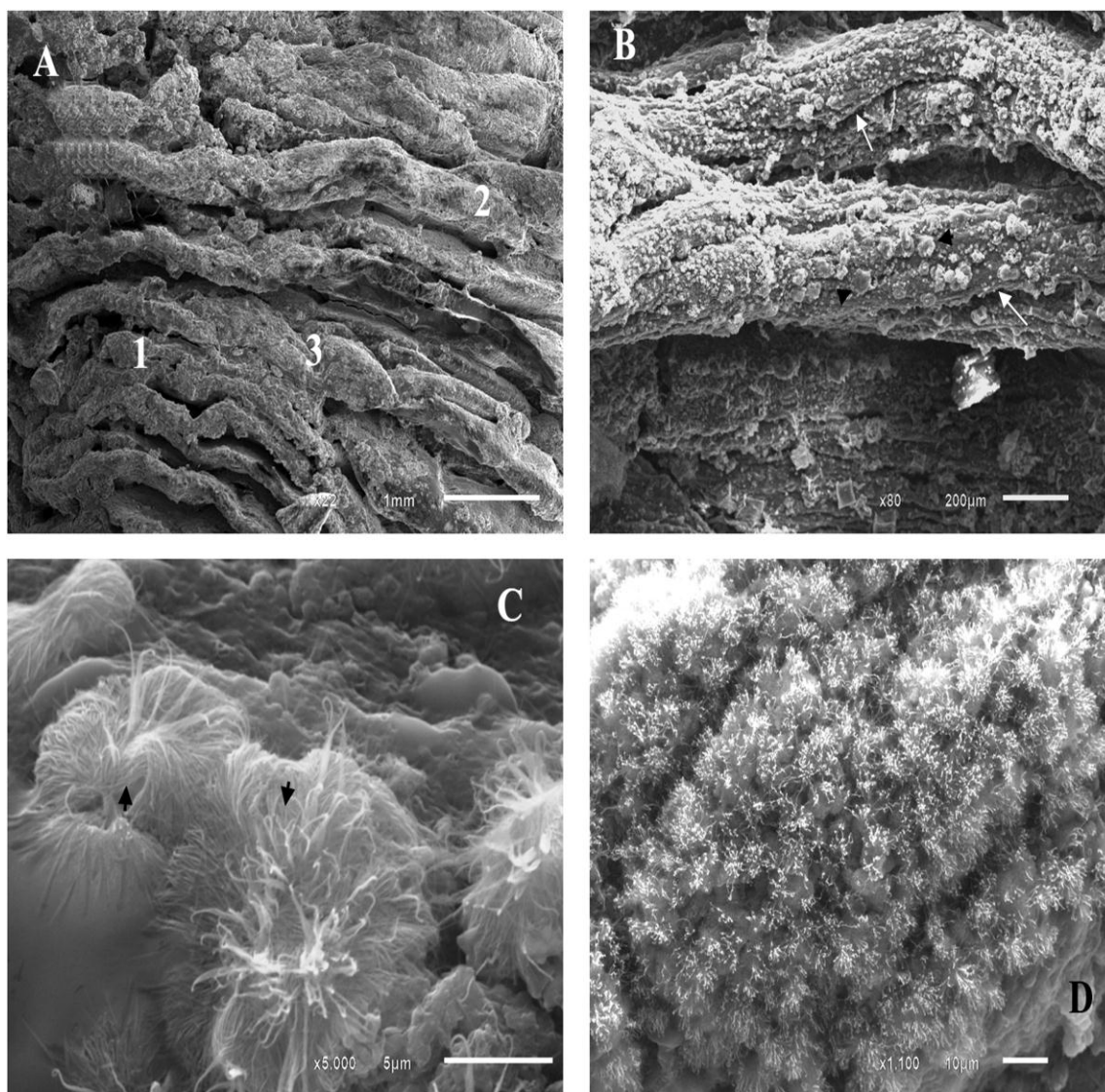


Fig. 2: (A) SEM image of infundibulum and magnum showing the longitudinal folds and junction between them 1. Infundibulum, contains thin longitudinal folds a; 2. Magnum, contains thick folds; 3. The junction between infundibulum and magnum is not clear. (B) Infundibulum showing the secondary folds in the primary longitudinal folds (arrows) also ciliated cells appeared scattered among nonciliated cells all over the secondary folds (arrow heads). (C) Infundibulum showing the ciliated cells (arrows) appeared scattered among nonciliated cells all over the secondary folds. The cilia were long and thin. (D) magnum showing the secondary folds in the primary longitudinal folds also ciliated cells appeared scattered all over the secondary folds.

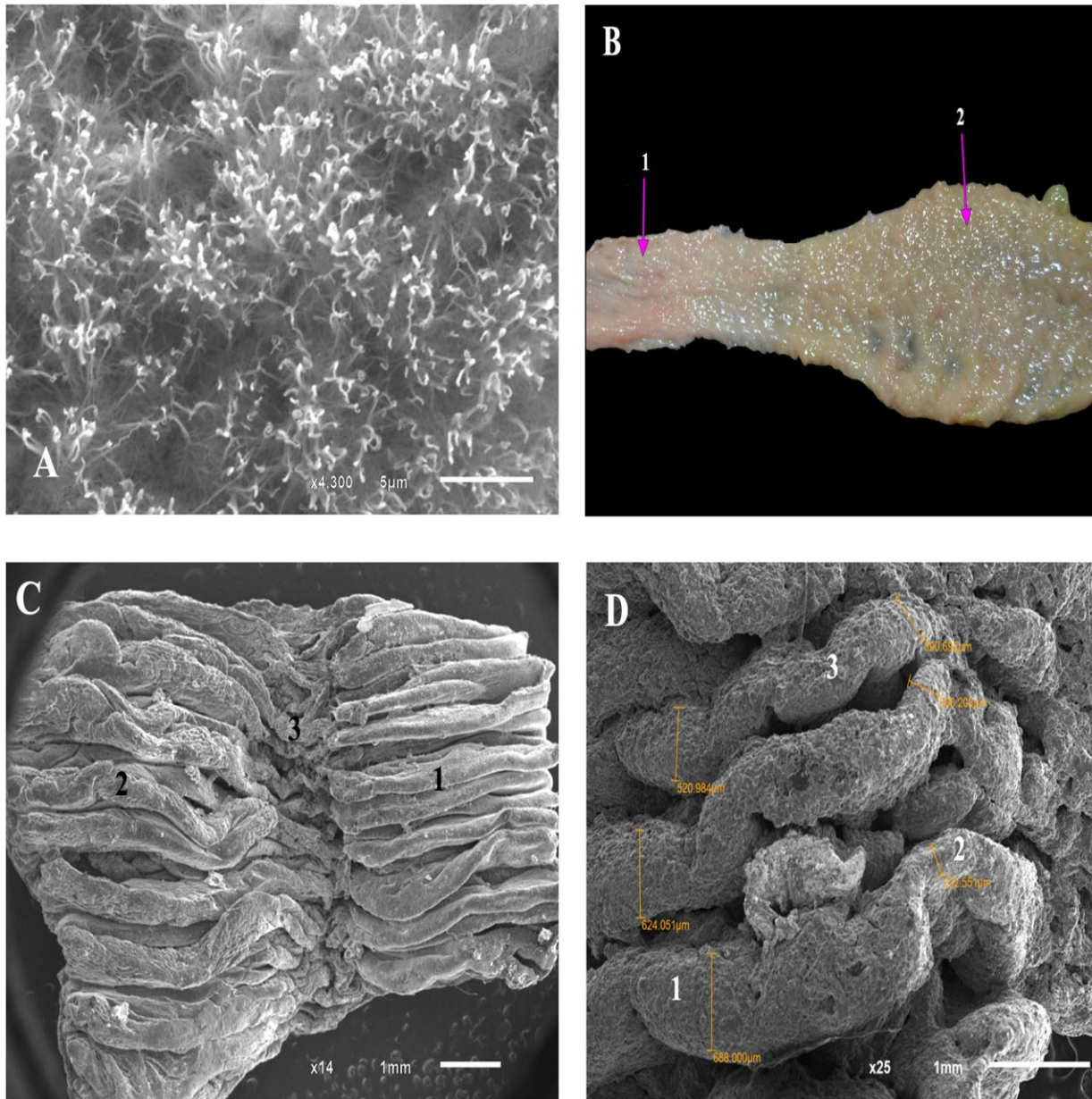


Fig. 3: (A) SEM image of magnum showing the ciliated cells appeared scattered all over the secondary folds. The cilia were short and thick. (B). a photograph showing the inner parts of isthmus and uterus ; 1. Isthmus (with its reddish color); 2. Uterus (with brownish granular mucosa).(C) SEM image of isthmus and uterus showing the longitudinal folds and junction between them 1. Isthmus, contain thin longitudinal parallel folds; 2. uterus, contain thick corrugated folds; 3. The junction between isthmus and uterus (D) SEM image of uterus and vagina showing the longitudinal folds and junction between them 1. uterus, contain thick corrugated folds; 2. Vagina 3. The junction between uterus and vagina

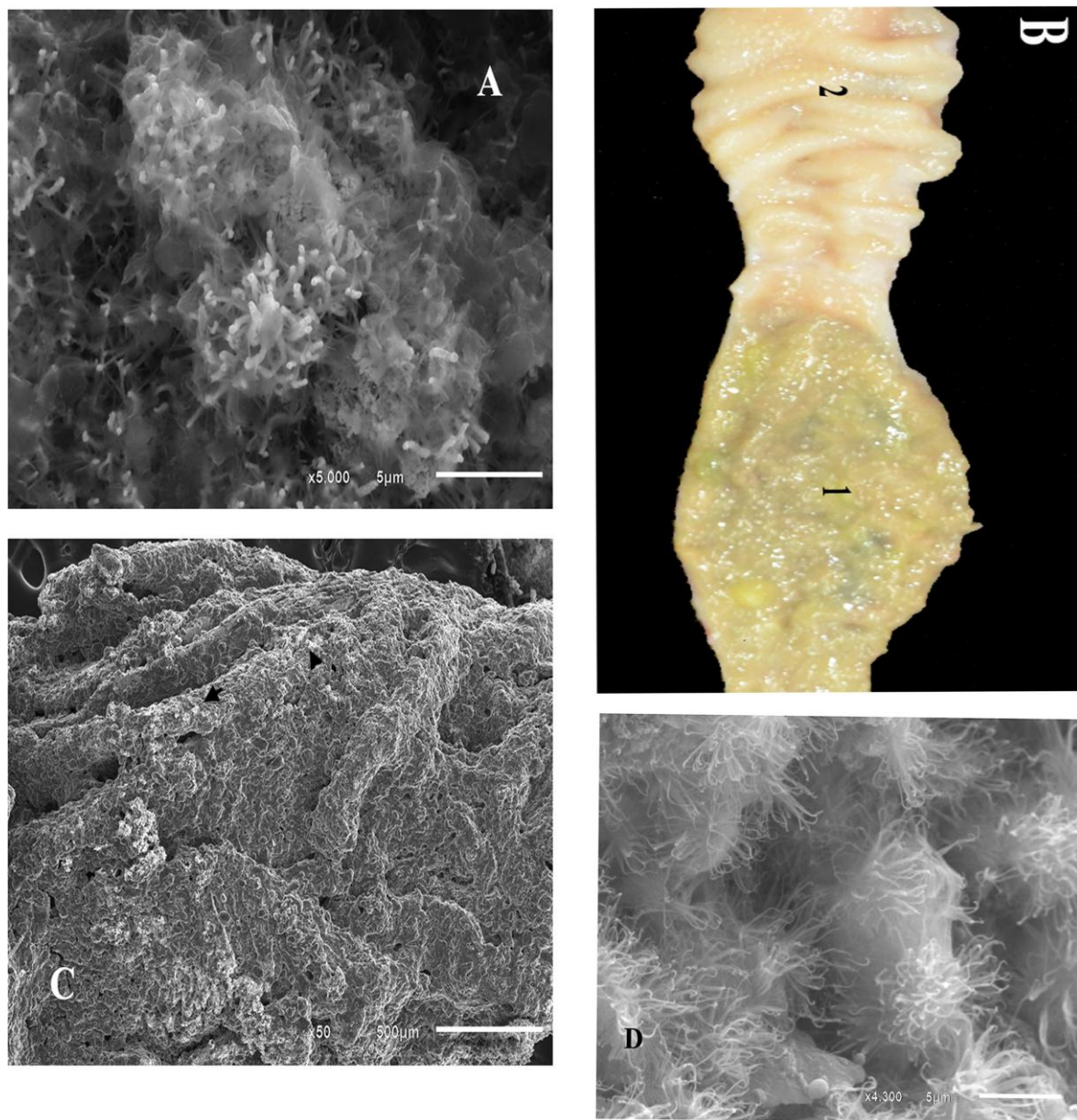


Fig. 4: (A) : SEM image of uterus showing the ciliated cells of uterus were short and thick (B). a photograph showing the inner parts of uterus and vagina; 1. Uterus (with brownish granular mucosa); 2. Vagina (showing thick macroscopic intermingled spiral folds and reddish white mucosa). (C) SEM image of vagina showing the secondary folds and tertiary folds, the primary longitudinal folds also ciliated cells (arrow heads) appeared scattered all over the secondary folds. (D) SEM image of vagina showing the ciliated cells appeared scattered all over the secondary folds. The cilia were long and thin.

4- discussion

Like other avian species the left oviduct only was present, located in the dorsal part of the abdomen and formed of five clear parts; infundibulum, magnum, isthmus, uterus and vagina, this come in accordance with Baumel et al., (1993) and Blendea et al., (2012) in domestic fowl, Chousalkar and Roberts (2008), Mohammadpour et al.,(2012), Sari et al., (2014) and EL Gendy et al., (2016) in duck and Saber et al., (2010) in ostrich. However six regions in hen were observed (Solomon, 1991 and Fernandez et al., 2003) where red isthmus or tubular shell gland was added

Concerning the whole length of the oviduct in the bird under investigation was recorded to be 33-59cm nearly similar to the result of Mohammadpour et al., (2012) in the same species. On the other hand EL Gendy et al., (2016) in Balady duck and Sari et al., (2014), in pegagan duck were recorded 45-50 cm length of the oviduct, in fowl it reached 60-70cm (Blendea et al., 2012) While Parizzi et al., (2008) in rheas detected 122cm length of left oviduct during egg laying season.

For inexperienced person in anatomy who needed to take samples for pathology, the present study, offered a good description to know the different part of the oviduct without being mistaken, as the infundibulum showing funnel and tubular part, while the magnum could be detected by its pale white or creamy color and its convolution, the reddish mucosa and narrow lumen of isthmus, the dilated part with different coloration of uterus and thick intermingled color of its mucosa in our results could not be observed in any of the available literatures.

The longitudinal primary folds of the uterus were numerous, thick and corrugated and crossed by transverse grooves which asserted

spiral folds with pale yellow color mucosa of the vagina.

The infundibulum in the current investigation consisted of funnel and tubular parts that come in line with the findings of EL Gendy et al., (2016) in Balady duck, Özen et al. (2009) in Pekin duck and Patki et al., (2013) in Kuttanad duck; Blendea et al., (2012) in domestic fowl and Sharaf et al., (2012) in ostrich. On contrary Moraes et al., (2010) in duck; Bakst (1998) in poultry; Mohammadpour and Keshtmandi (2008) in pigeon; Mirhish and Nsaif (2013) and El sayed (2016) in turkey observed that, infundibulum divided into three regions; the fimbriated region, funnel region and tubular region.

The presence of the longitudinal primary and secondary folds were characterizing the different part of the oviduct, which sometimes showed tertiary folds as in vagina, in this work could be observed in isthmus and vaginal mucosa in the findings of El-Habbak (1990) in Pekin ducks; and Saber et al., (2010) and Sharaf (2005) in ostrich. Together with EL Gendy et al., (2016) in Balady duck and Mohammadpour et al., (2012) in hens and ducks, Baumel et al., (1993) and Blendea et al. (2012) in domestic fowl, Mirhish and Nsaif (2013) and El Sayed (2016) in adult turkey our findings revealed that the uterus was the most dilated part of the oviduct was located between the isthmus and vagina. The granular texture and the different

and declared by SEM don't match the findings of El Sayed (2016) in adult turkey that, noted obliquely and horizontally arranged uterine mucosal folds.

The primary longitudinal, secondary and tertiary folds that observed in the vaginal wall by SEM come in agreement with Bakst and Howarth (19974) in the hen.

5. Conclusion

The present study, offered a good description to know the different parts of the oviduct without being mistaken, as the infundibulum showing funnel and tubular part, while the magnum could be detected by its pale white or creamy color and its convolution, the reddish mucosa and narrow lumen of isthmus, the dilated part with different coloration of uterus and thick intermingled spiral folds with pale yellow color mucosa of the vagina. SEM showed primary and secondary folds allover the oviduct which became more thicker in the uterus and carrying tertiary folds in the vagina

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