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A Scanning Electron Microscopy Study of the Female Reproductive Tract in White Leghorn Hens

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ABSTRACT

Background: The present study was designed to provide the scanning electron microscopic features of female reproductive tract (ovary and oviduct) of the White Leghorn hen.

Methods: The present investigation was conducted on twenty-five mature White Leghorn hens procured from Poultry Farm of College of Veterinary and Animal Science, Bikaner. The collected ovary and oviduct samples were processed as per the standard protocol for scanning electron microscopy and viewed under the scanning electron microscope.

Result: The surface of the left ovary had an irregular appearance with an outer cortex and inner medulla, surrounded by numerous small rounded lacunae. The mucosa of different oviduct segments was thrown into longitudinal folds with various glandular openings on the surface. Small secondary folds were present on the mucosal surface at the infundibulum-magnum and magnum-isthmus junction. At the uterovaginal junction, the mucosal surface presented a parallel arrangement of folds with narrow furrows between them. The mucosal folds of the vagina appeared as narrow longitudinal folds and divided into secondary folds.

Key words: Ovary, Oviduct, Scanning electron microscope, White leghorn.

INTRODUCTION

The White Leghorn is a light breed that matures early and starts lying at about 4 months of age (Silversides *et al.,* 2006). The birds have a good feed to egg conversion ratio. White Leghorn hens have been much used to create highly productive egg-laying hybrids for commercial and industrial operations. The morphology and function of the avian reproductive system have been much described for domestic hen in the literature, but literature on the scanning electron microscopic characteristics of the female reproductive tract of White Leghorn hen was found to be scanty. Hence, ovary and all parts of the oviduct of White Leghorn were examined by scanning electron microscope.

MATERIALS AND METHODS

The study was conducted on twenty-five mature White Leghorn hens which were procured from Poultry Farm of the College of Veterinary and Animal Science, Bikaner. After the procurement of birds, their live weight (kg) was recorded and then birds were sacrificed by cervical fracture. The tissues were collected after slaughtering the hens. For scanning electron microscopy, 2 mm thick sections of tissue were taken, washed with isotonic buffer and then primarily preserved in Karnovsky's fixative (a mixture of 4% paraformaldehyde and 1% glutaraldehyde in 0.1 M phosphate buffer).

After primary fixation, tissues were washed with 0.1 M phosphate buffer (3 changes, each of 15 minutes), followed by post-fixation in 1% solution of osmium tetraoxide and again washed with 0.1 M phosphate buffer solution (3 changes, each of 15 minutes). The tissues were chemically dried by acetone (3 changes, each of 15 minutes) and dry acetone (2 changes, each of 15 minutes). All steps up to chemical drying were carried out at 4°C. Then it was followed by critical point drying (Biostag, New Delhi) at 31.5°C and 1100 Psi. Then samples were mounted on aluminium stubs with double adhesive carbon tape, metal coating by sputter coater using gold (Polalis, South Korea) and finally viewed by scanning electron microscope (Genesis-1100, Emcraft, South Korea).

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RESULTS AND DISCUSSION

Ovary

The scanning electron microscopic observations revealed that the surface of ovary had an irregular appearance with an outer cortex and inner medulla with numerous rounded

lacunae (Fig 1). The present findings were favoured by Ukeshima (1995) in quail and Shokry *et al.* (2016) in chicks. The follicles with large size were evident on the surface of the ovary (Fig 2). However, Ingole *et al.* (1987) reported that all the follicles were below 1 mm in diameter up to 18 weeks in both dwarf and normal White Leghorn birds.

Oviduct

The infundibulum showed epithelial lining with spirally oriented ridges which was in congruence with the observations of Raghu *et al.* (2020) in emu. Various glandular openings were seen on the mucosal surface (Fig 3). At the infundibulum-magnum junction, the mucosa showed small longitudinal folds with narrow mucosal ridges between them and small secondary folds were seen on the surface.

The surface of the magnum showed wide longitudinal folds with no confirmation of secondary folding. A large glandular opening was seen on the mucosal surface (Fig 4). Similar findings were reported by Parto *et al.* (2011) in turkey hen. At higher magnification, the mucosalepithelial surface was covered by small ciliated cells, whereas, Sukhadeve *et al.* (2018) reported both ciliated and non-ciliated cells on the mucosal epithelial surface of Punjab White quail. At the junction of magnum and isthmus, multiple openings of glands were seen on the surface (Fig 5) with discontinuous furrows between them. Secondary folds were also evident, along with primary folds in the present study.

The isthmus of White Leghorn showed irregular shaped mucosal folds with few glandular openings on the surface (Fig 6). This finding resembled the reports of Bakst (1978) in hen. At the junction of the isthmus and uterus, multiple glandular openings were observed on the mucosal surface of White Leghorn. However, Hodges (1974) reported intermingling of glands on the mucosal surface in fowl.

Secondary folds were evident on the mucosal surface of the uterus with a series of elevations and depressions. Numerous cells containing cilia were also observed on the mucosal surface (Fig 7). The present study is in accordance with Sukhadeve *et al.* (2018) in Punjab White quail. At the uterovaginal junction, the mucosal surface presented a parallel arrangement of folds with narrow furrows between them whereas, Ibrahim *et al.* (2015) showed the transition of mucosal folds in Japanese quail from longitudinal folds of the uterus to the complex interconnecting folds of the vagina with mucous membrane densely covered with cilia. A large number of small glandular openings were seen on the broad mucosal surface.

The mucosal folds of the vagina appeared as narrow ridges with visible secondary foldings (Fig 8); these findings were in congruence with the pronouncement of Bakst and Howarth (1975) in hen.

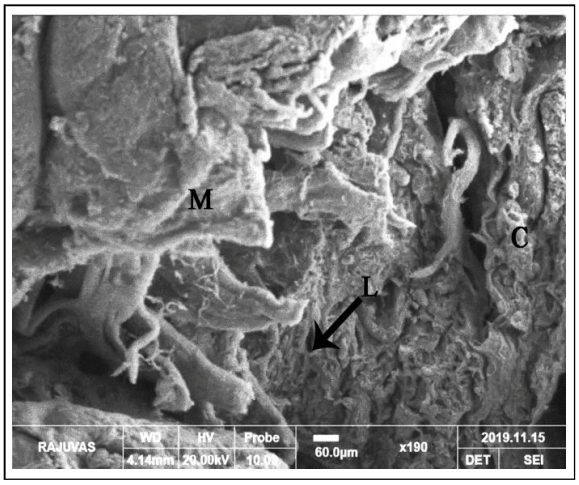

Fig 1: Scanning electron micrograph of left ovary of White Leghorn showing medulla (M), cortex (C) and lacunae (L). (X190).

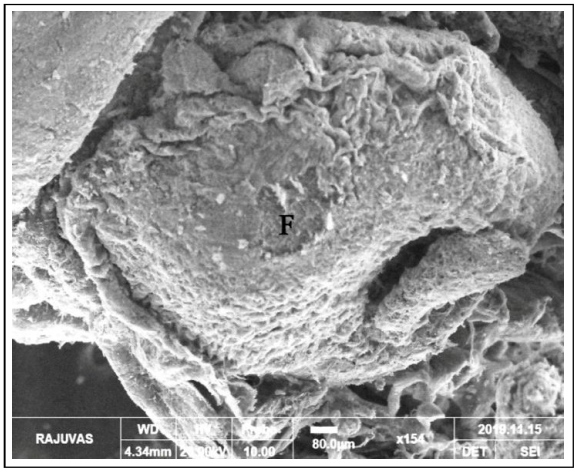

Fig 2: Scanning electron micrograph of left ovary of White Leghorn showing large-sized follicle (F). (X154).

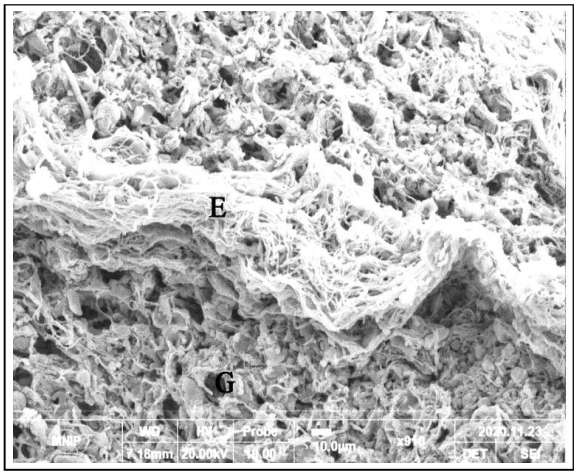

Fig 3: Scanning electron micrograph of the infundibulum of White Leghorn showing epithelial lining (E) with the glandular system (G). (X910).

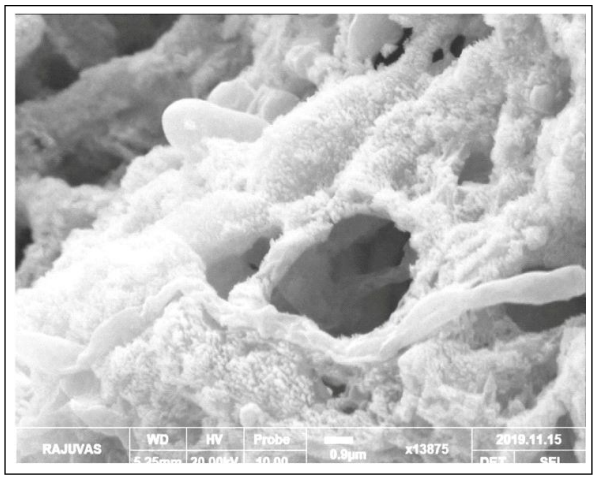

Fig 4: Scanning electron micrograph of the magnum of White Leghorn showing large glandular opening on the surface. (X13875).

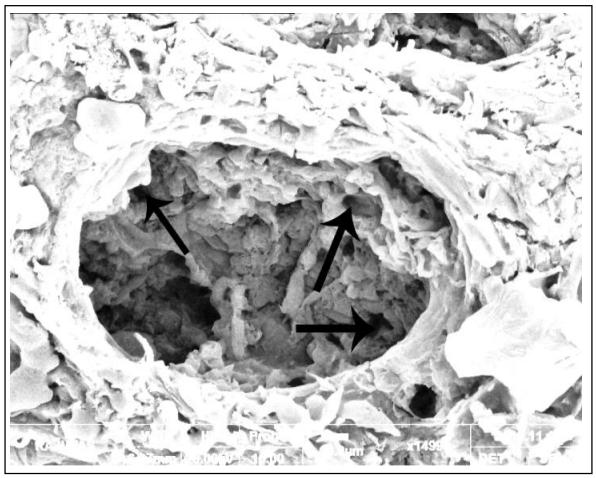

Fig 5: Scanning electron micrograph of the magnum-isthmus junction of White Leghorn showing multiple gland openings (arrows). (X1499).

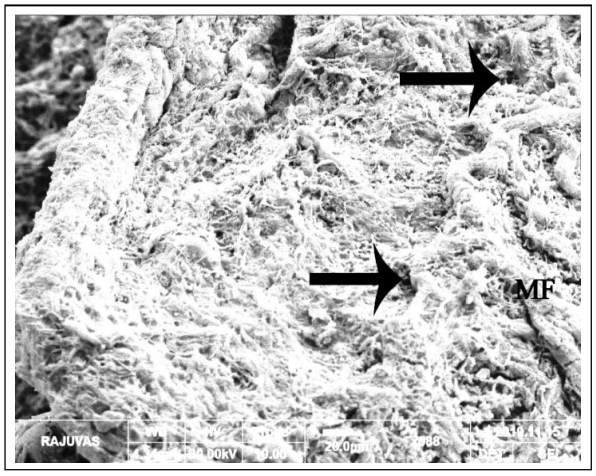

Fig 6: Scanning electron micrograph of isthmus of White Leghorn showing irregular shaped mucosal folds (MF) with few opening of glands (arrows). (X588).

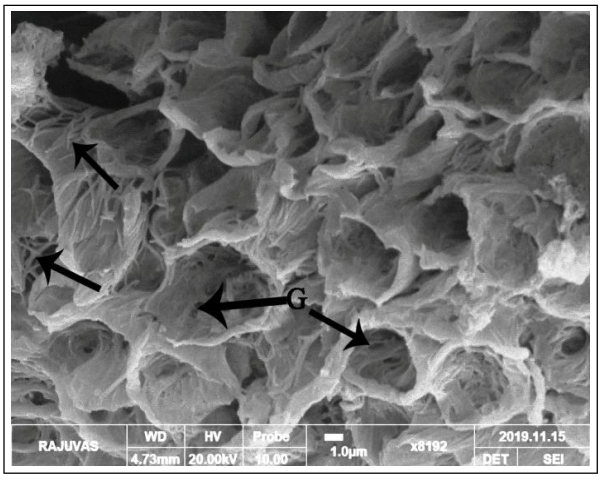

Fig 7: Scanning electron micrograph of uterus of White Leghorn showing series of elevations and depressions of secondary folds with few openings of glands (G) and cilia (arrows). (X8192).

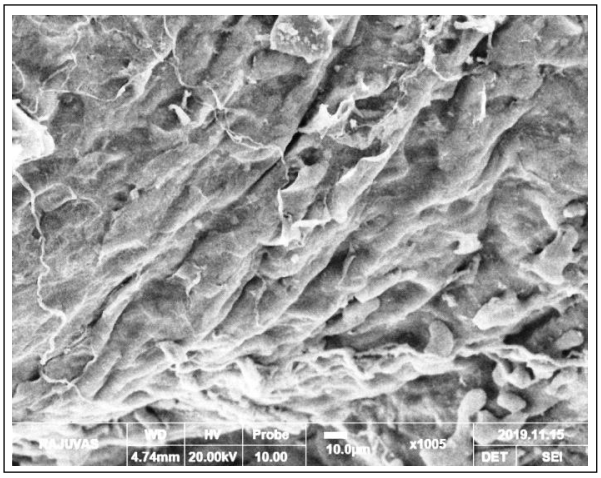

Fig 8: Scanning electron micrograph of the vagina of White Leghorn showing narrow mucosal ridges with secondary folds. (X1005).

CONCLUSION

Scanning electron microscopic observations revealed that the surface of the ovary had an irregular appearance with numerous rounded lacunae in between cortex and medulla. The mucosa of different segments of the oviduct was thrown into longitudinal folds and furrows with numerous glandular openings on the mucosal surface.

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