



SHORT COMMUNICATION

Electron Microscopic Studies on the Oviduct of Punjab White Quail

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Received: 11 June, 2018

Revised: 12 Aug., 2018

Accepted: 19 Aug., 2018

ABSTRACT

Electron microscopic studies were made on different segments of oviduct of six Punjab white quails which revealed that the ultra-structure of the surface epithelium of different segments showed two types of cells viz: ciliated and non-ciliated granular cells. The ciliated cells had bunch of cilia emerging from the apical surface into the lumen. The nuclei of these cells were apically placed and ovoid in shape while non-ciliated cells had elongated and basally placed nuclei. The non-ciliated cells were either secretory or non-secretory in nature. The ciliated cells had darkly stained basal bodies from where the cilia sprung out of the cells. The root of the cilia was seen attached to the basal bodies. The apical surfaces of the ciliated cells were crowded with cilia. The cross sectional profile of cilia revealed nine plus two arrangement of the microtubules. The apical part of the cytoplasm had numerous mitochondria. Basal part of the cytoplasm contained numerous mitochondria and rough endoplasmic reticulum (rER). The non-ciliated cells of magnum were mostly secretory in nature and apical part of cytoplasm was filled with secretory vesicles. The lining epithelium of vagina was composed of stratified squamous epithelium.

Keywords: Oviduct, Punjab White Quail, Ultrastructure

Quails constitute the third largest avian species in number in our country, only next to chickens and ducks, used for commercial production (Shanaway, 1994). This species is a good “dual-purpose” bird and is now reared for meat and egg production. Though the morphology and the function of the avian oviduct have been much described for domestic hen in the literature, but very few reports are available on surface morphology of the oviduct of Punjab White Quail. This prompted this present study on the transmission electron microscopic details of different parts of oviduct in Punjab white quail.

The present study was conducted on different segments of oviducts of 6 Punjab White quail at 36 weeks of age. These tissues were the properly processed, sectioned, stained and photographed using standard protocol (Pathak *et al.*, 2014).

Infundibulum

Transmission electron microscopic study revealed that the infundibulum was lined with two types of cells, ciliated

and non-ciliated. The ciliated cells showed bunch of cilia emerging from the apical surface into lumen. The nucleus of these cells was apically placed and ovoid in shape while non-ciliated cells had elongated and basally placed nuclei. The non-ciliated cells were either secretory or non-secretory in nature (Fig. 1A). Similar findings were reported by Wyburn *et al.* (1970) and Aitken and Johnson (1963) in the infundibulum of avian oviduct and Bansal *et al.* (2011) in the oviduct of domesticated hen.

The nuclei of the ciliated cells showed distinct nucleolus and patches of heterochromatin in the euchromatin. The ciliated cells had darkly stained basal bodies from where the cilia emerged out of the cells. The root of the cilia was seen attaching to the basal bodies. The apical surface of the ciliated cells was crowded with the cross section of cilia. The cross section of cilia revealed nine plus two arrangement of the microtubules. The apical part of the cytoplasm had numerous mitochondria (Fig. 1A, B). Basal part of the cytoplasm contained numerous mitochondria and rough endoplasmic reticulum (rER). Similar findings



were observed by Ozen *et al.* (2009) in pekin duck. They reported that the lamina epithelialis was composed of mono layered prismatic ciliated and secretory cells. They also reported the arrangement of the microtubules in the nine plus two formation in the transverse sections of the apically located cilia of ciliated cells. They observed short microvilli present in the apical region of the secretory cells.

Magnum

The lining epithelium of magnum was also consisted of two types of cells namely ciliated and non-ciliated cells. There was distinct lamina on which these cells lied. At places basal cells were also seen. Propria - submucosa consisted of tubular glands lined with granule filled pyramidal cells. The ciliated cells of the lamina mucosae were columnar in nature. The nuclei of these were oval to elongated with euchromatin material and disperse heterochromatin material. Supra nuclear compartment of cytoplasm had number of mitochondria. The apical part of cell showed number of kinocilia that emerged from basal bodies which were connected with electron dense filamentous structure referred as root (Fig. 1C, D).

The non-ciliated cells were mostly secretory in nature and apical part of cytoplasm was filled with secretory vesicles. The apical cytoplasmic membrane was reflected in the form of microvilli towards the lumen. The cells of tubular glands had round nucleus and few heterochromatin clumps. The cytoplasm of these cells towards the tubular lumen was filled with electron dense granules with diameter. The cytoplasm consisted of laminae of Golgi complex, secretory vesicles, smooth endoplasmic reticulum and a few mitochondria (Fig. 1C). Fertuck and Newstead (1970) observed that the Golgi apparatus was directly involved in the formation of secretory granules in the magnum of Japanese quail and in hen. Ogwuegbu and Aire, (1990) described that the granular or non-ciliated cells of surface epithelium of magnum of guinea fowl were more electron dense than the ciliated cells in both segments. In the magnum, the apical two-thirds of the non-ciliated cells were filled with foamy secretory vesicles, while the ciliated cells are filled with secretory globules in the apical half.

Wyburn *et al.* (1970) studied the magnum of fowl and observed that the surface of the mucosa was lined with

columnar epithelium and the cells had granules of low electron density in the epithelial cells. They hypothesized that the release of granules in tubules was through small size of granules. Lamina propria also showed connective tissue cells and capillaries filled with nucleated RBC. Saber *et al.* (2009) also observed ciliated and non-ciliated cells of which the ciliated cells were more in number in the magnum of the ostrich. They also described light cells and dark cells in lining epithelium.

Isthmus

The isthmus was lined with ciliated and non-ciliated cells. The ciliated cells were more in number in contrast to infundibulum and magnum. The non-ciliated cells had cytoplasm filled with electron dense granules (Fig. 1E). Similar to the findings of the present study, Bansal *et al.* (2011) reported that surface epithelium was lined by ciliated and non-ciliated granular cells in the isthmus of domesticated hen. The granular cells contained supra nuclear electron-dense granules of different density and showed blebbing in supra nuclear portion. The lamina propria submucosae showed tubular glands which were lined with pyramidal cells. These cells contained electron dense and electron opaque granules (Fig. 1E). Ozen *et al.* (2009) reported that the glands were demonstrated to contain electron dense secretory granules in the magnum and isthmus in Pekin duck. The cytoplasm of granulated cells was filled with extensive network of rER and secretory vesicles. The cytoplasm had dispersed ribosome (Fig. 1E). Similar observations have also been reported by Draper *et al.* (1972) in *Gallus domesticus*. They observed three types of surface epithelial cells. About half were ciliated cells, and contained scattered electron dense granules, lysosome-like bodies and secretory cells filled with aggregations of electron dense granules.

Uterus

Transmission electron microscopic study revealed that the uterus was lined by two different types of cells namely ciliated and non-ciliated cells (Fig. 1F) as also reported by Bansal *et al.* (2011). The ciliated cells possessed numerous cilia randomly interspersed with long slender microvilli. The cilia emerged from darkly stained basal bodies which were attached to the root of cilia. The apical part of cytoplasm of cells was filled with the numerous

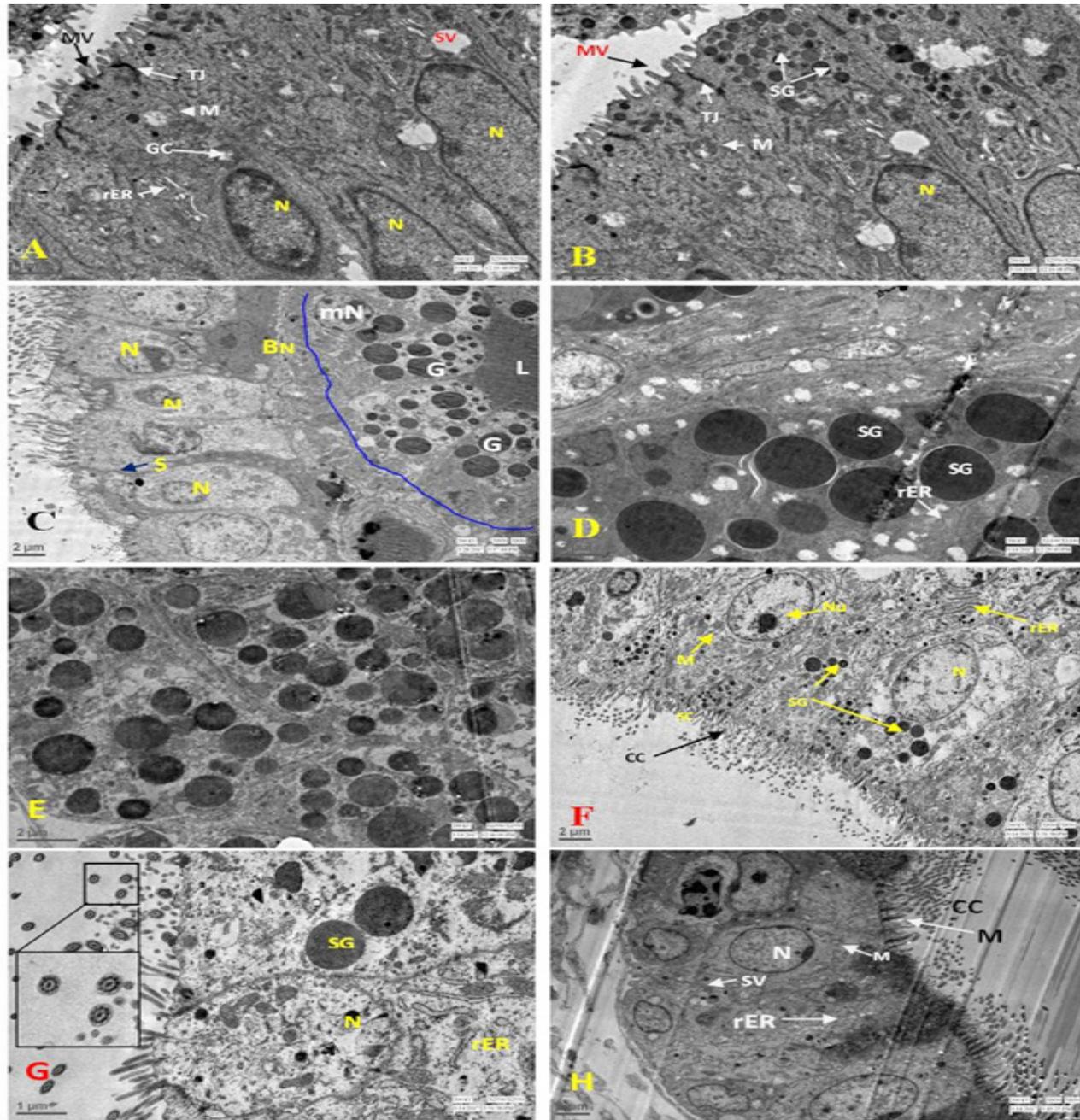


Fig. 1: Transmission electron micrograph of oviduct PWQ32 week of age showing. **(A)** Infundibulum with ciliated and non-ciliated cell, non-ciliated cells with microvilli (MV), nucleus (N), Golgi complex (G), mitochondria (M), rough endoplasmic reticulum (rER), tight junction (TJ) at apical surface and secretory vesicle (SV) $\times 2550$; **(B)** Infundibulum with ciliated and non-ciliated cell. $\times 2550$; **(C)** Magnum with ciliated and non-ciliated cell, non-ciliated cells with microvilli, nucleus, secretory vesicle, secretory granule (SG), basal nucleus (BN), nucleus of mucosal gland (mN) and lumen (L). $\times 830$; **(D)** secretory granule, rough endoplasmic reticulum. $\times 1100$; **(E)** Isthmus with abundant number of secretory granule and rough endoplasmic reticulum. $\times 1550$; **(F)** Uterus with ciliated and non-ciliated cell, non-ciliated cells with cilia, microvilli, nucleus, nucleolus (Nu), mitochondria, secretory granule and rough endoplasmic reticulum. $\times 830$; **(G)** Uterus with ciliated and non-ciliated cell, non-ciliated cells with microvilli, nucleus, secretory granule and rough endoplasmic reticulum, inset showing 9+2 arrangement. $\times 2550$; **(H)** Vagina with ciliated and non-ciliated cell, non-ciliated cells with cilia, microvilli, nucleus, mitochondria and secretory vesicle. $\times 830$



large size granules. The granules were electron dense (Fig. 1F, G). In between the granules numerous mitochondria and rough endoplasmic reticulum were observed. Basal compartment of the cytoplasm was filled with rER and free ribosomes and very few mitochondria. Ozen *et al.* (2009) also found that the propprial glands of the uterus contained electron light granules.

Apical cytoplasm of non ciliated cells was filled with electron dense granules which were smaller in size as compare to ciliated cells. The apical surface showed microvillus projections (Fig. 1F, G). At higher magnification distinct basal bodies of cilia were observed. The cross section of cilia presents in the lumen of uterus revealed the typical nine plus two arrangement of microtubules (Fig. 2F). The non-ciliated cells were secretory in nature and contained variable density of granules. The apical surface had microvillus projections. The cytoplasm consisted of rER and few ribosomes.

At further magnification distinct cell junction in form of gap and tight junctions were observed. The elongated cristae were observed in mitochondria.

Vagina

The lining epithelium of vagina showed stratified squamous epithelium as also seen in domestic hen (Bansal *et al.*, 2011). The apical surface of the epithelium revealed ciliated and non-ciliated cells. The nuclei of the ciliated cells were oval to elongated in shaped with few heterochromatin clump. Cilia showed basal bodies and root (Fig. 1H). Wyburn *et al.* (1970) reported in fowl that vaginal ciliated cells were narrow with an expanded apex carrying the cilia and microvilli and contained oval or round shaped nuclei, while the secretory granules and vacuoles were reported to be located either in the middle or apical regions of the non-ciliated cells. In present study, based on the electron density two types of cells were distinguished as electron lucent and electron opaque. The non-ciliated cells were mostly electron opaque, whereas ciliated cells had both electron lucent and opaque granules.

CONCLUSION

The present investigation using TEM revealed that the different segments of oviduct of Punjab white quail were lined by two types of cells viz: ciliated and non-ciliated

cells. The non-ciliated cells were either secretory or non-secretory in nature. The non-ciliated cells of magnum were mostly secretory in nature.

ACKNOWLEDGEMENTS

The authors are thankful to the staff of Electron Microscopic Facility, AIIMS, New Delhi, for their sincere cooperation and technical help during processing and imaging on TEM.

REFERENCES

- Aitken, R.N.C. and Johnson, H.S. 1963. Observations on the fine structure of the infundibulum of the avian oviduct. *J. Anat.*, **97**: 87-99.
- Bansal, N., Uppal, V., Pathak, D. and Anuradha. 2011. Transmission electronmicroscopic studies on the oviduct of domestic hen. *Indian J. Poult. Sci.*, **46**: 271-274.
- Draper, M.H., Davidson, M.F., Wenburn, G.M. and Johnston, H.S. 1972. The fine structure of fibrous membrane forming region of the isthmus of the oviduct of *Gallus Domesticus*. *Q. J. Exp. Physiol.*, **57**: 297-307.
- Fertuck, H.C. and Newstead, J.D. 1970. Fine structural observations on magnum mucosa in quail and hen oviduct. *Z. Zellforsch. Microsk. Anat. Histochem.*, **103**: 447-459.
- Ozen, A., Ergun, E. and Kurum, A. 2009. Light and electron microscopic studies on the Oviduct epithelium of the Pekin duck (*Anas platyrhynchos*). *Ankara Üniversitesi Veteriner Fakültesi Dergisi.*, **56**: 177-181.
- Pathak, D. and Bansal, N. 2014. Ultrastructural studies on blood brain barrier in hypothalamus of Indian buffalo. *Indian J. Vet. Anat.*, **26(2)**: 118-119.
- Saber, A.S., Emara, S.A.M. and Abosaeda, O.M.M. 2009 Light, Scanning and transmission electron microscopical study on the oviduct of the ostrich (*Struthio camelus*). *J. Vet. Anat.*, **2**: 79-89.
- Shanaway, M.M. 1994. Quail Production System: A Review. *Food and Agricultural Organization of United States*, pp. 2-9.
- Wyburn, G.M., Johnston, H.S., Draper, M.H. and Davidson. 1970. The fine Structure of the infundibulum and magnum of the oviduct of *Gallus domesticus*. *Q. J. Exp. Physiol.*, **55**: 213-232.