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Comparative gross, light and scanning electron microscopic study on magnum of Pati and Chara-Chemballi ducks during laying periods

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Abstract
The magnum was the longest and most coiled part of the oviduct. It was located just ventral to the left kidney in both the varieties. The length, breath, thickness and weight of magnum is significantly higher (P<0.01) in Chara-Chemballi duck than Pati duck. Histologically, the lamina epithelialis mucosa of the magnum was lined by pseudo stratified ciliated columnar epithelium in both Patiand Chara-Chemballi ducks. Primary, secondary and tertiary mucosal folds were observed in magnum, but the tertiary folds were less in magnum than the other parts of oviduct in both the varieties. The lamina propria sub-mucosa of magnum contained tubular glands. Tunica muscularis of magnum consisted of inner circular and outer longitudinal smooth muscle fibers. Tunica serosa of magnum consisted of loose connective tissue in both the varieties. The connective tissue fibers and nerve fibers were also present in the magnum of both Pati and Chara-Chemballi duck. The height of lamina epithelialis mucosae of oviduct was significantly higher (P<0.01) in Chara-Chemballi ducks than Pati ducks. In scanning electron microscopy, the secondary folds of magnum were more complex and tortuous and more number of glandular openings in Pati duck whereas in Chara-Chemballi duck, these folds were simple and less number of glandular openings were observed. It might be therefore concluded from the above study that the Chara-Chemballi duck revealed relatively significant difference in most of the parameters than the Pati ducks except in scanning electron microscopy.

Keywords: Gross, light, scanning electron microscopy, magnum, Pati, Chara-Chemballi, duck and layi

Introduction
The Pati duck is a major indigenous variety of Assam and annual egg production per duck is70-95eggs Kalita *et al.,* (2009) [1]. However, Chara-Chemballi duck is the indigenous varieties but their production performance did not differ significantly and annual egg production per duck was181.3with an average egg weight of 71.6±2.38g at 72weeks of age under free range condition of Assam [2]. Magnum is the longest and coiled part of oviduct. It secrets alubminous part of egg. It might, therefore be concluded that the observations in the present study establish a major role in recording the anatomical norms in respect of gross, histology and ultrastructure of magnum of both Pati and Chara-Chemballi ducks. These will help pathologist, physiologist and poultry scientists for effective production strategy as well as disease control regime. Literature on the magnum of Pati and Chara-Chemballi ducks during laying period is found to be scarce. Hence, considering the importance of these ducks the present work was undertaken to elucidate the gross, light and scanning electron microscopic feature of the magnum.

Materials and Methods
The present study was conducted on twelve each Pati and Chara-Chemballi ducks at 42 weeks of age. The Pati and Chara-Chemballi ducks were procured from Pathsala, Barpeta district and State Institute and Rural Development, Khanapara, respectively. The experimental birds were sacrificed according to the method of Gracey (1968) [3] and gross studies were made on it.After slaughter, the location and relative topographic in-situ position of the magnum were recorded. The magnums were taken out from the body of birds and weights of magnums were recorded with the help of electronic pan balance. The gross anatomical characteristics of magnums were studied and the different biometrical measurements *viz,* the length, breadth and thickness of magnum were recorded by Mc Cance (1974) [4]. For histological and micrometrical study magnums were collected from Pati and Chara-Chemballi ducks at 42 weeks of age.

The tissue Samples were fixed in 10% neutral buffered formalin. Then tissues were processed for Paraffin embedding method. Paraffin sections were cut in five micron thickness and stained with Haematoxylin and Eosin method for histomorphological study, Van Gieson's method for collagen fibre, Gomori's method for reticular fibre, Hart's method for elastic fibre, Bielschowsky's method for axis cylinder and dendrites and Mc. Manus method for glycogenas per standard methods of Luna (1968) [5]. After staining, histological characteristics of magnums were recorded. Different micrometrical parameters were recorded on Haematoxylin and eosin stained section by means of standard method of micrometry using Nikon E 200 camera mounted microscope and Image Pro Express Ver-2.0 Software. For scanning electron microscopy, the tissue samples were processed as per techniques of Parsons (1991) [6]. The data were analyzed as per methods described by Snedecor and Cochran (1994) [7] and were presented accordingly.

Results and Discussion

The magnum was the longest and most coiled part of the oviduct. It was located just ventral to the left kidney (Fig.1) in accordance with Dyce *et al.,* (1987) [8] on fowl. The mean length, breath, thickness and weight of magnum were found to be significantly higher in Chara-Chemballi ducks 32.67±0.41cm, 1.77±0.02cm, 1.02±0.08cm and 16.85±0.22gm, respectively than *Pati* ducks 20.98±0.32 cm, 1.77±0.02 cm, 1.02±0.08cm and 16.85±0.22gm, respectively (Table.1). However, Patki *et al.,* (2013) [9, 15] reported that the mean length, width and weight of magnum was24.30± 0.07cm, 2.30±0.01mm and 19.18±0.01gm, respectively in Kuttanad duck at 24 weeks of age. These might be due to age as well as different varieties of ducks. The average length of the magnum was 32.5 cm in laying hens (Nickel *et al.,* 1977) while Parto *et al.,* (2011) [11] found that the length of magnum was 36.3 cm in laying turkey.

The magnum of Chara-Chemballi duck was highly developed in respect of epithelial height of the mucosal folds than in *Pati* duck. The mucosal folds were of three types i.e. primary, secondary and tertiary (Fig.3 and Fig.4). Similar observations were also reported by Naragude *et al.,* (1999) [12] in Rhode Island Red birds.

Fig 1: Photograph showing the in- situ position of female reproductive system of *Pati* duck showing ovary (O), magnum (M) and vagina (V)

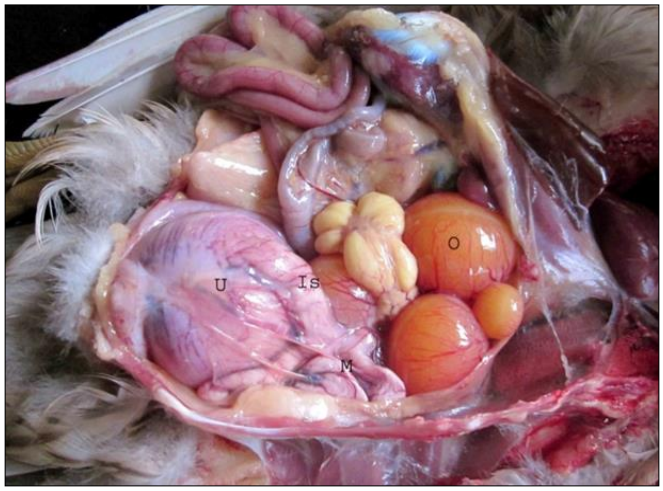

Fig 2: Photograph showing the in-situ position of female reproductive system of Chara-Chemballi ducks showing ovary (O), magnum (M), isthmus (Is) and uterus (U).

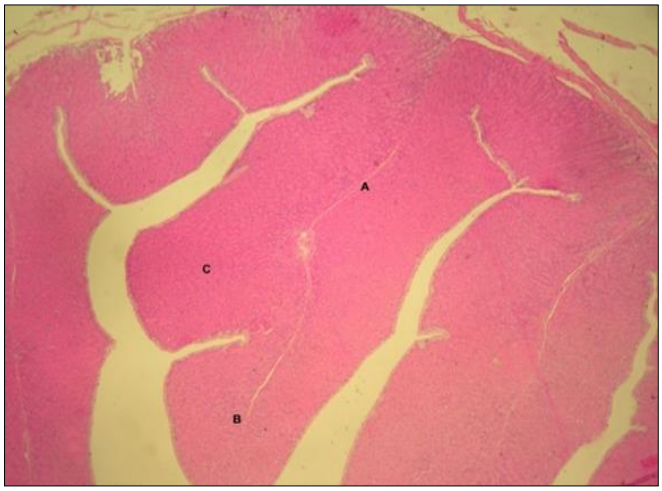

Fig 3: Photomicrograph showing the magnum of *Pati* duck along with primary (A), secondary (B) and tertiary folds (C). H&E, 100X

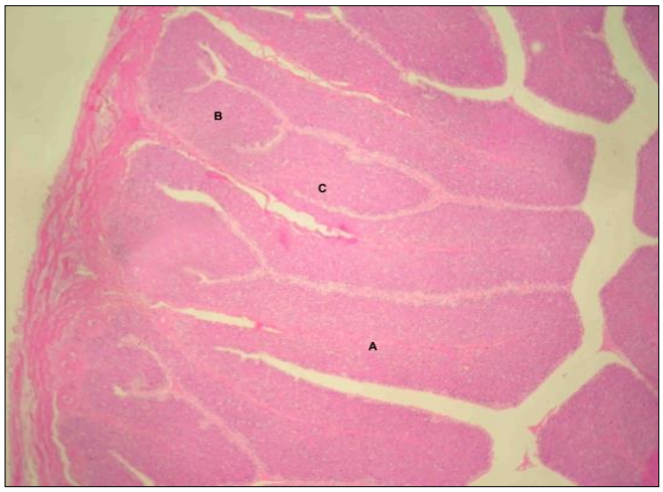

Fig 4: Photomicrograph showing the magnum of Chara-Chemballi duck along with primary (A), secondary (B) and tertiary folds(C).H&E, 100X

Table 1: Genetic group wise average length, breadth, thickness and weight of magnum of Patiand Chara-Chemballi ducks along with the results of't' test

Traits	Genetic groups		't' Value
	Pati duck	Chara-Chemballi duck	
Length(cm)	20.98±0.32	32.67±0.41	21.947**
Breadth(cm)	0.89±0.02	1.77±0.02	29.793**
Thickness(cm)	0.70±0.03	1.02±0.08	3.516**
Weight(gm)	6.94±0.22	16.85±0.22	31.221**

** Highly significant (P<0.01)

The lamina epithelialis mucosae comprised of pseudostratified ciliated columnar and goblet cells in both the varieties. The lamina propria-submucoa was packed with tubular glands which were well developed in both *Pati* and Chara-Chemballi ducks (Fig.5). These glands were surrounded by richly vascularized connective tissue. These findings were suppotered by Ozen *et al.,* (2009) [13] in Pekin duck. The lamina propria-sumucosa contained more collagen fibers and reticular fibers and less amounts of elastic and nerve fibers in Chara-Chemballi duck. However, these connective tissue fibers were less in *Pati* duck as compared to Chara-Chemballi duck. These reports were in accordance with Rao *et al.* (2000) in domestic duck. These might be due to difference in breed varieties.

The muscularis layers of magnum were somewhat thicker. The circular layer of tunica muscularis was wider than that of the longitudinal layers. Both circular and longitudinal layers contained more amounts of elastic fibers, reticular fibers and less amount of collagen fibers as well as nerves fibers in both the varieties. The tunica serosa was composed of loose connective tissue, blood and lymph vessels and nerves fibers in both *Pati* and Chara-Chemballi ducks. These findings were similar with Sharaf *et al.* (2012) [16] in Ostrich.

The lining epithelium and glandular epithelium exhibited weak PAS positive reaction in both *Pati* and Chara-Chemballi ducks. Mohammad pour *et al.* (2008) revealed that the magnum showed weak reactivity for PAS in turkey and pigeon whereas Ozen *et al.* (2009) [13] observed that PAS positive reaction did not occur in the glands of the magnum region in the Pekin duck. However, Joaquim *et al.* (1997) [18] marked that the epithelium of magnum showed intense PAS positive reaction in Muscovy duck.

The mean height of lamina epithelialis mucosae of magnum was 29.663±0.418 µm in *Pati* duck and 34.950±0.375 µm in Chara-Chemballi duck (Table.2). However, the epithelial height was 17.3± 0.60µm in domestic duck (Rao *et al.,* 2000). These might be due to difference in breed varieties of birds.

The scanning electron microscopy of magnum of both *Pati* and Chara-Chemballi ducks were studied. The secondary folds were more tortuous and complex in *Pati* ducks (Fig.6) while these folds were simple in Chara-Chemballi ducks (Fig.7). However, the secondary folds of magnum of *Pati* ducks revealed some series of elevations and depressions (Fig.8). In higher magnification these folds exhibited numerous opening of glands (Fig.10). The secondary folds were further divided into tertiary folds where numerous cells containing cilia were observed. No significant demarcation was observed between the two varieties of the ducks in the tertiary folds (Fig.9).

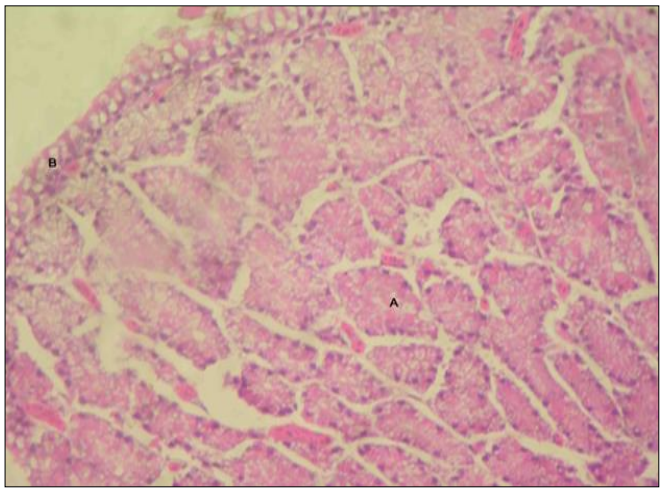

Fig 5: Photomicrograph showing tubular gland (A) and pseudo stratified ciliated columnar epithelium (B) of Chara-Chemballi duck. H & E, 400X

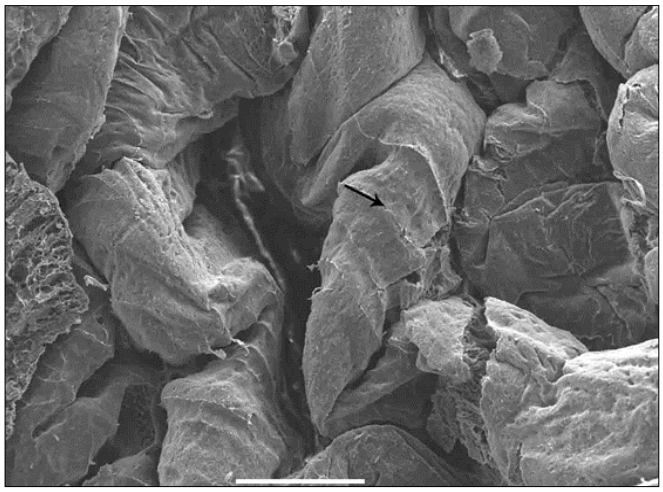

Fig 6: Scanning electron microphotograph showing the tortuous and complex secondary folds of magnum of *Pati* duck (arrow) bar=500µm, 500 X

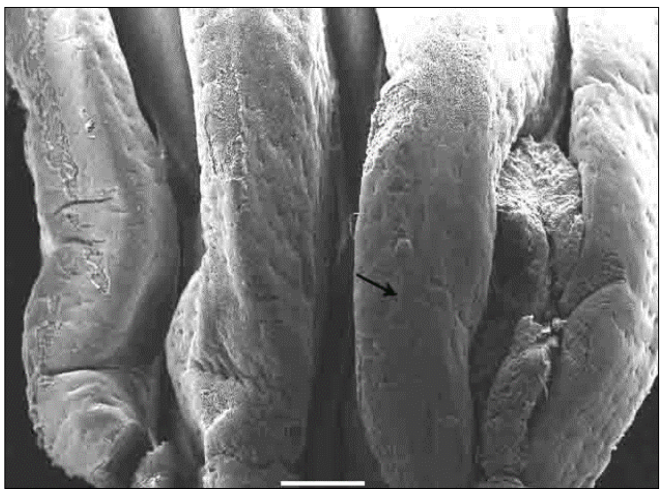

Fig 7: Scanning electron microphotograph showing the simple secondary folds of magnum of Chara-Chemballi duck (arrow) bar=500µm, 310X

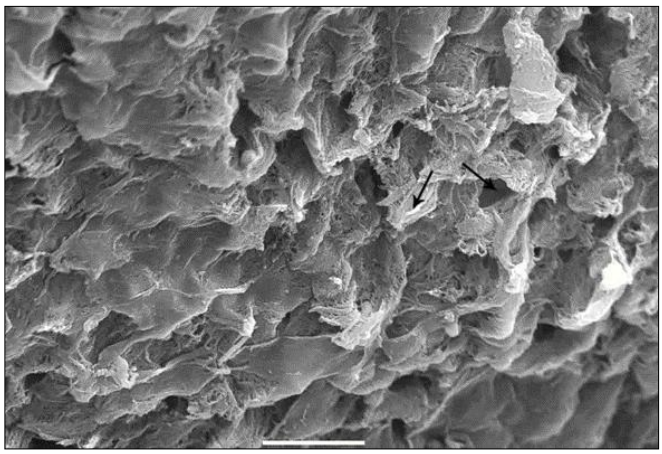

Fig 8: Scanning electron microphotograph showing the series of elevation and depressions of secondary folds of magnum of Pati duck (arrow) bar=10µm, 2000X

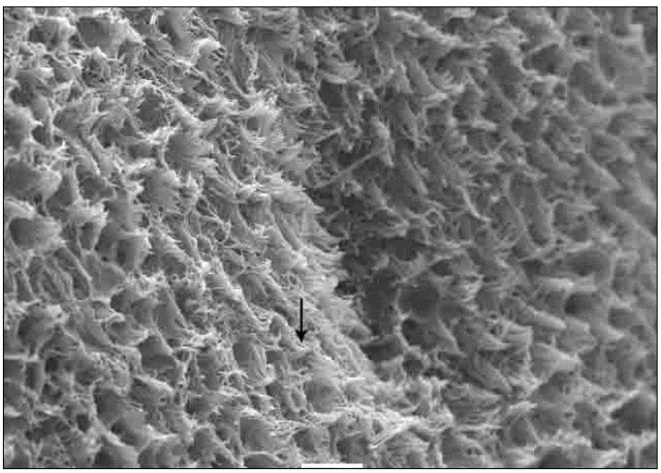

Fig 9: Scanning electron microphotograph showing the tertiary folds of magnum of Chara-Chemballi (arrow) bar=10µm,1200X

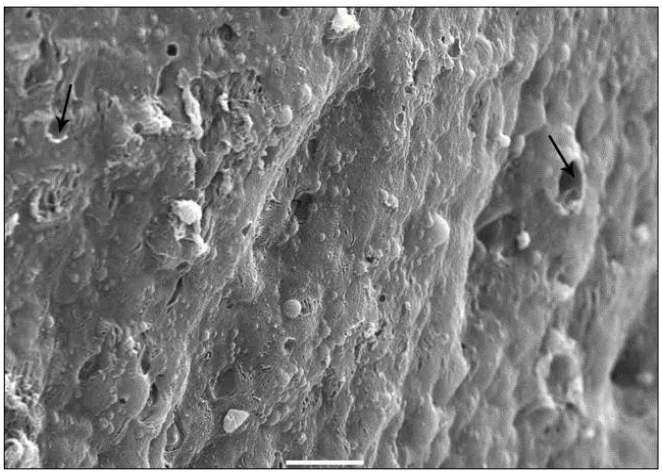

Fig 10: Scanning electron microphotograph showing thenumerous glandular opening in secondary folds of magnum of Pati duck (arrow) bar=10µm,1500X

Table 2: Genetic group wise average epithelial height (µm) of magnum of Patiand Chara-Chemballi ducks along with the results of 't' test

Traits	Genetic groups		't' Value
	Pati duck	Chara-Chemballi duck	
Height of lamina epithelialis mucosae of magnum.	29.663±0.418	34.950±0.375	9.40**

** Highly significant (*P*<0.01)

Most of the lining epithelial cells were ciliated and amongst them some non ciliated cells were also seen. These observations were in consonance with the findings of Bakst and Howarth, (1975) in hen. The cilia were mostly embedded in thick mucus. Some depressions characterized by electron dense areas were observed which had glandular opening in both varieties (Fig.11 and Fig.12). Similar observations were recorded by Parto *et al.* (2011) [11] in laying turkey.

The magnum of both the varieties was tubular organ and revealed the typical layers. The most prominent were the tunica mucosa and propria submucosa.The lamina propria sub mucosa formed the core of the tertiary folds. Strips of connective tissue fibers were prominent in this layer (Fig.13).

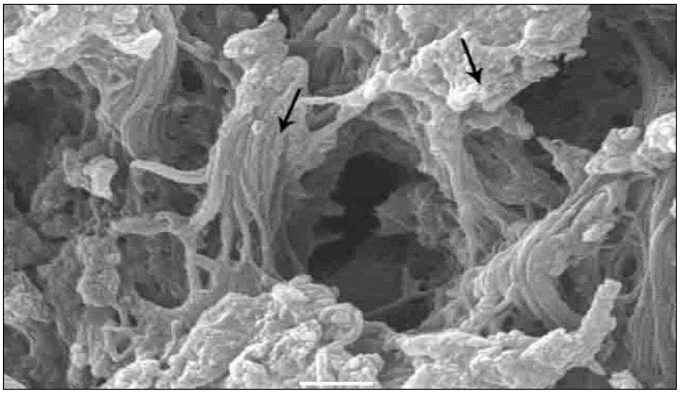

Fig 11: Scanning electron microphotograph showing the embedding of cilia in thick mucous of magnum of Chara-Chembali duck (arrow) bar=2µm,7000X

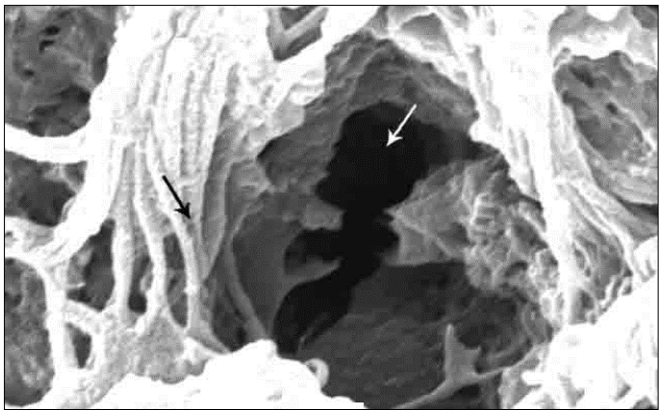

Fig 12: Scanning electron microphotograph showingthe glandular opening amongst the cilia of magnum of Pati duck (arrow) bar=2µm,10,000X

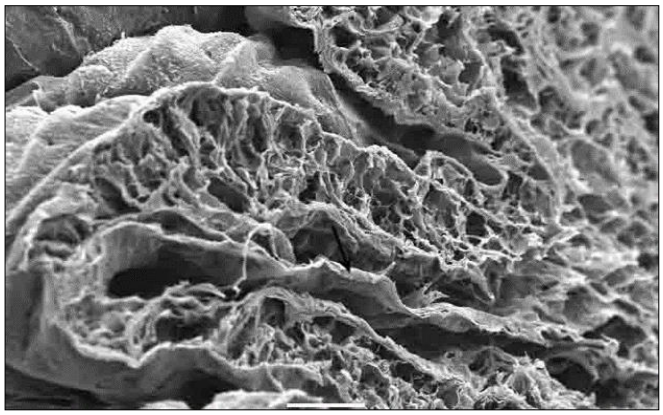

Fig 13: Scanning electron microphotograph showing the stripes of connective tissue in tunica sub-mucosa of magnum of Chara-Chemballi duck (arrow) bar=100µm, 1500X

Summary and Conclusion

The length, breadth, thickness and weight of all magnum of female reproductive system of Chara-Chemballi duck was significantly higher than Pati duck. Histologicaly there is no significant difference between the Pati and Chara- Chemballi ducks. The height of lamina epithelialis mucosae of magnum was significantly higher in Chara-Chemballi duck than Pati duck. Histo chemically, the lining epithelium and glandular epithelium exhibited moderate PAS positive reaction in both Patiand Chara-Chemballi ducks. In Scanning Electron Microscopy, the secondary folds of magnum were more complex and tortuous and more number of glandular openings were observed in Pati duck whereas in Chara-Chemballi duck these folds were simple and less number of glandular openings were found.

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