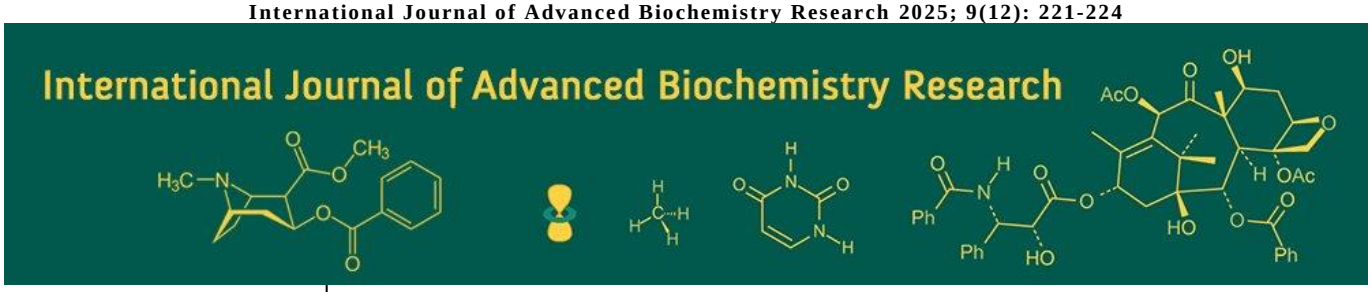

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An electron microscopy study on Harderian gland of *Pati* duck (*Anas platyrhynchos domesticus*) of Assam during the postnatal development

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Abstract
The present study was conducted on total forty-five (45) numbers *Pati* duck of Assam at different stages of postnatal development. In the Scanning Electron Micrograph of the Harderian gland of Pati duck (*Anas platyrhynchos domesticus*) the tubular structures were looked like hole having some secretion inside it. The apical portion of the cell was filled with mucous secretion and looked like empty space, more prominent in higher age group which was observed in the Transmission Electron Micrograph. The secretory mucous vesicles pushed the nucleus of the cell towards the basal border. The myoepithelial cells were also observed near the basement membrane.

Keywords: Electron microscopy, Harderian gland

Introduction
Duck rearing contributes a major part to uplift the socio-economic of the rural poor people of Assam and others states located in the coastal regions of India. Harderian gland acts as a part of the Head Associated Lymphoid Tissue (HALT) Olah *et al.* (1992) [7] and serves local innate immunity to the upper respiratory system, to the eye, and oral cavity. The Harderian gland is the major exocrine paraocular gland and a peripheral lymphoepithelial organ of the domestic fowl. In water fowl, they also have osmoregulatory functions (Wight *et al.*, 1971) [11].

Materials and Methods
The present study was conducted on total forty-five (45) numbers *Pati* duck of Assam at different stages of postnatal development. The Ducks were divided into five (5) as age group 0, 4, 16, 24, and 42 weeks. The ducks were procured from Pathsala and nearby area of Barpeta district of Assam and the duck farm under the project of Physiology department. For ultrastructral study (Scanning Electron Microscopic and Transmission Electron Microscopic) The samples were cut into small pieces of 2 mm size and fixed in 2% glutaraldehyde solution for 4 hours at 4 °C. After that the fixed tissue samples were kept in Na-cacodylate buffer. The tissue samples were processed as per the techniques of Parsons *et al.*, (1991) which was slightly modified by SAIF, NEHU, Shillong.

Results and Discussion
Scanning electron microscopic study
The harderian gland of *Pati* duck (*Anas platyrhynchos domesticus)* revealed that the connective tissue septa from the capsule extended in the parenchyma, divided the gland into lobes and lobules (Fig.1). Further the tubular structures were observed like hole with some secretion inside it. The size of the tubules increased advancement of age group. The hole represented the central canal of the lobe and lumen of the tubules (Fig.2&3). In higher magnification, the lining epithelium cells were found with secretion at the tip of the cells. The secretory cell had an opening at the tip of the cell (Fig. 4). The mode of secretion of the cell was apocrine as the secretion accumulated near the tip of the cell which gave an appearance of woolen ball (Fig.4) which was similar to the findings of Payne (1994) [9] in avian species.

The secretion which was accumulated in the lumen of the tubules and at the tip of the apical border of the cells found more at higher age group birds as comparison to the young one. McGadey *et al.* (1992) [6] also reported in hamster that active region of the cell surface bulged into the lumen with surface pits which were the sites of vacuole released; vacuoles in the process of release were easily seen as rounded blebs. Tsutsumi *et al.* (1966) [10] also reported the Harderian gland of albino rat that the mechanism of lipid release was apocrine. SEM analysis of the LG of the Egyptian agama Trapelusmutabilis by Fatma *et al.* (2022) [4] reported many secretory orifices of the glandular units and openings of the glandular ductules on the surface of the base of the nictitating membrane.

Transmission Electron Microscopic study

The present investigation found that tubular secretory units of the harderian gland of *Pati* duck (*Anas platyrhynchos domesticus)* were lined by simple columnar epithelium. The columnar cells were rest on the basement membrane and the connective tissue core occupied the inter tubular septa. The cells were filled with mucous secretion which gave an appearance of empty vacuoles (Fig. 5 & 6). The secretory mucous vesicles pushed the nucleus of the cell towards the basal border. The rough endoplasmic reticulum was associated with the nucleus and mitochondria were observed close to the rough endoplasmic reticulum. Dubey *et al.* (2014) [3] reported in Harderian Gland of Indian jungle quail that the cytoplasm filled with secretory material, the vesicles show tendency to fuse among themselves before discharging the content by fusion with the apical plasma membrane. The nucleus was oval and rough endoplasmic reticulum was observed around the nucleus (Fig.7). In goose, KlećKowsKa-Nawrot *et al.* (2015) [5] reported large and small secretory vesicles in the cytoplasm, a large nucleus with condensed heterochromatin, abundant rough endoplasmic reticulum. The Golgi apparatus, mitochodria were found near the nucleus. The shape of the cells was same in all the age group but numbers of secretory vesicles inside the cells found more abundant in advanced age groups. The myoepithelial cells were found at the basal lamina with flat nucleus. They occupied the space in between the basal border of the secretory cell and inter tubular connective tissue (Fig.10 &11). The size of the myoepithelial cell was smaller than the secretory cell and spindle shaped. Klećkowska-Nawrot *et al.* (2015) [5] reported the presence of the myoepithelial cells at the basal lamina of the columnar secretory epithelium of the Harderian gland of Goose. The present findings were also in agreement with the findings of Brownscheidle and Niewenhuis (1978) [2] in rat and Bejdić *et al*. (2018) [1] in laying hen.

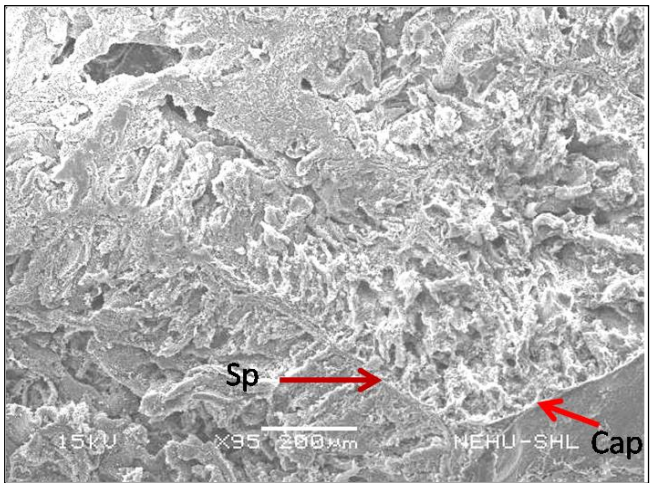

Fig 1: The scanining electron micrograph showing the Capsule (Cap) and Septa (Sp) of the Harderian gland of Pati Duck (0 week)

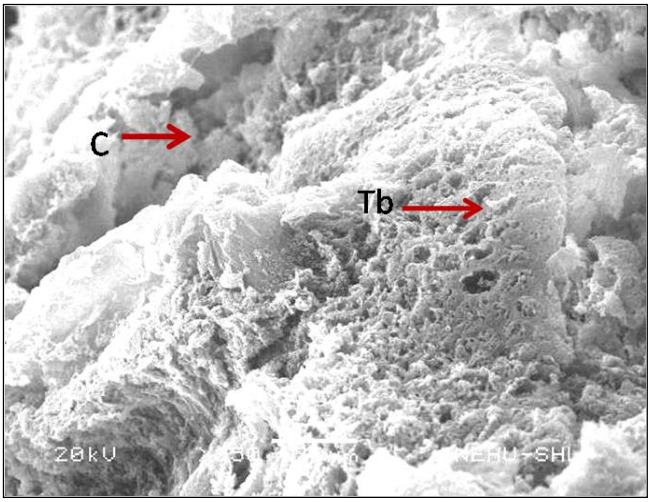

Fig 2: The scanining electron micrograph showing the cental Cannel (C)and Tubules (Tb) of the Harderian gland of Pati Duck (4 weeks)

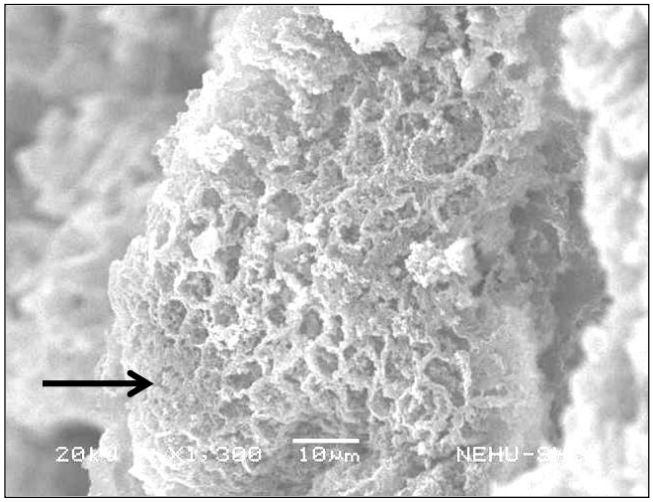

Fig 3: The scanining electron micrograph showing the secretion inside the tubule (Arrow) of the Harderian gland of Pati Duck (16 weeks)

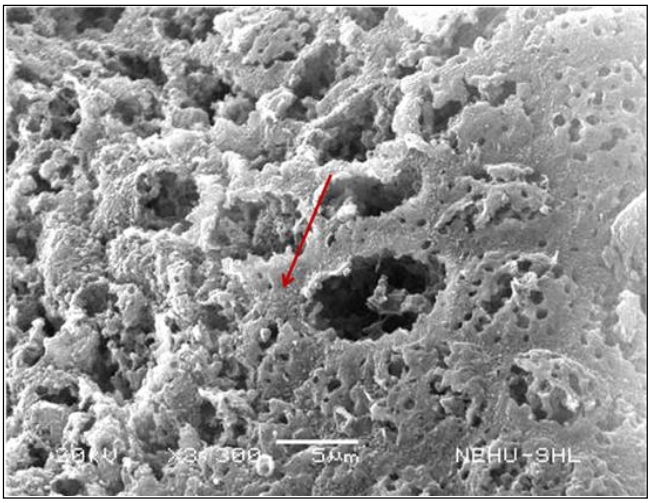

Fig 4: The scanining electron micrograph showing the secretion inside the tubule (Arrow) of the Harderian gland of Pati Duck (24 weeks)

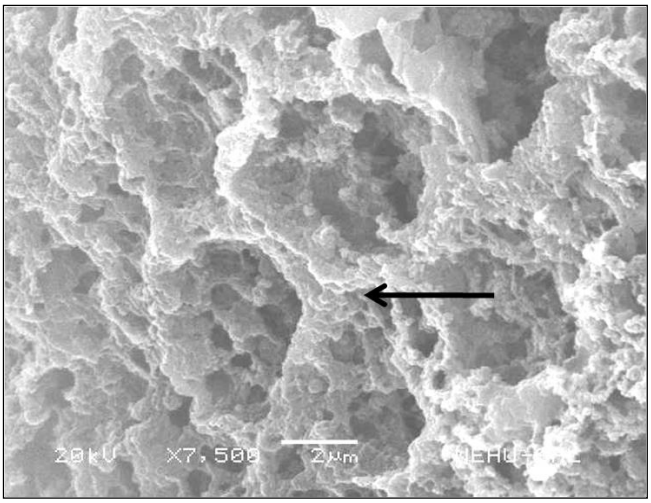

Fig 5: The scanining electron micrograph showing the secretion at the tip of the cell (Arrow) of the Harderian gland of Pati Duck (42 week)

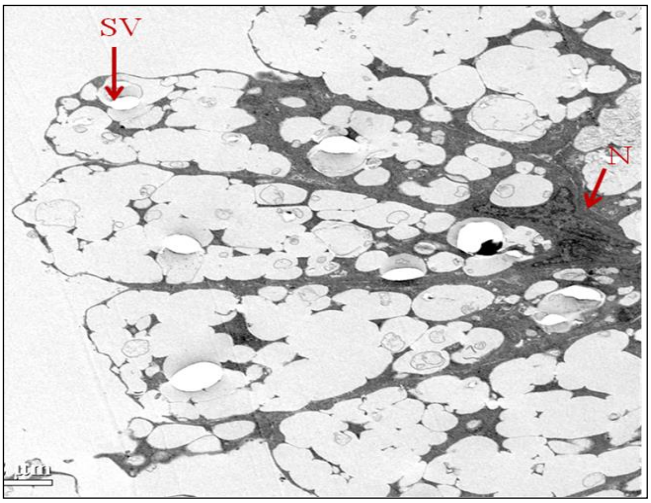

Fig 6: Transmission electron micrograph showing the secretory Sesicle (sv) & Nucleus (N) of the cell of the Harderian gland of Pati Duck, 4 weeks

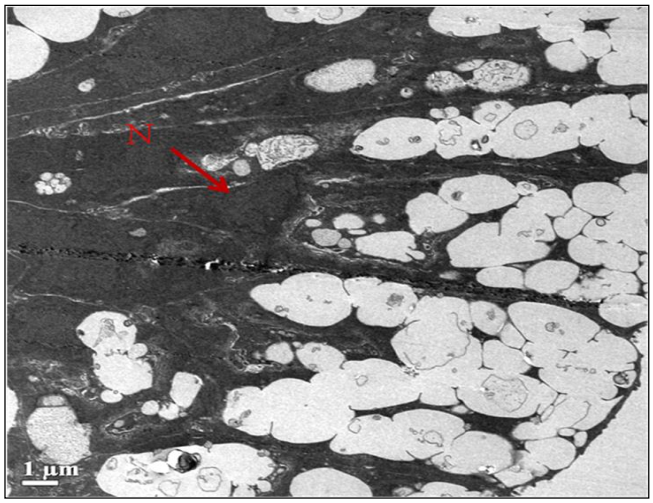

Fig 7: Transmission electron micrograph showing the Nucleus (N) of the cell of *Pati*duck, 16 weeks.

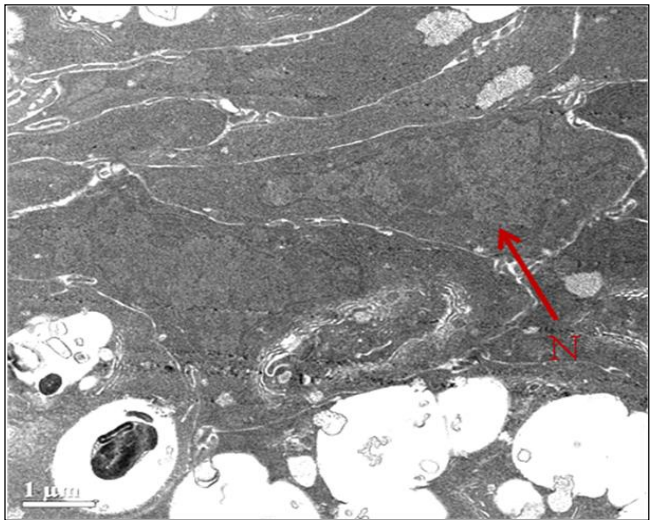

Fig 8: Transmission electron micrograph showing the Nucleus (N) of the cell of the Harderian gland of *Pati*duck, 24 weeks.

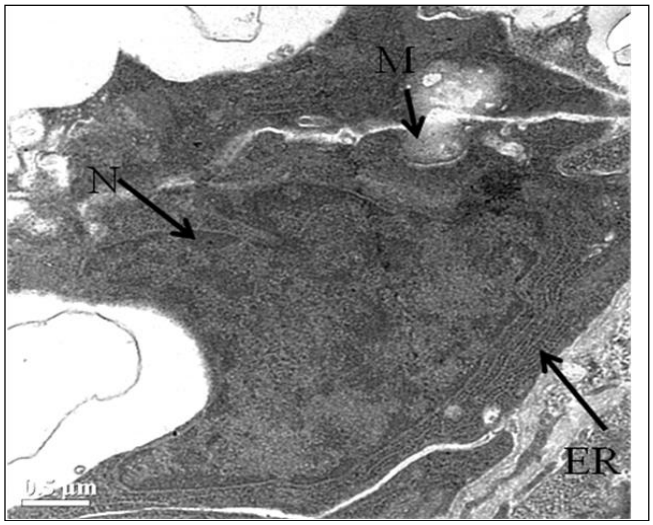

Fig 9: Transmission electron micrograph showing the Nucleus (N), Mitochondria (M) and Endoplasmic reticulum(ER) of the cell of the Harderian gland of *Pati*duck, 42 weeks.

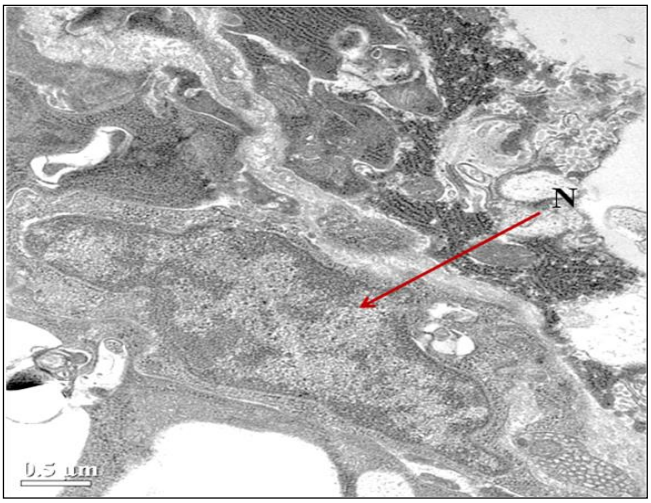

Fig 10: Transmission electron micrograph showing Nucleus (N) of Myoepithelal cell in transmission electron microscopic image of the Harderian gland of *Pati*duck, 0 week.

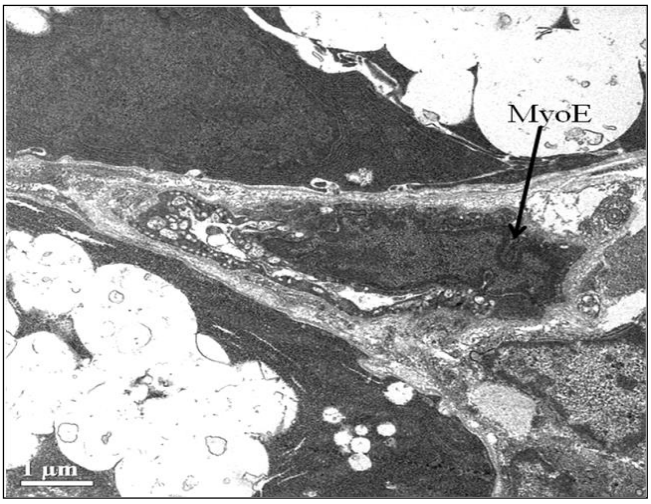

Fig 11: Transmission electron micrograph showing the Myoepithelial (MyoE) cell in transmission electron microscopic image of the Harderian gland of *Pati*duck, 24 weeks.

Conclusion

The present study demonstrated that the Harderian gland of Pati duck is organized into lobes and lobules by connective tissue septa, with age-related enlargement of tubular structures. The secretory epithelium exhibited apocrine mode of secretion, with accumulated material visible at the apical region and within the lumen, more prominently in older birds. Transmission electron microscopy confirmed simple columnar secretory cells filled with mucous vesicles that displaced the nucleus basally, along with well-developed rough endoplasmic reticulum and mitochondria. Myoepithelial cells were evident at the basal lamina. Overall, age influenced the secretory activity, supporting previous findings in other avian and mammalian species.

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