



HISTOCHEMISTRY OF THE RESPIRATORY SYSTEM IN KUTTANAD DUCKS (*Anas platyrhynchos domesticus*)*

A.D. Firdous¹, S. Maya², J. J. Chungath³
and N. Ashok⁴

Department of Veterinary Anatomy and Histology,
College of Veterinary & Animal Sciences,
Mannuthy, Thrissur,--680651

Received:25..02.2014

Accepted:21.06.2014

Abstract

A study on the histochemistry of the respiratory system was carried out in female Kuttanad ducks. The study was conducted in by 78 female birds from day-old to 24 weeks of age. The mucous glands and goblet cells over the respiratory system reacted positively to PAS and alcian blue. The intercellular matrix of the cartilages showed positive reaction for PAS, alcian blue and Safranin O. The nucleus and cytoplasmic granules of macrophages exhibited positive reaction for the acid phosphatase in the parabronchi.

Keywords: *Respiratory tract, histochemistry, Kuttanad duck*

The factors determining the designs of the vertebrate respiratory systems include the physiochemical characteristics of the respiratory medium used, the nature of habitat occupied and the lifestyle pursued. This in turn reflects the structural variations in animals and birds residing in a particular area. Studies on the histochemical architecture of the respiratory system in waterfowl are very less; hence this work was carried out to investigate the histochemical composition of the respiratory system in Kuttanad ducks.

Materials and Methods

Histochemistry of the respiratory system in the Kuttanad duck was studied using 78 female birds from day-old to 24 weeks of age. The material was collected from six birds in each group at fortnightly intervals from a single hatch reared at the university poultry and duck farm, Mannuthy under semi-intensive system of management. Immediately after collection, the material was fixed in 10 per cent neutral buffered formalin. The material was processed using routine procedures and paraffin sections of 5µm thickness were taken for histochemical studies. The sections were stained using Periodic acid Schiff's (PAS) and Alcian blue method for mucopolysaccharides, Best's carmine method for glycogen (Bancroft and Stevens, 1996), Gomori's method for acid phosphatase (Singh and Sulochana, 1996) and Oil Red' O' in propylene glycol method for fat (Luna, 1968).

Results and Discussion

The respiratory tract in Kuttanad ducks consisted of conducting part viz. nostrils, nasal cavity containing conchae, larynx,

* Part of PhD thesis submitted by the first author to the Kerala Veterinary and Animal Sciences University, Pookode

1. PhD scholar (corresponding author) Email: drromey@gmail.com
2. Professor and Head, CVAS, Pookode
3. Professor and Head (Retd)
4. Professor and Head

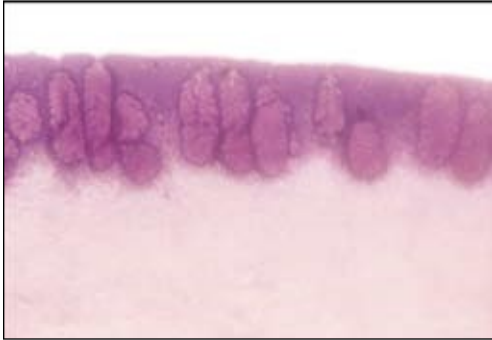


Fig. 1. Mucous glands of nasal cavity showing PAS positive reaction x 400

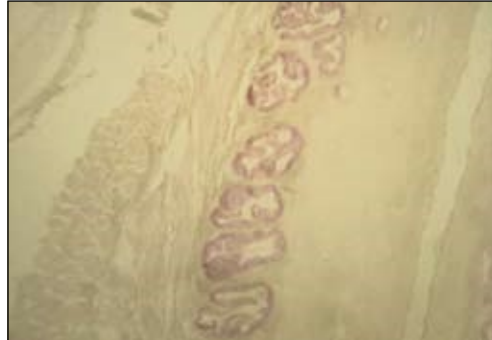


Fig. 2. Mucous glands of larynx showing PAS positive reaction x 400

trachea, syrinx, air sacs and respiratory part, the lungs. The conducting tract was lined with pseudostratified ciliated columnar epithelium with goblet cells. The mucous cells were aggregated as intraepithelial glands in conchae, larynx and trachea.

The mucous glands and goblet cells in the epithelial lining over the conducting part of the respiratory system reacted positively to PAS and alcian blue (Fig. 1 and 2). The parabronchi and airways distal to it showed mild reaction for PAS in the epithelium. Pal and Bharadwaj (1970) said that tunica propria submucosa of respiratory epithelium in chicken contained simple mucous glands reacted positively to PAS, alcian blue and toluidine blue stains and showed the presence of acid mucopolysaccharides. PAS and alcian blue (pH 1.0 and 2.5) demonstrated the presence of neutral and sulphated mucins secreted by goblet cells in the trachea of domestic fowl (Hodges, 1974).

The larynx and trachea presented different layers as epithelial lining, propria-submucosa, cartilage and tunica adventia. The cartilages throughout the respiratory tract showed positive reaction for Safranin O initially indicating the presence of chondroitin sulphate in the matrix. As the process of ossification started the cartilages became negative due to the reduction in the amount of cartilage matrix.

The nucleus and cytoplasmic granules of macrophages exhibited positive reaction for the acid phosphatase in the parabronchi. The surface of the epithelium lining the parabronchi exhibited scattered positive reaction for acid

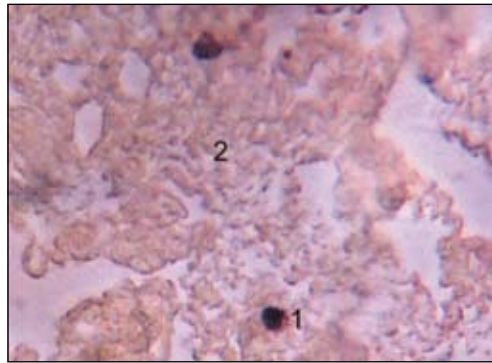


Fig. 3. Acid phosphatase positive macrophages in lung x 400

1. Macrophages 2. Lung parenchyma

phosphatase (Fig. 3). The acid phosphatase is the indication of phagocytic activity of macrophages as well as protective action of the lining epithelium of parabronchi. The epithelium lining the parabronchi also exhibited weak positive reaction for alkaline phosphatase. The luminal content of the parabronchi and atria contained small amount of fluid which showed a medium positive reaction for lipids indicative of the presence of the pulmonary surfactant. Harlan *et al.* (1996) demonstrated presence pulmonary phospholipid in birds similar in composition to mammals but occurring in lesser quantities. Tyler and Pearse (1996) carried out histochemical analysis of the lung lobule in birds and found that the epithelia of the tertiary bronchi and the atria gave strong reactions for the enzymes of the TCA cycle, the glycolytic scheme and the pentose cycle and high concentration of phospholipid.

References

- Bancroft, J. D. and Stevens, A. 1996. *Theory and Practice of Histological Techniques*. (4th Ed.). Churchill Livingstone, Edinburg, New York, 295p.
- Harlan, W. R., Margraf, J. H. and Said, S. I. 1996. Pulmonary lipid composition of species with and without surfactant. *Am. J. Physiol.* 211: 855-861.
- Hodges, R. D. 1974. *The Histology of Domestic Fowl*. Academic press, London. 648p.
- Luna, L. G. 1968. *Manual of Histological Staining Methods of the Armed Forces Institute of Pathology*. (3rd Ed.). McGraw-Hill Book Company, New York, 258p.
- Pal, C. and Bharadwaj, M. B., 1970: Histological and certain histochemical studies on the respiratory system of chicken. I. Nasal cavity, infraorbital sinus and larynx. *Indian J. Anim. Sci.* 40: 538-547.
- Sing, U.B. and Sulochana, S. 1996. *Handbook of Histological and Histochemical Techniques*. Premier Publishing House, Hyderabad, 111p.
- Tyler, W.S. and Pearse, A. G. E. 1996. Functional and analytical histochemistry of the chicken lung lobule with particular reference to surfactant. *Poult. Sci.* 45: 501-511. ■