Among the domestic birds, ducks become resistant to most common poultry diseases after 4th week of age. It is well known that the lymphoid tissue plays an important role in the defense against microorganisms. Cloacal bursa is the major primary lymphoid organ in birds that is responsible for production of immunoglobulins. Due to paucity of literature and the importance of immuno-competance of duck this research project was undertaken up to 4th week of age.

**MATERIALS AND METHODS**

To undertake the present investigation, six Khaki Campbell ducklings from day old to 4th week of age, irrespective of sex were collected from Gobardanga State Poultry Farms, North 24 Pargana, West Bengal. The birds were maintained in the animal house of the Department of Anatomy and Histology, with ad-libitum feed, drinking water and proper hygienic and managerial conditions. At a seven days interval, six birds of particular age were sacrificed for collection of samples. After collection, the samples were fixed in 10 % neutral buffered formalin and cleared in cedar wood oil. The sections (horizontal and vertical) of 5 µ were stained with routine hematoxylin and eosin, Van Gieson's method for collagen fibres, and Weigert's method for elastic fibres (Luna, 1968). Micrometry was done by using Leica Qwin Image Analyzer software in Leica DM 2000 microscope. The data collected for different characters were analyzed by Compare Mean Test with standard error by Tukey method (One Way ANOVA) and the significance (P value) of the test was recorded at 5% or 1% level and their interaction effects were further tested by LSD. The complete statistical analysis was made by using software SPSS, Windows version 10.0.

**RESULTS AND DISCUSSION**

In all the experimental age groups, the bursa of Fabricius was located on the dorsal aspect of cloaca and opened in to proctodeum at its dorsal surface (Fig. 1) as reported in fowl (Akter et al., 2006) and guinea fowl (Onyeanusi et al., 2007). The shape of the bursa was cylindrical to elongated and off white in colour (Fig. 1). A very small slit like opening was detected where the bursa opened in to the cloaca. it was described the bursa as pear shaped (Purushotham et al.,1989), as blind, globular shaped in fowl (Akter et al., 2006), oval blind sac in guinea fowl (Onyeanusi et al., 2007).

The average length, breadth and weight of bursa
were recorded (Table 1) in different age groups of duck. The average bursal weight and length increased linearly up to 4th week of age and it significantly varied from week to week. In case of bursal breadth, there was no significant difference between 3rd and 4th week. Bellamy and Mohamed (1982) reported that the bursa increased in size in relation to body weight during the first 3 weeks of life of the birds but there after underwent involution. Singh et al. (2006) also reported a progressive increase in weight according to the advancement of age in case of fowl.

The histological section of the bursa of Fabricius revealed that the gland was covered by a thin serosal layer. Four distinct layers were detected from periphery to inward right from the 1st week of age. The outer most serosal layer was composed of connective tissue fiber. It was mostly predominant in collagen fiber with few elastic fibres. The muscularis layer was formed by circularly and longitudinally arranged smooth muscle fibres. Major blood vessels and nerves were found within this layer. The mucosal layer was again divided into two components; connective tissue framework and follicles. The connective tissue was basically of a network of fine collagen, which surrounded the follicles. Few elastic fibres were also detected in wall of the blood vessels. The follicle associated epithelium was lined with a layer of cuboidal to tall columnar pseudostratified cells (Fig. 3). The central lumen of the organ was to a great extent obscured by the presence of plicae (Fig. 2). This observation was in accordance with Chakravarty and Sastry (1982) who reported that there were 10-12 smaller folds within the bursal lumen. The smaller folds had connective tissue trabeculae between lymphoid follicles. Average number of plicae in bursa was recorded (Table 2). The number of plicae increased with advancement of age although it was not significant in consecutive weeks. The plicae were found to be composed of several numbers of follicles. The number of follicles increased up to 4th week but there was no significance between 2nd and 3rd week. However, Purushotham et al. (1989) reported that the follicle diameter and the total number per section of plicae examined increased gradually and all the lymphoid follicles remained undifferentiated into cortex and medulla up to 30 days of age in case of fowl.

Bursal follicle had cortex and medulla (Fig. 2) being separated by a membrane which was composed of a large capillary network. Lymphocytes were present in the cortex and medulla. Few plasma cells were detected within the cortex. The diameter of the lymphocytes in the cortex was more as compared to that of medulla but less number of small to medium sized lymphocytes were also seen. The cortical region stained deeply basophilic. Fine arterioles, venules or capillaries were found to be present occasionally in the cortex. The medulla appeared to be almost completely devoid of blood capillaries. Average diameter of cortical and medullary lymphocytes of bursa was recorded. The diameter of cortical lymphocytes increased with age and highest diameter was recorded at 4th week and there was no significance between 1st to 3rd week. The average medullary lymphocytic diameter increased up to 4th week but it was insignificant. Onyeanusi et al. (2007) demonstrated about 12-14 number of plicae in case of guinea fowl. The population of immune-competent cells in the cortex of the bursal follicles was denser than in medulla.
This was in agreement with Akter et al. (2006). No atrophic or cystic follicles were observed up to 4th week of age. The plicae were lined by tall columnar pseudostratified epithelial tissue. Three cell types were identified. Type-I cell was found to be oval in shape with a clear round to oval shaped nucleus. These cells were distributed infrequently within this epithelium. This was noticed from 1st to 4th week of age. Type-II cells were numerous, rounded with an oval nucleus possessing single nucleolus. The cytoplasm was highly basophilic. Same observation was recorded up to 4th week. Type-III goblet cells were found but the number gradually decreased with the advancement of age (Fig. 3). Similar findings were recorded by Indu et al. (2000) in case of white pekin ducks.

Olah and Glick (1992) reported in case of turkey that the lining epithelium was supported by 3 to 5 layers of stratified epithelial cells, extension of cortico-medullary epithelial cells which was not in agreement with our present findings. Postnatal development of bursa indicated the maturity of cellular morphology with the increment of age and 4th week appeared as the most predominant age for functional competency of bursa in case of duck.

### REFERENCES


### Table 1. Mean±S.E. of different characteristics of cloacal bursa in ducks of different age groups

<table>
<thead>
<tr>
<th>Organ</th>
<th>1st week</th>
<th>2nd week</th>
<th>3rd week</th>
<th>4th week</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (gm)</td>
<td>0.09±0.002&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.16±0.002&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.20±0.002&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.22±0.003&lt;sup&gt;a&lt;/sup&gt;</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Length (mm)</td>
<td>13.43±0.170&lt;sup&gt;d&lt;/sup&gt;</td>
<td>17.06±0.039&lt;sup&gt;c&lt;/sup&gt;</td>
<td>22.49±0.033&lt;sup&gt;b&lt;/sup&gt;</td>
<td>27.01±0.062&lt;sup&gt;a&lt;/sup&gt;</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Breadth (mm)</td>
<td>0.09±0.037&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3.22±0.005&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.28±0.008a&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3.34±0.011a&lt;sup&gt;a&lt;/sup&gt;</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Body weight (gm)</td>
<td>67.83±0.22d&lt;sup&gt;d&lt;/sup&gt;</td>
<td>109.50±0.19c&lt;sup&gt;c&lt;/sup&gt;</td>
<td>142.50±0.38b&lt;sup&gt;b&lt;/sup&gt;</td>
<td>203.67±0.60a&lt;sup&gt;a&lt;/sup&gt;</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Mean values bearing common superscripts in a row do not differ significantly, where P<0.01

### Table 2. Mean±S.E. of number of bursal plicae and follicle in different age groups of ducks

<table>
<thead>
<tr>
<th>Organ</th>
<th>1st week</th>
<th>2nd week</th>
<th>3rd week</th>
<th>4th week</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follicle</td>
<td>65.00±0.027&lt;sup&gt;c&lt;/sup&gt;</td>
<td>81.16±0.036&lt;sup&gt;b&lt;/sup&gt;</td>
<td>89.33±0.037&lt;sup&gt;b&lt;/sup&gt;</td>
<td>110.83±0.042&lt;sup&gt;a&lt;/sup&gt;</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Plicae</td>
<td>7.83±0.030&lt;sup&gt;c&lt;/sup&gt;</td>
<td>10.66±0.050&lt;sup&gt;b&lt;/sup&gt;</td>
<td>12.16±0.065&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>14.00±0.075a&lt;sup&gt;a&lt;/sup&gt;</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Mean values bearing common superscripts in a row do not differ significantly, where P<0.01