CHAPTER 6

Histological observations of gonads and extra-gonadal tissues in Bank Myna and Brahminy Myna.

The annual rhythmicity in the reproductive cycle of the seasonally reproducing birds is also associated with the corresponding changes in the histological features of the gonads. Sex steroids play an important role in the structural development of testes and ovaries in birds (Clinton and Haines, 2001). In order to enunciate distinctly the morphological changes occurring in the ovaries and testes of the two species of Mynas studied, (Bank Myna, *Acridotheres gingianus*; Brahminy Myna, *Sturnus pagodarum*) which also reflects the variations in the hydroxysteroid dehydrogenase activities in various tissues (Chapters 1,2 & 3) and levels of steroid hormones in blood (Chapter 4), in the present chapter histological observations of gonads and also extra-gonadal tissues are noted during the pre-breeding, breeding, post-breeding and non-breeding phases of the reproductive cycle.

The avian ovary manifests the vertebrate ovarian pattern. Numerous ovarian follicles lined by granulosa layer, two thecal layers and the interstitial cells embedded in stroma (Bell and Freeman, 1971; Hodges, 1974; Clement, 1987). The yolk vesicles in the follicles in the central ooplasm are transformed into yolk bodies during the breeding phase of the reproductive cycle (Johnson, 1986a). During the breeding season, follicle cells are active in the secretion of lipids, glycogen, proteins and RNA, which are transported into growing follicles (Guraya, 1976).

The avian testes too, resemble the vertebrate pattern and consist of a mass of convoluted seminiferous tubules separated by interstitial tissue and a small number of Leydig cells (Hodges, 1974; Johnson, 1986b; Aire, 1997). The seminiferous tubule is lined by germinal epithelium consisting of sperm mother cells and non-germinal Sertoli cells. Connective tissue elements, blood capillaries and Leydig cells constitute the interstitial tissue. Seasonal morphological, histological and physiological changes taking place in the testes during the reproductive cycle of the birds provide useful index of their functional status.

In order to validate the cyclic histochemical changes observed in earlier chapters during the reproductive cycle of two species of Myna *i.e.*, Bank Myna and Brahminy Myna, histological changes and cytometric analysis of the testes and ovaries were also carried out. As observed in earlier chapters the variations in the HSDH activities of various non-gonadal tissues, the histological study of extra-gonadal tissues is also carried out to find out if any specific differences exist.

Ovaries :

The following types of ovarian follicles were identified and grouped in the Bank Myna and Brahminy Myna for specification as indicated below : (Hodges, 1974) :

1. Primary Oocytes: Smallest follicles devoid of any theca or granulosa layer (Chalana and Guraya, 1979a).
2. Developing and Mature Follicles: Well-developed granulosa layer with a single layer of cuboidal cells with round nuclei; broadened theca layer and conspicuous ovum nuclei.
3. Post-ovulatory Follicles: Thickened theca layer, sloughed granulosa cells into the centre, and regression is indicated with

growth of connective tissue from surrounding stroma of the ovary (Guraya and Chalana, 1976a).

4. Atretic Follicles: Follicles with ingrowths of the germinal epithelial cells is the first sign of follicular atresia. The oocyte becomes irregular in shape due to shrinkage and the granulosa layer gets detached from the basal lamina. The identity of the granulosa and theca layers is lost. Yolk and cellular debris are observed outside the oocyte (Gupta and Maiti, 1986; Guraya and Chalana, 1976b).

The histometrics of the ovarian follicles gave distinguishable differences between the pre-breeding, breeding, post-breeding and non-breeding seasons. Total counts of the follicles were made per season as primary oocytes, developing and mature follicles, post-ovulatory follicles and atretic follicles. Based on their size the follicles were categorized as : < 50 μm, 51-100 μm, 101-200 μm, 201-500 μm and > 500 μm.

Testes :

Tubule diameter: The diameter of the seminiferous tubules were estimated by measuring 25 tubules from each section with the help of an ocular micrometer. Perpendicular diameter of each tubule were measured, averaged and expressed as mean tubular diameter.

Observations:

Ovaries :

Pre-Breeding Season :

The ovaries weighed 51.16±10.46mg in Bank Myna and 30.69±3.95mg in Brahminy Myna (Table: 13&14). During this season, the primary oocytes below the range of 50μm diameter were 32.5% in

Bank Myna and 52.23% in Brahminy Myna. Though the developing follicles in the range of 51-100μm were almost same 17.5% in Bank Myna and 16.41% in Brahminy Myna, the percentage of follicles in the range of 101-200μm was significantly different in the two bird species. It was 22.5% in Bank Myna and 4.47% in Brahminy Myna. In the ovaries of the Bank Myna about 20% developing follicles was observed and 20.89% in Brahminy Myna in the range of 201-500μm. Only a couple of follicles in the range of 500μm or more were noted in the Bank Myna whereas only 5.59% follicles of this range were observed in the Brahminy Mynas. The % of atretic follicles was almost nil in both the Myna during this season [Plate LVII (a, e)].

Breeding Season :

During this season, the mean ovarian weight was 78.85±13.58mg in Bank Myna and 79.90±14.86 mg in Brahminy Myna (Table: 13&14). The percentage of the primary oocyte (<50 μm) decreased to 19.60% in Bank Myna and 15.66% in Brahminy Myna as compared to the previous season. The percentage of developing follicles ranging from 51-100μm and 101-200μm decreased to 13.7% and 17.64% respectively in Bank Myna and 13.04% and 22.89% respectively in the Brahminy Myna. Maximum numbers of matured follicles in the range of 201-500μm were present during this phase of the reproductive cycle *i.e.,* 39.21% in Bank Myna and 43.37% in Brahminy Myna. No follicles were found in the range of more than 500μm in both the Bank Myna and Brahminy Myna. Atretic follicles totaled upto 9.8% in Bank Myna and 6.02% in Brahminy Myna [Plate CVII (b, f)].

Post-Breeding Season :

The ovarian weight significantly decreased to 19.36±3.58mg in Bank Myna and 7.2±2.21 in Brahminy Myna (Table: 13&14). There was

an apparent increase in the number of small follicles in the range of <50μm during this phase; it was 37.5% in Bank Myna and 29.72% in Brahminy Myna. Among the follicles in the range of 201-500μm diameter, the percentage of mature follicles was higher (25% and 35.13% in Bank Myna and Brahminy Myna respectively) as compared to the developing follicles in the range of 101-200μm (3.12% in Bank Myna and 13.51% in Brahminy Myna). The follicles in the range of 500 *μm* or more were 15.62% and 8.1% in Bank Myna and Brahminy Myna respectively [Plate LVII (c, g)].

Non-Breeding Season :

The ovarian weight decreased to 18±3.69mg in Bank Myna and 10.88±2.39mg in Brahminy Myna (Table: 13 and 14). In the non-breeding season, the follicles in the range of below 50μm and in the range of between 51-100μm were 0% in both Bank Myna and Brahminy Myna. Few developed follicles still persisted and were seen scattered. An increase in the percentage of mature follicles in the range of 201-500μm was observed as 40.9% in Bank Myna and 55.55% in the Brahminy Myna. The quantum of atretic follicles also increased significantly during this phase; it was 40.9% in Bank Myna and 27.77% in Brahminy Myna as against 18.75% and 10.81% of the previous season [Plate LVII (d, h)].

Testes :

Pre-Breeding Season :

The mean testes weight during this season was 7±2.6mg in Bank Myna and 44±13.92mg in Brahminy Myna (Table: 15). During this phase, the mean diameter of the seminiferous tubule was 324.40±12.46μm which ranged from 126μm to 359μm in Brahminy Myna, however in the other

species, Bank Myna, the mean diameter was 318.46±24.62μm and ranged between 126 μm to 614.25μm. The seminiferous tubules were lined by sperm mother cells at the periphery and primary spermatocytes, secondary spermatocytes and spermatids had just started appearing in each tubule of testes of both the Mynas studied [Plate LVIII (a, e)].

Breeding Season :

During this phase the testes weight increased to 99.15±21.17mg in Bank Myna and 257.86±29.13mg in Brahminy Myna (Table: 15). The mean diameter of the seminiferous tubules was 350.36±13.01μm for Bank Myna, which ranged between 185.85μm to 472.50μm and that for Brahminy Myna was 265.08±17.41μm, which ranged between 189μm to 418.95μm. Morphologically, the tunica albuginea became stretched; the germinal epithelium consisted of spermatogonia, primary spermatocytes, secondary spermatocytes and spermatids, which showed different stages of spermatogenesis in both the species of male Myna. Sperm bundles were clumped close to the lumen of the tubules and blood vessels were prominently seen [Plate LVIII (b, f)].

Post-Breeding Season :

During this phase of the reproductive cycle the mean testes weight was 19.63±7.11mg in Bank Myna and 15.5±9.98mg in Brahminy Myna. This was corroborating with significant decrease in mean diameter of the seminiferous tubule, which was 104.42±12.92μm in Bank Myna and ranged from 94.5μm to 299.25μm and 302.2±14.87*μm* in Brahminy Myna, which ranged from 189μm to 393.75μm (Table: 15). The testes under went a regressive phase and this phase was marked by disruption of germ cells with necrotic debris in the lumen of the seminiferous tubules in both the species of Mynas [Plate LVIII (c, g)].

Non-Breeding Season :

During this phase, the testes weight further decreased significantly to 1.33±0.33mg in Bank Myna and 4.14±0.66mg in Brahminy Myna (Table 15). The mean diameter of the seminiferous tubules, which was 63.38±1.55μm in Bank Myna and ranged from 40.95μm to 75.60μm and in Brahminy Myna the mean diameter, was 60.49±5.2μm, which ranged from 44.10μm to 78.75μm. The testes became completely regressed during this season. This was indicated by compactly arranged seminiferous tubules lined by spermatogonia and the Sertoli cells and contraction of the tunica albuginea. The Leydig cells were prominent during this phase of the reproductive cycle [Plate LVIII (d, h)].

Extra - Gonadal Tissue :

Liver :

The hexagonal liver lobule with homologous cords of parenchymal epithelial cells arranged in a polygon can be seen in both the species of Myna [Plate LIX (a, e)]. Here a branch of portal vein and one of the branches of hepatic portal artery, both enclosed in connective tissue with bile ductules represents each corner of the polygon. In both the species of Myna bile canaliculi runs between the cords of epithelial cells of single cell thickness and forms a network throughout the entire parenchyma. Not much species-specific or sex-specific differences could be seen.

Intestine :

In both the species of Myna the basic avian pattern of histology of intestine is exhibited [Plate LIX (b, f)]. This consists of external

squamous epithelium, which has a thin layer of loose connective tissue with few elastic fibers and a network of blood vessels and nerves. Muscularis externa has a layer of longitudinal muscles, a narrow middle layer of connective tissue with elastic fibers, blood vessels and nerves and a thick layer of circular muscles. A not well-developed muscularis mucosa with outer longitudinal muscle layer and inner circular muscle layer is also present. The muscular fibers turn inwards to form the corium of villi. The intestinal mucosa is composed of finger-like projections (villi) at the base of which are present simple tubular glands, the crypts of Lieberkühn.

Kidney :

The kidneys in both the species of birds is elongated and irregular in shape and attached to the dorsal abdominal wall acquiring the shape of the bones in the pelvic region and other visceral organs. As in other species of birds, the kidneys can be divided into three regions: cranial, middle and caudal. Histologically, the kidneys of both the Mynas showed numerous lobules with cortical and medullary regions [Plate LIX (c, g)]. Cortical region is composed of Bowman's capsule with glomerulus and convoluted tubules where as the medullary region consists of collecting tubules.

Discussion :

Ovaries :

The study of histological changes in the ovaries and testes of the two Mynas reveals concurrent morphological variations with that of the hydroxysteroid dehydrogenase activities during the annual reproductive cycles (Chapter 1& 2). Noticeable changes were observed in the ovaries and testes of both Bank Myna and Brahminy Myna during

the Pre-breeding, Breeding, Post-breeding and Non-Breeding phases of the reproductive cycle. The rate of progression of follicles from the primary oocyte stage to the atresia in the developing ovaries in the hierarchical mode could be related with growth in different phases of the reproductive cycle. With the onset of the pre-breeding phase, the ovaries of the Myna showed the highest number of primary oocytes. Primordial oocytes in the range of 50μm and below are devoid of any distinct theca and granulosa cells which change with initiation of growth [Plate LVII (a, e)]. These small follicles may probably be the interstitial cells as observed in the House Sparrow ovaries (Guraya and Chalana, 1976b).

With further development in the breeding phase, a single layer of cuboidal granulosa cells with rounded nuclei was visible in both the species of Mynas [Plate LVII (b, f)]. Similarly a notable increase in the size of the oocyte nucleus from primordial follicle to yolky follicles with an increase in the height of the granulosa and its nuclear diameter were observed during the follicular growth of the ovaries in the Crow, *Corvus splendens* and Common Myna, *Acridotheres tristis* (Chalana and Guraya, 1979a) and in the Pied Myna, *Sturnus contra contra* (Gupta and Maiti, 1986). During the rapid growth phase of oocyte, there is a 13-fold increase in the surface area of the ovarian follicle and the 5-fold increase in granulosa cells (Gilbert *et al.*, 1980). The appearance of conspicuous theca layers in the developing follicles during the late pre-breeding and early breeding phases [Plate LVII (a, b, e, f)] in both the Mynas are an indicative of the beginning of regenerative phase or gearing up of the ovaries for steroidogenic activities. This can be correlated with the results in Chapters 1 and 2, which indicate positive 3β-HSDH and 17β-HSDH activities in the theca and granulosa layers during these stages of the reproductive cycle (Chapter 1 & 2; Table: 1&3). Studies on the role of steroid production

by the theca layers have revealed that in avian species these layers produce both testosterone as well as estradiol though it is not known whether they are produced by the same cell type (Porter *et al.*, 1989). Further the same workers have described the granulosa layer to be the principal source of progesterone and it is more pronounced during the post-breeding season in the female Myna where 3β-HSDH and 17β-HSDH activities are the highest as compared to other phases of the reproductive cycles.

With the progression to post-breeding season, once again the small follicles in the range of 50μm and below were seen in large numbers [Plate CVII (c, g)](Table: 13&14). The building up of the interstitial gland cells in this phase is closely related to the atresia of the follicles of variable sizes and these cells accumulate lipid droplets consisting of cholesterol, the steroid precursors (Guraya and Chalana, 1976b). The same can be ascertained by the presence of 37.5% and 29.72% small follicles in the range of 50μm and below in Bank Myna and Brahminy Myna respectively.

The absence of follicles within the range of 100μm was noted and regressing mature follicles with an increase in the post-ovulatory follicles were observed. The matured follicles in the range of 201-500μm were in large numbers (Table 13&14). These mature follicles were probably those follicles, which did not ovulate during the breeding phase. These follicles are expected to undergo shrinkage and simultaneously get disorganized resulting in atresia. Of the developing follicles, only small percentages eventually matures fully and ovulate and the majority undergo follicular atresia while still at the stage of maturation (Farner and King, 1983). In the later part of the post-breeding and in the non-breeding phases there was an increase in the number of atretic follicles with mild 3β-HSDH and sparse 17β-HSDH activities. As mentioned in Chapter 1 & 2, once atresia sets in there is

a loss of steroidogenic activity in the follicles as seen in both the female Mynas. Similar correlation of the morphological changes in the ovaries of the related species, Pied Myna, *Sturnus contra contra*, have been made indicating that the breeding phase showed sharp increase in the follicular diameter, the post-breeding phase showed gradual regression of the matured follicles and finally the non-breeding phase where the percentage of all the follicles decreased considerably (Gupta and Maiti, 1986).

Testes :

The testes of the both Bank Myna and Brahminy Myna showed identical changes during the pre-breeding, breeding, post-breeding and non-breeding phases of the reproductive cycles. During the pre-breeding season compactly arranged numerous seminiferous tubules and the interstitial tissue tightly packed with Leydig cells were observed [Plate LVIII (a, e)]. Germinal layer was flat and spermatogenesis was not yet initiated but there was an initial build up of 3β-HSDH and 17β-HSDH in the germinal layer of the seminiferous epithelium (Chapter 1 & 2).

As the testes advanced to the breeding season, the spermatogonia (sperm mother cells), known to act as germ cell reservoir for the successive spermatogenic activities (Johnson, 1986b) were very distinct in the seminiferous tubules [Plate LVIII (b, f)]. Similar structural and morphological changes were also observed in the developing testes of hen (Hodges, 1974; Pudney, 1995; Lin *et al.*, 1990), Japanese quail (Lin and Jones, 1990) and Munia (Saha, 1984). Primary spermatocytes, secondary spermatocytes and spermatids are found in the peripheral layers of the tubule and sperm bundles were clustered in the lumen in both the Mynas [Plate LVIII (b, f)]. This is also reflected by increase in the tubule diameter (Table: 15). In another

sturnid, the migratory Starling, *Sturnus roseus*, similar observations of increase in the diameter of the seminiferous tubule with increase in the testes size as the breeding season advanced were noted (Naik and George, 1964). During the first week of April, just before the Starlings migrate back for breeding, the primary and secondary spermatocytes appeared in abundance and the interstitial cells reduced in number with the development of spermatids and spermatozoa. Similar distinct cellular associations and spermiogenesis were also observed in the seminiferous epithelium of migratory wagtails, *Motacilla alba* and *Motacilla flava* (John and George, 1966) in the Guinea fowl, Numida meleagris (Aire *et al.*, 1980) and domestic quail, *Coturnix coturnix japonica* (Artoni *et al.*, 1997, 1999). The activities of the 3β-HSDH and 17β-HSDH in the testes were higher during this phase of the breeding season. The Leydig cells which attain maximum size also showed an increase in the steroid synthesizing activity (Chapter 1 & 2).

With the progression to post-breeding season the testes of both the Myna showed regressive change with necrotic debris of the spermatocytes and spermatids clustered in the lumen of the seminiferous tubule [Plate LVIII (c, g)], compactly arranged interstitial cells of Leydig and decreased testes size. Similar changes were observed in the testes of non-mammalian vertebrates (Pudney *et al.*, 1995), emu (Malecki *et al.*, 1998) and roosters (Rosenstrauch *et al.*, 1998). Moderate localizations of the steroid dehydrogenases were observed in the accumulated necrotic debris in the lumen of the seminiferous tubules (Chapter 1 & 2).

As the testes started entering the refractive period in the non-breeding phase, no spermatogenic activities were present in the seminiferous tubules. Leydig cells were compactly arranged [Plate LVIII (d, h)] and the testes weight was the lowest as compared to other phases of the reproductive cycle. The regressed testes now showed

apparently no 3β-HSDH and 17β-HSDH enzyme activity during this phase of the reproductive cycle (Chapters 1 & 2).

Extra-Gonadal Tissues :

Of recent, involvement of extra-gonadal tissues like, liver, intestine and kidneys in steroid metabolism is being investigated by various groups of scientists (Salomaa *et al.*, 1989; Belverde *et al.*, 2001; Chapters 1, 2 and 3). To substantiate this work when an attempt is made in earlier chapters to evaluate the involvement of the same in birds, it becomes important to know their histological structure and any species-specific or sex-specific variation over the reproductive cycle.

Liver :

In both the species of Myna, the liver has a typical avian lobular pattern with cords of epithelial cells and radially dispersed lacunae with branches of hepatic veins and blood vessels. Hodges, (1974) and Tsuniki *et al.*, (1981) have described similar structure in fowl liver with the hepatic plates predominantly one celled thick, which could be observed in the Myna too. Though the enzyme activities as observed in earlier chapter (Chapters 1, 2 & 3) varied during various phases of the reproductive cycle in the seasonally breeding species of Myna, no variations could be noted in the histological structure of the liver.

Intestine :

In both the species of Myna, no major differences could be seen in the histological structure from the basic avian pattern described by Humphary and Turk (1974) and Hodges (1974). As described in previous Chapters, the epithelium of villi shows positive steroid

dehydrogenase activities during all the phases of the reproductive cycle.

Kidney :

As observed in mammalian kidneys, there is no distinct cortical and medullary region in avian kidneys (Hodges, 1974; Siller, 1983). However there are three distinct lobes of kidneys, which have several lobules with cortical and medullary regions forming a cone. The cortical tissue extends in the depth of and surrounds the medullary cone. These regions can be clearly seen in the sections of kidneys of the two species of Myna studied. The glomerulus is seen as a compact mass of mesengial cells with large irregular nuclei. The convoluted tubules appear as rounded tubules packed together along with glomeruli. This is the region where variations in HSDH activities were observed during the reproductive cycles of the Myna (Chapter 1, 2, 3 & 5). Though the variations are observed in enzyme activities, no morphological or histological variations were noted in the kidneys during the various stages of the reproductive cycle.

From these observations on the histological studies on liver, intestine and kidneys along with the testes and ovaries it can be said that though there are seasonal variations in the steroidogenic activities and lipoid accumulation in the extragonadal tissues in the two seasonally breeding species of birds, no histological differences are seen in the tissues from the typical avian pattern.

Table 13: Mean diameter and percentage of ovarian follicles of various stages in Bank Myna during the reproductive cycle.

	Pre-Breeding		Breeding		Post-Breeding		Non-Breeding	
	Mean±SD	%	Mean±SD	%	Mean±SD	%	Mean±SD	%
<50 µm	32.5±6.62	32.50	29.25±5.62	19.60	0	37.5	0	0
51-100 µm	72.4±5.66	17.5	69.64±5.9	13.7	0	0	0	0
101-200 µm	144.35±10.47	22.5	140.33±12.49	15.64	195±0	3.12	136±22.51	18.88
201-500 µm	265.68±25.23	20	313.90±18.72	39.21	351.75±30.3	25	314.33±22.92	40.90
>500 µm	0	2.5	0	0	756.6±39.34	13.62	0	0
Total %		95.0		90.19		81.25		59.09
% of atr. foll		5		9.8		18.75		40.90
Ovary weight	51.16±10.46	-	78.85±13.58	-	19.36±3.58	-	18.00±3.69	-
Body weight	61.50±1.93	-	52±2.86	-	52.46±0.92	-	56±1.97	-

Table 14: Mean diameter and percentage of ovarian follicles of various stages in Brahminy Myna during the reproductive cycle.

	Pre-Breeding		Breeding		Post-Breeding		Non-Breeding	
	Mean±SD	%	Mean±SD	%	Mean±SD	%	Mean±SD	%
<50 µm	38±0	52.23	19±0	15.66	31.90±2.98	29.72	0	0
51-100 µm	76.22±4.14	16.41	70.2±5.3	13.04	58.5±0	2.70	0	0
101-200 µm	130.0±13.24	4.47	151.39±7.02	22.89	139.9±13.14	13.51	155.5±14.84	11.11
201-500 µm	348.21±20.96	20.89	275.14±10.35	43.37	331.5±14.84	35.13	367.25±14.84	55.55
>500 µm	633.75±20.29	5.59	0	0	526±0	8.10	975±0	5.55
Total %		100		93		89.18		72.22
% of atr. foll		0		6.02		10.81		27.77
Ovary weight	30.69±3.95	-	79.90±14.86	-	7.2±2.21	-	10.88±2.39	-
Body weight	37.84±2.76	-	32.38±7.65	-	37.66±7.65	-	39±4.70	-

Table 15 : Seasonal variations in the seminiferous tubule diameter, testes weight and body weight of Bank Myna

Months	Bank Myna				Brahminy Myna			
	Tubule Diameter	Testes weight		Body Weight	Tubule Diameter	Testes weight		Body Weight
		Left	Right			Left	Right	
Pre-Breeding	318.46±24.62	7±2.6	4.75±1.25	66.22±2.11	324.40±12.46	44±13.92	53.5±13.5	41.47±2.9
Breeding	350.36±13.01	99.15±21.17	67.13±14.526	58.5±2.99	265.08±17.41	257.86±29.13	248.93±28.57	40.08±3.33
Post-Breeding	104.42±12.92	19.63±7.11	14.44±5.26	56.86±1.19	302.2±14.87	15.5±9.98	5.54±0.97	43.45±2.11
Non-Breeding	63.38±1.55	1.33±0.33	1.55±0.36	62.08±1.63	60.49±5.2	4.14±0.66	3.91±0.49	41.5±1.69

Mean±SD

Plate LVII

Histology of **ovaries** in Bank Myna, *Acridotheres ginginianus*, and Brahminy Myna, *Sturnus pagodarum*.

Bank Myna	**Brahminy Myna**
a. Pre-Breeding Phase (500X)	e. Pre-Breeding Phase (500X)
b. Breeding Phase (800X)	f. Breeding Phase (800X)
c. Post-Breeding Phase (800X)	g. Post-Breeding Phase (800X)
d. Non-Breeding Phase (800X)	h. Non-Breeding Phase (800X)

Abbreviation :
Tl : Theca Layer ; G : Granulosa

PLATE **LVII**

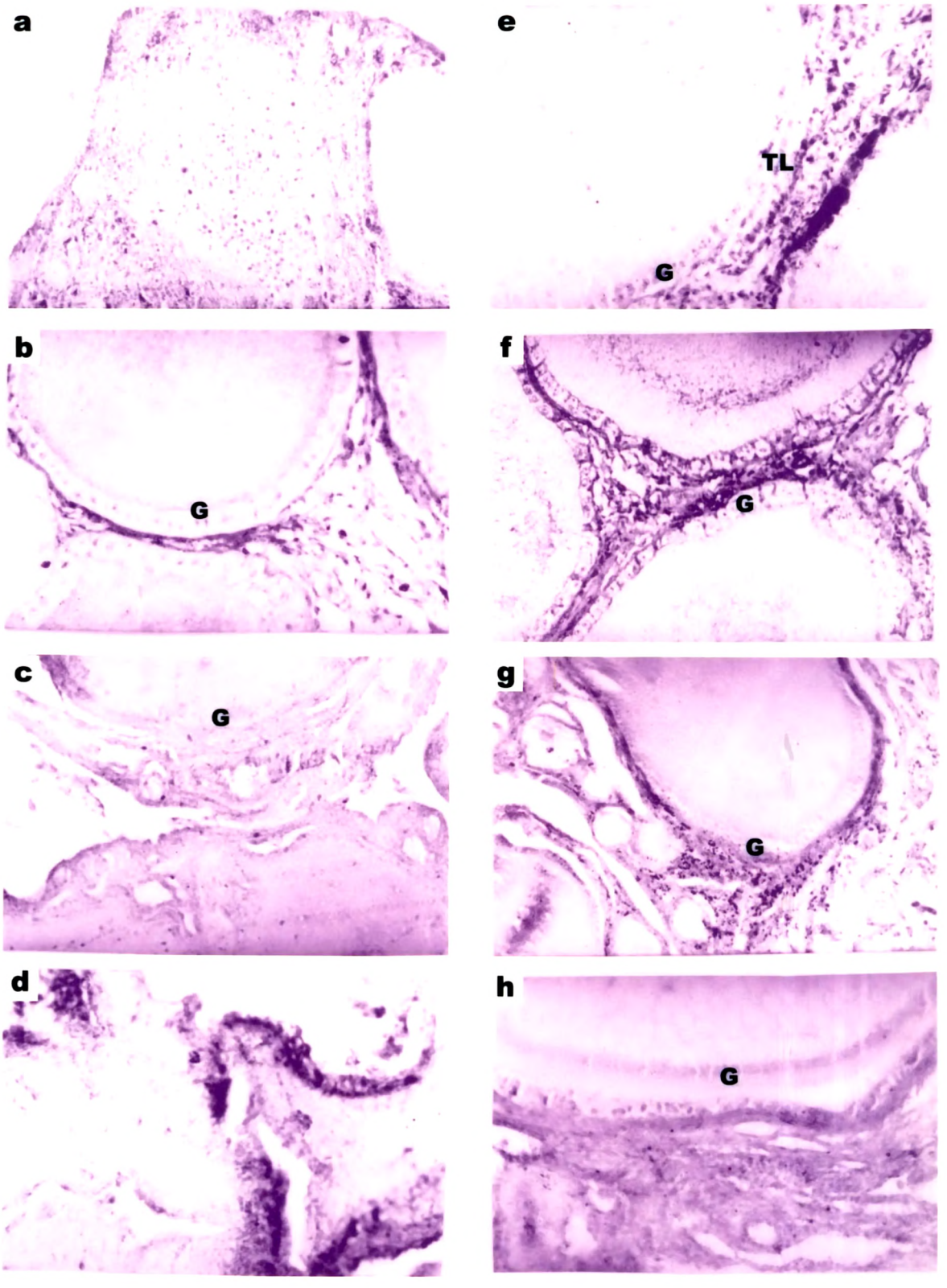


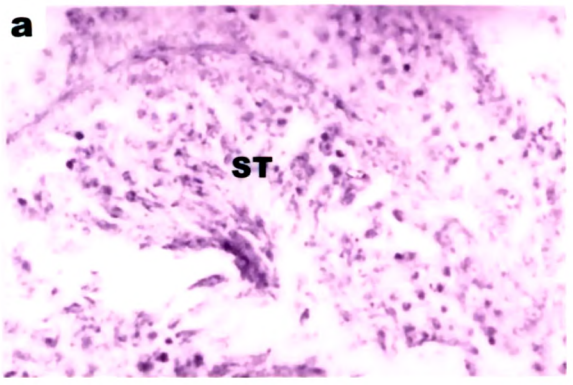
Plate LVIII

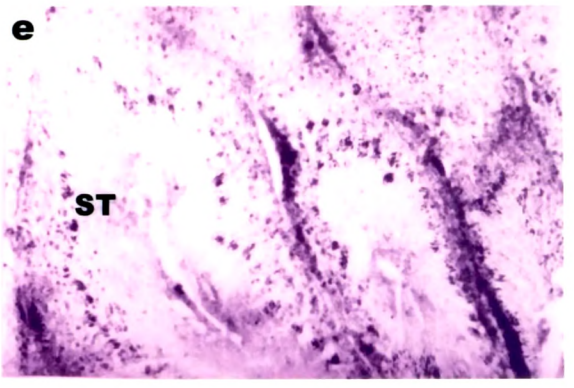
Histology of **testes** in Bank Myna, *Acridotheres ginginianus*, and Brahminy Myna, *Sturnus pagodarum*.

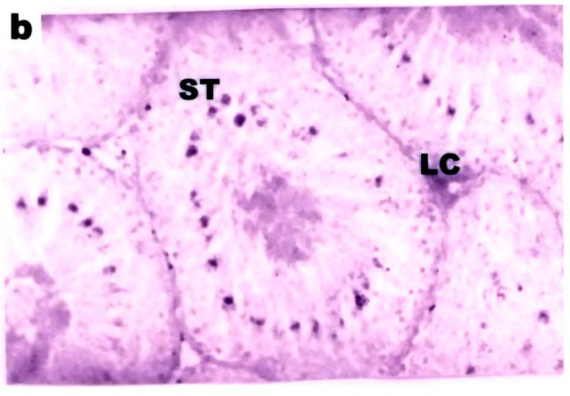
Bank Myna	**Brahminy Myna**
a. Pre-Breeding Phase (500X)	e. Pre-Breeding Phase (500X)
b. Breeding Phase (800X)	f. Breeding Phase (800X)
c. Post-Breeding Phase (800X)	g. Post-Breeding Phase (800X)
d. Non-Breeding Phase (800X)	h. Non-Breeding Phase (800X)

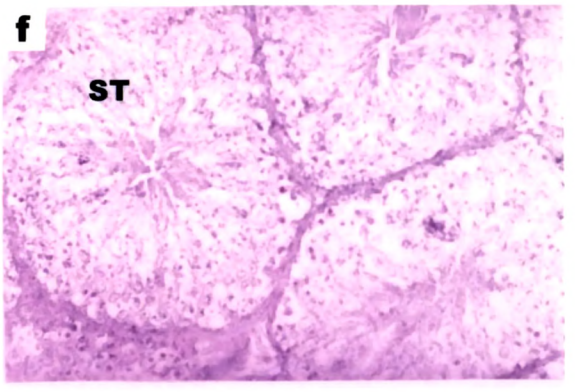
Abbreviation :
ST : Seminiferous Tubule ; LC : Leydig Cells

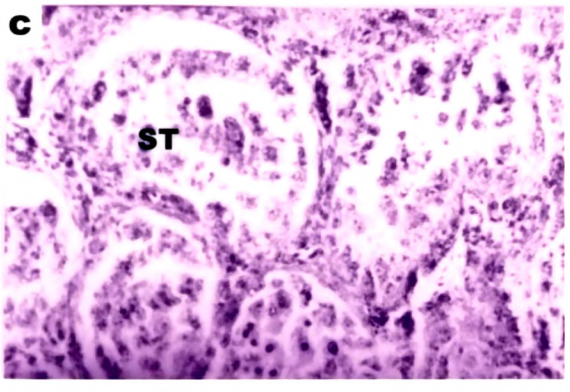
PLATE **LVIII**

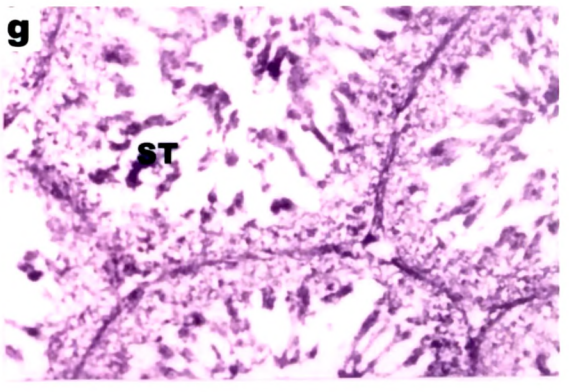


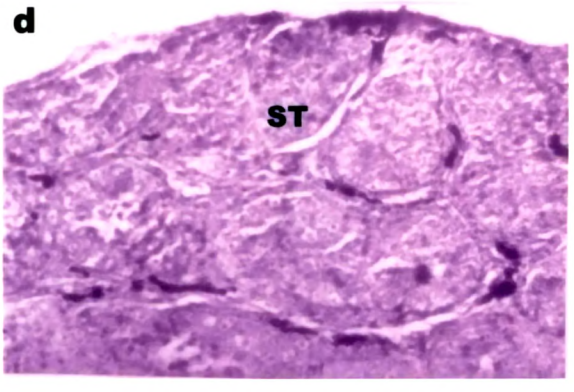












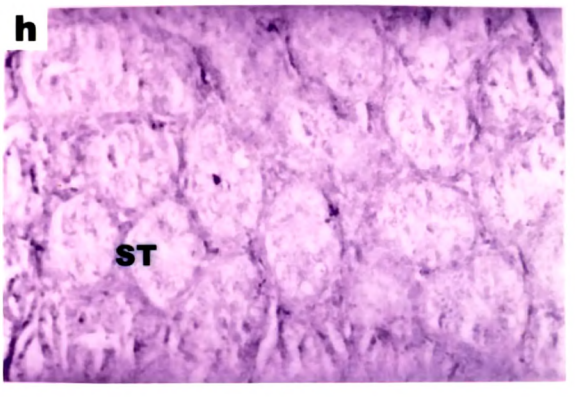


Plate LIX

Histology of **extra-gonadal tissues** in Bank Myna, *Acridotheres ginginianus*, and Brahminy Myna, *Sturnus pagodarum,* during the reproductive cycle.

Bank Myna {♀ and ♂}

a. Liver (500X)

b. Intestine (800X)

c. Kidney (800X)

Brahminy Myna {♀ and ♂

d.Liver (500X)

e.Intestine (800X)

f.Kidney (800X)

Abbreviation :
EV : Epithelium of villi ; IG : Intestinal Glands ;
NT : Nephric Tissue ; G : Glomerulus

PLATE **LIX**