CHAPTER : 5

Discussion:

During this investigation, spontaneous occurrence of conditions and their histopathological alterations in lung, trachea, heart and spleen in quails were studied. Hematological values on certain parameters were also determined.

In general the results obtained during the present study are in accordance with that described by the different workers and researchers in India and abroad, still there are variations especially in the frequency of occurrence of different pathological conditions and the hematological values, which may be due to the local environmental conditions and the management of farms. One of the reasons for these differences might be that most of the reported works have been carried out under experimentally induced conditions. Only a few works are there which describes spontaneous occurrence of hematological and pathological changes.

Hematology

Normal Hematology

During the present study it was observed that Hb, PCV, total RBC count and total WBC count increased with age. Hematological values for these parameters were slightly lower in young and older quails than adults. Highest value for Hb (11.33 %) was recorded in quails belonging to age group 16-20 weeks. Quails of age group 11-15 showed highest values for all other parameters (PCV- 34.50%,
RBC- 4.31 million / cu mm and WBC- 25.0 Thousand / cu mm) though the difference for RBC counts between age group 11-15 (4.31 million/cu mm) and 16-20 (4.30 million/cu mm) was negligible. In young quails (1—4 week age) these values are slightly lower (Hb 8.22%, PCV 28.95%, RBC 3.31 million/cu mm and WBC 18.90 Thousand/cu mm) and increased gradually with the advancement of age. In older quails (21-24 weeks age) these values were again slightly lower (Hb 9.23%, PCV 30%, RBC 3.33 million/cu mm and WBC 18.95 Thousand/cu mm) than the adult quails of age group 5-10 weeks (Hb 11.15%, PCV 31.7%, RBC 4.2 million/cu mm and WBC 24.19 Thousand/cu mm), quails of age group 11-15 weeks (Hb 11.16%, PCV 34.50%, RBC 4.31 million/cu mm and WBC 25.0 Thousand/cu mm) and quails of age group 16-20 weeks (Hb 11.33%, PCV 34.20%, RBC 4.30 million/cu mm and WBC 22.97 Thousand/cu mm).

Several workers have reported normal hematological values for chickens and quails. Some hematological alterations under specific conditions like dietary changes, effect of toxicant etc. have also been reported. Dukes, (1931), Kai and Prankline (1984) and & Islam (2004) have reported normal hematological values on certain parameters in chickens where as Kundu et.al. (1993) have reported it in Japanese quails( 1.5 month old, 3 months old and laying females and one year old quails). The general result discussed by Kundu et.al. is that the Hb, PCV, RBC & WBC values were lower in young quails than adults. Laying females had lower values for these parameters than adult males and in older quails values for all these parameters studied were low. In quails also the same trend is found in the present research work. Gradual increase in the values of Hb,
PCV, total RBC and WBC count with the advancement of age in this study was consistent with the findings of Kundu et al. Results are in accordance with Dukes (1955) and Kai and Pranklin (1984) also who reported that erythrocyte number was lower in early age and increased with advancement of age.

Liza Paul (1997) has reported normal hematological profiles in quails. The values reported by her are Hb 11% (normal range 11-15%) PCV 42% (Normal range 30-45%) RBC 4.7 x 10^{12}/L (normal range 4-55 x 10^9/L) and WBC bet 12.5 to 25.0 x 10^9/L. Similar values for Hb (11%), PCV (42%), total RBC count (4.7 x 10^{12}/L) and total WBC count between 12-25 x 10^9/L are reported by Leonard and Rosskopf (1982). The values of these parameters in present study are slightly lower than the values reported by Liza Paul and Leonard. The normal range found during the present study was Hb (8.22-11.33%), PCV. (28.95-34.50%), RBC (3.31-4.31 million/cu.mm.) and WBC (18.90-25 thousand /cu mm.). The average lowered hematological values may be due to several factors i.e. environment, nutrition and management procedures.

Islam et al. (2004) published normal hematological values in local breed of chicken from Bangladesh (Sylhat area). They reported Hb 7-9.37%, PCV 26.5-34.6%, total erythrocyte count 1.7-3.46 x 10^9/L. It shows that the chickens have significantly lower range of values for these parameters than the quails. It may be due to involvement of genetic factors.

**Effect of high temperature on Hematological Values:**

Quail are sensitive to high temperature. It affected them adversely. During the present study in the last week of month of May 2005 when the temperature was about 45^0C, in the afternoon, some
healthy quails died suddenly due to heat stroke. Heat stroke affected quails showed slightly higher values for all the hematological parameters (Hb 12.31%, PCV 39%, Total RBC count 4.67 million/cu mm and Total WBC count 27.0 Thousand/cu mm) as compared to normal mean values (Hb 10.20%, PCV 31.87%, Total RBC count 4.09 million / cu mm and Total WBC count 22.0 Thousand / cu mm).

Not much literature is available on the effect of high temperature on blood parameters. Bhattacharya (1990) reported short-term thermal stress on some hematological constituents in Japanese quail. He reported that heat exposed groups of quail has significantly higher value of Hb, PCV and total RBC count. According to him the quails were also showing respiratory stress.

Results of present investigation are in agreement with the findings of Bhattacharya (1990). All the hematological parameters showed higher values than normal. Total WBC count was also observed to be higher.

Ozbey et al. (2004) have reported effect of high temperature on certain blood serum parameters in Japanese quail. They observed that that the higher temperature increased certain blood serum parameters such as Na, cholesterol and uric acid and reduced blood serum protein and albumin. Sinovec et al. (1992) and Yashwant Singh et al. (2003) reported that quails on high salt water showed hemoconcentration with increased Hb, PCV and total erythrocyte count. It means that the increased values of hematological parameters (hemoconcentration) found during the present study might be due to increased blood serum electrolyte as a result of loss of water caused by high temperature. Bashir et al. (2005) have also reported increased RBC, PCV and Hb.
concentration due to increased serum electrolyte in alcohol fed quails.

Yulu et al. (1998) reported the similar findings of heatstroke on broiler chickens while Gupta and Hore (1999) reported effect of high temperature on albino rats.

Effect of coccidiosis on Hematological Values:

The values of Hb (7.5%), PCV (27.3%) and Total RBC count (3.1 million/cu mm) were low in quails affected with coccidiosis than the normal mean values (Hb 10.20%, PCV 31.87% and Total RBC count 4.09 million/cu mm). It was due to hemorrhage and diarrhea causing reduction in weight gain due to loss of water and decreased feed utilization. Total WBC count (27.7 Thousand/cu mm) was higher than the normal mean value (22.0 Thousand/cu mm).

Awadala et al. (1998) reported similar findings from Egypt. They reported lower Hb values; total RBC and total WBC count in quails affected with coccidiosis. The results of present study are in agreement with the findings of Awadalla et al. as far as Hb and total RBC count are concerned but the total WBC count was increased slightly as compared to normal value (table 1). However Looszova et al. (2001) have reported increased TLC (significant increase in lymphocytes and leukocytes) in chickens due to E. colchici and E. tenella. Kadam et al. (2002) from Parabhani, Maharashtra have also reported increased WBC count and decreased Hb, RBC and PCV values in chickens affected with coccidiosis. Lower Hb and PCV values in quails affected with Eimeria species also coincide with the findings of Rao et al. (1995).
Observation of fecal sample (Coccidiosis):

Coccidiosis due to *Eimeria* is quite common in quails. It is an important disease because it not only causes hematological alterations but the endogenous stages of parasite are also associated with intestinal lesions. Stages of oocyst were found developing in the epithelial lining of the intestine and also in faces. Various workers (Dimerdash et. al.1984, Ruff et.al.1988, Awadalla et.al. 1998, Corton et.al. 1999) have reported occurrence of coccidiosis due to different species of *Eimeria* in quails as well as in chickens. Teixeira et.al. (2004) have reported coccidiosis in Japanese quails and identified *Eimeria species* as *E. tsunodai; E. uzura* and *E. bateria*. They also reported presence of oocysts in the faces.

Results depict that out of total 501 quails observed 128 quails were found infected with coccidiosis. Mortality observed was 15.62% (20/128 quails).

Severely high mortality rate (55.55%) has been reported by Rai et.al. (1989) from Andaman due to coccidiosis. Alan Kokan et.al. (2003) from Okahama reported 28% quails in the flock were infected by *Emeria species*. During the present study the mortality due to coccidiosis found in Japanese quail was 15.62% and morbidity 25.34%. The difference may be due to climate and management of farm. It also depends on the age of quails in the flock because it is found that young quails are more susceptible to *Eimeria* infection. Awadalla et.al. noticed that the dietary aflatoxins adds to the severity of coccidial infection and mortality.
The occurrence of coccidiosis was found more during monsoon season as also reported by Panda et al. (1997). They reported prevalence of coccidiosis in the month of June/July From Bhubaneswar.

Quails affected with coccidiosis presented clinical signs like dullness, depression and bloody diarrhea. Gross lesions noticed were ballooning hemorrhagic patches and congestion in intestine, thickening of cecal wall and presence of numerous petechiae on the surface of intestinal mucosa. Microscopically necrosis, infiltration of leukocytes, loss of intestinal epithelial lining and presence of schizonts in intestinal epithelial lining was observed.

In present study the histopathological changes found in coccidiosis are in accordance with Panda et al. (1989). They reported common gross lesions like hemorrhagic spots, enteritis, ballooning and bleaching of intestinal ceaca due to coccidiosis. Teixireira and coworkers (2004) also mentioned the intestinal lesions due to *Eimeria* infection. They reported erosion of villous epithelium in intestine, hyperplasia of crypts of liberkuhn and infiltration of granulocytes and mononuclear cells associated with edema.
ORGAN PATHOLOGY:

LUNG

Histopathological observations revealed various types of pneumonic changes (suppurative, hemorrhagic, interstitial, fibrinous, broncho-pneumonia and emphysema) in lung, which included both gross and microscopic changes.

Various workers have described gross and microscopic inflammatory / pneumonic changes in lung of quail (Singh et al. 1995, Corton et al. 1999, Asrani et al. 1999, Tell, Lisa et al. 2002, Sunil kumar et al. 2002). Matsumoto et al. 1978 described granulomatous inflammatory changes. Not a single case of granulomatous change is found during the study.

Suppurative Pneumonia:

Among different pneumonic changes, occurrence of suppurative pneumonia was highest. It was observed in 70 cases (33.81%). Gross lesions were congestion, abscess formation and softening of the lung tissue. The microscopic changes were congestion of blood vessels, serous exudates, infiltration of leukocytes and scattering of alveoli. So many workers reported congestion in lung (Sah et al. 1983, Patnaik et al. 1993, Singh et al. 1995, Asrani et al. 1999, Shrilata et al. 2003). Suppurative pneumonia is reported by Thakur et al. (2000). They reported a little high % of occurrence (37.05% cases) of suppurative pneumonia with pathological changes like scattered alveoli, edematous fluid along with large number of heterophils and a few mononuclear cells. Thus the findings are similar. Ceseous exudates in air saculitis have been

**Interstitial Pneumonia:**

Occurrence of Interstitial pneumonia was seen in 40 cases (19.13%). Grossly lung showed petechial hemorrhage and congestion. Microscopically thickening of alveolar septa, infiltration of leukocytes and erythrocytes, loss of epithelial cells and vacuolated serous exudates were seen. Interstitial pneumonia is reported by Thakur et al. (2000). They reported 4.92% cases of interstitial pneumonia with proliferation of fibrous connective tissue in the intra-alveolar spaces. Fethy Yilmaz et al. (2004) also reported interstitial pneumonia with infiltration of lymphocytes, and hemorrhage in lung of quail. Glisson et al. (1989) described interstitial pneumonia in Japanese quails due to Pasturella multocida infection with pathological alterations like multi-focal pale areas on lung and the color of lung was darker than normal and Microscopically lung showed multifocal necrotic areas. Present findings such as thicking of alveolar septa serous exudates and erythrocytes and infiltration of leukocytes are in agreement with the results described by Fethy Yilmaz et al. and Thakur et al.. Necrosis is not observed in interstitial pneumonia instead petechial hemorrhage and loss of epithelium is seen. Also the frequency of occurrence of interstitial pneumonia (19.32%) in Durg district area was higher than as reported by Thakur et al. from Patna, Bihar.

**Fibrinous Pneumonia:**

Fibrinous pneumonia revealed clumps of serofibrinous exudates and alveoli were broken and surrounded with RBCs. 12
cases (5.79%) exhibited fibrinous pneumonia. Asrani et al. (1999) reported serofibrinous exudates in tertiary bronchioles. Thakur et al. (2000) reported fibrinous pneumonia (16.52%) with fibrinous exudates in intra-alveolar spaces. Jayaramu et al. (1999) observed fibrinous exudates in lung of chicks due to formaline vapour which is used as disinfectant in farms. Thus the result revealing fibrinous pneumonia (5.79%) is in accordance with these studies.

**Emphysema:**

The incidence of emphysema was seen in 20 cases (9.66%). Gross lesion was pale patches on lung surface. Microscopically hemorrhage and distention, thinning and rupture of alveoli were seen. The study appeared almost in consonance with the observations of Mutenelli et al. (2002) and also by Thakur et al. (2000). They reported pathological changes like thinning of alveolar wall, dilation of air vesicles, congestion and hemorrhage along with epithelial desiliation and hyperplasia. Thakur et al. (2000) reported 4.46% occurrence of emphysema from Patna (Bihar), which is lower than observed during present investigation. Yasunori et al. (2000) mentioned Emphysema (loss of alveolar structure) in quails. Mutenelli et al. (2002) described congestion, hemorrhage and air sac rupture in emphysema in different species of birds including quails.

**Hemorrhagic Pneumonia:**

Hemorrhagic pneumonia was investigated in 50 cases (24.15%). Main gross lesion was petechial hemorrhage. Microscopic changes were bloody exudates, damaged blood vessels and alveoli were packed with RBC. Hemorrhage in lung is reported by Perkin
and Swane (2001) who reported congestion and hemorrhage in lung of quail. Thakur et al. (2000) reported 32.14% hemorrhagic pneumonia with pathological conditions like ruptured blood vessels and alveoli packed with RBC. Thus the study was consistent with the findings of Thakur et al. (2000) and Perkin and Swane (2001).

**Broncho Pneumonia:**

Results of histopathological study revealed occurrence of broncho-pneumonia in 15 cases (7.24%) with gross pathological change like necrosis and microscopic changes like destruction of bronchial epithelium, degeneration of erythrocytes and leukocytes, presence of serous exudates and thrombus. It is invariably associated with infection in trachea and bronchi. Broncho-pneumonia as such is not reported in literature in quails but necrosis in lung has been reported by Buchholz et al. (1992) in bobwhite quail. Degeneration of leukocytes and erythrocytes has been reported by Perkin and Swane (2001). Serofibrinous exudates in tertiary bronchioles have been described by Asrani et al. (1999) and similarly Fethy Yilmaz et al. (2004) have described degeneration and desquamation of epithelial lining in lung. Thus the results are in agreement with the findings of different workers mentioned above.

The histopathological changes found in lung during the investigation correlates with the findings of various workers. Differences may be due to the fact that most of the workers examined experimentally infected birds.
**Trachea:**

Observation of gross pathological lesions and histopathological study revealed tracheitis (18 cases, 75%) and hemorrhage in trachea (6 cases, 25%).

**Tracheitis:**

Pathological changes observed in tracheitis were increased mucus secretion, swollen and edematous mucosal lining, congestion, patchy desquamation of pseudo stratified columnar epithelial lining and infiltration of leukocytes. Gross pathological lesions in trachea are observed by Pradhan et al. (1980), Thom et al. (1982) and Jack and reed (1994). A number of workers have reported bronchitis and tracheitis in quail (Pradhan et al. 1980, Chandra and Kumar 1998). Fethy Yilmaz et al. (2004) reported edema, deciliation, necrosis and detachment of tracheal and bronchial epithelium. Swollen epithelial lining, excess mucus secretion in trachea deciliation and desquamation of cells, infiltration of inflammatory cells and necrosis is reported by Thom et al. (1982). Sah et al. (1983) described increased mucus secretion in trachea due to *P. mirabilis* infection. Jack and Reed (1990) observed Necrosis associated with tracheitis /bronchitis in quail which were experimentally infected with Quail Bronchitis Virus. They have also reported desilialation and desquamation of tracheal and bronchial epithelium and leukocyte infiltration (Jack and Reed 1994). Necrosis in tracheitis is also described by Fethy Yilmaz et al. (2004) in Japanese quails experimentally infected by Avian Influenza Virus. Necrosis is not observed during the investigation. Tracheitis showing
caseous exudates due to *P. multocida* infection is reported by Murakami *et al.* (2002).

**Hemorrhage:**

Increased mucus secretion and sometimes-bloody exudates along with loss of cilia and epithelial desquamation of trachea was observed in hemorrhage in Trachea. No reference has been found for hemorrhage in trachea but it is quite evident in the present study. Along with mucus secretion, RBCs were also seen. Even blood was seen in tracheal lumen.

**Heart:**

Different pathological conditions found in heart were endocarditis (20 cases, 24.39%), necrosis (43 cases, 52.43%), edema (03 cases, 3.65%) and hemorrhagic endocarditis (16 cases, 19.51%).


**Endocarditis:**

Endocarditis revealed swelling of cusps of heart valve, petechial hemorrhage, necrotic foci in cardiac muscles and congestion in blood vessels. Loss of branching in cardiac muscles and infiltration of leukocytes and RBC in between the cardiac muscles were also observed. Similar observations are reported by Perkin and Swane (2001). They reported endocardial hemorrhage, swelling in endothelial cells, rapid multifocal to confluent myocardial
Degeneration and necrosis due to Avian Influenza Virus. Devender Rao (2000) reported degenerative cross striations and sarcolysis in cardiac muscles of quail due to malathion toxicity. Infiltration of heterophils and macrophages are observed by Asrani et al. (1999). Petechial hemorrhage on epicardium is reported by Mutenelli et al. (2002) in different species of birds including quails naturally infected by avian influenza virus.

Necrosis:

Quite a good number of affected heart (43 cases) showed necrosis. The samples revealed necrotic fosse and loss of striations and branching in cardiac muscles. Necrosis in heart is reported by Buchholz (1992), Asrani et al. (1999), Devendra Rao & Yadgirkar (2000). Fethy Yilmaz et al. (2004) reported myocardial hyperemia, degeneration, necrosis and myocarditis.

Edema:

Three cases revealed edema in heart showing enlargement in the size and accumulation of edematous fluid and increased interstitial spaces. Enlargement in the size of heart or cardiac hypertrophy is reported by Gencheve et al. (2001) due to toxic effect of Datura seeds in diet. Hyperemia and accumulation of liquid is observed by Fethy Yilmaz et al. (2004).

Hemorrhagic Endocarditis:

Sixteen cases of hemorrhagic endocarditis were observed. It revealed hemorrhage both grossly and microscopically. Cardiac muscles were degenerated and loss of striations was seen. Shrilatha et al. (2003) reported hemorrhage in heart in Japanese

Thus the finding of present study correlates with works of various workers.

**Spleen:**

The gross pathological observations and microscopic study of spleen revealed hemorrhage (6 cases, 20%), necrosis (12 cases, 40%), amyloidosis (2 cases, 6.6%). and depletion of lymphocytes (10 cases, 33.33%).

Gross lesions like congestion, hemorrhage on the surface and enlargement or reduction in the size of spleen due to different conditions are observed by a number of workers (Pradhan et.al.1985, Glisson et.al. 1989, Kalpana et.al. 1998, Batta et.al. 1999, Premkumar et.al. 1999 Tell, Lisa et.al. 2002).

**Hemorrhage:**

Hemorrhage in spleen during the present study revealed petechial hemorrhage (on the surface of spleen), escape of blood from blood capillaries and infiltration of RBCs and leukocytes in scattered pattern. These findings are similar with the findings of various other workers. Perkin and Swane (2001) reported hemorrhage in both Japanese quail and bobwhite quail along with other species of birds. Bell et.al. (2003) also observed hemorrhage and enlargement of spleen in quail. Mutenelli et.al. (2002) reported
hemorrhage and necrosis in spleen. Srilatha et al. (2003) observed hemorrhage in spleen of Japanese quail due to pasturellosis.

**Necrosis:**

Necrosis showed degenerated and atrophied cell, which were more glassy and homogeneous in appearance. The finding is in agreement with the findings of various workers. Necrosis in spleen is reported by Dillon et al. (1980); Jack and Reed (1990), Sentivelen et al. (1996), Craig et al. (2000) and Bell et al. (2003). Dillon reported multifocal splenic necrosis in bobwhite quails due natural out-break of histomoniasis. Jack and Reed observed sever necrotizing splenitis in bobwhite quails inoculated with quail bronchitis virus. Necrotic spleen is also observed by Bell in quails suffering from ulcerative enteritis. Mutenelli et al. (2002) mentioned fibrinoid necrotic foci in spleen and reduced size of spleen due to natural infection of avian influenza virus. Reduced size of spleen is also reported by Chang and Hamilton (1982) due to induced aflatoxicosis.

**Amyloidosis:**

In amyloidosis, enlargement of spleen and amyloid deposition were observed. Systemic Amyloidosis in quail is described by Nakamura et al. (1998). They observed amyloid deposition predominantly in spleen. Splenomegaly or the enlargement of spleen is observed by Sunil kumar et al. (2002) in Japanese quails experimentally infected with *Salmonella typhimurium* and also by Perkin and Swane (2001) due to avian influenza virus infection. Dubey et al. (1994) observed hypertrophied spleen due to *Toxoplasma gondii* infection.
Depletion of Lymphocytes:

In depletion of lymphocytes mottled spleen, necrotic foci and reduction in the size of spleen was observed grossly. Microscopically degeneration and destruction of lymphocytes were observed. Severe depletion of lymphocytes in spleen is reported by Senthivelan (1996) in quail due to New-castle disease. Craig et al. reported varying degree of lymphoidal depletion due to *Riemerella anatipestifer* infection. Hyalinization of lymphoid follicles in spleen in quail chicks and Heterophilic parementing in capillaries of spleen is reported by Perkin and Swane (2001) in quails as well as in other species of birds. Thus the present findings are in agreement with these findings.