CHAPTER- 5
GENERAL DISCUSSION
The present study provides preliminary information on the parasite fauna of Chatla Haor of Silchar and Awangsoi Lake of Manipur. It also gives information on seasonal occurrence of parasites, correlation of physico-chemical characteristics of water with seasonal occurrence of parasites and effect of length of fish on the occurrence of parasites.

The number of parasites necessary to cause harm to a fish varies considerably with the species and size of the host and its health status. Many parasite species are host specific to at least some degree and are capable of infecting one or only a limited number of host species. In the present study most of the parasites were found in the intestine of the host. Some parasites were infected in liver, stomach wall and body cavity of the host.

All the parasite species observed in the present study except the five new species, proposed above resemble the species already described by earlier workers. For example, Moghe described *L. indicus* in 1925 with stumpy scolex, wing like follicular ovary, absent of post ovarian set of vitelline follicles, testes larger in size than vitelline follicles, uterus with thick coat of glandular cells thrown in lateral coils and absence of seminal receptacle. The same characters were also observed in the present form of *L. indicus*. Similarly the present form of *P. manipurensis* shows close relationship with *P. tenerrima* v. Linstow, 1878 and *P. Anguilla* Karve, 1941 but differs from them in the number and arrangement of caudal papillae and the size of spicules. It resembles with the already described species *P. manipurensis* Shomorendra and Jha, 2003 in the presence of 12 pairs of caudal papillae, 4 preanal, 1 adanal and 7 postanal and in the
presence of equal spicules. Hence the present form is referred as a synonym of \textit{P. manipurensis} Shomorendra and Jha, 2003.

The new Caryophyllaeid species, \textit{Pseudolytocestus assamensis} n. sp. differs from all the known species of the genus \textit{Pseudolytocestus} Hunter, 1929. The present form differs from \textit{P. differtus} Hunter, 1929 and \textit{P. clariae} Gupta, 1961 in having vitellaria smaller than testes, cortical ovarian lobes, in the presence of shell gland and in the extention of vitellaria upto the anterior end of ovarian lobes instead of extending upto the posterior end of cirrus sac. In \textit{P. thapari} described by Gupta and Parmer (1990), vitellaria extends from the same level of anterior testes upto the posterior end of cirrus sac while it extends from a little posterior to the base of neck but a little anterior to the level of anterior testes upto the anterior end of ovarian lobes in the present form.

The nature of parasitisation of fish population in any confined body of water is affected by a variety of factors. Some of the biotic factors are host species, age and size of the host, condition of host, spawning period of the host, host sex, life history of host, diet or feeding behavior of host, availability of infected intermediate host as food, site of infection, host hormone level etc. Some of the abiotic factors are temperature, pH, DO content, salinity, and pollution of water. Wisniewski (1958) formulated the concept of the characterization of parasito fauna and further suggested that the character of a water body could be used to influence and determine the parasitic fauna.

In the present study the maximum and minimum water temperatures were observed in monsoon and post-monsoon respectively. Similar results have been reported by Gupta \textit{et al.} (2008), Jayabhaye (2009) and Manikannan \textit{et al.} (2011) from different wetlands.
Aquatic organisms are affected by pH because most of their metabolic activities are pH dependent (Wang et al., 2002). Optimal pH range for sustainable aquatic life is pH 6.5 - 8.2 (Murdock et al., 2001). Pawar and Pulle (2005) stated that the pH of water is important for biotic communities because most of the plant and animal species can survive in narrow range of pH from slightly acidic to slightly alkaline condition. In the present study the water of the two lakes showed slightly acidic condition.

Ayoade et al. (2006) and Adeyemo et al. (2008) reported that DO concentration at different water bodies attained its peak at the height of rainy season. Higher value of DO in the present study indicates the good water quality of these two lakes and is supported by Sahu et al., (2000).

A prominent inverse relationship of FCO$_2$ with the amount of DO was also observed by Jagadeshappa et al. (2011). Similar results of positive correlations of alkalinity with temperature and pH have been reported by Shinde et al. (2011).

The results of the present study revealed that there were fluctuations in the physico-chemical characters of the water of Chatla Haor and Awangsoi Lake. Variations in the physico-chemical characters also found between the two lakes and these may be due to difference in atmospheric condition, water level, amount of solar radiation, decomposition of aquatic vegetation etc. of the two lakes.

In the present study percentage of infection of parasites was positively correlated with temperature, pH, DO and conductivity in Awangsoi Lake. There was a significant positive correlation (p<0.05) with FCO$_2$ and a negative correlation with alkalinity. In Chatla Haor positive correlations were found with temperature, alkalinity and conductivity, significant negative correlation with DO, significant positive correlation with FCO2 and a negative correlation with pH.
For seasonal occurrence of parasites, in Chatla Haor the prevalence and intensity of infection was highest during monsoon season (Fig. 4.2.2.1). In the present study, significant difference of prevalence was found at $p<0.01$ among different seasons. But there was no significant difference in the intensity of parasites. The same result of maximum prevalence and intensity of helminth infection during monsoon have also been reported by Kennedy (1969), Gupta et al. (1984) and Niyogi et al. (1982). Amin (1987) has also reported higher prevalence and intensity of helminthes in summer months in fishes.

In Awangsoi Lake, the trematode, *Metaclinostomum srivastavai* showed maximum prevalence in monsoon, *Allocreadium fasciatusi* showed in pre-monsoon and *Genarcopsis goppo* showed its maximum prevalence in post-monsoon (Fig. 4.2.2.2). There was a great diversity of digenian trematodes infecting *C. punctata* in Awangsoi Lake. In the present study, there was concurrent infection by two or more helminth parasites. Gupta et al., 1984; Niyogi et al., 1982; Sinha and Sinha, 1994, 1996; Amin, 1987 have also reported concurrent infection of helminth. Concurrent infection causes niche segregation and reduction in the number of helminth parasites in fish. Jha et al., 1992 also showed that water temperature did not play an important role in the seasonal occurrence of helminth parasites. In the present study no significant difference was found in both the prevalence and intensity of infection among different seasons ($p>0.05$). Occurrence of helminth parasites may be attributed to ecological conditions and particularly distribution of intermediate hosts. Ecological factors have been held widely responsible for the occurrence of adult digenetic trematodes by Halvorsen, 1972 quoted from Chubb, 1979; Madhavi, 1978.

In the present investigation, increase in helminth infection with the increase in size of fish host agrees with the observation of Jha and Singh (1990) and Olofintoye
(2006). The infection of different species of helminth parasites in the fish species studied may be related to varied feeding habits of the host. There is significant change in the diet of the fish with increase in the length. Lower length groups mainly feed on zooplanktons and algal mass, middle length groups feed on insects, crustaceans and molluscs while the fishes of higher length groups mostly feed on small fishes.

Alam et al. (2010) worked on comparative study of endo-parasitic infestation in Channa punctata from different water bodies of varying water quality. In fresh water fishes they observed 100% prevalence of infection and 85.71% prevalence was observed in polluted water fishes. Poulin and Valtonen (2002) reported varied abundance of fish helminthes among adjacent lakes and varied abundance was also observed between seasons within lakes.

In our present study, the overall percentage of infection of the fishes of Awangsoi Lake was very high in comparison to that of Chatla Haor. Over 3206 fish samples examined from Awangsoi Lake belonging to 31 species, 20 genera, 5 orders, 14 families, Seven hundred and sixtyfour (23.83 %) were infected. In case of Chatla Haor the overall percentage of infection is very low i.e. 6.98. Out of 1560 fishes belonging to 34 species, 27 genera, 7 orders, 18 families, only 109 fish individuals were infected. The helminth fauna of fish may depend on various environmental factors such as geographical location of the habitat, season of the year, physico-chemical characters of the water etc. The two wetlands under study are of different types. Awangsoi Lake is a perennial wetland while Chatla Haor is a seasonal floodplain wetland. Valtonen et al. (1997) found differences in the parasite faunas of the lakes were influenced by differences in larval helminths and ectoparasites. The variability in the infection of helminth parasites in the two study areas may be related to the availability of their intermediate host, life cycles of the parasites and feeding habits of the fish host.