The domestication of animals occurred during the hunting and gathering phase of human civilization. Domestic ruminants such as sheep and cattle are among the first animals to be domesticated by man to obtain mutton, wool, leather, and milk.

India ranks sixth among the countries of the world with respect to sheep population. India is at the top with fourteen percent of cattle population. Sheep are for the most part docile, non-aggressive, gregarious creatures. From husbandry perspective, the most important behavioral characteristic of sheep are their tendency to flock. Sheep dung is a natural source of organic fertilizers with nitrogen and potassium contents double than cattle, so sheep manure is preferable for increasing the fertility of soil. The cow serves as the primary source of milk, the only dietary animal protein for a majority of Indians. In fact cow was so important to early
people of Central Asia that wealth was measured in numbers of cattle. From the early days to present, the cow has continued to be the servant of man. India is occupying first position regarding milk production among the developing countries of the world. India happens to be one of the largest exporters of leather goods made from cattle skin. Hides, horns and hooves are used to prepare cattle feed and fertilizers. Cattle are used by Indian farmers in ploughing and in harvesting agricultural products and transporting it to the market.

Jammu and Kashmir is primarily an agricultural state and animal rearing is one of the major sources of economy to farming community. Our state is situated in the north 32°.17’ and 36°.59’ north latitude and 72°.26’ and 80°.30’ east of longitude with total area of 2,22,236 km². The climate is variable from subtropical (Jammu plains) to temperate (Kashmir), to temperate cold but arid (Ladakh region). The valley of Kashmir is a bowl shaped basin of Western Himalayan range. Thus practically, the valley is cut off from the Ladakh province in north and from Jammu in south. Named as the “Paradise on the Earth”, it has earned its name due to heavenly features that it possesses. The soil topography, geoclimate, natural meadows and highland pastures of valley are naturally conducive for sheep and cattle rearing. In our state 70% of total population lives in rural areas (1991 census) whose main occupation is agriculture, farming and rearing of livestock. Its contribution to
state economy according to preliminary estimates has been calculated to Rs. 1127 crores (1991-1992).

There are various diseases which are a major setback to sheep and cattle industry. There are other practices which contribute to low wool, milk and meat production for this industry. The main contributing factors include large animal population with largely diminishing grazing areas and consequent over stocking, poor nutritional standards and traditional husbandry practices. Among diseases viral, bacterial and parasitic diseases are very important in retarding the progress of this industry. The first two i.e., viral and bacterial diseases are easily diagnosed by their clinical signs but parasitic infections when less in number or in early stage are without clinical signs and thus act as one of the major causes of production loss. Faizal (1999) reported 1/3rd growth retardation in ruminants due to helminth infections.

Almost 300 species of helminths parasitize livestock in India. These belong to three classes of helminths viz. Trematoda, Cestoda and Nematoda. The higher incidence of parasitic infections in domestic animals in a grazing system lowers productivity, leading to important economic losses. The parasite – infected animals increase their metabolic rate and reduce the amount of metabolic energy used for production, as the parasites use their nutrients, damage some vital organs and cause animal to become susceptible to other pathogenic agents (Sykes et al., 1992).
Pathogenecity of these helminth parasites is varied with different intensity. Nematodes are more pathogenic in adult stages. Cestodes are far less pathogenic than nematodes and trematodes, as they only compete for food with host in less numbers but may block the intestinal lumen in heavy infections.

Trematodes are usually more pathogenic in immature stages, feeding vigorously on mucosa in duodenum and other parts of the body. Trematodes are known to infect spectrum of hosts and cause considerable damage to both poikilothermic as well as homeothermic animals, hardly sparing any organ system. The survival of the parasites is influenced by the general biotic factors associated with the micro and macro environments as well as by the intimate physiological and immunological interactions between the parasite and the host which forms the basis of host-parasite relationship. Among the trematode infection, Fascioliasis and Paramphistomiasis rank high in significance of helminthic diseases of sheep and cattle. Various species of paramphistomes such as Paramphistomum cervi, Cotylophoron cotylophorum, Gastrothylax crumenifer, Paramphistomum microbothrium and Gigantocotyle explanatum have been incriminated as aetiological agents of Paramphistomiasis.

Kashmir is full of meadows and pastures. It is surrounded on all sides by mountains which almost appear to touch the skies. These mountains are covered by lush green grass and over flow with
water streams and springs. These streams and springs contain plenty of snails which serve as intermediate hosts of amphistomes. In early spring, sheep and cattle are allowed to graze in pasture lands and other grazing grounds available in every village. But in the middle of spring and early summer these animals are sent to meadows, pastures and far away forests. These are reared by “Bakerwals” and “Gujars” who are a nomadic race. In the middle of spring they go along with their livestock to these meadows and pastures. They return to the warmer places in autumn. It is at these sites that the livestock get the infection of various diseases, one of them being Paramphistomiasis which is caused by eating grass contaminated with metacercarial stage of different species of amphistomes.

Paramphistomes are parasitic in the alimentary canal of many ruminants. Mature parasites are especially prevalent in the reticulum and rumen. They are usually thick, short (4 – 12 mm. long), fleshy, maggot like worms. These stomach flukes have a complex life cycle which requires an intermediate host for completion. The intermediate hosts are aquatic snails belonging to genus Helisoma, Planorbis, Lymnaea etc. These are small, flat snails from 2 – 5 mm. in diameter. These snails are found in permanent and temporary water courses, irrigation channels, swamps, dam edges and depressions. They are normally found attached to vegetation in these habitats. Adult flukes live in the rumen and reticulum of cattle, sheep and goats. The eggs are passed in faecal
mater. Larvae then hatch in a wet environment and infect the intermediate host – Planorbid snails. Larval development is completed in the snail, and the next stage, the cercaria, leave the snail and attaches to vegetation where it encysts (metacercaria). When the vegetation is grazed by ruminants, the immature fluke excysts and attaches itself to the walls of the small intestine. It later migrates to the rumen and reticulum to become egg producing adult. In light infections, young flukes migrate to the rumen within 4 – 6 weeks and normally no clinical symptoms occur. Egg production begins soon after the fluke enter the rumen.

Fig 1.1. Graphic representation of life cycle of Paramphistomum: a. Adult fluke found in rumen and reticulum of ruminants pass eggs in manure; b. Egg hatches in wet environment; c. Miracidium comes out of the egg; d. Larval development in Planorbid snail; e. Cercaria comes out from snail; f. Cercaria encysts on grass to form metacercarial, where it is eaten by grazing ruminant.
Mature paramphistomes rarely produce clinical symptoms (Horak, 1967; Dube et al., 2003), however immature migrating parasites have been reported causing serious disease and even the death of their hosts by burying themselves in the sub mucosa of duodenum and feeding on the epithelial cells of Brunner's glands which results in anorexia, polydypsia, profuse diarrhoea, a drop in plasma protein concentration and anemia (Buttler and Yeoman, 1962; Boray, 1969; Singh et al., 1984).

A thorough understanding of the physiological aspects of host-parasite relationship can not be realized until a careful study is made on the biochemical nature of parasite and its host. Our knowledge in the field of biochemistry is increasing day by day. The parasite biochemists are employing latest experimental techniques which provide increasingly more accurate results. Most of the findings of biochemical and physiological nature are based on total homogenates because the isolation of different organs and organ system is impossible. The results thus obtained may not provide possible clues to the biological significance of a particular substance in relation to specific organs and organ systems.

To overcome this difficulty to some extent, the biochemical and physiological studies should be supplemented by histochemical studies. The histochemical studies help us to investigate qualitatively the biochemical pattern of different tissues in cellular architecture. Recent advances in the field of histochemistry have
made this task possible. Specific staining techniques give exact location and intensity, thus revealing the degree of involvement of the substances in biochemical reaction in the organ. Histochemical studies will increase the knowledge of worm physiology, which could further lead to deeper understanding of the well recognized host parasite interactions and such information according to Rolfe et al. (1994) would be valuable in designing control measures that are efficient and economical.

In recent years much attention has been focused on the histopathology of helminth parasites. Although studies have been made on the histochemistry of various digenetic trematodes, however most of these studies have been restricted to some model species like Fasciola hepatica and Schistosoma mansoni. Many other equally important species of trematodes like Paramphistomes from the point of view of their veterinary importance have remained more or less neglected. Besides, literature survey reveals no information on histochemistry of Paramphistomes of ruminants in Kashmir valley. To fill this void, a comprehensive work covering the histochemical localization of proteins, lipids, glycogen, calcium, alkaline phosphatase, acid phosphatase and cholinesterase in Paramphistomum cervi collected from sheep in comparison with that of Cotylophoron cotylophorum of cattle was undertaken.